Selected Correspondence of Descartes

René Descartes

[Brackets] enclose editorial explanations. Small ·dots· enclose material that has been added, but can be read as though it were part of the original text. Occasional •bullets, and also indenting of passages that are not quotations, are meant as aids to grasping the structure of a sentence or a thought. Every four-point ellipsis . . . . indicates the omission of a brief passage that has no philosophical interest, or that seems to present more difficulty than it is worth. (Where a letter opens with civilities and/or remarks about the postal system, the omission of this material is not marked by ellipses.) Longer omissions are reported between brackets in normal-sized type. —The letters between Descartes and Princess Elisabeth of Bohemia, omitted here, are presented elsewhere on this website (but see note on page 181).—This version is greatly indebted to CSMK [see Glossary] both for a good English translation to work from and for many explanatory notes, though most come from AT [see Glossary].—Descartes usually refers to others by title ('M.' for 'Monsieur' or 'Abbé' or 'Reverend Father' etc.); the present version omits most of these.—Although the material is selected mainly for its bearing on Descartes as a *philosopher*, glimpses are given of the colour and flavour of other sides of his life.

First launched: April 2013

Contents

Glossary

accident: Often used to mean 'non-essential property': your being more than 5' tall is an accident of you, whereas some philosophers would say that your having the power of thought is not. But quite often 'accident' is used just to mean 'property or quality', with no special emphasis on non-essentialness.

a priori, ***a posteriori***: In Descartes's day these phrases were used to mark the difference between •seeing something happen and working out what will follow from it and •seeing something happen and working out what must have caused it, i.e. between •causally arguing forward and •causally arguing backwards; quite unlike Kant's use of the terms to mean •'independently of experience' and •'on the basis of experience'.

animal spirits: This stuff was supposed to be even more finely divided than air, able to move extremely fast and seep into tiny crevices. Descartes describes their formation on page 163.—Apparently some people thought of spirits as so rarefied as to be almost mind-like(!), and thus suitable to mediate between mind and body; but Descartes is innocent of this absurdity. Its most famous occurrence is in Donne's superb lines: 'As our blood labours to beget / Spirits as like souls as it can, / Because such fingers need to knit / The subtle knot that makes us man. . . '.

art: Any human activity that involves techniques or rules of procedure.

AT: This refers either to *Œuvres de Descartes*, edited by Charles **A**dam and Paul **T**annery, or to Adam and Tannery themselves.

beg the question: Until fairly recently, to 'beg the question' was to offer a 'proof' of P from premises that include P. It now means 'raise the question'. It seems that complacently illiterate journalists (of whom there are many) encountered the phrase, liked it, guessed at its meaning, and saw no reason to check on the guess.

burning mirror: A concave mirror which can reflect the suns ray to a point, creating enough heat there to start a fire.

catoptrics: The part of optics that deals with reflections.

chimera: A chimera can be a fabulous beast or monster, or a thought or idea of image of something fantastic, fabulous, etc. In Descartes's usage it is always the second meaning that is at work.

circular: Descartes holds that all motion is in a closed loop (despite his always calling it 'circular', he has no views about its shape). His reason for the loop thesis is this: Absolutely all space is full of extended substance(s), there are no gaps; and no material substance can shrink, or expand, or spatially overlap another material substance. Therefore, if body b_1 is to move from location L_1, it must shove aside body b_2, which must shove aside b_3. . . and so on; so if an infinite chain of movements is to be avoided, somewhere along the way there must be body b_n which is pushed into location L_1, thus closing the loop. (It has to be instantaneous: L_1 mustn't be empty for a split second between the departure of b_1 and the arrival of b_n.)

common notion: In Descartes's usage, a 'common notion' is a really basic elementary logical truth.

common sense: The phrase '*the* common sense' was the name of a supposed faculty or organ or brain-region where inputs from the various senses are processed together and united.

concurrence: God's concurrence in an event is his going along with it, in some (supposed) sense that is weaker than •his outright causing it but stronger than •his merely not preventing it.

CSMK: This is volume 3 of *The Philosophical Works of Descartes*, translated by John **C**ottingham, Robert **S**toothoff, Dugald **M**urdoch, and Anthony **K**enny.

doctor: Learned man.

efficient cause: This is an Aristotelian technical term. The •formal cause of a coin is its design, the plan according to which it was made; its •material cause is the stuff it is made of; its •final cause is its purpose, namely to be used in commerce; and its •**efficient cause** is the action of the die in stamping the coin out of a metal sheet. So the efficient cause is what you and I would call, simply, 'the cause'.

eminently, formally: These are scholastic technical terms that Descartes adopts for his own purposes. To say that something has (say) intelligence 'formally' is just to say that it is intelligent; to say that it has intelligence 'eminently' is to say that it has intelligence in some higher form that doesn't involve its being straightforwardly intelligent. The distinction comes into play through the doctrine that whatever is present in an effect is also present in its cause. Obviously something can be caused to be rigid by a cause that isn't itself rigid; and God presumably doesn't straightforwardly have many of the qualities he causes other things to have—he isn't square or muddy or (for that matter) given to telling bad jokes. So the doctrine takes the form 'Whatever is present in an effect is also present *formally or eminently* in its cause. Descartes's only explanation of this terminology is to say that 'x has Fness eminently' means 'x has the power to cause things to have Fness', which you'll notice turns the doctrine into a triviality.

de volonté: Descartes repeatedly associates rationally loving x with joining oneself *de volonté* with x. This doesn't mean joining oneself voluntarily, by volition [*volonté*]; it is a technical term, which he explains on page 191 where he equates 'x joins itself to y *de volonté*' with 'x considers itself and y as forming two parts of a single whole'. A bit less abruptly, you join yourself *de volonté* with the person you love if you *will yourself into a state in which you feel as though* you and that person are the two parts of a single whole.

ens per accidens, per se: A pyramid is a collection of stone blocks that constitute an *ens per accidens* = an entity by happenstance. It just happens to be the case that they are inter-related in a way that makes them a pyramid, a thing, an *ens*. They don't have any features that intrinsically draw them together, somehow making them *belong* together as a single entity; that would be an *ens per se*.

heaven: Sometimes Descartes uses 'the heavens', as we still sometimes do, to mean 'the whole visible universe outside the earth'. But in the *Principles of Philosophy* and some of his letters 'heaven' occurs as a technical term referring to any large spherical mass of rotating fluid material with a star or planet at its centre. The earth, he says, 'is completely immersed in a very fluid heaven'.

indifferent: A situation where your will is 'indifferent' with respect to your doing A is a situation where you are under no external pressure to do A and none to refrain from doing A. For finer tuning, see page 175.

ineffable: Too great to be fully described in words. (The antonym 'effable' occurs these days only in jokes.)

inform: When Descartes says that your body is 'informed' by your soul, he means only that your body *has* that soul, is united with it in the standard body-soul manner. It's odd that he uses this verb in this way: it echoes the Aristotelian doctrine that your soul is *the form of your body*; and that doctrine, whatever it means, is denied by Descartes's thesis that your body is one substance and your soul is another.

interpenetration of dimensions: Descartes holds that it impossible for two distinct •portions of matter to overlap spatially: for any two such items, the volume of them both is the sum of the volumes of each separately. For him this is equivalent to saying that two distinct •regions of space can't overlap; and he expresses by saying that he rejects the 'interpenetration of dimensions'.

metempsychosis: The movement of a soul from one body to another.

mœurs: A person's *mœurs* includes his morality, his basic habits, his attitudes and expectations about how people will behave, his ideas about what is decent. . . and so on. This word—rhyming approximately with 'worse'—is left untranslated because there's no good English equivalent to it.

moral certainty: A degree of certainty that is high enough for practical purposes, high enough to make practical doubt unreasonable; similarly with **morally impossible**. (In this phrase 'moral' is used in its old sense of 'having to do with human behaviour'.)

natural light: If you know something to be true just by thinking hard about it in the right way, Descartes will say that you know it 'by the natural light'.

numerical identity: To say that x is numerically identical with y means simply that x is y, which is equivalent to saying that x and y are *one*—that's how 'numerical(ly)' comes into it. Why have any adjective or adverb in these contexts? Because the writer thinks that the reader might take the unvarnished 'identity' to refer to some kind of mere similarity.

objective: When Descartes speaks of the 'objective being' of an idea he is referring to its representative content, the being that is its object, the item that it is about.

parhelia: Two bright patches flanking the sun, sometimes called 'false suns'.

passion: When Descartes speaks of 'passions' that people and other animals have, he using the word in about the same sense as we do. Outside the animal context the word is the antonym of 'action': action/passion = doing/undergoing.

Pelagian: Follower of Pelagius, a 4th-century theologian whose stress on the role of human effort as a means to salvation was thought by many to push divine grace out of the picture.

pineal gland: This is the current name for the gland that Descartes always refers to as 'the gland called "the conarium"'.

prejudice: This translates the French *préjugé* and the Latin *præjudicium*. These basically mean 'something judged or believed in advance' (of the present investigation, of the evidence, or of etc.). These days 'prejudice' usually has the narrower meaning of 'something pre-judged concerning race, sex, etc.'. To avoid that taint, CSMK uses 'preconceived opinion' (7 syllables); the present text will use 'prejudice' (3 syllables) accompanied by this warning.

princess: When Descartes speaks of *Queen* Christina as a princess he is following a usage that used to be fairly common for 'prince' (and its cognates in French and Latin), namely as standing for any ruler of a state, whether a king or queen or duke or count etc.

principle: In Descartes's writings a *principe* (French) or *principium* (Latin) is often a certain kind of universal proposition—e.g. in the title standardly translated as *Principles of Philosophy*. But he sometimes uses one of these words in a sense, once common but now obsolete, in which it means 'source', 'cause', 'driver', 'energiser', or the like (see pages 23 and 215). The English 'principle' also had that sense; Hume's *Enquiry Concerning the Principles of Morals* is, he tells us, an enquiry into the *sources in human nature* of our moral thinking and feeling.

privation: A privation in x is x's not having something that it ought to have. If a person can't speak, that is a privation in him; a rock's lack of the ability to speak is not a privation in it but a mere **negation**.

rarefied: In early modern times, 'rare' and the French *rare* meant the opposite of 'dense', and was usually understood to mean 'very finely divided'.

real quality, **real accident:** These phrases use 'real' in its old sense of 'thing-like' (from Latin *res* = 'thing'). The core thought is this: if heat, for example, is a 'real quality' or 'real accident', then any instance of heat can be thought of independently of anything's *having* it. When a thing x comes to be hot, what happens is that it comes to *have* a real quality, a particular instance of heat. Descartes rejects this, and holds that predicative propositions should be thought of as having the form 'x is-hot' rather than 'x relates-by-possession-to hotness'. When on page 158 Descartes says that he doesn't credit *motion* with any more reality than is generally attributed to *shape*, he means that philosophers generally wouldn't speak of a ball's being round as a result of a thing-like instance of roundness that the ball possesses; and he says that the same goes for the ball's being in motion.

reflection, **refraction:** How light bounces off a mirror, how light *tilts* as it enters a translucent medium. The problem with refraction was to get a sound general account of how the angle at which the light meets the surface of the translucent body [incidence] relates to the angle at which it carries on from there [refraction]. This could involve light going from air into glass or from glass into air; this problem was central to the making of optical lenses,

reminiscence: Plato's doctrine that things you know without having learned them from experience or from other people are things you *remember* from a previous life when the soul you now have was joined to a different body.

School: The 'Schools' were philosophy departments that were almost entirely under Aristotle's influence, as mediated by Roman Catholic philosophers and theologians.

science: In early modern times the English word 'science', the French *science* and the Latin *scientia* applied to any body of knowledge or theory that is (perhaps) axiomatised and (certainly) well founded and conceptually highly organised.

sensible: Translating French *sensible* and Latin *sensibilis*, this usually means 'capable of being sensed', i.e. '. . . of being perceived through the senses'. But on page 217 and perhaps elsewhere, Descartes uses 'sensible quality' to refer to what are commonly called the 'secondary qualities' such as colour, smell, sound, etc. and *not* including shape and size, though these are perceptible by the senses.

soul: This translates *âme*. It doesn't obviously mean anything different from *esprit* = 'mind', and has no theological implications.

species: When on page 103 Descartes speaks of 'the species that enter the eyes' etc. he is using the language of a theory of Aristotle's that he doesn't actually believe. According to this theory, when you see a kitten a tiny *representation of a kitten* enters your eyes, and this **representative something-or-other** is called a 'sensible species'. All Descartes needs from this on page 103—and presumably all he intends—is to speak of eyesight as involving a **something-or-other** entering your eyes.

speculative: This means 'having to do with non-moral propositions'. Ethics is a 'practical' discipline, chemistry is a 'speculative' one.

substantial form: When Descartes first **uses** this term here, on page 25, it is not clear what he means by it. In many other places—e.g. on pages 75 and 136—he merely **mentions** it as an item in false Aristotelian metaphysics. In his letter to Regius on January 1642—starting on page 148—he says that he isn't denying that there are substantial forms but merely saying that he can do (meta)physics without them.

subtle: When Descartes speaks of some matter as 'subtle', he means that it is *extremely* finely divided, more fluid than water; and he usually thinks of the ultra-tiny particles composing it as moving very fast.

transubstantiation: The doctrine that in the Eucharist the bread comes to be part of the *substance* of Christ's body although it still has the *qualities* of mere bread.

violent: Aristotle divided motions into 'natural' and 'violent': the movement to the ground of a dropped pebble is natural, its upward movement when you throw it up is 'violent'. Thus when on page 57 Descartes rejects the natural/violent distinction, he is rejecting Mersenne's apparent assumption that some states of water are natural and others are not (though he would hardly say that the others are 'violent').

vivid: This belongs to the pair

'vivid' and 'clear',

which translates the Latin

clarus and *distinctus*

and the French

clair and *distinct*.

Every other English translator has put

'clear' and 'distinct'

but this is certainly wrong. The crucial point concerns *clarus* (and the French *clair*). The word can mean 'clear' in our sense, and when Descartes uses it **outside** the *clarus et distinctus* phrase, it seems usually to be in that sense. But **in** that phrase he uses *clarus* in its other meaning—its more common meaning in Latin—of 'bright' or 'vivid', as in *clara lux* = 'broad daylight'. If in the phrase *clarus et distinctus* Descartes meant *clarus* in its meaning of 'clear', then what's left for 'distinctus' to mean? Descartes's only explanation of these terms is in *Principles of Philosophy* 1:45–6, a passage that completely condemns the usual translation. He writes: 'I call a perception *claram* when it is present and accessible to the attentive mind—just as we say that we see something *clare* when it is present to the eye's gaze and stimulates it with enough strength and accessibility. I call a perception *distinctam* if, as well as being *clara*, it is so sharply separated from all other perceptions that every part of it is *clarum*. . . . A perception can be *clara* without being *distincta* but not vice versa. When someone feels an intense pain, his perception of it is *clarissima*, but it isn't always *distincta* because people often get this perception muddled with an obscure judgment

they make about something they think exists in the painful spot. . . .' and so on. He can't be saying anything as stupid as that intense pain is always *extremely clear*! His point is that pain is vivid, up-front, not shady or obscure. And for an idea to be *distincta* is for every nook and cranny of it to be vivid, i.e. for it as a whole to be in our sense 'clear'.—Sometimes when *clair* and *distinct* occur together, the traditional translation is forced on us because *distinct* is used as a relational term rather than a one-place predicate; there's an example of this on page 137, where notions are spoken of as *claires* and *distinctes les unes des autres*—clear and distinct *from one another*.

we: Sometimes when this version has Descartes speaking of what 'we' may do, he has written of what 'one' may do. It is normal idiomatic French to use *on* = 'one' much oftener than we can use 'one' in English without sounding stilted. He often slides from *on* to *nous*, clearly not intending any distinction; for example, paragraph (i) on page 66.

Letters written in 1619–1637

to Beeckman, 26.iii.1619:

. . . .In the past six days. . . .I have been working more diligently than ever before. In that short time, with the aid of my pair of compasses, I have discovered four remarkable and completely new demonstrations.

The first concerns the famous problem of dividing an angle into any number of equal parts. The other three have to do with three sorts of cubic equations:

(1) equations between a whole number, a root number and a cube root—[equations of the sort $\pm a \pm bx = x^3$];

(2) equations between a whole number, a square root, and a cube root—[equations of the sort $\pm a \pm bx^2 = x^3$];

(3) equations between a whole number, a root number, a square root and a cube root—[equations of the sort: $\pm a \pm bx \pm cx^2 = x^3$].

I have found three sorts of demonstrations for these three sorts of equations, each of which has to be applied to different terms owing to the difference between the signs + and -. My account of this is not yet complete, but what I have found to apply in one case can easily be extended to others. It will thus be possible to solve four times as many problems, and much more difficult ones, than was possible by means of ordinary algebra. . . . Another thing I'm investigating at present is the extraction of roots consisting of many different terms. If I find out how to do this, as I hope I shall, I'll really put this science in order, if only •I overcome my natural idleness and •fate gives me the freedom to live as I choose.

Let me be quite open with you about my project. What I want to produce is not something like Lull's *Ars Brevis*, [a fourteenth-century work purporting to provide a universal method of solving problems], but rather a completely new science that would provide a general solution of all possible equations involving any sort of quantity, whether continuous or discrete. The solutions would be different depending on the nature of the equation: in arithmetic, for example, some problems can be solved by means of rational numbers, while others require irrational numbers, and others again we can only imagine how to solve but can't actually solve. So I hope I shall be able to demonstrate that certain problems involving continuous quantities can be solved only by means of straight lines or circles, while others can be solved only by means of curves produced by a single motion, such as the curves that can be drawn with the new compasses (which I think are just as exact and geometrical as those drawn with ordinary compasses), and others still can be solved only by means of curves generated by distinct independent motions which are surely only imaginary, such as the notorious quadratic curve [a curved line discovered by Hippias in the first century BCE; called 'quadratic' because it was used in attempts to square the circle.] With lines such as these available, I think, every imaginable problem can be solved. I'm hoping to demonstrate what sorts of problems can be solved exclusively in this or that way, so that almost nothing in geometry will remain to be discovered. This vast task is hardly suitable for one person; indeed it's an incredibly ambitious project. But I have glimpsed a ray of light through the confusing darkness of this science, and I think I'll be able with its help to dispel even the thickest obscurities. . . .

After I left Middelburg I reflected also on your art of navigation, and discovered a method for working out, simply

by observing the stars, how many degrees east or west I had travelled from some place I knew, no matter where on earth it might be, or whether I had been asleep during the journey and had no idea how long I had slept. It is hardly a subtle discovery, and I can hardly believe that no-one has made it before now. I suspect that it has been neglected because of the difficulty of applying it; for in order to make the measurement we would need an instrument thirty times as exact as the instruments currently used to work out the height of the pole star; so the measurement couldn't be very exact, although astronomers do measure ·angular· minutes and seconds, and even much smaller intervals, with existing instruments. But if that is the only drawback with it, I would be very surprised if sailors thought it such a useless discovery. So I would like to know for sure whether or not a similar discovery has been made before. [It had.] If you know of any such, write and tell me about it. It is still a confused speculation in my head, but I would work it out more exactly if I suspected it was as novel as it was certain. . . .

to Beeckman, 23.iv.1619:

Your letter reached me almost on the same day you sent it. I didn't want to leave here—[Breda, Holland]—without writing to you once more, to keep up what will surely be a lasting friendship between us. But don't expect anything from me at the moment, for while I am preparing for tomorrow's departure my mind has already started traveling. I am still uncertain 'where fate may take me, where my foot may rest' [from Virgil's *Aeneid*]. The preparations for war haven't yet led to my being summoned to Germany, but I suspect that many men will be called to arms, though there will be no outright fighting. If that state of affairs continues, I'll travel around in Denmark, Poland and Hungary until I can find a safer route—one not occupied by marauding soldiers—or until I have definitely heard that war is likely to be waged. If I stop somewhere, as I expect to, I promise to see to it that my *Geometry* is put in order, and I will salute you as the promoter and prime author of my studies.

For it was you alone who roused me from my state of idleness, and reawakened the learning which by then had almost disappeared from my memory; and when my mind strayed from serious pursuits it was you who led it back to worthier things. Thus, if I happen to produce something that has some merit you can rightly claim it all as your own; and I'll send it to you without fail, so that you can use it—and check it for errors. That's what I was doing the other day when I sent you a piece on navigation. You must have read my thoughts! for you were sending me the exact same thing—your discovery about the moon is the same as mine. I did think that the method ·of using the moon to fix one's location· could be made easier with the aid of certain instruments; but I was wrong about that.

As for the other things I boasted of having discovered, I really did discover these with the help of the new compasses—I'm not wrong about *that*. But I shan't send these to you piecemeal, because I'm thinking of writing a complete work on the subject some day—a work that I think will be new and pretty good. For the last month I have set my studies aside because my mind was so worn out by these discoveries that I hadn't the strength to discover the other things in this area that I had planned to investigate. But I have the strength to keep my memory of you ever fresh.

[Those closing words are a sample of something Descartes does often, namely to word his (polite or friendly) signing-off in a way that links it with what has just gone before. Most of these signings-off are omitted from the present version.]

to Beeckman, 29.iv.1619:

I don't want to miss any opportunity of writing to you and demonstrating my affection for you and my remembrance of you—not dimmed amid all the fuss of travel.

Three days ago I had a conversation about Lull's *Ars Brevis* with a learned man whom I met in an inn at Dordrecht. He was a loquacious old fellow, who kept his rather bookish learning not so much in his brain as on the tip of his tongue. He boasted that he could apply Lull's method, doing it so skillfully that he could talk for a whole hour on any subject I cared to mention; and if he was required to talk for another hour on the same topic he would find fresh things to say, and could go on with this for twenty-four hours at a stretch. Should you believe him? See for yourself!

I questioned him carefully, to see whether his method consists in arranging dialectical headings in a certain way and deriving arguments from them. He said that it does, but he added that Lull in his writings hadn't supplied certain 'keys' that 'are essential' for revealing the secrets of the method. In saying this, I suspect, he was trying to impress an ignorant listener rather than to speak the truth.

I'd be happy to go on about this if I had the book; but since you do have it, please look into it when you have time and tell me whether there's any intellectual substance in that 'method'. I'm so sure of your intelligence that I'm certain that you'll easily see what is missing in the way of so-called 'keys' that are essential for understanding the rest. I'm writing to you about this so as not to miss an opportunity to discuss a learned question with you, which is what you asked for. When I ask for the same thing from you, please don't go to too much trouble.

Today I set off for Denmark. I'll spend some time in Copenhagen, where I hope to have a letter from you. Ships leave here for that city every day. You don't know where I'll be staying; but I'll shall make a point of inquiring among the sailors whether they have a letter for me; so it is not likely to go astray. . . .

⊕ [Between 1622 and 1626, two letters from Descartes to his father, and three to his older brother.]

⊕ [18.vi.29: A very friendly letter to Ferrier, enthusiastic about his researches on telescopic lenses, and inviting him—firmly and with convincing detail—to leave Paris and come and live with Descartes.]

to Gibieuf, 18.vii.1629:

Ferrier will give me some news, and I don't expect you to take the trouble to do that; but I do expect to put you to some trouble when I complete a little treatise that I am starting. I wouldn't have told you it was under way if I hadn't been afraid that it will take so long to finish (more than three years, I expect) that you'll forget your promise to correct it and give it the finishing touches. I may eventually decide to burn it, or at least to keep it within the circle of my friends until I have carefully reconsidered it. If I am not clever enough to produce something worthwhile, I'll try at least to have the good sense not to publish my shortcomings.

to Mersenne, 8.x.1629:

I don't think I was so uncivil as to ask you not to ask me any more questions. I am honoured by your taking the trouble to send them to me, and I learn more from them than I do from any other sort of study. But of course I should have said: 'Forgive me if I don't make the effort to reply as precisely as I would try to do if I weren't wholly taken up with other thoughts.' My mind is not so strong that I can tackle many tasks at once; I never make any discoveries

except through a long sequence of thoughts, so I have to devote myself •wholly to a topic when I want to investigate some •part of it. I had experience of this recently when I was investigating the cause of the phenomenon that you write about in your letter [parhelia, see Glossary]. About two months ago a friend showed me a full description of the phenomenon and asked me what I thought of it. I couldn't answer this in a way that satisfied me until I had interrupted my current work and made a systematic study of the whole of meteorology. But I think I can now give some explanation of the phenomenon. I have decided to write a little treatise on the topic [namely the future *Meteorology*, published along with the *Discourse on the Method* in 1639.]; this will explain •the colours of the rainbow (a topic that has given me more trouble than any other), and •all terrestrial phenomena in general. That's why I asked you for a description of the phenomenon at Rome in particular; I wanted to know whether it agreed with the description I had seen. There was this difference: you say that the phenomenon had been seen at Tivoli, whereas the other account says that it was seen at Frascati. Please tell me whether you know for sure that it did appear at Tivoli. . . . There's no need to hurry; I haven't yet begun to write.

Please don't speak to anyone about this, because I have decided that when I publish this specimen of my philosophy I'll do so anonymously, so as to hear what people say about it. It's one of the most beautiful subjects I could choose, and I'll try to expound it in such a way that it will be a pleasure to read for those who understand only Latin. [He later decided to write it in French.] I would prefer it to be printed in Paris rather than here ·in Amsterdam·; if it wouldn't be asking too much, I'll send it to you when it is finished, so that you can correct it and place it with a publisher. . . .

[The letter now touches on the following topics: The news that Mersenne put some questions to Beeckman and is offended by Beeckman's responses; a request for suggestions about where Ferrier might get financial support to continue with his important research on the making of lenses for telescopes; questions in geometry and musical theory. Then:] As for your other question ·about the movements of a pendulum·, I needed a long time to think about this, for there are many different forces to take into account. Firstly, take the case where

> the pendulum's weight is in a vacuum where there's no air to slow it down,

and take it as given that

> by doubling the force on it we can halve the time it takes to travel the same path;

then the calculation I made earlier is as follows. If the cord is 1 foot long and it takes the weight 1 second to from a certain point A in its swing back to its mid-point B, it will take $\frac{4}{3}$ seconds when the cord is 2 feet long; if the cord is 4 feet long, it will take $\frac{16}{9}$ seconds; if 8 feet long, $\frac{64}{27}$ seconds; if 16 feet long, $\frac{256}{81}$ seconds (which is not much more than 3 seconds), and so on in due order. [Descartes adds that he isn't offering an account of a related aspect of pendulum-movement because it involves some extremely difficult calculations.]

⊕ [8.x.29: Descartes writes to Ferrier expressing some optimism about his chances of getting research support, and giving much advice about how to improve them. Then five pages on technical aspects of lens-making.]

⊕ [26.x.29: Ferrier replies to Descartes, with fervent gratitude for his support and interest; and then, having been invited to do this, he offers a dozen pages on his research, and the engineering and mathematical problems it involves.]

⊕ [13.xi.29: Descartes to Ferrier. Pleasure at the trouble Ferrier has taken; then about fifteen pages of technical stuff; then 'If there's anything

in this that you don't understand, tell me and I won't grudge the paper I'll need for a reply'; and finally 'If you had a year or two to settle all this, I'd make so bold as to suggest that your work will enable us to answer the question "Are there animals on the moon"?']

to Mersenne, 13.xi.1629:

I'm sorry you have been put to a lot of trouble in sending me your description of parhelia, for what you saw is just like the one I had seen. Still, I'm indebted to you for this, and even more for your offer to see to the printing of the little treatise I'm planning to write—but I should tell you that it won't be ready for over a year. Since I wrote to you a month ago, all I have written is an outline of the contents. Rather than explaining just one phenomenon, I now plan to explain all the phenomena of nature, i.e. the whole of physics. [This projected larger work was to become *The World or Treatise on Light*, which Descartes refers to as his 'Physics' (later on he refers to his *Principles of Philosophy* in that way.)] I like my present plan better than any other I have ever had, for I think I see how to expound my thoughts in a way that some will find satisfying and others won't have any reason to reject.

[A paragraph commenting on the supposed discovery that Gaudey had made in geometry. While contending that it was neither as new or as useful as Mersenne had thought it was, Descartes has good words about it. Then:]

You ask for the basis of my calculation of how long it takes the pendulum-weight to fall [i.e. to get from a given point to the mid-point of its swing] when the cord supporting it has this or that length. I'll have to deal with this in my Physics, but you shouldn't have to wait for that; so I shall try to explain it here. I start with the assumption ·of the law of inertia, which says· that a body that is caused to move will keep moving in the same way for ever unless some other cause goes to work on it. In other words, in a vacuum a moving thing keeps on moving at the same speed. Thus, suppose that an unsupported weight is falling to the earth at a certain velocity at time t. If it lost its heaviness at t, it would stay at that velocity throughout the rest of its fall. But of course that's not what happens; it keeps its heaviness, which gives it at each moment a new force pushing it down. So at each moment in its downward journey it moves faster than it did just before, because it still has the impetus it brought with it into that moment and an additional impetus—an additional downward push—because of its heaviness. [Having explained •why falling bodies accelerate, Descartes goes on to explain •the rate of acceleration; but we can afford to by-pass that because AT [see Glossary] point out that the explanation fails because it involves Descartes in misunderstanding the diagram that he uses.]

. . . .You asked me for a precise account of how much the air resists the movements of bodies through it; but there is no answer to that. How much a given environment of air resists the movement of a given body varies greatly, depending on whether

> the air is hot or cold, dry or wet, clear or cloudy,

and on whether

> the body is made of lead or iron or wood, is round or square or some other shape,

and hosts of other factors. And this applies to all the questions you raise about air resistance.

[The next topic concerns the vibrations in a taut string that is plucked. (It's not clear what Mersenne's question about this was.) Descartes's reply is accompanied by a diagram, but we can do without it. What matters is this: The taut unplucked string is on a straight line; then it is on a curve on one side of that line followed by a curve on the other side; at the middle of the string each curve will be at

the maximum distance from the straight line; add these two maximum distances for a given back-and-forth motion of the string, and call that distance D. The value of D will of course decrease as the vibration goes on. Now hear Descartes:]

In a vacuum the distance D decreases in geometrical proportion. That is to say, if D is 4 units at the first motion and 2 at the second, it will be only 1 at the third motion; and if it is 9 at the first motion and 6 at the second, it will be 4 at the third, and so on. If the vibrations all take the same length of time, their speed will decrease in proportion as D decreases. I say 'in a vacuum', for in air I believe that the motions will be a little slower towards the end than they were at the beginning, because the motion will have less force then and thus won't so easily overcome the air resistance. But I'm not sure about this; perhaps on the contrary the air even aids the motion at the end, since the motion is circular [see Glossary]. But you can test this by ear. Check whether sound of a plucked cord is sharper or flatter at the end than at the beginning: for if it is flatter that's because the air is slowing it down; if it is sharper that's because the air is making it move more quickly.

[This letter is incomplete. It now tails off in the middle of a sentence mentioning further questions about vibrating strings.]

to Mersenne, 20.xi.1629:

This proposal for a new language seems more remarkable at first than I find it to be when I look more closely. There are only two things to learn in any language: the meanings of the words and the grammar. As for the meanings of the words, •the proposer doesn't offer anything specific; in his fourth proposition he says 'the language is to be translated with the aid of a dictionary', and anyone who knows a bit about languages can do *that* in any common language without •his help! I'm sure that if you gave Claude Hardy—·who is said to know thirty-six oriental languages·—a good dictionary of Chinese or any other language, and a book in the same language, he would undertake to work out its meaning.

Not everyone could do the same, because of the difficulty of the grammar. That, I imagine, is your proposer's whole secret; but there's nothing difficult in it. If you make a language

- •with only one pattern of conjugation, declension and word-construction, and
- •with no defective or irregular verbs introduced by corrupt usage, and
- •with nouns and verbs that are inflected, and sentences that are constructed by prefixes or suffixes attached to the primitive words, and
- •with all the prefixes and suffixes listed in the dictionary,

it's not surprising if ordinary people learn to write the language, with the help of a dictionary, in less than six hours. That's all his first proposition says.

The second says 'once this language has been learned, the others can be learned as dialects of it'. This is just sales talk. He doesn't say how long it would take to learn them, but only that they could be regarded as dialects of his language, which he takes as basic because it doesn't have the grammatical irregularities of the others. Notice that in his dictionary he could handle each primitive word by bringing in synonyms of it from all the other languages. To signify *love*, for instance, he could use *aimer*, *amare*, $\phi\iota\lambda\epsilon\iota\nu$, and so on; a Frenchman, adding to *aimer* the affix for a noun, will form the noun *amour*, a Greek will do the same with $\phi\iota\lambda\epsilon\iota\nu$, and so on. So it's easy to see what is going on in his sixth proposition, about 'inventing a script'. For if

he put into his dictionary a single symbol corresponding to *aimer*, *amare*, and each of the synonyms, a book written in such symbols could be translated by everyone who had the dictionary.

The fifth proposition also strikes me as mere advertising. As soon as I see the word 'mystery' in any proposition I begin to suspect it. But all he means, I think, is that because he has thought hard about the grammars of other languages in order to simplify his own he can teach them more easily than the average instructor.

There remains the third proposition, which is a total *mystery* to me. He says he will expound the thoughts of the ancient writers going by the words they used, while taking each word as expressing the true definition of the thing the word refers to. To put it plainly: he will expound the thoughts of these writers while giving their words a sense they never gave them themselves; which is absurd. But perhaps he means it differently.

Now this plan of reforming our grammar, or rather inventing a new one to be learned in five or six hours and applicable to all languages, would be useful if everyone agreed to adopt it—except for two difficulties I can see standing in the way.

(1) The discordant combinations of letters would often make the sounds unpleasant and intolerable to the ear. Why has common usage led to words' being inflected differently in different languages? Solely in order to remedy this defect. Your author, with his single grammar for all the languages, has no such remedy; for what is easy and pleasant in our language is coarse and intolerable to Germans, and so on. The most he could do is to avoid discordant combinations of syllables in one or two languages; and so his 'universal language' would do only for one country. But we ·Frenchmen· don't need to learn a new language to talk only to Frenchmen!

(2) There will be trouble over learning the words of this ·supposed 'new'· language. If each person uses as primitives the words of his own language he won't have much difficulty except that he'll be understood only by the people of his own country; if he is to be understood by foreigners he'll have to *write* what he wants to say, so that the foreigner can look up all the words in the dictionary; and this is too burdensome to become a regular practice. If your man wants people to learn primitive words that are common to every language, he won't find anyone willing to take the trouble. It would be easier to get everyone to agree to learn Latin or some other language in current use than to get them to learn this new one that doesn't yet have •books for practice in reading or •speakers for practice in conversation. If this invented language is to do any good, it seems to me, it would have to be in connection with writing. Suppose I had a big dictionary for all the languages in which I wanted to be understood, and put for each primitive word a symbol—e.g. a single symbol for *aimer*, *amare* and $\phi\iota\lambda\epsilon\iota\nu$: then those who had my dictionary and knew my grammar could translate what I wrote into their own language by looking symbols one by one. But no-one who had anything better to do would take this much trouble. . . . So I don't see that all this has much use. Perhaps I am wrong; I just wanted to write to you all I could conjecture on the basis of the six propositions that you sent me. When you have seen the system, you'll be able to say if I worked it out correctly.

I believe, though, that a system could be devised for constructing a universal language—a system of primitive words and associated symbols—that could be taught very quickly. The crucial thing is *order*—the order in which thoughts enter the human mind. Think about the natural order of the numbers: in a single day one can learn to name every one of the infinite series of numbers, and I can use this

to name a given number to someone who doesn't understand any language that I know; I can write (say) '271' and direct the minds of a Serb, an Eskimo, and a Mongolian to that number although I haven't the faintest idea what *words* their languages use to name it. Well, the same could ·in theory· be done for all the other words needed to express all the other things that the human mind is confronted by. If this ordering were discovered, I'm sure that the language would soon spread throughout the world. Many people would willingly devote five or six days to learning how to make themselves understood by the whole human race.

[Two remarks on the above paragraph: •The sentence about numbers is a rather free rendering of what Descartes wrote, but it's true to his intent. •Descartes's proposal assumes that any thought that is complex enough to be the content of a whole sentence

(1) consists of a number of simpler thoughts,
(2) which go through the thinker's mind in an ordered series,
(3) the order being *natural*, and thus the same for everyone, no matter what language(s) he understands, and
(4) the order being systematic in a way that would let it be learned as the system of numerals can be learned.

Most language-theorists these days would regard **(1)** as dubious; and all would reject **(2)** outright, thus making **(3)** an answer to a question that doesn't arise. And it's hard to believe that Descartes really accepted **(4)**.]

I don't think that your author has thought of this. It isn't suggested by anything in his propositions, and anyway the discovery of this language depends upon the true philosophy [here = 'psychology']; for we need that if we are •to number and order all the thoughts of men or even merely •to separate them out into clear and simple thoughts, which in my opinion is the great secret for acquiring solid science [see Glossary]. If someone explained correctly what the simple ideas are out of which all human thoughts are compounded, and if his explanation were generally accepted, I would venture to expect there to be a universal language that was easy to learn, to speak and to write, and—the main thing—that would help men's judgement by presenting matters to them so clearly that it would be almost impossible for them to go wrong. Contrast that with what we have now: almost all our words have confused meanings, and men's minds have been accustomed to them for so long that there's hardly anything they can perfectly understand.

I maintain that •this language is possible and that the science it depends on can be discovered, thus enabling peasants to be better judges of the truth of things than philosophers are now. But I don't expect ever to see •it in use. That would require changes in the whole scheme of things—*big* ones, turning the world into a terrestrial paradise. . . .

to Mersenne, 18.xii.1629:

I was astonished to hear that you have often seen a corona around a candle, apparently just as you describe it, and that you have a device that lets you see it at will. I rubbed and rolled my eyes in all sorts of ways to try to see something similar, but with no success [but see page 33]. I'm willing to believe that the cause of this ·difference between us· must have to do with the liquid of the eye; this could easily be confirmed if not everyone saw the coronas at the same time. I would like to know when *you* see the coronas: does it happen

•at night, when your eyes are full of the vapours of sleep?
•after you have been reading for a good while?
•when you have gone without food for some time?
•when the weather is dry? or rainy?
•whether you were indoors? or out in the open air?

and so on. When that is settled, I think I could explain the matter. The corona that can be seen around the sun is quite

different; this is proved by the very thing you tell me, namely that the order in which the colours appear is different ·in the two phenomena·. I don't want to dispute the point that Gassendi is so convinced of. I'm willing to believe that he has on several occasions seen a corona with a diameter of 45 degrees; but my guess is that there are coronas of many sizes below that one, and that the ones that appear only as a white or reddish circle are smaller. If the empirical evidence doesn't support that, I admit that I don't yet know what explains the coronas.

Please tell me who the author is who relates that 'Dutch sailors saw three suns separated from each other by a pattern of six rainbows'. The thing is beautiful and regular, and its basis is like that of the phenomenon at Rome.

Thank you for the other comments you sent me. I shall be obliged if you will continue sending me comments on anything to do with nature that you think is worth explaining, and especially anything that is universal and can be checked by anyone—those being the only topics that I have undertaken to deal with. As for particular observations that depend on the reliability of individual witnesses, I have never discussed these and have decided to say nothing about them.

Thank you also for offering to take care of the little treatise that I have in hand. I'm a little ashamed of putting you to so much trouble, but since you have kindly offered to help me I'll send it to you if by God's grace I complete it. It will be a long time before I have it published: although I've decided not to put my name to it, I don't want this work to be released until it has been thoroughly checked by you and other intelligent people (we can find some) who are willing to take the trouble. Your judgement would be enough if I weren't afraid that your affection for me would bias you in my favour. I want this mainly because of ·its implications for· theology, which has been so dominated by Aristotle that it's almost impossible to expound any philosophy without making it seem to be directly contrary to the Faith. Incidentally, please tell me •whether there's anything definite in religion about the extent of the created world, i.e. whether it is finite or infinite; and •whether in all these regions called 'imaginary spaces' there are genuine created bodies. I wasn't keen to touch on this topic, but I believe I'll have to go into it.

[Descartes now responds to questions that Mersenne has put to him, about the psychology of musical sounds and the physics of a vibrating string. The final topic is the physics of falling bodies, and specifically:] something you say Beeckman told you about this. I'll approach this through your last question: Why did I say that the speed is impressed by heaviness as 1 at the first moment, as 2 at the second moments, etc.? Forgive me but that's *not* what I think. Rather, the speed is impressed by heaviness as 1 at the first moment, and by the same heaviness as 1 at the second moments, etc. Now, 1 at the first moment and 1 at the second moment make 2, and with 1 at the third moment this makes 3; in this way, the speed increases in arithmetical progression. This is sufficiently proved, I thought, by the fact that heaviness *stays with* the body that has it, which it can't do without pushing the body downwards at every moment. Consider a mass of lead (say), falling under the force of its own heaviness: God suddenly takes away its heaviness, making it light as a feather; it will go on falling, at least in a vacuum, because it is moving and there's no reason why it should stop; but its speed won't increase. (I'm **assuming** that anything that moves will, in a vacuum, continue to move. I'll try to demonstrate this in my treatise.) But suppose that after some time God restores the heaviness to the lead momentarily and then takes it away again. At the second moment wouldn't the lead be pushed by the force of its heaviness just as it was at the first moment? So wouldn't

its speed be twice as great? And this applies to all the other moments of its fall. It follows that if you let a ball fall 50 feet in an absolute vacuum, no matter what stuff the ball is made of it will take exactly three times as long to fall the first 25 feet as it will take to fall the last 25 feet. But in air it is an entirely different matter. Now back to Beeckman: although what he told you is false, namely that once a falling body reaches a certain point it goes on falling at the same speed, it *is* true that after a certain distance the increase in speed is so small as to be imperceptible. I'll explain to you what he meant to say; ·I can do this· because he and I have discussed this together in the past.

[Descartes starts by saying that Beeckman accepts Descartes's **assumption** and his figures for speed-increase in a vacuum] which I tried to establish twelve years ago at Beeckman's suggestion and still have among my notes from that time. But what follows is something that he has added of his own accord, namely that the faster a body falls the more air-resistance it meets. I was doubtful about this at first, but now that I have examined it carefully I can see that it is true. From this he draws the following conclusion. The force that creates speed always increases uniformly (i.e. by one unit at each moment), whereas the air-resistance always impedes it in a non-uniform way (less than a unit at the first moment, a little more at the second moment, and so on). So, he says, there must be a point at which air-resistance exactly equals the thrust from heaviness, reducing the thing's speed at the same rate that its heaviness is increasing it. At the moment this happens, it is certain that the body doesn't fall more quickly than it did at the immediately preceding moment; and at the subsequent moments the speed will neither increase nor diminish, because from then on the air resistance remains uniform (its previous variation came from variation in the body's speed, and that has been taken away), and the force of the body's heaviness always pushes it in a uniform way.

This argument is plausible, and anyone ignorant of arithmetic might be convinced by it; but as long as you can *count* you can see that it is unsound. If the air resistance increases in proportion to the increase in the speed, the resistance can't increase at a proportionally greater rate than the speed does. Suppose that at the beginning of the motion the speed is 1 if there is no air resistance, and only $\frac{1}{2}$ if there is air resistance (i.e. that the air resistance is also $\frac{1}{2}$). Then at the second moment, when the heaviness adds another unit to the speed, the speed would be $\frac{3}{2}$ if again there were no immediate air resistance. But how much air resistance *will* there be? One might say that the air resistance won't be proportionally as great as it was the first time, because now the body is already moving; and if that's right the proposition that Beeckman infers will be even less true. But one can't say that the resistance will be proportionally greater than it was the first time, i.e. that it will reduce the speed by a half, from $\frac{3}{2}$ to $\frac{3}{4}$, and at the third moment the weight will add yet another unit to the speed, which will be $\frac{7}{4}$ unless the air resistance reduces it by $\frac{1}{2}$, leaving $\frac{7}{8}$. Thus in the succeeding moments the air resistance will be $\frac{15}{16}$, $\frac{31}{32}$, $\frac{63}{64}$, $\frac{127}{128}$, $\frac{255}{256}$, and so on ad infinitum. As you can see from this, the numbers always increase and are always less than a unit. Thus the reduction in speed due to air resistance is never as great as the increase in speed due to heaviness, which is one unit at every moment. The same is true if you say that air resistance reduces the speed by $\frac{2}{3}$ or $\frac{3}{4}$. Yet you can't say this at the first moment it reduces the speed by one unit, for in that case the body wouldn't fall. So it is demonstrated mathematically that what Beeckman wrote is false. If you write to him, I shan't mind if you tell him this—it may teach him not to deck himself out in someone else's feathers.

But to come back to the falling body, one can see from the calculation that the non-uniformity in the speed is very large at the beginning of the motion but almost imperceptible later on, and that it's even less perceptible in a body made of light matter than in one made of heavy matter. Your two excellent experiments can show this empirically. [In the next sentence, *pouce*, which ordinarily means 'thumb', here refers to the length of a thumb, say about three inches.] If you follow the calculation above and represent a moment by a very small space, you'll find that a ball that falls 50 feet will move almost three times as fast over the second *pouce* as it did over the first *pouce*, though it won't move perceptibly faster over the third *pouce* than over the second, and that it will take no longer to fall the first 25 feet than to fall the last 25 feet, save what it needs to fall 2 or 3 *pouces*, and this amount will be quite imperceptible. That's what will mainly happen if the ball is made of light matter, but if it is made of iron or lead, the non-uniformity in the motion won't become imperceptible so early in the journey; yet if the fall is from a great height you will hardly be able to perceive it any better, since the motion will last for a shorter time than it would if the ball were made of light matter.

[Then ten more pages on topics Mersenne had raised: physics, ancient music, and natural expressions of states of mind (laughing, crying).]

to Mersenne, i.1630:

I am sorry about your erysipelas. . . . Please take care of yourself, at least until I know whether a system of medicine can be discovered that is based on infallible demonstrations—which is what I'm investigating right now.

The familiar 'corona' around a candle has nothing in common with the corona that appears around stars, for there's no gap between it and the candle: it's simply secondary light coming from the rays which pass straight through the iris; like a ray of sunlight that enters a room through a small hole and lights up the inside. But you'll see the colours more clearly if you look at a candle from seven or eight feet away, across the edge of a quill or even across a hair held upright straight in front of your eye: place the hair right up against the eye and you'll see a great variety of fine colours. I'll now respond to the rest of your letter point by point [Descartes numbers these items 1–12.].

[**(1)** Remarks about the physics and psychology of listening to music. **(2)** One sentence about the physics of a bouncing ball. **(3)** Sounds again. **(4)** Dismissing as 'ridiculous' something that Beeckman had said about the transmission of sound. Then:]

(5) Most small bodies seen through eyeglasses appear transparent because they *are*; but many of them jumbled together are not transparent, because they aren't joined together in a uniform way, and this jumbled arrangement is enough to make opaque what was originally transparent. You can see this from a piece of glass or a sugar-crystal: when it is crushed it won't be transparent any more, though each part of it is transparent.

[**(6)** One sentence about *qualities*. **(7)** Remarks about how big a concave mirror would have to be to produce heat at a considerable distance. **(8)** Music. **(9)** Christian virtue in relation to natural virtue. **(10)** Criticising someone (unnamed) whose writings on music theory plagiarise the work of others. **(11)** The physics of bells. **(12)** The physics of breaking a cord by putting it under tension. Then an unnumbered paragraph on how someone who knows several languages can fairly quickly get the gist of a new one; also dismissing as 'puerile' some claims about where the Romans and the Germans got their names for God from. Then:]

Thank you for offering to send me Gassendi's observations. I didn't want to put you to so much trouble, since they aren't yet published. All I want are answers to these questions:

- Has he seen a number of sunspots? If so,
- how many has he seen at the same time?
- Did they all move at the same speed?
- Did they always appear to be round?

And also the answers to these:

- Has he observed *for certain* that refraction [see Glossary] due to the air makes stars near the horizon appear higher in the sky than they really are? and if he has,
- did this refraction effect also occur with the moon?; and
- was this refraction effect greater or smaller with stars close to the northern horizon than with stars close to the southern horizon?

But these questions call for such accurate instruments and exact calculations that I doubt if anyone has yet been able to answer them definitively. If anyone could do it, I would expect it to be Gassendi.

I think I heard you say once that you had made an accurate investigation of the weights of all the metals and made a list of them. If that is right, I'd be grateful if you would send it to me if that's not too much trouble.

I would also like to know whether you have any empirical data on whether ·a projectile·—a stone thrown from a sling, or a ball shot from a musket, or a bolt from a crossbow—travels faster and has greater force in the middle of its flight than at the start, and whether its power increases. The common opinion is that it does, but I have reasons for thinking that this is wrong. I find that any projectile must have more force when it is first launched then it has just after that.

to Mersenne, 25.ii.1630:

[This letter mainly consists of six numbered items, preceded by a comment on this correspondence: Mersenne asks questions but says that he only wants answers that Descartes can come up with easily. Descartes comments, in effect: 'Do you think I am omniscient? I can't answer your questions off the top of my head; I'd be willing to take trouble over them if I saw any prospect of finding the answers, but in the case of the questions in your last letter that seems to be impossible.' **(1)** A question about how far sounds travel. **(2)** Listening to sounds—sharps and flats. Then:]

(3) About the bouncing of a ball: what I said was not •that the cause of this is entirely ·what happens to· the air inside the ball, but •that it is mainly due to the continuation of the motion that all rebounding bodies have, i.e. due to the fact that

> any moving thing continues to move for as long as it can; and if it can't continue to move in a straight line it doesn't come to a halt but rebounds in the opposite direction.

The air inside a ball acts as a spring that helps it to rebound; and so does the matter of nearly all other bodies—those that bounce and those that other bodies bounce off, such as the strings of a tennis racket, the wall of a handball court, etc. As for the air that follows or precedes a bouncing ball, that's an imaginary idea of the scholastics, and in my view it is quite pointless.

[**(4)** The physics and psychology of hearing sounds. **(5)** Remarks about devices that were thought to turn water into air; leading on to this:]

Why does the air inside the barrel of a gun resist the force of many men? Not because air is denser than water but because it's composed of parts that can't pass through the

sides of the barrel, and consequently cannot be condensed. Whenever something is condensed, it loses some of its parts and retains the bulkier parts—think about squeezing a wet sponge. If a vessel filled with the most highly rarefied air that could be imagined had no pores that any of the air could escape through, then all the forces in the world wouldn't be powerful enough to condense it *at all*. But in fact all bodies that can be condensed (air included) have some particles that are small enough to pass through the pores of any bodies—even gold and diamonds. . . .

[**(6)** A technical discussion of mirrors. Then an unnumbered paragraph about clocks and stretched cords. Then:]

Thank you for your observations on metals. I couldn't draw any conclusions from these, except that it's hard to perform accurate experiments in this area. If your bells were all the same size, the *difference* between performance in air and performance in water would have been the same for all of them; yet that's not what I find in your results. Also, you treat gold as lighter than lead, which it is clearly the wrong way around. And you treat pure silver as being as heavy in water as in air, and bronze heavier, which is impossible; but perhaps that was a slip of the pen.

[A bit more about coronas and candles, and a request for news about Ferrier's work on telescope lenses.]

⊕ [4.iv.30: To Mersenne, with remarks about sun-spots, mathematical problems posed by Claude Mydorge, children as linguistic inventors, optics, music, and snow.]

to Mersenne, 18.iii.1630:

[Four pages of complaint against Ferrier, who told Mersenne that he was going to live with Descartes but hasn't answered Descartes's long letters on this subject; complaints also about his conduct as a researcher. Then:]

You ask whether there's a discoverable essence of beauty. That's the same as your earlier question as to why one sound is more pleasing than another, except that the word 'beauty' seems most at home with the sense of sight. But in general 'beautiful' and 'pleasing' each signify merely a relation between our judgement and an object; and because men's judgements are so various, there can't be any definite standard of beauty or pleasingness. I can't explain it any better than I did in my treatise on music [*Compendium Musicae*]. I have it right here, and will quote the passage word for word:

> Among the objects of the senses, those most pleasing to the mind are neither the easiest to perceive nor the hardest, but the ones that are not •so easy to perceive that they don't fully satisfy the natural inclination of the senses towards their objects and not •so hard to perceive that they tire the senses.

I explained what I meant by 'easy or difficult to perceive by the senses' in terms of the divisions of a formal garden. If there are only one or two shapes arranged in a single repeated pattern, they will be easier to take in than if there are ten or twelve arranged in different ways. But that's not to say that one design can be called absolutely more beautiful than another; to some people's fancy one with three shapes will be the most beautiful, to others it will be one with four or five, and so on. The one that pleases most people can be called *the most beautiful*, period; but there's no way of fixing what this is.

Secondly, what inclines some people to dance may incline others to weep. This is purely because it stirs up ideas in our memory: those who have enjoyed dancing to a certain tune feel a new wish to dance the moment they hear a similar one; and someone has never heard a galliard without some affliction befalling him will certainly be downcast when he hears it again. This is so certain that I think that if you

whipped a dog five or six times to the sound of a violin, it would begin to howl and run away as soon as it heard that music again.

[Then a paragraph about how different sounds are made by a flute. And finally a request:]

If you happen to meet someone who mentions me and remembers that I am still alive, I would be glad to know what he says about me, and what he thinks I am doing and where he thinks I live.

to Mersenne, 15.iv.1630:

I'm aware of being enormously in your debt for all your kind services; there have been so many of them that I can't thank you for each individually. I assure you that I'll repay you in any way you ask, if I can; and I will always let you know where I am living, provided—please!—that you don't tell anyone else. If anybody thinks that I am planning to write, please try to remove this impression, not to confirm it. I swear that I *wouldn't* be planning to write if I hadn't already told people I do plan to do so. I did this so ·as to motivate myself with the thought· that if I didn't produce anything they could say I hadn't been able to carry out my plan. If people are going to think about me, I am civilised enough to like them to think well of me; but I would much prefer them to have no thought of me at all. I don't *want* fame as much as I *fear* it, because those who acquire it seem to me always to lose some degree of freedom and leisure, which are two things I possess so completely and value so highly that no monarch in the world is rich enough to buy them from me.

This won't prevent me from completing the little treatise that I have begun, but I don't want this to be known, so that I'll always be free to disavow it. My work on it is going very slowly, because I enjoy •learning much more than •writing down the little that I know. I'm now studying chemistry and anatomy simultaneously; every day I learn something that I can't find in any book. I wish I had already started to research into diseases and remedies, so as to find some cure for your erysipelas, which I'm sorry you've been troubled by for so long. Moreover, I'm so contented when acquiring knowledge for myself that I never settle down to add anything to my treatise except under duress, in order to carry out my resolution—namely, that if I live I'll have it ready to send to you by the start of 1633. I'm telling you a definite time so as to put myself under a greater obligation, and so that you can reproach me if I fail to keep to the date. You'll be surprised that I take so long to write a discourse that will be short enough—I should think—to be read in an afternoon. It's because I take more trouble, and think it more important, to learn what I need for the conduct of my life than to spend time publishing the little I have learned. If you're wondering why I haven't persevered with some other treatises that I began in Paris, I'll tell you why: while I was working on them I acquired a little more knowledge than I'd had when I began, and trying to take account of this I was forced to start a new project, a bit bigger than the first. It's like a man who starts building a house and then acquires unexpected riches which so change his status that the building he has begun is now too small for him. No-one would blame him if he made a fresh start on a house more suitable to his wealth. I'm sure I won't change my mind again, because—whether or not I learn anything more—the knowledge I now have will serve my turn and enable me to bring my plan to completion.

[A paragraph exclaiming at Ferrier's conduct, and asking Mersenne to pass the word to Ferrier that Descartes is angry with him. Then remarks about mathematical problems: Descartes has grown tired of mathematics and can't be bothered with tackling such problems, though he is willing

to send Mersenne as many of them as he wants. He presents three geometrical problems, and adds that he could come up with harder ones if he put his mind to work on it, but he doesn't think there's any need for this. Then 'As for your questions:']

(1) The corpuscles that enter a thing during rarefaction and exit during condensation—corpuscles that can penetrate the hardest solids—are of the same substance as things we can see and touch; but don't think of them as atoms or as being *at all* hard. Think of them as an extremely fluid and subtle [see Glossary] substance filling the pores of other bodies. You must admit that even gold and diamonds have pores, very tiny ones; and if you agree also that there's no such thing as a vacuum—·a region of space with literally *nothing* in it·—as I think I can demonstrate, you're forced to admit that these pores are full of matter that can penetrate everywhere with ease.

the next sentence: Or la chaleur et la raréfaction ne sont autrechose que le mélange de cette matière.

literally meaning: Now, heat and rarefaction are simply an admixture of this matter.

what Descartes perhaps meant: When matter is heated and becomes more rare—e.g. when water turns into steam—what's happening is that subtle matter is coming to replace some of its non-subtle matter.

To convince you of this would take more space than a letter permits. I have said this about many other questions that you have put to me; but, believe me, I have never used this as an excuse to conceal from you what I'm planning to write in my treatise on physics. I assure you that I don't have any knowledge that I'm keeping secret from anyone, especially from you whom I honour and admire and owe so much to. But the difficulties of physics that I told you I had taken on are all so linked and interdependent that I couldn't solve one without giving the solutions to all; and the quickest and simplest way I know of for doing that will be in the treatise that I am writing.

[**(2)** Metals. **(3)** Three pages on how far different sounds carry, and why. Then:]

(4) [Descartes doesn't explicitly number this or any of the remaining points.] Your question of theology is beyond my mental capacity but not, it seems to me, beyond the scope of philosophy, because it doesn't connect with anything dependent on revelation, which is what I call 'theology' in the strict sense. It's a metaphysical question, and should be examined by human reason. I think that all those to whom God has given the use of this reason ought to use it primarily in trying to know him and to know themselves. That's the task I began my studies with; and I couldn't have discovered the foundations of physics if I hadn't looked for them along that road. I have studied this topic more than any other and, thank God, I have achieved something in it. At least I think I have found how to prove metaphysical truths in a way that makes them more evident than the demonstrated propositions of geometry—in my own opinion, that is: I don't know if I can convince anyone else. During my first nine months in this country [Holland], I worked on nothing else. I think I told you once about my plan to write something on the topic; but I want to see first how my treatise on physics is received. (If the book that you mention was very well written and fell into my hands, I might feel obliged to reply to it immediately, because if the report you heard is accurate it says things that are very dangerous and, I believe, very false.) However, in my treatise on physics I shall discuss a number of metaphysical topics and especially the following. The mathematical truths that you call 'eternal' have been laid down by God and depend on him entirely, no less than the

rest of his creation. To say that these truths are independent of God is to talk of him as if he were Jupiter or Saturn and to subject him to the Styx and the Fates. Don't hesitate to assert and proclaim everywhere that it's God who has laid down these laws in nature just as a king lays down laws in his kingdom. There's not one of them that we can't grasp if we focus our mind on it. They are all inborn in our minds, just as a king would, if he could, imprint his laws on the hearts of all his subjects. God's greatness, on the other hand, is something that we can't •grasp even though we •know it. But our judging it to be beyond our grasp makes us esteem it all the more; just as a king has more majesty when he is less familiarly known by his subjects, provided they don't get the idea that they have no king—they must know him enough to be in no doubt about that.

You may say:

•'If God had established these truths he would have been able to change them, as a king changes his laws.'

To this the answer is:

•He can change them, if his will can change.

•'But I understand them to be eternal and unchangeable.'

•And so is God, in my judgment.

•'But his will is free.'

•Yes, but his power is beyond our grasp. In general we can say that God can do everything that we can grasp, but not that he can't do what is beyond our grasp. It would be rash to think that our imagination reaches as far as his power.

I expect to put this in writing within the next fifteen days, in my treatise on physics; but I'm not asking you to keep it secret. On the contrary, feel free to tell people whenever you have the opportunity, but don't mention my name. I'll be glad to know what objections I can expect to be made against this view. I want people to get used to speaking of God in a way that is worthier, it seems to me, than the common and almost universal way of imagining him as a finite being.

(5) With regard to infinity. . . . You said that if there were an infinite line it would have an infinite number of feet and of fathoms, so that the infinite number of feet would be six times as great as the number of fathoms. I agree entirely.

•'Then this latter number is not infinite.'

•That doesn't follow.

•'But one infinity can't be bigger than another.'

•Why not? Where is the absurdity? Especially if it is only greater by a finite ratio, as in this case, where one number is reached by dividing the other by six, which doesn't in any way affect the infinity.

Anyway, what basis do we have for judging whether one infinity can be greater than another? If we could grasp it, it would no longer be infinity.

to Mersenne, 6.v.1630:

Thank you for Gassendi's account of the corona. As for the bad book [mentioned a page back], I'm no longer asking you to send it to me, because I have decided on other projects, and it would be too late to carry out the plan that made me say that if it were a well-written book and fell into my hands I would try to reply immediately. ·The plan was this:· I thought that even if there were only thirty-five copies of the book, if it were well written it would go to a second printing and circulate widely among curious people, however much it might be prohibited. I thought of a remedy that seemed more effective than any legal prohibition. My idea was that before the book was reprinted secretly it should be printed with permission ·from the authorities·, with each paragraph or each chapter followed by arguments refuting its conclusions.

I thought that if it were sold thus publicly in its entirety with a reply, no-one would care to sell it in secret without a reply; so nobody would encounter its false doctrine without at the same time being disabused of it. . . . I expect you'll say that we don't know whether I *could* have replied to the author's arguments. I can only reply that at least I would have done my best; and since I have many arguments that convince *me* of the contrary of what you report as being in the book, I ventured to expect them to convince others as well. I trusted that •truth expounded by an undistinguished mind would be stronger than •falsehood maintained by the cleverest people in the world.

As for the eternal truths, I repeat that they are true or possible only because God knows them as true or possible; and he doesn't have this knowledge in a way that implies that they are true independently of him. If men really understood the sense of their words, they could never say without blasphemy that the truth of anything is prior to God's knowledge of it. In God, willing and knowing are a single thing in such a way that by the very fact of willing something he knows it and it is only for this reason that such a thing is true. So we mustn't say that even if God didn't exist these truths would be true; for the existence of God is the first and the most eternal of all possible truths and the sole source of all the others. What makes it easy for this to be misunderstood is that most people don't regard God as a being who is infinite and beyond our grasp, the sole author on whom everything depends; they get no further than the syllables of his name and the knowledge that 'God' means •what *Deus* means in Latin and •what is worshipped by men. Those whose thoughts go no higher than that can easily become atheists; and because they perfectly grasp mathematical truths and don't perfectly grasp the truth of God's existence, it's no wonder they don't think the former depend on the latter. But they should rather take the opposite view that because •God is a cause whose power goes beyond the limits of human understanding and •the necessity of these other truths doesn't put them out of our reach, these truths are less than, and subject to, the incomprehensible power of God. What you say about the Second Person of the Trinity being generated by the First doesn't conflict with what I'm saying, I think; but I don't want to get into theology, and I'm already afraid that you will think that my philosophy is going too far when it ventures to express an opinion on such lofty matters.

to Mersenne, 27.v.1630:

(1) You ask me by what *kind* of causality God established the eternal truths. I reply: by the same kind of causality as he created all things, namely as their efficient [see Glossary] and total cause. It is certain that he is the author of the essence of created things as well as of their existence; and this essence is just these eternal truths. I don't think of them as being given off by God as light-rays are given off by the sun; but I know that

- •God is the author of everything, and
- •these eternal truths are something, and therefore
- •he is their author.

I say that I *know* this, not that I conceive it or *grasp* it; because we can know that God is infinite and omnipotent although our soul can't grasp or conceive him because it is finite. In the same way we can touch a mountain with our hands but we can't put our arms around it as we could around (for example) a tree. To grasp something is to embrace it in your thought; to know something you need only touch it with your thought.

You also ask what *necessitated* God to create these truths; and I reply that ·nothing did·: he was as free to

make it not true that the radii of a circle are all equal

as he was to

not create the world.

And it's certain that •these truths are no more necessarily attached to his essence than are •other created things. You ask what God *did* in order to produce them. I reply that from all eternity he willed and understood them to be, and by that very fact he created them. Or, if you restrict the word 'created' to the existence of *things*, then he established them and made them. Willing, understanding and creating are all the same thing in God, no one of them is prior to the others even conceptually.

(2) As for the question 'Is it in accord with God's goodness to damn men for eternity?', that's a theological question, so please allow me to say nothing about it. It's not that the arguments of free thinkers on this topic have any force—indeed they strike me as frivolous and ridiculous—but I think that when truths depend on faith and can't be proved by natural demonstration it's not doing them justice to want to support them by human reasoning and mere probabilities.

(3) As for God's freedom, I entirely agree with what you report Father Gibieuf to be maintaining. I didn't know that he had published anything, but I'll try to have his treatise sent from Paris as soon as possible so that I can see it. I'm delighted that my opinions coincide with his, because that assures me that they are, at least, not too extravagant to be maintained by very able men.

Topics **(4)**, **(5)**, **(6)**, **(8)**, **(9)** and **(11)** in your letter are all theological matters, so if you please I'll say nothing about them. As for **(7)** the point about birth-marks caused on children by their mothers' imagination, I quite agree it is worth examination, but I'm not yet convinced.

(10) Given that •God leads everything to its perfect state and that •nothing is annihilated, you ask 'Then what is the perfect state of a dumb animal? and what becomes of its soul after death?'. These questions are within my field (·rather than being outside it in theology·), and I reply that God leads everything to perfection collectively but not individually. The very fact that particular things perish and others appear in their place is one of the principal perfections of the universe. As for animals' souls and other forms and qualities, don't worry about what becomes of them. I'm about to explain all this in my treatise, and I expect to make it all so clearly understood that no-one will be able to doubt it.

⊕ [ix or x 1630: Descartes writes to Beeckman saying that he has been reliably informed that Beeckman has been publicly boasting about how much he has taught Descartes. He advises him that such conduct will get him laughed at rather than admired, and. . . .on and on it goes.]

to Beeckmann, 17.x.1630:

[Two pages in which Descartes again addresses the question of what he has learned from his former friend, and the morality of Beeckman's boasting about it. Eventually he works his way around to this:] But I can see from your latest letters that in all this you weren't sinning out of malice but were in the grip of some kind of illness. So from now on I'll be sending you sympathy rather than complaints. And now—because of our former friendship—I'd like to advise you of certain remedies that may help you to recover.

Consider first what are the things that one person can teach another: you'll find they are languages, history, observational data, and clear and certain demonstrations (like those of geometers) that bring conviction to the mind. As for mere opinions and received doctrines like those of the philosophers, simply repeating them isn't teaching them.

Plato says one thing, Aristotle another, Epicurus another, Telesio, Campanella, Bruno, Basson, Vanini, and the innovators all say something different. Which of these people do you think has anything to teach (I won't say *me*, but) anyone else who cares about wisdom? Doubtless it's the man who can first convince someone by his arguments, or at least by his authority. But if someone *comes to believe* something without being brought to this by any authority or argument, having merely heard many people say it, this doesn't mean that anyone has *taught* him anything. It may even happen that •he really knows it, being led to believe it by true reasons, and that •no-one before him has ever known it—those who believed it had inferred it from false principles, so that they didn't *know* it. If you think carefully about this you'll easily see that I have never learned anything but idle fancies from your *Mathematical Physics*, any more than I have learned anything from the ·comic-verse parody· *Batrachomyomachia*. Have I ever been influenced by your authority or convinced by your arguments? You have said that I believed some of your views as soon as I understood them. But my accepting them at once doesn't show that I learned them from you; I accepted them because I had already arrived at them for myself. Don't make your sickness worse by dwelling on the fact—which I here openly acknowledge—that I have sometimes accepted what you said; because in discussing philosophy even the most incompetent person can't help saying things that *happen* to coincide with the truth. Many people can know something that none of them learned from the others; and it's ridiculous to fuss as you do about distinguishing the items of knowledge that are yours from the ones that aren't—as if items of knowledge were pieces of land or sums of money. If you know something, it is completely yours, even if you have learned it from someone else.

[Descartes devotes about six pages to hammering away at the idea of 'ownership' of propositions or of sciences, suggesting different ways of taking this, and mocking them all. Of Beeckman's claim to have discovered something about the vocal cords, Descartes asks 'Then did Aristotle steal it from you?' He then addresses Beeckman's complaint that Descartes has never praised him for his discoveries, although he has often publicly praised Descartes. Reply: that praise wasn't the act of a friend, because Descartes—longing for solitude and quiet—had asked Beeckman not to talk about him to others. Eventually:]

You accuse me of having sometimes put myself on a level with the angels. There's no reason or basis for this—can you really be *so* out of your mind that you believe it? But I realise that your sickness may be at an advanced stage, so ·I ought to be patient, and in that spirit· I'll explain what may have led you to make this complaint. When philosophers and theologians want to say that P is in conflict with reason, they often express this by saying that *not even God* could make it the case that P. This turn of phrase has always struck me as too bold; so on occasions when others might use it I prefer the more modest statement that *not even an angel* could do it. If that's why you say I put myself on a level with the angels, you could as well say that the wisest people in the world put themselves on a level with God! It's hard on me to suspect me of vanity because of conduct that displays extraordinary modesty.

[A final page is spent saying that Descartes is not writing in anger but purely in a sympathetic attempt to help a sick friend.]

⊕ [4.xi.30: Descartes writes to Mersenne about his personal relations with Beeckman, Ferrier, Mydorge and others. A paragraph on the vibration of taut strings. A message of good will to Gibieuf.]

to Mersenne, 25.xi.1630:

[Descartes tries to head off damage to his relations with Mersenne caused by things Beeckman has said. Then:]

I'm sorry for Ferrier's troubles, though he has brought them on himself. As for my letter to you about him [we don't now have that letter], since you have thought it proper to show it to Mydorge I won't make a fuss about that; but I'd have preferred you not to put it actually in his hands. For one thing, my letters are usually written with too little care to be fit to be seen by anyone except the addressee. Also, I'm afraid that he may have inferred from the letter that I'm planning to have my *Optics* printed, because I think I mentioned it in some parts of the letter other than the last paragraph which you say you cut off. I would like this project to remain unknown, because at my rate of work it won't be ready for a long time. I want to include an account of the nature of colours and light, which has held me up for six months and still isn't half finished; but it will be longer than I expected and will contain something like a complete physics. I think it will serve to keep my promise to you to have my *World* finished in three years, because the *Optics* will be something like an abridged version of that. After that I don't think I'll ever have anything else printed, at least in my lifetime. I'm too much in love with the fable of my *World* to give it up if God lets me live long enough to finish it; but I can't answer for the future. [The 'fable' referred to here is a many-chapter account of a 'new world', an imagined possible world, in terms of which Descartes discusses the physics and cosmology of the actual world.] I think I'll send you this discourse on light as soon as I've finished it, before sending you the rest of the *Optics*; ·I'm in hurry about the former·, because in it I aim to give *my* account of colours, which requires me to explain how the whiteness of the bread remains in the Blessed Sacrament; and I want to have this examined first by my friends before everyone sees it. As for the rest of the *Optics*, although it won't be finished for some time, I'm not afraid of anyone's getting in ahead of me, because I'm sure that no-one will write anything that coincides with my account—unless they take it from my letters to Ferrier.

Whenever you encounter someone who thinks that I'm planning to write something, please do what you can to get him to think otherwise, convincing him that nothing could be further from my mind. In fact, once the *Optics* is finished I plan to study conscientiously, for the sake of myself and my friends, trying to discover something useful in medicine. I don't want to waste time writing for others who would mock me if I did badly, be envious of me if I did well, and show me no thanks if I produced a masterpiece. . . .

[Descartes goes on to say that he is too focussed elsewhere to be able to deal with Mersenne's questions, though he briefly answers one, concerning the vibration of the strings of a lute. Then remarks about the safest way to send letters. Then:]

I am most obliged to you for taking the trouble to send me an extract from the manuscript you mentioned [see page 15]. The shortest way I know to reply to his and other atheists' arguments against the existence of God is to find an evident demonstration that will make everyone believe that God exists. I can boast of having found one that satisfies me entirely, making me know that God exists more certainly than I know the truth of any proposition of geometry; but I don't know whether I could make everyone understand it the way I can. I think it's better not to treat this matter at all than to treat it imperfectly. The universal agreement of all nations is enough to maintain God against the atheists' insults, and no individual should argue with them unless he is very certain of convincing them.

·The reception of· my *Optics* will show whether I am capable of explaining my conceptions and convincing others of truths of which I have convinced myself. I doubt it very much! But if it turns out that I *can* do this, I don't rule out my some day completing a little *Treatise of Metaphysics* that I began when in I was Friesland. [This refers to the *Meditations*.] Its chief aim is to prove *the existence of God and of our souls apart from our bodies*, from which it follows that our souls are immortal. It makes me angry to see that there are people so bold and so impudent as to fight against God.

⊕ [2.xii.30: Descartes writes at length to Ferrier, setting forth his grounds of complaint; briefly to Condren about his relations with Ferrier, and to Mersenne mainly on the same topic.]

to Mersenne, 23.xii.1630:

[In an intense first paragraph, Descartes assures Mersenne of his unshakable affection for him, begging him not to think otherwise if there are long periods during which Descartes doesn't write to him. When he doesn't write, he says, it's because he has nothing to say. Then:]

What I'm working at now is—·metaphorically speaking·—sorting out chaos so as to get light to shine from it! This is one of the hardest and most important matters I could ever undertake, because it involves almost all of physics. I have to take into account many different things all at once if I'm to find an angle on all this that will let me tell the truth without doing violence to anyone's imagination or shocking received opinion. That's why I want to spend a month or two thinking solely about this topic. [And then two more pages touching on about eight minor topics.]

to Balzac, 15.iv.1631:

[Descartes explains at length why he hasn't written during the past eighteen months, insisting that this didn't express any disregard for Balzac, and saying that now that Balzac is in Paris, Descartes would like to be there too so as to have conversations with him, if he weren't kept in Amsterdam by 'the most important work I could ever devote myself to'. He continues:]

Please don't ask me what this task is, for it would embarrass me to tell you. I've become so philosophical that I despise most of the things that are ordinarily valued, and I value others that are usually disregarded. Still, I'll tell you about it more openly some day, if you wish; for your own views are far removed from those of the majority, and you have often shown that you regard me more highly than I deserve. For the time being I'll settle for telling you that I'm no longer of a mind to commit things to paper as you've seen that I used to do. It's not that I wouldn't set great store by reputation if I could be sure of getting an illustrious one like yours, but as for a middling and uncertain reputation, which is all I could look forward to, I value that much less than the peace of mind that I have now. [Descartes gives details: ten hours sleep each night, and fruitful inter-mingling of day-dreams with night-dreams. Then on to further compliments.]

⊕ [25.iv.31: A lavishly friendly letter from Balzac to Descartes, whose letter •reached Balzac when he was in 'the blackest mood I have ever been in', and •somewhat reduced his sadness. He announces his intention to go to Amsterdam because Descartes is there.]

to Balzac, 5.v.1631:

When I read that you are planning to come here, I rubbed my eyes to see whether I was awake. . . . But I don't find it so strange that a mind as great and generous as yours should be unable to adapt itself to the constraints of service that one is subject to at Court; and since you seriously assure me that God has inspired you to retire from the world, I would think it a sin against the Holy Ghost if I tried to deflect you from such a pious resolution. [The idea is that going to Amsterdam would be one way of 'retiring from the world'. There's no mention of divine inspiration or retiring from the world in Balzac's letter of 25.iv.31.]

You must excuse my enthusiasm if I invite you to choose Amsterdam for your retreat, and to prefer it not only to the monasteries of the Franciscans and the Carthusians that many good folk retire to, but also to the finest houses in France and Italy, and even to the famous Hermitage where you spent the past year. No matter how polished a country house may be, it always lacks countless conveniences that are found only in towns, and even the solitude one hopes to find there turns out never to be quite perfect. There, I agree, you'll find a stream that would make the greatest talkers start day-dreaming, and a valley so secluded that it could make them ecstatic; but it can easily happen that you also have neighbours who will bother you at times, and their visits will be even more of a nuisance than the ones you receive in Paris. In this large town where I live [Amsterdam], by contrast, everyone but myself is engaged in trade, and thus is so focussed on his own profit that I could live here all my life without ever being noticed by anyone. I take a walk each day amid the bustle of the crowd, with as much freedom and repose as you could get in your avenues, and I don't *attend to* the people I see, any more than I would to the trees in your woods or the animals grazing there. [More to the same effect, and then:] I don't know how you can be so fond of the Italian air, through which one often breathes in diseases—Italy where the heat of the day is always unbearable, the cool of the evening is unhealthy, and the darkness of night is a cover for thieves and murderers. If you're afraid of the northern winters, tell me what shades or fans or fountains could shield you from the burning heat in Rome as a stove or a roaring fire would protect you from the cold here?. . . .

⊕ [2.vi.31: Descartes writes to Reneri, dealing with a problem Reneri had put to him regarding barometers, the weight of air, etc.]

to Villebressieu, summer 1631:

You saw these two results of my fine rule—my natural method—in the discussion I was obliged to have in the presence of Cardinal de Berulle, Father Mersenne and all that great and learned company assembled at the Cardinal's 's palace to hear Chandoux lecture about his new philosophy. I made the whole company recognise what the art [see Glossary] of right reasoning can do for the minds of those who aren't very learned, and how much better founded, more true and more natural my principles are than any others that are currently accepted in the learned world. You were as convinced as any of those who took the trouble to beg me to write them up and publish them.

I read through and examined most of the things in your memoir during my recent trip to Dordrecht, from which I have returned to await you at Amsterdam, where you'll find me in good health. . . . There I'll tell you what I think about all these things. I'll advise you to put most of your ideas in the form of propositions, problems and theorems, and to publish them so that someone else will feel obliged to provided the needed research and observations. That's

what I would like everybody to do, so that many people's experiments would help to discover the finest things in nature, and to build a physics that is clear, certain, based on demonstrative proof, and more useful than what is commonly taught. You for your part could greatly help to disabuse poor sick minds concerning the adulteration of metals that you have worked on so hard—twelve years of assiduous work and many experiments—without having found any truths. Your work would be generally useful as a warning to individuals of their errors.

It seems to me too that you have already discovered some general principles of nature, such as that •there is only one material substance, which gets from an external cause its movements or ability to move from place to place, and that •from this it acquires the different shapes or modes that make it into the kind of thing we see in the primary compounds that are called 'the elements', namely earth, water, air and fire. And you have pointed out •that what marks off these elements or primary compounds from one another consists only in differences ·of size and shape· between the fragments—the small and large particles—of this matter; and that the matter often changes from one element into another when heat and movement change the larger particles into smaller ones, or the absence of heat and movement changes them back again; and the mingling of these four compounds results in a mixture that can be called 'the fifth element'. You call this the 'principle' [see Glossary] or the most noble preparation of the elements, because it is (you say) a productive seed. . . .which takes a specific form in all the noble particular individuals that are for everyone an object of wonder. I'm quite in agreement with your view that the four elements that constitute matter and the fifth that results from them can jointly constitute an animal or plant or mineral, and that when this happens all five are so changed that none of them continues to be what it was. All this suits my style of philosophising very well, and it accords admirably with all the mechanical experiments I have conducted in this field.

⊕ [x.31: Descartes writes to Mersenne on personal matters (including messages to others) and the physics of falling bodies and of sounds.]

to Mersenne, x or xi 1631:

[Descartes says that most of Mersenne's latest questions are ones he has already answered in earlier letters. He says a little about musical intervals, going on to compare 'what your musicians say about dissonances being agreeable' with 'someone who says that olives, though bitter, sometimes taste better than sugar'. Then:]

I'm not retracting what I said about the speed of bodies falling in a vacuum. If we (mistakenly) suppose a vacuum, which everyone does, the rest follows demonstratively. I'll try to explain what heaviness, lightness, hardness, etc. are in the two chapters that I promised to send you by the end of this year. . . .

[Some personal matters, explaining a gap in correspondence, asking about Ferrier's whereabouts and activities, and reporting on Reneri's recent professorship. Mersenne's last letter asked a question about whether and why certain musical intervals are 'better' than certain others. Descartes replies that he answered that in the book on music that he wrote a dozen years earlier, quotes the relevant passage, and then comments: 'This can be proved not only by reason but also by experience—with the voice and with several other instruments.' Then:] You ask me to reply to your earlier question as to whether 120 is the only number that has the property that you noticed in it, [Namely, the property of being equal to twice the sum of its aliquot parts, i.e. the sum of its whole-number

divisors (including 1 but excluding 120).] My response is that I don't know and have never wanted to know. Investigating questions like this usually requires more patience than intelligence, and the answers are not useful. . . . [Then something about falling bodies—Mersenne has asked a question but hasn't made clear what question it is. Then:] I think I could now determine the rate at which the speed of a falling body increases, not only in a vacuum but also in real air. But my mind is now full of other thoughts, so I don't have time to investigate this, and there wouldn't be much profit in it. *Please* •excuse me for writing to you in such a scrappy way, and •accept that my letters would be shorter if they were they composed with greater care.

⊕ [i.32: Descartes writes to Golius expressing pleasure that Golius has agreed to read something [apparently a lengthy discussion/solution of a mathematical problem] that Descartes has sent him, and insisting that Golius must frankly report on all his dissatisfactions. Descartes himself already knows of some imperfections in the work, and is sure there must be others.]

to Golius, 2.ii.1632:

I'm much obliged to you for your favourable judgement on my analysis, for I know very well that it is mostly an expression of your courtesy. Still, it gives me a somewhat better opinion of myself because I see that you examined the analysis thoroughly before passing final judgement on it. I'm very pleased that you would like examine in the same way the question of refraction. I'll tell you how I would want to go about it if it were my research project. I'm hoping that this will be a help, if only in strengthening your motivation to push through all the experimental difficulties.

[Descartes now offers an abstract picture of a proposed apparatus, accompanied by an account of what it all means and how he would use it. We can spare ourselves these details. The aim of the apparatus is to enable the experimenter to know at exactly what angle a ray of light meets a water-surface, and at exactly what angle it leaves it. (The hope is that when enough readings for different angles have been collected it will be possible to devise a general rule covering them all.) Descartes presents all this with a great deal of careful practical detail. He ends the letter thus:]

No doubt if you hunt for them you'll find other inventions better suited to the present experiment than the one I have described; but I know that you're engaged in many other activities, and it occurred to me that if you haven't yet given the matter any thought, I might lighten your burden a little by telling you about this apparatus.

to Mersenne, 5.iv.1632:

It's too long since I heard from you, and I'll start to worry about your health if you don't write to me soon. I expect that you've been waiting for me to send you the treatise that I promised you for this Easter. It's almost finished, and I could keep my promise if I thought you would hold me to the letter of it; but I would prefer to keep the treatise for a few months, to re-read it and tidy it up and also to draw some needed diagrams. They are a burden, because I am, as you know, a very poor draughtsman and careless about matters that don't help me to learn anything. If you blame me for having so often broken my promise, my defence is that I have put off writing the little I know simply because I hoped to learn more that I could add to the book. For instance, in the version of the treatise that I now have in hand, after generally describing the stars, the heavens [see Glossary] and the earth, I didn't intend to give an account of particular bodies on the earth but only to treat of their various qualities; but now I am

including also some of their substantial forms [see Glossary], and trying to clear the path to eventually discovering them all through reasoning and experience. That's what I have been busy with recently—conducting a variety of experiments to discover the essential differences between oils, alcohols, ordinary water and acidic liquids, salts, etc. The only reason I'm delaying the payment of my debt is that I want to pay it with interest. But it will be for you to decide whether what I send you is worth anything. I'm afraid that it may fall so far short of your expectations that you won't be willing to accept it in payment!

In your last letter you wrote to me about a man who boasted of being able to solve mathematical problems of all kinds. I would be glad to know if you have set him the problem of Pappus that I sent to you. I admit that I took five or six weeks to find the solution, and that if anyone else discovers it I'll acquit him of being ignorant of algebra!

to Mersenne, 10.v.1632:

You tell me that you have Scheiner's description of the phenomenon of parhelia [see Glossary] at Rome. If it's more detailed than the one you sent me before, I'd be most obliged if you would take the trouble to send me a copy.

Do you know of any author who has made a special collection of the various accounts of comets? If so, I would be grateful to be told of him; because for the past two or three months I have been quite caught up in the heavens. I have discovered their nature and the nature of the stars we see there and many other things that a few years ago I wouldn't have been optimistic about discovering; and now I have become so bold that I'm trying to explain the position of each fixed star. Although the stars seem very irregularly scattered through the heavens, I'm sure that they are ordered in a way that is natural, regular, and determinate. Discovering this order is the key to, and foundation of, the highest and most perfect science of material things that men are capable of. If we had it, we could discover *a priori* [see Glossary] all the different forms and essences of terrestrial bodies, whereas without it we have to content ourselves with guessing them *a posteriori* [see Glossary] from their effects. I don't know of anything that could give me more help in discovering this order than the empirical study of many comets. As you know, I have no books, and even if I had I would begrudge the time spent in reading them; so I would be very glad to find someone who has collected the things that I couldn't easily get from the literature—consulting individual authors each writing about only one or two comets.

You once told me that you knew some people who were so dedicated to the advancement of science that they were willing to make every kind of experiment at their own expense. I would like it if someone with this attitude were to present the natural history of celestial phenomena, doing this in Bacon's way,

- describing the present appearances of the heavens without any explanations or hypotheses,
- reporting the position of each fixed star in relation to its neighbours,
- listing their differences in size, colour, visibility and brilliance etc.,
- reporting on how far this account squares with what ancient astronomers have written, and what differences are to be found, and
- including all the data we have on comets, with a table of the path of each of them, like the tables Tycho Brahe made of the three or four that he observed, and
- including the variations in the ecliptic and apogee of the planets.

[Descartes follows the fourth of those items with an explanation of his confidence that there will be differences between modern observations and ancient ones: 'I'm sure that the supposedly "fixed" stars are constantly changing their relative positions.' Now back to what he says about the whole list:] Such a work would be more useful to •scientists in general than might seem possible at first sight, and it would save •me from a great deal of trouble. But there's no hope of anyone's doing this, just as there's no hope of finding the answers to my present questions about the stars. The science I'm describing is beyond the reach of the human mind, I believe, and yet I'm so foolish that I can't help dreaming of it, though I know that this will only make me waste my time as it has been doing for the past two months. In that time I have made no progress with my treatise; still, I'll finish it by the date I told you. . . .

to Mersenne, vi.1632:

Thank you for the letters you kindly sent me. I am now at Deventer, and I'm not going to leave here until the *Optics* has been completed. For the last month I have been wondering whether to include in *The World* an account of how animals are generated, and have decided not to because it would take me too long. I have finished all I had planned to cover regarding inanimate bodies. All I have left to do now is to add something about the nature of man, and then to make a fair copy of the work and send it to you. But I shan't risk saying when that will be—I have already failed to keep my promises so often that I'm ashamed.

As for your questions, I do not believe that sound is reflected at a point as light is, since it is not propagated like light in rays which are all straight; rather, it spreads out in all directions in a circle. [He says a little more about this, accompanying it with a sketch showing this difference between light and sound. Then one sentence on a mathematical point about sounds. Then:]

The refraction of sounds can't be measured exactly, any more than their reflection can. . . . As for my method of measuring the refractions of light, **I introduce a correspondence between the sines of the angles of incidence and the angles of refraction**; but I'd be glad if this was not yet made public, because the first part of my *Optics* will be devoted entirely to this topic. It's not easy to determine what shape a line under water will be seen to have, because the image's location is not fixed either in reflection or in refraction, as optics theorists are commonly convinced. [The passage in bold type is Descartes's first announcement of his 'sine law' about how angles of refraction relate to angles of incidence—the problem he implied, four months earlier (see page 24), that he wasn't working on. This important result was achieved first by Willebrord Snell and then *independently* by Descartes; it is still commonly referred to as 'Descartes's Law' (in France) or as 'the Snell-Descartes law' (elsewhere).]

[The letter concludes with a paragraph about some mathematical problems, with mentions of Golius and Mydorge.]

⊕ [Summer 32: Descartes writes to Mersenne a letter of which we have only a fragment, date uncertain. Annoyance with Ferrier; more about the physics of sound; brief suggested explanations of events reported by Mersenne—a one-stringed instrument that sounds like a trumpet, and an experiment in which a bullet from a musket penetrated the target further when it was 100 paces away than when it was 20 paces away.]

to Mersenne, xi or xii 1632:

. . . .As for what you tell me about Galileo's calculation concerning the speed at which falling bodies move, it has no relation to my philosophy [here = 'physics']. According to my philosophy the relation between

two spheres of lead, one weighing 1lb and the other weighing 100lb

will be different from the relation between

two wooden spheres, one weighing 1lb and the other weighing 100lb

and indeed different from the relation between

two spheres of lead, one weighing 2lb and the other weighing 200lb.

Galileo doesn't distinguish amongst these cases, which makes me think that he can't have hit on the truth.

I would like to know what he says about the ebb and flow of the tides, that being one of the things I have had the greatest trouble in understanding, and though I think I have mainly succeeded, some of the details still aren't clear to me.

[A paragraph each on •Ferrier's doings, •the placing of the holes in a wind-instrument, and •the physics of sounds. Then]

In *The World* I'll be saying rather more about *man* than I had intended; I'm now aiming to explain *all* the main functions in man. I have already written about the vital functions—digestion, heart-beat, the distribution of nourishment, etc.—and about the five senses. I'm now dissecting the heads of various animals, as an aid to explaining what imagination, memory, etc. consist in. I have seen the book *De Motu Cordis* [= 'The Movement of the Heart'], by the English physiologist William Harvey, which you previously spoke to me about. I find that it differs slightly from my own view, although I didn't see it until I had finished writing on this topic.

⊕ [7.ii.33: Descartes writes to Wilhelm about a student of Wilhelm's in whom Descartes has taken an interest.]

⊕ [22.vii.33: Descartes writes to Mersenne about •letters of Mersenne's that have gone astray, •the physics of sounds, •a report of an *horloge sans soleil* (= 'clock that doesn't use the sun') which Descartes greets with scepticism but not outright rejection, and •his news that his treatise is almost finished.]

to Mersenne, late xi.1633:

[This fragment of a letter is all we have of it.] This is the point I had reached when your letter of 11.xi arrived. I was inclined to act like a bad debtor who asks his creditor for 'a little more time' when he sees the day of reckoning approaching. In fact I had intended to send you my *World* as a New Year gift, and only two weeks ago I was determined to send you at least a part of it, if the whole work couldn't be copied in time. But I have to say that I inquired in Leiden and Amsterdam whether Galileo's *World System* was available, for I thought I'd heard that it was published in Italy last year. I was told that it had indeed been published but that all the copies had immediately been burnt at Rome, and that Galileo had been convicted and fined. I was so astonished at this that I almost decided to burn all my papers or at least to let no-one see them. For I couldn't imagine that he—an Italian and, as I understand, in the good graces of the Pope—could have been made a criminal for any reason except than that he tried, as he no doubt did, to establish that the earth moves. I know that some Cardinals had already censured this view, but I thought I'd heard it said that it was nevertheless being taught publicly even in Rome. I must admit that if the view is false then so are the foundations of my philosophy, for it clearly follows from them; and it's so closely interwoven in every part of my treatise that I couldn't remove it without damaging the whole work. But I utterly didn't want to publish a discourse in which a single word would be disapproved of by the Church; so I preferred to suppress it rather than to publish it in a mutilated form.

I've never had an inclination to produce books, and I would never have completed this one if I hadn't been bound by a promise to you and some of my other friends. . . . But after all I am sure you won't send a bailiff to force me to pay my debt! And perhaps you'll be quite glad to be spared the trouble of reading wicked doctrines. There are already so many views in philosophy that are plausible and can be maintained in debate that if my views aren't more certain than that and can't be approved of without controversy, I don't want to publish them—ever. But having promised you the whole work for so long, I would be ashamed to try to buy you off with trifling pieces; so as soon as I can I shall, after all, let you see what I have written, but please allow me a year's grace so that I can revise and polish it. . . . Please also tell me what you know about the Galileo affair. [Then a final paragraph about the physics of vibrating strings.]

⊕ [12.xii.33: Descartes writes to Wilhelm expressing humble gratitude for Wilhelm's good opinion of him.]

⊕ [end of 33: Descartes writes to Stampioen offering his solution of a geometrical problem that Stampioen had sent him and, at the latter's request, sending him a geometrical problem in return.]

to Mersenne, ii.1634:

[He opens with assurances that he doesn't infer, either from Mersenne's two-month silence or from his own failure to send Mersenne the promised 'something of my philosophy', that Mersenne's affection for him has waned. Then:] I have decided wholly to suppress the treatise I have written, and to forfeit almost all my work of the last four years, in order to obey the Church's ban on the view that the earth moves. But I haven't yet seen that the ban has been ratified by the Pope or the Council—only by the Congregation of Cardinals set up for the censorship of books—and I would like to know whether the authority of that Congregation is sufficient to make the ban an article of faith; I would also be glad to hear what people in France think about this affair. The Jesuits have helped to get Galileo convicted: Scheiner's book ·*Rosa Ursina*· clearly shows that they are no friends of Galileo's. But the observations in the book provide such good evidence that the sun *doesn't* move that I can't believe that Father Scheiner himself doesn't—in his heart of hearts—share the Copernican view [that the earth moves and the sun doesn't]; and this astonishes me so much that I don't trust myself to write down what I think about it.

As for myself, I seek only repose and peace of mind—goods that can't be possessed by anyone who is angry or ambitious. I'll still have things to do, but for the time being I intend only to instruct myself. I don't think I can instruct others, especially those who would feel threatened by the truth, fearing that if it were known it would deprive them of the reputation they have already acquired through views that are false.

to Mersenne, iv.1634:

It seems that my last letter to you has been lost. . . . In it I told you at length my reason for not sending you my treatise. I'm sure you would find it so just that, far from blaming me for deciding never to show it to anyone, you would be the first to urge me to make that decision if I hadn't already done so.

Doubtless you know that Galileo was recently censured by the Inquisition and that his views about the movement of the earth were condemned as heretical. Now, all the things I explained in my treatise, including the thesis that the earth moves, were so interdependent that the discovery that one of them is false shows that all the arguments

I was using are unsound. I *thought* they were based on very certain and evident proofs, but I wouldn't wish, for anything in the world, to maintain them against the Church's authority. 'Not everything that the Roman Inquisitors decide is automatically an article of faith, but must first be approved by a General Council'—well, perhaps, but I'm not so fond of my own opinions as to want to maintain them by splitting hairs. I want to live in peace and to continue the life I have begun under the motto *Bene vixit, bene qui latuit* [Latin, by Ovid, meaning 'He lives well who is well hidden']. So I'm more •happy to be delivered from the fear that this work would make my social circle larger than I wanted it to be than I am •unhappy at having lost the time and trouble I spent on its composition.

[Mersenne has reported that musicians of his acquaintance had disagreed with certain of Descartes's views about musical intervals. Descartes finds their views 'so absurd that I hardly know how to respond'. Then he responds. Then]

What causes a stone one has thrown to stop moving? Clearly, it is air resistance—something one can easily feel. But the reason why a bent bow springs back is more difficult, and I can't explain it without referring to the principles of my philosophy, which I'm apparently obliged to keep quiet about from now on.

There has been a rumour around here that not long ago a comet was seen; if you have heard anything about this, please let me know. Also: you told me in a previous letter that some people you knew could help to perform the experiments that I wanted done; so let me tell you about an experiment that was published not long ago in ·Leurechon's· *Mathematical Games*. It involves a large cannon placed on flat ground, pointing straight up at the sky, ·and fired·. I would like this experiment performed by people who are interested and have the means. The author of the book says that the experiment has already been performed many times, and the cannon-ball didn't once fall back to the ground. Many might think this quite incredible, but I don't judge it to be impossible, and I think it's well worth looking into. [This is referred to again on page 79.]

As for the outcomes of Galileo's experiments that you report to me, I deny them all; but I don't infer that the motion of the earth is any less probable. I do indeed agree that if you throw a stone forward from a moving chariot the stone will in some manner retain the motion from the chariot ·in addition to the motion from the throw·, but there are other factors that prevent it from retaining *all* the chariot's motion. As for a cannon ball shot ·horizontally· off a high tower, it must take much longer to reach the ground than one that is simply *dropped* from that height; that's because it meets more air on its way, which resists its vertical motion as well as its horizontal motion.

I'm astonished that an ecclesiastic should dare to write about the earth's motion, whatever excuses he may give. For I have seen official documents about Galileo's condemnation, printed at Liège on 20.ix.1633, which contained the words '. . . even if he pretended he was putting his view forward only hypothetically. . . '; thus they seem to forbid even the use of this ·as a· *hypothesis* in astronomy. So I don't dare to tell anyone any of my thoughts on the topic. Moreover, I don't see that this censure has been endorsed by the Pope or by any Council, but only by a single congregation of the Cardinals of the Inquisition; so I don't entirely lose hope that this case may turn out like that of the Antipodes, which were similarly condemned long ago. So in time my *World* may yet see the light of day; and in that case I'll need my arguments for my own use.

[In a final paragraph, Descartes returns to Mersenne's musicians, saying that either they know nothing about music or they have been merely teasing Mersenne.]

⊕ [13.v.34: Descartes writes to Mersenne about missed letters, the physics of falling bodies (dropped or shot), the physics of a bent bow's return to straightness, the perception of differences between musical tones (more scorn aimed at 'your musicians').]

⊕ [2.vii.34: Descartes writes to Reneri addressing a question about some aspect of the behaviour of siphons. Descartes's answer deploys his doctrine that all motion is 'circular' [see Glossary].]

to Mersenne, 14.viii.1634:

I was beginning to be troubled at not getting your news, but then it occurred to me that you would have been so preoccupied by the printing of the book you recently told me about [probably Mersenne's translation of Galileo's *Mechanics*] that you'd have had no time left for writing. Beeckman came here the other day and lent me Galileo's *Dialogue Concerning the Two Chief World Systems*; but he took it away with him to Dordrecht this morning, so that I've had it in my hands for only thirty hours. Still, I was able to leaf through the whole book, and I find that he philosophises pretty well on motion, though very little of what he says about it is entirely true. As far as I could see, he goes wrong more often when following accepted opinion than when striking out for himself, with the exception of his ·original· treatment of the rise and fall of the tide, which is rather forced. In my *World* I had also explained the tides in terms of the motion of the earth, but in a quite different way from his. But I must admit that in his book I have come across some of my own thoughts, including (among others) two that I think I wrote to you about some time ago. **(1)** The first is that the distance covered by a falling heavy body is proportional to the square of the time the body takes to fall. [Note in CSMK: Descartes is mistaken here: in his law the distance travelled is proportional, not to the square of the time, but to another power of the time, namely $\frac{log 2}{log \frac{1}{3}}$.] For example, if a ball takes three seconds to fall the first three feet it will take only one second to fall the next three, and so on. I said that this holds only with many qualifications, for it's never exactly true ·just as it stands·, as Galileo thinks he has demonstrated that it is. **(2)** The second idea is that the up-and-down vibrations of a cord ·under tension· take practically the same amount of time, even though some cords are very much longer than others.

The arguments he uses to demonstrate the movement of the earth are very good; but it seems to me that he doesn't present them in a way that will make them convincing. He keeps introducing digressions that make the reader forget the earlier arguments when he is engaged in reading the later ones.

As for what he says about a cannon that is fired horizontally: if you perform that experiment precisely, I believe you'll find observable differences ·between your results and what Galileo says will happen·.

As for the other things you write about, I haven't time to reply if I'm to catch the next post. Anyway, I can't thoroughly answer any question in physics without first setting out all my principles, and the only way I can do that is by presenting the treatise that I have decided to suppress.

Here's the text of the document printed at Liège:

'The said Galileo, therefore, who had confessed at an earlier interrogation, was summoned to the Sacred Tribunal of the Inquisition, interrogated and detained in custody. He clearly showed himself once again to be still of the same opinion, though he pretended that he put forward his view only hypothetically. The outcome is that the authorities of the Inquisition, after discussing the matter thoroughly, have declared that the said Galileo is under strong suspicion of heresy, because he seems to have followed a doctrine that is false and contrary to Scripture, namely that

•the sun is the centre of the universe and does not rise from sunrise to sunset, whereas

•the earth moves and isn't the centre of the universe,

or to have been of the opinion that this doctrine could be defended as a probability, although it has been declared to be contrary to Holy Scripture.'

to Beeckman, 22.viii.1634:

I'm glad that you still remember the disagreement we had recently. I see that you are still not satisfied with the argument I used then, so I'll write frankly about your reply. But first I'll give a brief account of the whole matter, so that we can be clear about what we are arguing about.

I didn't say at our meeting that **(i)** light instantaneously **moves to the eye** from the light-emitting body, but that **(ii)** it instantaneously **arrives at the eye** from the light-emitting body. (In your letter you attribute **(i)** to me; you also say that there's no difference between the two. You're wrong on both points.) And I also said that I was so certain of this that if it were shown to be false I would admit that I knew absolutely nothing in philosophy.

You, on the other hand, maintained that light can move only in time, and you added that you had thought up an experiment that would show which of us was mistaken. . . . It goes like this:

> In the night someone holds a torch in his hand and waves it around while watching the reflection in a mirror a quarter of a mile away. He'll be able to tell whether he feels the movement in his hands *before* he sees it in the mirror.

You were so sure of the outcome of this experiment that you admitted that your entire philosophy would have to be regarded as false if there was no observable time-lag between the instant when the movement was felt by the hand and the instant it was seen in the mirror. And if such a time-lag was detected, *my* philosophy would, I admitted, be completely overturned. What was at issue between us was not so much

> Does light travel instantaneously or does it take time to get anywhere?

but rather

•What will the outcome be of this experiment?

But the next day, wanting to be done with this dispute and to save you from pointless labour, I told you of another experiment—already carefully done by many attentive observers—which shows clearly that there is no time-lag between the instant the light is emitted from the luminous body and the instant it enters the eye.

[Descartes's account of his experiment is interspersed with bits of his reason for regarding Beeckman's as useless. The present version separates the two, but doesn't alter the content of either.] First, there was the issue of your experiment. I asked you to settle what the smallest observable interval would be between t_1 when the torch is moved and t_2 when the movement appears in the mirror a quarter of a mile away. The day before, you stipulated that this time-interval would have to be at least as short as a single pulse beat; but then more liberally you allowed that it could be as short as I liked. So, to show that I didn't want to take advantage of your concession, I assumed that the interval was no longer than one-twenty-fourth of a pulse beat; and you agreed that that interval would be undetectable in your experiment.

But it would be perfectly detectable in mine. To explain this experiment to you, I first asked whether you thought •that the moon gets its light from the sun and •that eclipses occur because the earth comes between the sun and the moon or the moon comes between the sun and the earth. You answered Yes to both. I then asked how you suppose

the light from ·the sun and· the stars reaches us, and you replied 'in straight lines'. On your view, therefore, we never see the sun in its true position but only in the position it had at the moment when the light we're seeing now was emitted from it. Let us now suppose that the distance between the moon and the earth is fifty times the radius of the earth, and astronomy and geometry together imply that that radius is at least 600 miles long. Now if light takes $\frac{1}{24}$ of the interval of a pulse beat to cross a quarter of a mile twice, it will take an interval of 5,000 pulse beats, i.e at least one hour, to cross the space between the moon and the earth twice, as is obvious when you work it out.

I'm arguing here on the basis of the points that you conceded. [Descartes's description of the 'experiment' is needlessly hard to follow, but it's basic point is simple. Let T be a time at which we on earth see the moon starting to undergo an eclipse; we may think that the sun, earth and moon are coming to be on a straight line at that time, but according to Beeckman's thesis that light travels at a velocity not greater than 12 miles per pulse-beat they aren't. The start of the eclipse as we see it represents where the sun was *an hour earlier*, when its position relative to the earth was different (Descartes is careful to say that it doesn't matter whether it's the sun or the earth that is moving!) Descartes continues:] The careful and painstaking observations of every astronomer testify, and countless experiments confirm, that when the moon is seen from earth to be undergoing an eclipse, the sun and earth and moon *are* in a straight line. This shows that light takes no detectable time to travel a vast distance, whereas your experiment doesn't show anything either way. I claimed that this argument is conclusive; you called it fallacious and question-begging.

[Descartes devotes more than a further page to arguing against Beeckman's accusation.]

to Morin, ix or x 1634:

The fine book that you did me the honour of sending to me has arrived. I am grateful—especially since I have done nothing to deserve it, having never had occasion to do you any favour that could put you in mind of me. The work you have put into finding longitudes certainly deserves a public reward; but because scientific discoveries are too valuable to be rewarded with money, God seems to have arranged things so that monetary rewards usually go to those who achieve large-scale mechanical things or to those whose actions are low and servile. So I'm sure that an artisan who made fine lenses would make more money from them than I would from all the thoughts in my *Optics* if I planned to sell them. . . .

⊕ [15.iv.35: Descartes writes to Huygens: Friendly and apologetic for perhaps writing to Huygens at a time when military goings-on are preoccupying him. He is sending his drawings of certain machines, to have improved versions made of them.]

⊕ [6.v.35: Huygens writes to Descartes: Apologies for delay in reading things Descartes has sent to him.]

to Golius, 16.iv.1635:

[Descartes thanks Golius for telling him about a particular maker of optical lenses; as soon as he can he'll visit 'that town' in order to see him. Then:] But what counts for more than all the lathe-operators in the world is that I've had the opportunity here in Amsterdam to meet Constantijn Huygens. After putting up with hearing a reading of part of my *Optics*, he offered to run some tests on my behalf. This relieved me of all worry on that score, because I'm sure that if the experiment *can* be carried out Huygens will find out how to do it sooner than anyone else could. He really is above all praise that I know how to give, and I have heard him praised

extremely highly by people who should know. His example shows that a single mind can occupy itself with many things and perform splendidly in all of them, and remain cleanly focussed when all sorts of other thoughts are clamouring to be let in, yet also retaining a freedom that isn't spoiled by the constraints of the ·royal· court. There are personal qualities that make a person admired but not loved, and others that make him loved without that adding to one's admiration; but I find that Huygens has perfections for which he is lovable and admirable. And I'm more than a little proud of the fact that whenever he said anything I pretty well understood it before he had finished explaining it. If the Socratic theory of metempsychosis [see Glossary] and reminiscence [see Glossary] were true, I would believe that in an earlier life he had the body of a man who had all the thoughts that I have now.

[Descartes closes with remarks about •how he is confirmed in the reasonableness of his own views by seeing them held so perfectly by Huygens, •his gratitude to Golius for making this meeting possible, and •sympathy for Golius in his current illness.

to Golius, 19.v.1635:

[Descartes explains his delay in replying to Golius's last. Then:] I changed my lodgings recently, and haven't yet had the time to interrogate sea-water to see if I could discover the cause of phosphorescence.

The observations by you and Schichardus on coronas and parhelia completely confirm the view I had; so that I won't want anything more on that topic. . . . Let me tell you about another observation I made one night about a week ago when I was on the Zuider Zee on my way from Friesland to Amsterdam. Resting my head on my right hand for quite some time, I covered my right eye with my hand, keeping the other eye open. The room I was in was rather dark until someone brought in a candle. As soon as I opened both eyes, I saw two coronas around the candle, with more perfect colours than I thought ever possible, just as you see in the drawing here. [Reddish brown on the outer circle, blue inside that, and the other 'rainbow colours' sandwiched between those two. We don't need the drawing or the further minor details. The account ends:] I had plenty of time to observe these things, for they lasted right up until I fell asleep some two or three hours later.

This showed me that the coronas were arranged in exactly the opposite way to those that appear around stars, i.e. red at the outside; and I also found they formed not in the air but in the water of one of my eyes, for when I closed my right eye and opened my left I didn't see them at all; and when I then closed my left eye and ·again· opened my right, I still couldn't see them. I think I can explain this quite well. I am so by this observation that I mustn't forget to include it in my *Meteorology*. . . .

to Mersenne, vi or vii 1635:

. . . .As for the lenses, I have to tell you that after Galileo's condemnation I revised and completed the treatise that I began some time ago [the *Optics*]. I have detached it completely from *The World*, and am planning to have it published separately quite soon. . . .

[Descartes now addresses six numbered items in the letter of Mersenne's that he is answering: about **(1)** the weight of an extremely light kind of wood; **(2)**–**(3)** the sonic properties of that wood; **(4)**–**(5)** other aspects of sound-production; then finally:]

(6) I don't think that heat is the same thing as light or as the rarefaction of air. I think of it as something quite

different, which can often arise from light and give rise to rarefaction. I no longer believe that heavy bodies fall because of some real quality [see Glossary] called heaviness, as philosophers imagine, or because of some attraction of the earth. But I couldn't explain my views on all these topics without publishing my *World* (with the forbidden movement ·of the earth·), and the time isn't ripe for that—I'm very surprised that you're planning to attack the book *Against the Movement of the Earth*, but I leave this to your own discretion. [He means: I leave it to you to decide whether this is a risk worth taking.]

⊕ [28.x.35: Huygens writes to Descartes, encouraging him not to be dissuaded from publishing his *Optics* by a fear of rejection by the public. He offers •a recommendation of a trustworthy printer; •suggestions about typography and page layout; •news about a supposedly forthcoming machine for shaping lenses; and •remarks about someone who claims to have produced a perfectly circular lens through which one could read a letter at a distance of over three miles—'If it's true, I'll pay him a good price for one'. Apologising for the seeming extravagance but insisting that it's the sober truth, he says 'You have left me with a strong impression of something superhuman about you'.]

to Huygens, 1.xi.1635:

I am obliged to you beyond words, and am amazed that having so many important tasks you're willing to see to all the details of the printing of my *Optics*. That is an excess of courtesy and sincerity that's going to cause you more trouble than you expect. I'll try to follow the detailed instructions that you kindly gave me on these external matters; and—by way of repayment!—I shall be so bold as to ask you to correct the content of the book before I let it go to the printer. At least that's what I shall do if this winter you live somewhere more accessible than your present abode, so that I'll be able to discuss things with you. The three mornings I had the honour of spending in conversation with you left me with such an impression of the excellence of your intellect and the soundness of your judgement that—I mean this literally—I don't know of anyone else in all the world who could be so confidently entrusted to discover my errors as you. and. . . .I'm sure that you would rather I knew my own errors and removed them than that they should be seen by the public.

I plan to add the *Meteorology* to the *Optics*, and I worked pretty hard at this during the first two or three months of this year, because I found many difficulties that I hadn't yet tackled and that it was a pleasure to resolve. But. . . .as soon as I had lost hope of learning anything more about this subject, having nothing more to do in it except to tidy up what I had written, I *couldn't* make myself •do that work or •write a preface that I'd be satisfied with. So I'll need another two or three months before speaking to the publisher.

You are unique in how much you combine promptness with patience, and manual dexterity with intellectual skill. [This leads into some remarks about the shaping of lenses; it seems that Huygens favours the hyperbola, Descartes the circle.]

from Huygens, 3.xii.35:

The lens-maker in Amsterdam slowed down in his work for me, but now here he is at the end of my hyperbola—though in saying that I am exaggerating a little. His first attempt seems to have gone well. Other lens-makers who have seen the model of what he wants to do have said that if he succeeds they'll eat dirt; but that's to be expected—if he succeeds *their* trade will be ruined. [The letter continues on this theme: what a skilled artisan can do if he has the right instruments; where Descartes's work fits into this; and so on.]

⊕ [8.xii.35: Descartes writes to Huygens, saying that he has been to test the lens that Huygens had sent him, and found that the lens-maker hadn't properly followed Huygens's prescription. He writes at length about his own work on designing and making lenses, and thinks it is on a more promising path than Huygens's.]

to Mersenne, iii.1636:

About five weeks ago I received your most recent letter, dated 18.1.36; I hadn't received its predecessor until four or five days before that. I postponed replying to you because I reckoned on being able to tell you soon that I had sent ·my work· to the printer. [This refers to *Discourse on the Method*, with the *Optics*, *Meteorology*, and *Geometry*, published by Jean le Maire of Leiden in June 1637.] That's why I came here to Leiden, because the Elzevirs have said they would like to be my publishers. But now that they've seen me here they seem to think that they have *caught* me, which has led them to make difficulties; so I have decided to drop them. I could find several other publishers here, but I shan't settle with any of them until I have news from you, provided I don't have to wait too long. If you think that my manuscripts could be printed in Paris more conveniently than here, and if you would be willing to take charge of that as you once kindly offered to do, I could send them to you as soon as you gave the word. However, there are two difficulties. •My manuscript is no better written than this letter; the spelling and punctuation are equally careless; and the diagrams are drawn by me, i.e. very badly (so that the engraver won't understand them unless you explain them on the basis of your understanding of the text). •I would like to have the whole thing printed in a handsome font on handsome paper, and I would like the publisher to give me at least 200 copies because I want to distribute them to a number of people.

You'll want to know what I am planning to have printed. There will be four treatises, all in French, and the general title will be as follows:

> The Plan of a Universal Science that can raise our Nature to its Highest Degree of Perfection. And the *Optics*, the *Meteorology* and the *Geometry*, in which the Author supports his proposed universal Science by explaining the most abstruse Topics he could find, doing this in such a way that even beginners can understand them.

In this *plan* [which is of course the *Discourse on the Method*] I reveal a part of my method, try to prove the existence of God and of the soul apart from the body, and add many other things that I don't expect to displease the reader. In the *Optics*, besides treating of refraction and the manufacture of lenses, I give detailed descriptions of the eye, of light, of vision, and of everything belonging to catoptrics [see Glossary] and optics. In the *Meteorology* I dwell principally on the nature of salt, the causes of winds and thunder, the shapes of snowflakes, the colours of the rainbow—here I try also to show the nature of each colour—and the coronas or haloes and the mock suns or parhelia [see Glossary] like the ones that appeared at Rome six or seven years ago. Finally, in the *Geometry* I try to give a general method for solving all the so-far-unsolved problems. All this I think will make a volume no bigger than fifty or sixty sheets. I am sticking to my long-held resolve not to put my name to it; please don't mention it to anybody except when you think it proper to mention it to some publisher to see whether he would like to have the job. But don't make any contract for me, please, until you hear my reply; I'll decide on the basis of what you tell me. I would prefer to use a publisher who isn't in contact with Elzevir. . . .

I have used up all my paper in telling you this. There's just enough space left for me to say that examining what Galileo says about motion would take me more time than I can spare just now.

•I think that the experiment showing that sounds travel no faster with the wind than against the wind is correct, at least so far as the senses are concerned; for the movement of sound is a quite different thing from the movement of wind. •Thank you for the account of the ball shot vertically that doesn't drop back; it is very remarkable. •As for the subtle [see Glossary] matter of which I have often spoken, I think it's the same matter as terrestrial bodies; but just as air is more fluid than water, so I suppose that this matter is much more fluid = liquid, and more penetrating, than air. •A bow bends back because when the shape of its pores is distorted the subtle matter that passes through tends to restore them, whichever side it enters from.

⊕ [31.iii.36: Huygens writes to Descartes about arrangements for them to meet at the country home of Huygens's sister and her husband, not far from Leiden, where Descartes is now visiting to supervise the printing of his book. He hopes to be allowed to see some of Descartes's *World*, and jokes that 'my avarice ·is like a lake that· has no bottom and no shores'.]

⊕ [31.iii.36: Descartes (in Leiden) tells Huygens that he will call on him the next day, bringing with him all his writings that are fit to be seen, for Huygens to choose the ones he will read and criticise.]

⊕ [11.vi.36: Descartes writes to Huygens: 'I am sending you a masterpiece from my hand, the model of a hyperbola that you asked me to have done by someone else', and the letter continues joking, e.g. about Descartes's well-known skill as a portrait-painter.]

⊕ [15.vi.36: Huygens (now back in The Hague) writes to Descartes: a little about lens-making, encased in a thick crust of jokes.]

⊕ [Huygens writes to Descartes, sending a new sample lens. He says that his lens-maker says that on this second attempt he has done 'everything that the mind can ask of the hand'; Descartes's reaction and further instructions are awaited.]

⊕ [13.vii.37: Descartes writes to Huygens: The lens-maker has done what was asked of him, but this second attempt is scarcely better than the first because of tiny irregularities on the surface of the glass. More about this, and some personal matters.]

⊕ [23.x.36: Huygens writes to Descartes expressing extreme impatience to see Descartes's published book.]

⊕ [30.x.36: Descartes writes to Huygens bringing him up to date on how the publishing of the book is going, including the information that illustrations are being handled in exactly the way Huygens has suggested. He reports that he isn't doing any serious work. 'I would have been seriously upset about this if I didn't know that my mind is like infertile ground that won't be productive unless it is first allowed to lie fallow for a few years.']

⊕ [1.i.37: Descartes writes to Huygens: Greetings for the New Year, and a request that Huygens send the enclosed offprints to Paris in order to obtain a royal 'privilege' (*privilège*, a kind of license to publish that is needed to protect the interests of Descartes's Dutch publisher in Paris).]

from Huygens, 5.i.1637:

Your packet [containing offprints of the works Descartes is having published] will leave here today in company with something you would be very upset to lose, and there's no doubt that the person by whom I am sending it will very punctually do his part. . . . In leaving my hands the material has finished the dangerous part of its voyage, because my hands have been sorely tempted to snatch it from Mersenne's! But my greed gave way to your interests, and I shall now wait, armed with Stoic patience, for the opportunity to read one of the works when the whole thing is published. Actually, I'm lying; I *have* flipped through it; but that was under the pressure of so many different occupations—none of them anywhere near true wisdom—that I took in hardly anything except the quality of the printing and of the diagrams, which seemed to me equally satisfactory. As regards formal features: I'd have

liked the paper to be a bit less shiny, and the pages—quarto but nearly as long as small-folio—to be correspondingly wider by having more generous margins. But narrow margins are just one of the ways in which printers show their greed! Anyway, we aren't going to learn anything from the *form*; it's the *matter*, the content, that will occupy us. . . . I'm delighted to see how well the proof-reading has been done. If your own (evidently considerable) labour on this has left you tired, I'll present myself at Leiden to do what remains to be done. Rather that than see us spending an extra day waiting for this excellent work.

⊕ [25.ii.37: Huygens writes to Descartes enclosing •a certificate of delivery of the material Descartes asked him to send to Paris, and (asking for comments) •something Mersenne has sent him relating to a work that Mersenne has just finished.]

⊕ [27.ii.37: Descartes writes to Huygens in warmly appreciative terms. He declines to comment on the Mersenne material Huygens had sent him because 'he's an extremely good friend' and also because he has read very little of Mersenne's writings. Golius had told Descartes that Huygens thought that the title *Discourse on the Method* should have the word 'Discourse' removed, analogously to the titles of the other works. Descartes replies that in the other works he aimed to •cover the whole of optics, geometry, etc. whereas he is merely •'saying something' about his method.]

to Mersenne, iii.1637:

You must have a very poor opinion of me, regarding me as very inconstant and irresolute, since you think that what you tell me should lead me to change my plan and attach my opening Discourse to my Physics. . . . I couldn't help laughing at your suggestion that I'm forcing the public to kill me so as to see my writings sooner. I can only reply •that the writings are now in such a place and condition that someone who killed me would never lay his hands on them; and •that if I don't die in my own good time and on good terms with the survivors no-one will see my works for more than a hundred years after my death.

Thank you for objections that you have sent me, and I beg you to continue to tell me all those you hear. Make them as unfavourable to me as you can; you couldn't please me more. I'm not in the habit of wailing while my wounds are being treated, and anyone kind enough to instruct and inform me will always find me very teachable.

But I don't understand your objection to the title. I didn't put *Treatise on the Method* but *Discourse on the Method*, which means 'preface to the Method' or 'announcement of the Method', to show that I'm not trying to teach the method but only to discuss it. Any reader can see that it's practical rather than theoretical. I call the other treatises *Essays in this Method* because I claim that what they contain could never have been discovered without it, so that they show what it's worth. And I put into the first *Discourse* a bit of metaphysics, physics and medicine, to show that my method extends to topics of all kinds.

Your second objection is that I haven't explained fully enough how I know that •the soul is a substance distinct from the body and that •its nature is solely to think. This, you say, is the only thing that makes my proof of God's existence hard to understand. I admit it. But my best way of dealing with this topic was to explain in detail the falsehood or uncertainty of all judgements that depend on the senses and the imagination, in order then to show which judgements depend only on the pure understanding, and what evidentness and certainty they have. But I deliberately chose not to go that way, mainly because I was writing in the vernacular, and was afraid that readers who weren't very bright might •embrace the doubts and scruples that

I'd have had to propound, and •not be able to follow as fully the arguments by which I would have tried to remove them—setting them on a false path and not being able to bring them back off it. But about eight years ago I wrote a fairly full presentation of that argument in Latin (in the beginnings of a treatise of metaphysics); I could have that included in my present book if a Latin version of it is made, as is planned. But I do think that readers who study my arguments for God's existence will find that the more they try to fault them the more compelling they are. I claim that they are clearer in themselves than any of the demonstrations of geometers; in my view they're obscure only to those who can't withdraw their minds from their senses. . . .

I'm extremely grateful for your offer of help with the printing of my manuscripts; but if any expenses are involved they must be met by me, and I'll make sure of sending to you whatever is necessary. I don't think in fact that there will be any great expense; some publishers have offered me gifts to get me to engage them, even before I had left Paris or begun writing. So there may still be publishers foolish enough to print my works at their own expense, and readers gullible enough to buy copies and save the publishers from their folly. I shall want to lie low, not distancing myself from my works as though they were crimes, but merely wanting to avoid being disturbed and to keep the liberty I have enjoyed up to now. I won't be very alarmed if some people know my name; but for the present I prefer that no-one says anything about my forthcoming work—that way my work won't fall short of expectations because no expectations will have been raised. . . .

⊕ [1.iii.37: Huygens writes to Descartes apologising for having criticised, ignorantly, the title of *Discourse on the Method*. (See 25.ii.37 above.) He gently complains that Mersenne 'has this time served not as my intermediary but as my third hand, without alerting me'.]

to Huygens, 3.iii.37:

[The letter opens with a complaint that Mersenne has messed up the matter of the royal 'privilege' (see 1.i.37), making Descartes's name known and having it appear in the 'privilege'. (He had wanted the book to be published anonymously.) Then an explanation of why he can't yet send the *Discourse on the Method* to Huygens. Then:]

At this time I'll send you only the *Meteorology* and the *Optics*. I'll be infinitely obliged if you will take the trouble to read them, and mark (or get someone to mark) your corrections in the margin, and then let me see them. If your wife was willing to add hers, I would regard that as an inestimable favour. I think much more highly of her judgment—she who is by **nature** excellent—than I do of the judgment of many philosophers, whose **art** or training often makes them judge badly. I am already very proud of the fact that she condescended to listen to a reading of a part of the *Meteorology*.

⊕ [22.iii.37: Descartes writes to Huygens sending the *Discourse on the Method* for him to forward to France 'along with yours'. (Huygens's high position in the Dutch government made it easier for him than for Descartes to get things safely to Paris.) In a PS: 'This letter will be presented to you by the young Schooten. Don't judge him by how he looks; there's more to him than appears on the surface.' (Franz Schooten jr. did all the drawings for Descartes's current publication and, later, for the *Principles of Philosophy*.)]

⊕ [24.iii.37: Huygens writes to Descartes with glowing praise for the *Discourse on the Method*, which he has read. He isn't competent to read the *Geometry*, but young Schooten has tutored him in this ('I took time off from my work'), and 'I can learn to see a little into this mystery'.]

⊕ [29.iii.37: Descartes writes to Huygens expressing rapturous pleasure at Huygens's opinion of the *Discourse on the Method*, and begging him to express any criticisms he has of the work. He is sending a copy of

the *Discourse* for Huygens to keep, and of the *Geometry*, to add to the *Meteorology* and *Optics*, which he already has. They are not bound like proper books. 'I am sending you two naked infants. . . .with two or three sheets missing, which are needed to clothe these babies when they first enter the world. Women know more about these things than men, so with your permission I shall commend these two to the care of Madame your wife and Madame your sister.']

to Silhon, iii.1637:

You are right that in the work you have seen there is a great defect, concerning the arguments by which I think I prove that there's *nothing* more evident and certain than the existence of God and of the human soul. The defect is that I haven't presented those arguments in a way that would make them easy for anyone to grasp. I didn't want to run the risk of doing that: I'd have had to present at length the sceptics' strongest arguments to show that there is no material thing of whose existence one can be certain. That would have accustomed the reader to detach his thought from things that are perceived by the senses; then I'd have shown that a man who doubts everything material still can't have any doubt about his own existence. From this it follows that he—i.e. the soul—is a being or substance that isn't at all corporeal, whose nature is solely to think, and that it's the first thing that can be known with certainty. Anyone who spends enough time on this meditation will gradually acquire a very clear—I would even say *intuitive*—knowledge of intellectual nature in general [= 'knowledge of what it is to be a thinking thing']. This idea when taken without any limitation represents God to us, and when limited it's the idea of an angel or a human soul. Now, a reader can't fully understand what I say later about God's existence of God unless he comes at it in this way, as I hinted in the *Discourse on the Method*. But I was afraid that this introduction would look at first as if it were designed to bring in scepticism, and would disturb weaker minds, especially as I was writing in the vernacular. So I didn't dare to put in even the little I said about this without some words of warning. But more intelligent people like you, Sir, if they take the trouble not only to read but also to follow me in meditating on the various topics, spending long enough on each point to check whether I have gone wrong, I think they'll come to the same conclusions as I did. I'll be glad to try to explain this further, when I have time.

⊕ [20.iv.37: Descartes writes to Huygens expressing relief at the news that Huygens's wife seems to be recovering from a recent illness (in fact she died three weeks later); and accepting a correction to one of Descartes's diagrams—'I admit that Schooten and I went astray'.]

Fermat to Mersenne, iv or v 1637:

You ask for my judgment on Descartes's *Optics*. De Beaugrand lent me the work but didn't give me long to read it, and that seems to excuse me from providing exactly and in detail what you want; and the subtlety and complexity of the work tells me that you want more than informal half-considered thoughts. [He goes on to say that nevertheless he *will* say what he thinks about the *Optics*: it's good to search for the truth, and we often find it by groping in the dark, so perhaps his offerings may be useful and perhaps some day he'll be able to build them into something good. He then sets the scene: the study of refractions [see Glossary] has so far led nowhere; what is needed is a general formula by which, given one refraction-angle for a given medium we can then find all the others. Then:] So now it remains for Descartes to exercise his intelligence and reveal to us some new insights into translucent bodies that have so far produced such obscurities.

The first two parts of the *Optics*—about light and refraction—seem to me to be the main ones, because they contain the foundations of the science from which we then see Descartes drawing beautiful conclusions.

Here, in brief, is his reasoning. Light is simply bodies' inclination to move; and •the inclination to move probably follows the same laws as •actual movement does. So we can get the rules governing the effects of light from our knowledge of the rules governing movement.

He considers the movement of a ball when it is reflected and when it is refracted. I shan't here repeat his whole treatment of these matters—that would be useless and boring—so I'll settle for giving you my comments on it.

Firstly, I am not convinced that •the inclination to move should follow the same laws as •movement, because they are *different*—as different as •potentiality and •actuality. And the gap seems especially large in this case, because the movement of a ball can be faster or slower, depending on the forces acting on it, whereas light goes through a translucent body in an instant, apparently with no succession involved [i.e. with no facts about when it was at one point, when it was an inch further on, and so on]. But geometry doesn't get involved in going deeper into these issues in physics.

[Fermat then has two pages of technical criticisms of Descartes's purported proof of a 'law' about how angles of incidence relate to angles of reflection; concluding that the same criticisms apply to Descartes's treatment of incidence and refraction, which is (he says) based on the same faulty reasoning. He continues:]

That's my view of these new propositions from which Descartes draws splendid conclusions about the right way to shape optical lenses. So splendid that I wish the premises had been better supported than they are. But I think that they lack not only support but truth.

I had been going to reveal to you my own thoughts on this topic; but •I am not yet perfectly satisfied with them, and anyway •I would rather wait until I know the outcomes of the experiments you have done, or are going to do at my request, regarding the relations between angles of incidence and angles of refraction. I'll be most grateful if you would send me all that as soon as you can, and I promise that in return I'll tell you some new things about this matter.

What I have said here doesn't prevent me from greatly admiring Descartes's intellect and ingenuity; but it needs a communal effort to get the truth—which I think is still hidden from us—about this subject. . . .

⊕ [27.iv.37: Descartes writes to Mersenne complaining that Mersenne is •making a mess of the application for a royal 'privilege' and •needlessly showing the forthcoming book to too many people.]

to Huygens, 20.v.1637:

Although I have withdrawn to a very secluded place, the sad news of your affliction has reached me even here. If I measured you by the standards of ordinary souls, the sorrow you have experienced since your wife fell ill would lead me to fear that you would find her death quite unendurable; but I'm sure that your life is governed entirely in accordance with reason, so I'm convinced that you'll find that consoling yourself and regaining your former peace of mind is easier now that all hope of remedy has gone than it was when you still had cause to fear and hope. Once hope is gone, desire ceases or at least grows weaker, and the sense of loss can't be very pressing when one has little or no desire to recover what has been lost. It's true that ordinary minds don't appreciate this argument; they imagine (without knowing it) that whatever was the case once can be the case again, and that God's love for them *obliges* him (as it were) to do

whatever they wish. But a soul as strong and noble as yours knows the condition God has given us from birth and accepts the necessity of his law. This does involve some pain, but I value love so highly that I think that anything we endure for the sake of it is pleasant—so that even those who are about to die for the good of those they love seem to be happy to their last breath. While you were going without food or sleep so as to care for your invalid, I feared for *your* health, but I'd have thought it sacrilegious of me to try to divert you from such a devoted and tender task. But your grief, now that it can't be of any use to her, can no longer be so appropriate, and hence can't now be accompanied by the joy and inner contentment that follows virtuous actions and makes wise people happy in all the vicissitudes of fortune. So if I thought that your reason wasn't able to overcome your grief, I would visit you and do what I could to distract you, that being the only cure I know for such distress.

I'm taking no account here of your own personal loss in being deprived of a companion whom you dearly cherished, for it seems to me that our own troubles can't be compared with those of our friends—it's a virtue to feel pity at the slightest afflictions of others, to grieve over our own is a kind of feebleness. Besides, you have so many close relations who are devoted to you that you could have no cause to complain on that score; and although you have only one sister, Madame de Wilhelm, I think she alone is all you need to rescue you from the solitude and household cares that anyone but you would dread after losing his partner. Please excuse the liberty I have taken here in expressing my thoughts as a philosopher.

I have just received a parcel from your part of the country. I can't understand what Mersenne is up to: he still hasn't sent me any licence to publish, and seems intent on obliging me by doing the very opposite of what I ask.

to Mersenne, late v.1637:

You argue that if the nature of man is solely to think, then he has no will. I don't see that this follows; for willing, understanding, imagining, and sensing and so on are just different ways of thinking, and all belong to the soul.

You reject my statement that *In order to act well it is sufficient to judge well*; yet it seems to me that the common scholastic doctrine is that *The will doesn't tend towards evil except when evil is presented to it by the intellect as some kind of good*—which generates the slogan *Whoever sins does so in ignorance*—so that if the intellect never represented anything to the will as good without its actually being so, the will could never choose wrongly. But the intellect often represents different things to the will at the same time, and that is the source of *I see and praise the better, but I follow the worse* [Latin *video meliora proboque deteriora sequor*, by Ovid; Descartes also gives the other two emphasised statements in Latin]. This applies only to weak minds, as I said in the *Discourse on the Method*. The well-doing I'm talking about can't be understood in a theological sense—for *there* grace comes into the picture—but simply in the sense of moral and natural philosophy, where no account is taken of grace. So I can't be accused here of the error of the Pelagians [see Glossary]. Analogously: if I said that *To be a man of honour you need only good sense*, it would obviously be irrelevant to object that you need to be a man and not a woman.

Similarly, when I said that 'The world was created just as it should be' is probable, I meant •probable according to human reason; I wasn't denying that perfect faith can make it •certain. . . .

I don't find in your two letters anything else that needs a reply, except that you seem to be afraid that the publication of my opening *Discourse* may commit me to never publishing

my *Physics*. You needn't be afraid of that, because I don't anywhere promise never to publish it during my lifetime. I merely say that I did once plan to publish it but (for reasons that I give) I have decided not to do so during my lifetime. . . . That implies that if the reasons that prevent me from publishing should change, I could reasonably make a fresh decision, because 'When the cause is removed, the effect is removed' [Descartes gives it in Latin: *sublata causa tollitur effectus*]. You say also that people may think I am boasting when I say things about my *Physics* without actually presenting any of it. Well, perhaps; but I won't be accused of that by anyone who •reads not only my opening *Discourse* but the whole book, or by anyone who •knows me. And such a person won't reproach me, as you do, for despising my fellow men because I don't press on them a gift that I'm not yet sure they want. I spoke of my *Physics* as I did solely in order to urge those who want to see it to put an end to the causes that prevent me from publishing it.

Once more, I ask you to send us either the licence to publish or the refusal of it, as promptly as possible. I would rather have it in the simplest form than have it in the most ample form one day later.

to *, late v.1637:**

[This was written to some friend of Mersenne's.]

In revealing my name, Mersenne has done the very opposite of what I asked, but I can't hold it against him because his action had given me the honour of being acquainted with someone of your merit. But I have good reason to dissociate myself from his application for the licence to publish that he says he wants to try to obtain for me; for he introduces me as praising myself, describing myself as the discoverer of many fine things, and as saying that I intend to publish treatises other than those already in print. This contradicts what I wrote both at the beginning of the *Discourse on the Method* and in other places. But I'm sure he will let you see the letter I am sending him, since I learn from your very kind letter that it was you who obliged me by suggesting to him some of the objections that I deal with.

As for the treatise on physics that you have been so kind as to urge me to publish, I wouldn't have been so rash as to speak of it in the way I did if I hadn't been anxious to publish it if •the public wanted it and if •it would be safe, and also profitable, for me to do so ['profitable' is based on reading AT's *j'y trouve mon conte* as slip for *j'y trouve mon compte*]. But I want you to know that my whole purpose in the present publication is to prepare the way and to test the waters [*sonder le gué*, literally 'to find out how deep the shallows are']. To this end I am proposing a general method. I'm not actually *following* the method, but trying to let it show its paces in the three treatises that follow the *Discourse ·on the Method·* in which I describe it. [In what follows, 'philosophy' = 'natural science'.]

- •The first treatise [*Optics*] is a mixture of philosophy and mathematics.
- •The second [*Meteorology*] is entirely pure philosophy.
- •The third [*Geometry*] is entirely pure mathematics.

In these treatises I can state that I didn't refrain from discussing anything (at least anything knowable by the power of reasoning) because I lacked knowledge of it. So I believe that I am using a method that could be used to explain any other subject just as well, provided I had done the required experiments and taken time to think about them. Also, to show that the method can be applied to everything I have included brief remarks on metaphysics, physics and medicine in the opening discourse. If I can get the public to view my method in this way, I don't think I'll have any reason to fear that the principles of my physics will be ill

received; and if I encountered only critics who are as well disposed towards me as you are, I would have no fear of it from now on.

to Mersenne, 25.v.1637:

[Descartes apologises for having offended Mersenne by what he wrote in a recent letter. Some of Mersenne's conduct had seemed to him to increase the risk of not getting permission to publish, and Mersenne had gone against his wishes by showing Descartes's writings to other people and telling them who wrote them. But he is sure that this was all well-meant, and he is grateful for Mersenne's unceasing friendship and support. Then:]

I have received all the packets that you mention in your last letter; but I didn't comment on the list of printing errors, because they had already been printed; or on the passage from St Augustine ·that you sent me·, because he seems to me to be using it [i.e. the inference from *I think* to *I exist*] quite differently from how I do. [He reports that Huygens has received the books that Mersenne sent him; and if he hasn't written to acknowledge them, that's because of the illness and death of his wife. He mentions two 'small books' that Mersenne has sent him, and expresses approval of one and contempt for the other. Then:] You also sent me a proposition [here = 'problem'?] by the geometer Fermat; it is very fine and has given me great pleasure, because it is easy to resolve through what I have written in my *Geometry*, where I present the general method ·for dealing with such problems· for three- as well as for two-dimensional figures. I expect that if Fermat is honest and open, he will be one of those •who give my work the best reception and •who can actually understand it—because I have to say that I don't think many *will* be able to understand it.

As for the physician who denies that the valves of the heart close tightly, he is going against the anatomists (who all say the opposite in their writings) rather than going against me, for I don't need that thesis to demonstrate that the movement of the heart is as I describe it in my book. Even if the valves let through half the contents of each blood vessel, the Automaton would still move necessarily, as I have said. Besides, observation makes it clear to the naked eye that the six valves in the aorta and the pulmonary artery close these vessels tightly. . . .

As for his further comment that I considered the brain and eye of an animal rather than that of a human being, I don't see where he gets that from. Perhaps he thinks that since I'm not a professional medical man I haven't had the opportunity to observe human organs, which I readily admit; or perhaps he is going by the fact that the diagram of a brain given in the *Optics* was based on a sheep's brain, the ventricles and internal parts of which are, I know, much larger in relation to the brain as a whole than they are in the human brain. But I thought the sheep's brain was more suitable for making clear what I had to say, which applies both to animals and to human beings. And that can't be held against me, because nothing that I said relating to anatomy is original or in any way disputed by those who write on that subject.

Lastly, I am not in the least bit surprised that my explanations of refraction and of the nature of colours don't satisfy everyone, for no-one has yet had time to read and think about them thoroughly. When they *do* have the time, those who take the trouble to alert me to any mistakes they notice will be doing me a great favour, especially if they consent to my reply being published along with their comments, so that my reply to one may serve as a reply to all. To conclude, I thank you for all your trouble.

⊕ [2.vi.37: Huygens writes to Descartes, with thanks for Descartes's recent letter of condolence, and telling him that the long-sought-after 'privilege' is on the way.]

⊕ [14:vi:37: Descartes writes to Colvius thanking him for taking the trouble to inform Descartes of the recent death of Beeckman.]

⊕ [14.vi.37: Descartes writes to Balzac telling him of the publication (six days earlier) of his *Discourse on the Method and Essays*, saying that the work isn't well enough written or thought-out to deserve Balzac's attention but that nevertheless criticisms will be gratefully received. He speaks respectfully of a recently published volume of Balzac's letters, and says that his silence toward Balzac for several years arose not from any lack of friendship and admiration but from a sense that he hadn't anything to say that was worth Balzac's attention.]

to Noël, 14.vi.1637:

I am sure that you don't remember the names of all the disciples you had during your 20-odd years of teaching at La Flèche, and that mine is one of the names that have been erased from your memory. But that hasn't erased from my memory my obligations to you; and I have wanted to recognise them, though my only occasion for doing so has been the publication last week of the volume that you will receive with this letter. I am happy to offer it to you as a fruit that belongs to you because it was you who sowed the first seeds of it in my mind, just as I owe to members of your Order [the Jesuits] such knowledge as I have of literature. [He goes on to say that he will be glad to hear of any faults that are found in the book by Noël or by colleagues of his who have time to read the book.]

to Huygens, 12.vi.1637:

At last I have received from France the licence to publish that we were waiting for, and which caused the publisher to delay the printing of the last sheet of the book, which I am sending you with a request that you present it to His Highness the Prince of Orange. I won't venture to say 'present it in the name of the author', because the author's name isn't given and I don't think my name is worthy of his attention, but present it as something written by an acquaintance of yours who is warmly devoted to the Prince's service. In fact I can say that ever since I decided to leave my native land and all my friends order to lead a quieter and more tranquil life than I had before, it wouldn't have occurred to me to retire to this country—preferring it to all the other places where no war was going on and where the purity and freshness of the air seemed better suited to intellectual work—if my high opinion of His Highness hadn't made me utterly confident of his protection and government. And because I have since enjoyed to the full the peace and leisure I had looked to find here under the shelter of his military power, I am deeply in his debt and think that this book, which contains nothing but the fruits of his peace, should be offered to him above all others. . . .

⊕ [14.vi.37: Descartes writes to Huygens, asking him to give two copies of Descartes's recent book to Charnacé, the French ambassador to Holland, one for the French King and the other for Cardinal Richelieu. He doesn't think that either of those two grand people will lower his thoughts to Descartes's level, but the gift of the volume is something he *owes*. Although the book was published anonymously, Descartes's name has come to be publicly linked with it, and he accepts that.]

⊕ [22.vi.37: Descartes writes to Mersenne expressing annoyance with the conduct of Delaunay, who had written to Descartes with challenges and questions, and told Mersenne that Descartes's slowness to reply

was caused by his not being sure of his ground. Descartes swats this down, and says that he isn't answering Delaunay's questions because he doesn't have a relationship with Delaunay that would make that appropriate. Annoyance also with de Beaugrand, who isn't apologetic about having kept the *Optics* for so long (see Fermat on page 39) and whose works Descartes hasn't the slightest desire to see.]

⊕ [27.vi.37: Huygens writes to Descartes with an apology for his delay in doing a favour for a third person that Descartes had asked for. Also reporting that 'the offer of your book has been received, as it deserves, by His Highness' the Prince of Orange; and that de Charnacé is coming up with some strong objections to the recently published book.]

⊕ [5.vii.37: Descartes writes to Huygens with thanks for doing the favour at a difficult time. He is honoured that Charnacé is taking trouble over his work, and is sure—given the excellence of Charnacé's mind—that his objections will be strong. But Descartes isn't in the least *afraid* of them: 'I'll be more •happy to learn my faults than •ashamed of having made them.']

⊕ [30.viii.37: Descartes writes to someone about domestic arrangements in his new home in Egmond, and arrangements for him to be joined there by his 'niece'—actually his daughter—and the girl's mother. AT (see Glossary) has a charming note on this letter. 'Where were his child and her mother? And to which faithful friend (a physician?) is this letter addressed? *Autant d'énigmes*—so many puzzles.']

⊕ [8.ix.37: Huygens writes to Descartes, writing from 'before Breda' (the army of Huygens's employer the Prince of Orange is laying siege to Breda, a Dutch town that has been seized by Spain). Some remarks about the ongoing pursuit of satisfactory magnifying lenses, and then a paragraph about the study of music: he deplores the incompetence in this field of his own friends, and anxiously declares his desire not to waste Descartes's time with such matters.]

⊕ [13.ix.37: Plempius writes to Descartes, forwarding eighteen numbered critical comments on Descartes's work that he had just received from Fromondus.]

to Plempius, 3.x.1637:

I received your letter with Fromondus's comments, which were very welcome, though I was surprised at their arriving so soon ·after the publication of the book they are commenting on·. A few weeks ago I heard that the book hadn't yet been sent to you, and many who did have it have told me that they can't judge it until they have read it several times. I am the more grateful to you both—to you for your over-generous praise and to Fromondus for •his care in reading my book and •his taking the trouble to send me his opinion of it. The judgement of such a gifted and learned man enables me, I think, to discern the view that many other readers will take. But because in many places I see that he hasn't understood my meaning, I can't yet tell what he and others will say after a closer reading.

I can't agree with your judgement that my explanations can be •rejected and ignored but not •refuted or disproved. By using only very evident principles and (like a mathematician) taking account of nothing but sizes, shapes and motions, I cut myself off from all the evasive tricks of philosophers. So the slightest error will be easy to detect and refute by a mathematical demonstration. On the other hand, if something is so true and solid that no such demonstration can overthrow it, then no-one can afford to ignore it—or at least no-one who claims to be a teacher. It's true that on the surface I expounded my opinions without proving them; but it's not hard to extract from my explanations syllogisms that destroy the rival accounts of the same topics; doing this so evidently that anyone who sides with one of the rivals and tries to defend it against people who have understood what I say will find it hard to do this without making himself a laughing stock.

I'm aware that my geometry won't have many readers. I left out things that I thought others knew, and tried to cover or at least touch on many things in very few words—*many* things, indeed everything that can ever be discovered in that science. So it demands readers who are skilled in the whole of what is so far known in geometry and algebra and also industrious, intelligent and focussed. I have heard that in your university [Louvain] there are two such men, Wendel and van der Waegen. I will be very pleased to hear from you what they, or any others, judge of it.

I'm anxious to see what you write about the motion of the heart. Send me it as soon as possible, please, and tell me how Fromondus takes my replies. Greet him warmly in my name. As for the philosophers of Leiden: I left there before the book was published, and so far as I know *conticuere omnes* [Latin, Virgil, 'they have all fallen silent'], which is what you predicted of others also.

to Plempius for Fromondus, 3.x.1637:

The learned and distinguished Fromondus starts his objections with a reminder of the fable of Ixion, ·who made love to a cloud, mistaking it for the goddess Juno·. This is apt, for two reasons. •He does well to warn me to avoid accepting empty cloudy speculations as though they were the truth (which I will always do my best to do, and have always done until now). •The Ixion story fits him too: he thinks he is attacking my philosophy, but all he refutes are empty theories that have *nothing* to do with me—ones based on the system of atoms and empty space that is attributed to Democritus and Epicurus and their like.

(1) Concerning the *Discourse on the Method* [Part 5, about a third of the way through] he comments that 'noble actions like *seeing* can't result from such a low-down and brutish cause as *heat*'. He is assuming that I think that animals see just as we do, i.e. sensing or thinking that they see, which Epicurus is said to have thought and that even today is accepted by almost everyone. But in the whole of Part 5 I show openly that my view is that animals don't see as we do when •we're aware that we are seeing, but only as we do when •our mind is elsewhere. When that happens the images of external objects are depicted on our retinas, and the impressions they make in the optic nerves may cause our limbs to make various movements of which we are entirely unaware. In such a case we're moving just like automata, and no-one thinks that heat doesn't have enough power to cause *their* movements.

(2) Concerning the *Discourse* late in Part 5, he asks what need there is to attribute substantial souls to animals, and remarks that my views might open the way for atheists to deny the presence of a rational soul even in the human body. I'm the last person to deserve this criticism, because like the Bible I believe—and I thought I had clearly explained this—that the souls of animals are nothing but their blood when it is warmed by the heart, converted into *spirit*, and sent through the arteries to the brain and from there to the nerves and muscles. [Descartes is here using 'spirit' to mean 'animal spirits' (see Glossary).] This theory makes animal souls so different from human ones that it provides an argument—the *best* argument yet thought of—to refute the atheists and establish that human minds can't be drawn out of the powers of matter. As for those who credit animals with some sort of substantial soul distinct from blood, heat and spirits, ·they are in trouble in at least two ways·. **(i)** I don't see how they can respond to these biblical texts:

> •'The soul of all flesh is in its blood, and you shall not eat the blood of any flesh, because the soul of flesh is in its blood' [Leviticus 17:14];

> •'Only take care not to eat their blood, for their blood is their soul, and you must not eat their soul with their flesh' [Deuteronomy 12:23]

which strike me as much clearer than others that have been quoted against certain other opinions that some people condemn solely because they appear to contradict the Bible. **(ii)** Given that these people see so little difference between the operations of a man and of an animal, I don't see how they can convince themselves that there's so much difference in nature between the •rational and •sensitive souls that (on their view)

> •when the sensitive soul is alone its nature is corporeal and mortal, and
> •when it is joined to the rational soul it is spiritual and immortal.

How do they think sensation is distinguished from reason? Sense-cognition, they say, is a matter of simple sensory intake and therefore can't be false, whereas the cognition of reason is a little more complex, and can be carried along lengthy chains of syllogisms. This doesn't seem to show any superiority in cognition of reason, especially given that these same people say that God's cognition, and that of the angels, is utterly simple and intuitive, a sheer intake that isn't bound up in wrappings of theory. So it seems that on their view •sensation in animals is closer to cognition in God and the angels than •human reasoning is! ·In my book· I could have said many things like this to support my theses about the soul and about almost everything else discussed ·there·. I didn't do so partly for fear of teaching some falsehoods while refuting others, and partly for fear of being seen as aiming to ridicule received scholastic opinions.

(3) Concerning Part 5 [about half-way through] he says: 'It would take the heat of a furnace to rarefy the drops of blood fast enough to make the heart expand.' Apparently he hasn't noticed how milk, oil and most other liquids, when placed on a fire, expand gradually and slowly at first, then suddenly burst into flame when they reach a certain temperature, so that most of the liquid overflows and pours out onto the ashes unless •it is removed from the fire at once or at least the lid is removed from the pot containing so to let out the vapours that are the main cause of the liquid's being rarefied. What the crucial temperature is depends on the nature of the liquid; some liquids are rarefied and expand in this way when they are barely lukewarm. If Fromondus had noted these points, he would easily have reached the conclusion that the blood in the veins of any animal comes very close to the temperature that it must have in the heart if it is to be rarefied there instantaneously.

(4) [In the next sentence, the Juno/clouds contrast echoes the first sentence of this letter.] But nowhere does he show more clearly that he has embraced •the clouds of Democritus's philosophy instead of •the Juno of mine than in his comment on page 4 of the *Optics*, where he maintains that

> my example of a blind man's stick isn't analogous to the instantaneous transmission of light rays, because a ray that shoots out from the sun should be compared with an arrow shot from a bow, which flies through the air not instantaneously but through a series of instants.

Is he confusing me with Leucippus or Epicurus. . . .? I nowhere suppose that there's a vacuum anywhere; indeed I explicitly say the very opposite, namely that all the space between us and the sun is filled with a body that is extremely fluid yet even smoother ·than other fluids· (I call it 'subtle matter'). So I don't see how anyone can object to the two analogies—of •the stick and of •the vat of pressed grapes—that I used to explain the instantaneous transmission of light rays. And if Fromondus says that my philosophy is

'crude and thick' because ·it overlooks the fact that· some body can easily get through the pores of glass, he must allow me to reply that I consider it an even cruder (though less solid) philosophy which holds that there are no pores in glass because sound doesn't pass through them; for we know that sound is wholly deadened or at least greatly diminished and dulled by a curtain placed in its path. This shows that sound can't pass easily through any sort of aperture, but only through apertures that are sufficiently wide and open. Indeed, given that sound. . . .depends on a movement of the air, no-one should be surprised that it can't pass through apertures that don't let through a breath of air let alone a whole mass of air.

[**(5)–(8)** These four short sections seek to correct various misunderstandings in Fromondus's comments—three concerning light and movement, one concerning colours.]

(9) He expresses surprise that on page 30 of the *Optics* I recognise no sensation except what occurs in the brain. But I expect all physicians and surgeons will help me to persuade him; for they know that amputees often think they still feel pain in the parts they no longer possess. [He gives a detailed story about a girl he used to know who had an arm amputated, didn't know this, and for weeks complained about pains in parts of that arm and hand. Conclusion:] This was obviously due to the condition of the nerves that used to lead from her brain to her arm. This certainly wouldn't have happened if the feeling—or as he says, the sensation—of pain had occurred outside the brain.

(10) I don't understand his objections to pages 159 and 163 of *Meteorology*. If my philosophy seems too 'crass' for him because it deals only with shapes and sizes and motions (like mechanics), he is condemning the aspect of my philosophy

- that seems to me its most praiseworthy feature,
- that is the main reason I prefer it to all its rivals, and
- that I am especially proud of.

I mean the fact that **(i)** all the reasoning in my kind of philosophy is mathematical and evident, and **(ii)** all the conclusions are confirmed by true observational data. Whatever I concluded to be possible from the principles of my philosophy actually happens whenever the appropriate agents are applied to the appropriate matter. I'm surprised that he doesn't realise that the mechanics now current is nothing but a part of the true physics which, not being welcomed by supporters of the common ·scholastic· sort of philosophy, took refuge with the mathematicians. This part of philosophy has in fact remained truer and less corrupt than the others because it has useful and practical consequences, so that any mistakes in it result in financial loss. So if he despises my style of philosophy because it is like mechanics, to me that's the same as despising it for being true.

If he doesn't agree that water and other bodies are made up of parts that are actually distinct, he should observe that we can often *see* such parts with the naked eye: specks of dust in stones, fibres in wood,. . . . It is perfectly reasonable to base our views about things that are too small for the senses to perceive on the model of the bigger things that we do see. . . . Perhaps the reason why he won't agree that terrestrial bodies are composed of actually divided parts is that he's worried about his 'integral union' and the other shadowy entities that a subtle philosophy packs into its continuum. If so, he should reread page 164 of *Meteorology* and he'll find that I conceive each of these particles as a continuous infinitely divisible body about which could be said everything that he has proved in his most subtle treatise *On the Composition of the Continuum*. He'll also find that I don't explicitly *deny* in bodies any of the things that

others admit in addition to the elements—·of my approach to natural science, namely shapes and sizes and motions·—but that these, few as they are, are all that my 'crass unsubtle' philosophy needs.

(11) If he's convinced that my supposition that the parts of water are oblong like eels is rash and baseless, he should remember what is said near the end of the *Discourse on the Method*. If he would favour the *Meteorology* and the *Optics* with an attentive reading of everything I wrote there, he would find countless reasons from which countless syllogisms could be constructed to prove what I say. They would go like this.

- If water is more fluid and harder to freeze than oil, that's a sign that oil is made of parts that stick together easily, like the branches of trees, while water is made of more slippery parts, like those with the shape of eels. But experience shows that water is more fluid and harder to freeze than oil. Ergo, etc.
- If cloths soaked in water are easier to dry than cloths soaked in oil, that's a sign that the parts of water have the shapes of eels, and can thus easily come out through the holes in the cloth, and that the parts of oil have the shapes of branches, and thus get entangled in the same holes. But experience shows, etc.
- If water is heavier than oil, that's a sign that the parts of oil are branch-shaped, and so leave many spaces around them, and that the parts of water are like eels, and therefore are satisfied with less space. But, etc.
- If water is easier to turn into vapour than oil, that's a sign that it is made up of parts that can easily be separated from each other like eels; and that oil is made up of branch-like parts that are more closely intertwined. But, etc.

Although each of these points taken by itself gives only probability to the conclusion, taken together they amount to a demonstration of it. But if I had set out to derive all these conclusions in the manner of a dialectician [= 'an expert in scholastic logic'], the sheer size of what I produced would have worn out the type-setters' hands the readers' eyes.

(12) What I say on page 162 of *Meteorology* seems paradoxical to him: that a slow motion produces the sensation of cold, and a fast one the sensation of heat. So he should find it paradoxical that a gentle rubbing on the hand produces a sensation of pleasure, and a harder rubbing produces pain; because pleasure and pain are at least as different from each other as are heat and cold.

[There are six more numbered items: **(13)** about cold in relation to rarefaction; **(14)** about evaporation as caused by the sun; **(15)** about why the surface of an undisturbed body of water is smooth; **(16)** about what rarefaction is; **(17)** about the taste of salt; and **(18)** about the movements of winds.]

to Huygens, 5.x.1637:

[This letter begins with two pages about lens-making. Then:] As for your request for something on mechanics, I've never been less in the mood to write than I am at present. For one thing, I don't have as much free time as I had when I was living in Breda; also, I regret—*daily*—the time that my recent publication has cost me. White hairs are rapidly appearing on my head, which brings it home to me that the only thing I should be devoting myself to is ways of slowing down their growth. That's what I am doing now, trying energetically to make up for my lack of experimental data. This task needs all my time—needs it so badly that I have decided to concentrate on this alone and have even laid aside all work on my *World* so that I'm not seduced into ·spending time on·

putting the finishing touches to it. Still, I am sending you the lines you requested, seeing that you asked for only three sheets.

An account of devices that enable us to use a small force to raise a heavy weight

The single underlying principle of all these devices is that a force that can raise a 100lb weight two feet can raise a 200lb weight one foot, or a 400lb weight six inches, and so on.

You'll accept this principle if you consider that an effect must always be proportional to the action needed to produce it. Thus, if what we need to lift a certain weight x one foot is a force that can raise a 100lb weight two feet, then x must weigh 200lb. For •lifting 100lb one foot twice over is the same as •lifting 200lb one foot or 100 pounds two feet.

Now, mechanical devices can rely on this principle to move a weight over a shorter distance by applying a force over a longer distance. They include

- •the pulley,
- •the slope,
- •the wedge,
- •the cog-wheel,
- •the screw,
- •the lever.

There are some others, but they don't relate to these six as closely and clearly as these relate to one another. [Descartes offers diagrams (except for the screw); they will be omitted here, which has required a good many changes to details of the wording.]

The pulley

♢Take a 200lb box of pebbles, attach two ropes to it, and give one rope to each of two men. To support or raise it, each man will need to exert only as much force as is needed to hold up or raise 100lb, since each bears only half of the weight. ♢Now run a single rope through a pulley and give each man one end of it; and attach the pulley to the 200lb box. Same upshot, because this differs only trivially from the previous case. ♢As before except that one end of the rope through the pulley is nailed to a beam: the situation of the man holding the other end is the same: he can still support the 200lb box with force that would be exactly enough for him to support 100lb unaided. ♢Same setup as before but now the man wants to *raise* the 200lb box; it's obvious that to raise it one foot he will have to raise his end of the rope two feet, which he can do using the amount of force that would be exactly enough for him to raise 100lb unaided. (We always need a little more force to lift a weight than to support it; that's why I have treated supporting and lifting separately.)

For perfect precision we would have to take into account •the weight of the pulley and •the friction of the rope against the pulley, but these are small in comparison with the weight of the box.

[Descartes goes on to speak of cases using two or three or more pulleys. Each time a pulley is added, the box is easier to lift to the desired height, because each addition of a pulley adds to the length of rope involved in lifting the box to that height. 'So if we add more pulleys, we can raise the heaviest of loads with the smallest of forces.' He offers all that as illustrating the fact that what is reducing the man's task is not the pulley but the lengthening of the needed rope-pull.]

The slope

If we have only enough power to lift a weight of 100lb and we want to raise a 200lb body to a height of four feet, all we need do is to pull it or roll it up an eight-foot sloping surface that ends at a height of four feet. To get the body up to that height in this way we'll employ as much force as is required to raise 100lb eight feet. And the less steep we make the slope, the less force we'll need to do the job.

[Descartes adds a warning that here again friction makes a difference. If the force needed to get the body up the slope were *entirely* devoted to weight-lifting, with none of it needed to overcome friction, then pushing it along at ground level would require no force. And another diminutive error would arise from the fact that 'flat ground' isn't perfectly flat because of the shape of the earth.]

The wedge

[Descartes explains briefly that when you raise a weight by driving a wedge under it, what you are basically doing is to force the weight up a slope; so that this isn't significantly different from the preceding device. And the same to possibilities of small errors are present here too.]

The cog-wheel

Consider a cog-wheel with a six-inch circumference, fixed to a cylinder with a one-inch circumference around which is wound a cord attached to a weight that we want to raise. To raise it one inch we must make the cylinder rotate once, which we do by making the cog-wheel rotate once; the latter rotation involves moving any given cog six inches; so the distance through which we exert force is six times the distance through which the weight rises, this proportion being exactly the proportion between the two circumferences.

[Descartes adds that we can have a cog-wheel driving another which drives another etc., each wheel smaller than the one driving it, so that there's no limit to how much weight we can lift with any given force. Except, he adds, that we have to allow for the friction involved in making the wheels turn.]

The screw

Once we know the power of the cog-wheel and the slope, it's easy to calculate the power of the screw; for the screw consists simply of a steeply sloping surface that turns on a cylinder. Say the slope of the surface is such that it takes ten turns of the screw to move it one foot into the wood, and the circumference of the circle described by the turning force is ten inches long. Since $10 \times 10 = 100$, with such a screw a single man could press as hard as a hundred men could without it, provided we make due allowance for the force that would be needed to turn it ·even if it weren't doing any other work·.

I put that in terms of 'pressing' rather than 'raising' or 'moving', because that's what a screw is most often used for. But if we want to use the screw to lift a weight, as distinct from driving it down into something, we attach a cog-wheel to it. [Descartes whips through the arithmetic of this, in terms of an apparatus by which 'one man will be able to lift as heavy a weight as 300 men could lift without it; but the details of *how* the screw is to be 'attached' to the cog-wheel are not clear. He goes on to say:] Again we have to allow for the difficulty there may be in turning the screw, which strictly speaking is due not to the weight of the load but to the form or matter of the apparatus; and since a greater force is involved in this case, the difficulty is inherently more conspicuous.

The lever

I have left the lever to the last, because it's the weight-lifting device that is hardest to explain. [Descartes's explanation (accompanied by a complex diagram) is hard to follow, and its details won't be given here. The core idea is fairly simple. Consider a lever three feet long and name three points on it:

- A is one end;
- F is a fulcrum to which the lever is attached in a way that lets it freely swing one way and the other;
- B is the other end;

and the distance A–F is two feet, leaving one foot for F–B. Suspend a 10lb box from B, and lift it by pushing down

on A. This is clearly a case where raising the box n inches will require the A end of the lever to be pushed down **more** than n inches, and the force needed to do this will be **less** than would be needed to lift 10lb n inches just by pulling it up directly. Descartes's complications all have to do with working out **how much more** distance and **how much less** force for any given position of the lever. To see that lever-position does count in this, consult your own experience: you know that the lever's force-saving power is much greater when it is horizontal than when it is almost vertical. [For the details, consult CSMK.] Descartes then adds warnings about how perfect precision would require us to take account of the curvature of the earth's surface, but says 'These points, however, have no practical significance', and then:]

It would be useful if would-be inventors of new devices ·for lifting weights etc.· knew the things I have written here *and no more*. If they did bring anything else into their plans and calculations, it would have a good chance of being wrong and leading them into error.

The devices that I have explained can be applied in many different ways. There are countless other things to consider in mechanics that I'm saying nothing about, as I have filled up my three sheets of paper, and that's all you asked for.

to Mersenne, 5.x.1637:

You tell me that your friend Fermat saw the *Optics* and had certain objections to make [they are presented starting on page 40 above]. The first was that he doubts that •the inclination to move should follow the same laws as •movement, because they are as different as potentiality and actuality. I think he acquired this doubt because he imagined that I had it too, inferring this from what I wrote early in the *Optics*: 'It's very easy to believe that in this respect the tendency to move must follow the same laws as does the movement itself.' He thought I was equating 'It is easy to believe that P' with 'It is no more than probable that P'—which is far from being the case. If P is merely probable I count it as almost false; and when I say that P is 'easy to believe' what I mean is not •that it is only probable but •that it is so clear and so evident that there's no need for me to spend time and page-space proving it. As in fact it can't reasonably be doubted that the laws governing movement (which Fermat rightly says is the actuality) must also govern the tendency to move (which is the potentiality of that same actuality). Although not it's true that anything in potentiality is later in actuality, ·the converse does hold·: nothing can possibly be in actuality without first being in potentiality.

As for his further remark that 'the gap seems especially large in this case, because the movement of a ball can be faster or slower, depending on the forces acting on it, whereas light goes through a translucent body in an instant, apparently with no succession involved', I don't understand his reasoning here. He can't say that the two are unalike because the motion of a ball can be more or less forceful, because the action I think light consists in can also be more or less strong. And it can't be because the movement of bodies is sequential whereas the transfer of light is not; because I think I have made it sufficiently clear (through the analogies with a blind man's stick and wine sinking to the bottom of a vat) that while the inclination to move is transmitted instantaneously from one place to another it still *follows the same path* as sequential motions would have done, and that's all that is at issue here.

[Two pages disagreeing with Fermat about the concept of divisibility in geometry, and then:] When you encounter objections to anything I have written, please send them to

me, however good or bad they are, and I shall respond to them. At least, I'll respond to any that are worth troubling about if their authors are willing to have them published. . . .

to Noël, x.1637:

I'm extremely glad to learn from the letter you kindly wrote me that I am still so fortunate as to have a place in your memory and affections. Thank you also •for promising to have the book I sent you examined by those of your fellow-Jesuits who most enjoy ·thinking about· such matters, and •for being so kind as to send me their criticisms. I only wish that you would also send me your own criticisms, because—I assure you—you have more authority over me than any of the others, and I more willingly defer to you than to any of them. Friends of mine who have already seen the book tell me that a lot of time and study is required if one is to asses it properly, because

- •the introductory parts (at least in the *Optics* and the *Meteorology*) can't be wholly persuasive unless one knows everything that comes after them, and
- •the later parts can't be understood unless one remembers everything that came before.

So I'll be *very* much obliged to you if you'll give it your attention or get others give it theirs. The fact is that I'm simply trying to get instruction for myself; and those who bring errors to my attention will always please me more than those who give praise. Besides, I think it's more in the interests of the Jesuits than of anyone else to examine this book. I see already that so many people are going to accept the book's contents (especially the *Meteorology* part of it) that I don't know how anyone can go on teaching these subjects in the way they been taught down through the years in most of your Colleges unless he first disproves what I have written. [Descartes adds 'or unless he follows it', but of course someone who follows Descartes's theories wouldn't 'go on teaching these subjects in the way they been taught' etc.] I know that the main reason why your people take such care to reject all sorts of innovations in philosophy is the fear that these innovations may force some change in theology as well; so I assure you that you have nothing to fear on this score so far as my writings are concerned, and that I have reason to thank God that

> the views that my reflection on natural causes has led me to regard as the most true in physics have always been the ones that are the most compatible with the mysteries of religion,

as I hope to show clearly when I have the opportunity.

⊕ [x.37: Descartes writes to a Jesuit priest—who is a teacher of a nephew of Descartes's—thanking him for his willingness to read and criticise Descartes's recently published book. He gives advice on how to tackle the work, and says there's no need to hurry: 'The later your comments come, the more favourable they will be.']

⊕ [x.37: Descartes writes to someone who is a gentleman, a soldier, an amateur mathematician, and a writer of beautiful Latin, expressing joy and admiration for a discovery that this man has made in geometry ('your rule couldn't be better'); expressing surprise that a soldier should write Latin so well; and responding to something he has said about presence of mind in battles.]

⊕ [23.ix.37: Huygens writes to Descartes with an elaborate explanation for his delay in replying to Descartes's letter of 5.x.37 and the accompanying short course in mechanics; lengthy praise of Descartes; and a question about what he should do if he 'can't keep quiet' about having received writings from Descartes and people clamour to see them.]

⊕ [ix.37: Fermat writes to Mersenne with a ten-page response to Descartes's 5.x.37 letter to Mersenne replying to Fermat's first comments. The topic is, again, Descartes's supposed 'proof' of the Descartes-Snell law relating angles of incidence to angles of refraction. Fermat opens

with an earnest declaration that what motivates him to persist with 'this little dispute' is neither envy nor ambition but a desire to know the truth.]

to Huygens, 4.xii.1637:

The three sheets that I sent you [the Account starting on page 50] don't in the least deserve the good words in the letter which you kindly wrote me, and I assure you that I'm ashamed to have sent you such a meagre offering. In fact my fear of getting into something much longer than you had asked for led me to omit the finest parts of my topic, such as

- the treatment of velocity,
- problems concerning the balance, and
- several ways of increasing motive force other than the ones I explained.

But so that you won't think that I'm trying to get you to invite me to add these topics to the treatise, I'll reply to the last part of your letter and tell you what I'm busy with.

I have never taken greater care in looking after myself than I'm doing now. I used to think that death couldn't deprive me of more than 30 or 40 years, but now I wouldn't be surprised if it were to rob me of more than 100 years. It seems obvious to me that if we merely guard ourselves against certain habitual errors in our way of life we'll be able to reach a much longer and happier old age than we could otherwise—and to do this without any further medical discoveries. But I need more time and more observational data if I'm to investigate everything relevant to this topic, so I'm now working on a compendium of medicine, basing it partly on books and partly on my own reasoning. I count on being able to use this as a provisional means of obtaining from nature a stay of execution, and of being better able from now on to carry out my plan. . . .

to Plempius, 20.xii.1637:

I'm glad that my answers to Fromondus's objections [see page 46] have at last reached you. I am surprised that they have led him to think that I was annoyed by his paper. I was not at all; and I don't think that I uttered the slightest word against him without his having said similar or harder things against me first. I concluded that he liked that style of writing, and so against my own inclinations I followed him in it because I thought he might enjoy the game less if I received his attack too gently and softly. Friends don't stop being friends when they play chess against each other; indeed their very skill in the game often creates and strengthens their friendship between them. I was only trying by my reply to earn his goodwill. . . .

I don't expect to have a sufficiently ripe judgement on my book from anyone who merely whips through a borrowed copy. The points near the end of each treatise can't be understood unless everything that goes before is remembered; and the proofs of the propositions at the beginning depend on everything that follows. What I say in the first chapters about the nature of light, and about the shape of the particles of salt water and fresh water, are not my *principles*, as you seem to object, but rather *conclusions* that are proved by everything that comes after. Sizes, shapes, positions and motions are my •formal object (in philosophers' jargon), and the physical things that I explain are my •material object. The principles or premises from which I derive these conclusions are only the axioms that geometers base their demonstrations on—'The whole is greater than the part', 'If equals are taken from equals the remainders are equal', and so on—but they aren't abstracted from all sensible matter, as in geometry; rather, they are linked with various indubitable empirical data. For instance, from **(i)** the oblong and inflexible shape

of the particles of salt I deduced **(ii)** the square shape of its grains, and many other things that are also obvious to the senses; I wanted to explain **(ii)** by **(i)**—explaining effects by their cause. I wasn't trying •to prove things that are already well enough known, but rather •to demonstrate the cause by the effects *a posteriori* [see Glossary], as I remember I wrote at length in my reply to Fromondus's objection **(11)** [see page 49].

I'll be glad if the Jesuit to whom you recommended my book writes to me about it; anything that comes from the men of that Society is likely to be well thought out, and the stronger the objections he puts forward the more pleased I'll be with them. For the same reason I eagerly await your objections about the movement of the heart.

to Mersenne, end of xii.1637:

The judgment of my writings by ·de Beaugrand·, the author of *Geostatics*, doesn't bother me. I don't like having to speak well of myself, but because few people can understand my Geometry, and you ask me what my own view of it is, I think it is appropriate that I should tell you:

> I couldn't wish it to be better. In the *Optics* and the *Meteorology* I merely tried to •convince the reader that my method is better than the usual one; but in my *Geometry* I claim to have •demonstrated this.

Right at the beginning I solve a problem that Pappus says none of the ancients managed to solve; and it can be said that none of the moderns has been able to solve it either, since none of them has written about it, even though the ablest of them have tried to solve the other problems that Pappus says were tackled by the ancients. These modern writers include Ghetaldi, Snell, and others among whom ought to be counted that Counsellor of yours, Fermat—yet none of these knew how to solve a problem that had defeated the ancients. [Descartes refers to each of these moderns not by name but by the title of one of his books.]

Moreover, my discussion in Book II of the nature and properties of curved lines and how to study them seems to me to be as far removed from ordinary geometry as Cicero's rhetoric is from a child's ABC. And when your geostatician promises to provide better methods than mine for finding the tangents to all curved lines, I am so far from believing him that I see him as making a fool of himself like the strutting captains in Italian comedies. As for the claim that the things I have written could easily have been taken from Viète—the fact is that I tried to include only things that I thought were not known to him or to anyone else. That's what makes my *Geometry* hard to understand.

[Descartes invites Mersenne to compare his treatment of problems about the number of roots in each equation with Viète's treatment of them. The difference is that Descartes presents general rules that solve all these problems, whereas Viète only gives particular examples. He adds 'between ourselves' a disparaging remark about Viète's level of knowledge.]

For each type of problem I have •determined what solutions are possible and •shown how to find them; so I claim that people should not only believe that I have accomplished more than my predecessors but should also be convinced that posterity will never discover anything in this subject that I couldn't have discovered just as well if I had troubled to look for it. Please keep all this to yourself. I would be very embarrassed if others knew that I have written you as much as I have on this topic.

I am not so anxious to see Fermat's disproof of what I had written on refraction as to ask you to send it to me by post, but when it's convenient to send it to me by sea with some cargo I'll be pleased enough to see it, along with the

Geostatics and de la Chambre's book on light, and anything else of that sort. I would in fact be glad to see at once what others write for or against my views or about their own discoveries, but the cost of sending letters ·by post· is too high.

Letters written in 1638–1640

to Mersenne, i.1638:

[This letter opens with two pages of disparaging remarks about Fermat. He has a bold and lively mind, Descartes says, but he has been overpraised by people who aren't qualified to judge his work, and this is doing him harm. Then a renewed request to Mersenne to pass on anything he hears for or against Descartes's own work. Finally:]

You ask whether I think that water is in its natural state when it is liquid or when it is ice. I reply that I don't regard anything in nature as violent [see Glossary] except in relation to the human intellect, which calls 'violent' anything that isn't in accordance with its will or with what it judges ought to be the case. It's no less natural for water to be ice when it is very cold than to be liquid when it is less cold, because the causes of each are equally natural.

⊕ [i.38: Descartes writes to Mersenne with more criticisms of Fermat, and dismissive comments on something Fermat had written in criticism of Descartes's *Geometry*.]

⊕ [i.38: Plempius writes to Descartes in response, he says, to Descartes's frequently expressed wish to hear of anything that Plempius finds wrong with his account of the movement of the heart. He quotes a passage from Aristotle in support of his claim that 'your new theory is old'. Then a couple of pages objecting to some of Descartes's details.]

⊕ [25.1.38: Descartes writes to Mersenne about: •letters that seem to have gone astray; •a lens-maker named Cardinal who is having some success, but 'I am not sure whether to want him to follow my designs' because he likely to get things wrong on his first attempt and 'then blame me'; •Mydorge, who is so able and worthy that he will in time, Descartes expects, come around to Descartes's views about vision; •and a few other small things.]

⊕ [25.1.38: Descartes writes to (probably) Huygens, mainly about 'your lens-maker' whom he has now met and thinks well of; if he gets far enough with his work, Descartes is willing to go to Paris to help him further, preferring him to Cardinal.]

⊕ [2.ii.38: Huygens writes to Descartes, apologising a little for Fromondus, deploring the state of the world, praising Descartes to the skies, and asking him to 'have pity' on the world by publishing all his work.]

from Pollot to Reneri for Descartes, ii.1638:

[This version follows CSMK in accepting 'from Pollot' and 'to Reneri'; AT isn't sure of either.]

I'm not brave enough to put my difficulties over Descartes's work directly to him; so I ask you to pass them on to him, doing this in such a way that he will find them acceptable, as coming from someone who is more concerned with learning than with contradicting.

(1) The second of his moral rules ·in Part 2 of the *Discourse on the Method*· says that if we have decided to act in accordance with some opinion, we should continue to abide by it—even if it is highly doubtful—as firmly as if it were utterly certain. This seems dangerous. If the opinion is false or bad, the more we follow it the more we'll be involved with error or vice.

(2) The third rule is not a philosopher's resolution but rather a fiction that someone can use to soothe and deceive himself ·in times of trouble·. If something is possible but there are reasons for disregarding it, *that* is what a philosopher should do—not pretend that they are impossible. And no-one with common-sense will ever believe that nothing is in his power except his thoughts.

(3) The first principle of his philosophy is: *I think, so I am*. This is no more certain than plenty of others such as *I breathe, so I am* or than this: *Every action presupposes existence* [i.e. 'presupposes something that *performs* the action']. 'You can't breathe without a body, but you can think without a body'—well, that ought to be shown through a clear demonstration. Of course we can *imagine* •that we don't have a body (though it isn't easy to do), and •that we can live without breathing; but it doesn't follow from this that we don't have body or that we can live without breathing.

(4) So there's a need to prove that the soul can think without the body; Aristotle presupposes it in one of his axioms, but he doesn't prove it. He holds that the soul can •act without bodily organs, from which he concludes that it can •exist without them; but he doesn't prove the premise, and experience contradicts it. . . .

(5) If we doubt ·the existence of· things in our environment, it doesn't follow that there is some being more perfect than we are. Most philosophers have doubted many things. . . .without concluding that there is a divinity; there are other proofs that can give one the thought of God and prove his existence.

(6) We see that the beasts make their attitudes and passions known through their sort of language: they have many signs showing their anger, fear, love, sorrow, regret at having acted badly. . . . It's obvious that the behaviour of animals is driven by a principle [see Glossary] that is more excellent than merely being compelled to act by the state of their organs. The principle I'm talking about is *instinct*—something that never occurs in a machine or in a clock, which don't have passions or attitudes as animals have.

(7) The author says ·near the end of Part 5· that the soul must be necessarily created; he'd have done well to give a reason for that.

[A note on item **(7)**: The phrase 'must be necessarily created' (*doit être nécessairement crée*) is peculiar; and it doesn't connect with anything in the *Discourse*. What Descartes does say in the *Discourse* is that the human soul must be created expressly (*doit être expressement crée*) , meaning that whatever created your soul must have created specifically *it* rather than something or other out of which your soul arose. There is nothing peculiar about that, and Descartes's reply to **(7)** on page 69 precisely fits the *expressement* version and has nothing to do with the *nécessairement* version. Conjecture: •a slip of the pen on Pollot's part, and •an editorial interference with what Descartes wrote (we don't have the manuscript).]

(8) If light were extended, like a stick, it would be not a •movement but a •line that pushes. And if it were a movement ·of something· that goes from the sun to us, it wouldn't do that in an instant, because all movement takes time; and if •light has to pass. . . .across an interval full of bodies that are much bigger than the subtle [see Glossary] matter that carries •it, those bodies will bounce it around so that it doesn't go in a straight line.

(9) Given that the author says that he is writing methodically, clearly, and distinctly, you would expect him to show what this 'subtle matter' that he supposes *is*. We are entitled to ask:

—Does it exist?

—If it does, is it •elementary [i.e. the kind of stuff that ordinary things are made of] or rather •a kind of ether ·that exists only in outer space·?

—If it is elementary, is it •an element itself or rather •an ingredient in all the elements?

(10) If water is liquid only because this 'subtle matter' makes it so, it follows that ice doesn't melt any faster near the fire than it does elsewhere. ·This is obviously false, so· it has to be admitted that what melts ice is not subtle matter but heat.

(11) It's hard to imagine that water is—·i.e. that its tiny particles are·—shaped like eels. And the reasons given for this. . . .show only that the parts of water are slippery and able to fit into all sorts of shapes; they don't show that they must be shaped like eels. And if the most penetrating bodies must be eel-shaped, then *air* must even more so than water is.

(12) If salt has its taste because of its sharp pointed shape, other bodies with that shape would taste salty, whereas in fact they are bland. It would also follow that *liqueurs* [= 'liquids', or = 'alcoholic drinks', or = 'liqueurs'], which Descartes says are eel-shaped with nothing sharp about them, would be tasteless, especially those that are mild and don't have the salt-like sharp point. And, finally, the taste would be merely external shape, not an internal quality of the salt; and salt's power to stop meat from rotting would consist merely in its pointedness, its shape.

[Some further challenges to Descartes's explanations in *Meteorology*. **13** Why some bodies sink in water and others float. **(14)** If small particles of salt are shaped as Descartes says they are, and are rigid as he also says they are, it should be easy to strain the salt out of sea-water. **(15)** Then some remarks about inconsistent spelling in Descartes's text.]

⊕ [12.ii.38: Descartes writes to Pollot thanking him for his tokens of esteem, and saying that he will do anything in his power to repay them. He had a few separately printed copies of the *Geometry* to be given to people skilled in geometry, and he has set aside one for Pollot. He hasn't kept a copy of the short course on mechanics that he wrote for Huygens [see page 50], but he'll be happy for Pollot to see it if Huygens is willing; but also happy if he *isn't* willing, because he (Descartes) is ashamed of its imperfections.]

⊕ [12.ii.38: Descartes writes to Huygens, reporting on his recent doings with the *tourneur*—operator of a lathe for making lenses—whom Huygens had first introduced to him. Having been to Amsterdam and seen a model this man has made, Descartes is optimistic about his eventual success. But he needs copper and steel for making his machine, and there is competition for those materials. Descartes now asks Huygens to do what he can to obtain from the Dutch government an *octroi* for this man—a certificate that would entitle him to priority.]

to Plempius, 15.ii.1638:

I had been eagerly awaiting your objections to my views on the movement of the heart, and have been well rewarded. When I considered your learning, intelligence and character, not to speak of the kindness you have shown me, I knew that your objections would be erudite, ingenious and unsullied by any prejudice due to ill-will; and I wasn't wrong in my judgement. I thank you for •sending them to me and •showing me how to support my views with the authority of Aristotle. That man was lucky! Anything that he wrote, whether thoughtfully or casually, is regarded by most people today as having oracular authority. So there's nothing more I could wish for than to be able to follow in his footsteps in all things without departing from the truth; but on the point at issue I couldn't boast of having done as well as that! It's true that I say as he did that the beating of the heart is due to the expansion of liquid heating up within it; but by 'liquid' I simply mean *blood*; I don't talk as he did of 'the expansion of liquid that is being continually produced from food, causing the outer membrane of the heart to expand'. If I said any such thing I could be refuted by many clear arguments; and if I said that it was only the outer membrane of the heart that swelled, ignoring the ventricles, the blood vessels and the valves, I would be inviting the suspicion that I had never actually *looked at* the structure of any animal heart. Drawing a true conclusion from false premises, it

seems to me, is no better than drawing a false conclusion from them. If two people reach the same place, one by the right road and the other by a wrong one, we oughtn't to think that the former is following in the other's footsteps.

(1) You object that sometimes even in a heart that has been taken from the body and dissected, individual parts of it go on beating although no blood is flowing into or out of it. Well, I once made a rather careful observation of this phenomenon in fish, whose hearts after removal from the body go on beating for much longer than the heart of any terrestrial animal. But I could always judge—and in many cases I could *see*—that some remaining drops of blood had fallen from higher up into the lower part where the pulse was occurring. This easily convinced me that even a tiny drop of blood falling from one part of the heart into a slightly warmer part was enough to cause this beat. Bear in mind that the •smaller the quantity of any liquid the •easier it is to rarefy. The oftener our hands make some movement, the more apt they are to make it again on future occasions; similarly, as the heart continually expands and contracts right from the first moment of its formation, the slightest force comes to be enough to push it into this repeated movement. . . . Anyway, this objection strikes me as much more damaging to the common view that the heart's movement is due to some faculty of the soul. How could the movement of the cut-up bits of the heart depend on the human soul, when it's an article of faith—·in the Aristotelian philosophy·—that the rational soul is indivisible. . . .?

(2) Your second objection is one that Galen made at the end of his book on the question whether blood is contained in the arteries. I have never performed the relevant experiment: it would be hard for me to perform, and I don't think it would be worthwhile. [There follow two pages of details explaining why it wouldn't be worthwhile. Then:]

We aren't impressed by the authority of Galen when he says in various places that *What happens is not that the arteries expand because of what is in them, but rather that matter flows into them because they expand.* For this is disproved by a decisive experiment that I have seen done several times and did again today in the course of writing this letter. [Descartes describes at considerable length a protracted vivisection—cutting open a live rabbit in order to see how it heart responds to various changes. We can spare ourselves the details of this. Descartes concludes:] This experiment is fatal to Harvey's view about the movement of the heart, for he clearly states the very opposite, namely that the ventricles dilate. . . .in order to take in blood and then contract. . . .in order to force the blood into the arteries.

(3) You say that if the heart's dilation is due to the rarefaction of the blood, the expanded stage of the heart should last longer than it in fact does. Perhaps you think this because you are imagining the rarefaction as being like what happens when water is boiled to make steam; but there are other sorts of rarefaction, e.g. when the character of the liquid remains the same but its volume increases. The water-into-steam kind of rarefaction is obviously quite different from the rarefaction of the blood in the heart [and Descartes goes on to give two reasons for this].

The second sort of rarefaction, where the liquid increases in volume, can be either gradual or instantaneous. In the gradual sort the parts of the liquid gradually take on some new motion or shape or position that causes the gaps between them to increase in number or size. . . . In the instantaneous sort of rarefaction . . . .most of the particles of the liquid, which are randomly dispersed throughout its volume, undergo some simultaneous change that causes them to take up significantly greater space. The facts show that *this* is how blood is rarefied in the heart, for

the expansion takes place instantaneously. If we attend to all the points made in Part 5 of my *Discourse on the Method* we should have no more doubts about this than we have about whether oil and other liquids are rarefied in this way when we see them suddenly boiling up in a pot over the fire. The entire fabric of the heart, the heat in it, and the very nature of the blood all contribute to this effect; nothing that we perceive by the senses seems to me more certain than this. As for the question of *heat*: we don't feel much heat in fishes, but their hearts do feel warmer than any other organs in their body. . . .

It remains for me to reply to your objections against the circulation of the blood.

The first objection is that arterial blood is different from venous blood, I pointed this out in my *Discourse on the Method* as a possible objection against Harvey, because he holds that no change in the blood occurs in the heart. I on the other hand wasn't threatened by this objection because I hold that when the blood is in the heart it suddenly expands—boils, as it were—and it could hardly go through that without suddenly changing. . . ,

Then there's the experiment in which most of the veins going to a limb are tied, while the arteries remain free. When this is done, you say, the limb doesn't swell up, but rather wastes away gradually through lack of nourishment. Surely two situations have to be distinguished here. **(i)** When the veins have been ligated as described, they will certainly swell a little, and if you open one of them above the ligature nearly all the blood in the body can flow out, as surgeons see every day. I think this provides not merely •highly probable evidence but •conclusive proof of the circulation of the blood. **(ii)** I can readily believe that you are right about the results of leaving the veins ligated for a long time, though I haven't investigated this for myself. For if the blood in ligated veins stagnates, it will soon become quite thick and hardly fit for nourishing the body; and no fresh blood will reach it from the arteries, since the tiny channels between the arteries and the veins will all be blocked by the thick blood. Perhaps the veins themselves will contract a little, owing to a loss of the fluid content of the blood brought about by imperceptible evaporation. But this poses no difficulty for the circulation thesis.

To sum up, even if I regard your objections as the most powerful that could be raised against my views on the movement of the heart and blood, not one of them induces me to change my view. But please let me know whether you think that my brief replies really answer your objections.

from Morin, 22.ii.38:

Since I had the honour of meeting you in Paris I have thought of you as having a mind that could leave something rare and excellent to posterity; and I am delighted to see that I was right, by seeing the fine book that you have published on mathematics and physics. . . . In mathematics you'll have only people who admire the scope and elevation of your mind; but in physics, I don't think you'll be surprised that there are people who contradict you.

[He then presents difficulties and objections—20 pages of them—that aren't given here because we learn enough about them from Descartes's long reply on 13.vii.38 starting on page 74. He closes thus:]

I could present various other difficulties concerning various points in your physics, but for the present I will settle for having you clarify the nature of light for me, if you think I am worthy of that favour. Mersenne can assure you that I have always been one of your partisans. By temperament I really hate the ill-natured mob who, when they see a superior

intellect like a new star in the sky, instead of •wishing him good fortune in his efforts and inventions, •turn on him enviously and do their best to blot out his name, his glory, and his merits—despite the fact that his generosity with his results is drawing them out of their ignorance. I try to keep at a safe distance from these back-stabbers. Later generations will pity me for my misfortunes and, speaking of this *hard* century, will say: 'Back then, fortune didn't favour the learned.' I hope it will do better for you than it has for me, so that we can see your new physics, the principles of which will, I'm sure, remove all my difficulties. . . . Of all the learned men I know you are the one I honour most, for your virtue and your big-hearted plans.

to Vatier, 22.ii.1638:

I am overwhelmed by your kindness in studying my book of essays with such great care, and sending me your opinion of it with so many marks of goodwill. When I sent it to you I should have enclosed a letter assuring you of my very humble service, were it not that I was hoping—vainly as it turned out—to circulate the book anonymously. I must believe that it is your affection for the father rather than any deserts of the child which has made you welcome it so favourably. I am extremely grateful to you. Perhaps I am too flattered by the very favourable things you say in your two letters, but I must say frankly that no-one, among all those who have been good enough to express an opinion of my work, has done me such good justice as you. No-one else's criticism has been so favourable, so unbiased and so well informed. By the way, I am surprised that your second letter followed so closely on your first. I received them more or less at the same time, though when I saw your first I was sure that I must not expect another before your vacation.

I will answer you point by point. I must say first that my purpose was not to teach the whole of my method in the discourse in which I propound it, but only to say enough to show that the new views in the *Optics* and the *Meteorology* were not casual thoughts and might be worth the trouble of examining. I couldn't display the use of this method in the three treatises that I published, because it prescribes an order of •research that is quite different from the one I thought proper for •exposition. Still, I gave a brief sample of it in my account of the rainbow in *Meteorology*, and if you reread that rather difficult passage I expect it to satisfy you more than it did the first time. I attached these three treatises to the *Discourse* that precedes them because I'm convinced that if people examine them carefully and compare them with earlier writings on the same topics, they'll see that the method I'm using is no ordinary one and is perhaps better than some others.

What I wrote in the *Discourse on the Method* about the existence of God is indeed too obscure; although it's the most important section in the book, it is—I admit—the least worked out. . . . The main reason for that is that I didn't want to take the risk of going into detail about the arguments of the sceptics, or say everything that is needed to withdraw the mind from the senses. To have a proper sense of the certainty and evidentness of my kind of argument for God's existence you need to have a clear recollection of arguments that show the uncertainty of all our knowledge of material things; and these thoughts did not seem to me suitable for inclusion in a book that I wanted to offer something even to women while also giving the finest minds something to think about. I confess also that this obscurity arises partly—as you rightly observed—from my assuming that certain notions that the habit of thought had made familiar and evident to me must be equally so to everyone; for example the supposition that

since our ideas can't get their forms or their being except from external objects or from ourselves, they can't represent any reality or perfection that isn't either in those objects or in ourselves. I'll explain this further in a second edition. . . .

I'm grateful for your care in examining my view about the movement of the heart. If your physician has any objections to it I'll be glad to have them and won't fail to reply. About a week ago a friend of mine who is a Professor of Medicine at Louvain [Plempius] offered seven or eight objections to that same material, and I sent him two sheets in reply. I would like to receive more of the same kind about all the difficulties that crop up in my attempted explanations. I shan't fail to reply carefully to them, and I'm sure I can do this without offending those who present them. This is something that a group can do more easily than one man on his own, and no-one could do it better than the members of your Society [the Jesuits]. I would regard it as a great honour and favour if they took the trouble to do this; it would be the quickest way to find out all the errors or all the truths in my works.

As for light, if you look at the third page of the *Optics* you'll see that I said explicitly that I was going to speak about it only hypothetically. Indeed, since the treatise that contains the whole body of my physical theory is named *On Light*, and since in it I explain light in greater detail and at greater length than anything else, I didn't want to write it all out again in *Optics* but only to convey some idea of it by comparisons and hints, so far as seemed necessary for the latter work. [Descartes is referring here to a work that was published posthumously under the title *The World, or Treatise on Light*.]

You express pleasure at my not allowing others to get in first in publishing my thoughts; thank you for that. But that's something I have never been afraid of. •It matters little to me whether I am the first or the last to write what I write, provided that what I write is true. •Anyway, all my thoughts are so closely connected and so interdependent that no-one could steal any one of them without knowing them all.

Please tell me without delay about difficulties you find in what I have written on refraction or anything else; because if you wait until my more detailed views on light are published, that may be a long wait! I can't prove *a priori* [see Glossary] the assumptions I made at the start of the *Meteorology* without expounding the whole of my physics; but the empirical results that I have deduced rigorously from them, and that can't be deduced in that way from other principles, seem to me to prove them sufficiently, *a posteriori*. I realised that this procedure would shock the readers at first, and I think I could easily have prevented this by two changes in my handling of these starting-points: •not calling them 'assumptions', and •not stating them until I had given some reasons to prove them. I chose the procedure because **(a)** I thought I could strictly deduce my results from the first principles of my metaphysics, so I wanted to ignore other kinds of proofs; and **(b)** I wanted to see whether the simple exposition of truth, without any quarrels with contrary opinions, would carry conviction. Those of my friends who have read most carefully my treatises on *Optics* and *Meteorology* assure me that I have succeeded in this. At first they found the material as difficult as everyone else did; but now that they have reread it three or four times, they tell me, they no longer find anything it that they think is open to question. And it isn't always necessary to have *a priori* reasons to convince people of a truth. Thales—or whoever it was who first said that the moon receives its light from the sun—presumably had no support for this except that it provides an easy explanation for the different phases of the moon; that was enough to ensure that from then until now this view has been peacefully accepted by everyone. My thoughts are so interconnected that I look forward to the time

when people will find my principles—having become familiar by frequent study, and being considered all together—are as well proved by the consequences I derive from them as the borrowed nature of the moon's light is proved by its waxing and waning.

[In the background of this paragraph is the fact that Descartes would have published the works in question if he hadn't been scared off by the Roman Catholic Church's condemnation of work by Galileo.] Finally, you ask about the publication of my Physics and Metaphysics. Briefly: No-one wants that more than I do, but only under certain conditions without which I would be foolish to want it. I will say also that I am deeply calm about the risk of their containing anything against the faith. Indeed, I'm vain enough to think that my principles can *support* the faith more strongly than any human arguments up to now. Especially the doctrine of transubstantiation [see Glossary], which the Calvinists say can't be explained by the ordinary philosophy, is very easily explained by mine. But it doesn't look as though the conditions that could oblige me to do so [he means: 'the conditions that would make it safe for me to publish that work'] will be fulfilled any time soon; so I settle for doing whatever I regard as my duty, leaving everything else to the Providence who rules the world; knowing that it is he who gave me the small beginnings of which you have seen the samples, I expect him to give me the grace to complete my work if that would be useful for his glory; and if it wouldn't be, I give up all desire to do it. [In the preceding sentence, providence could be referred to as 'it' rather than 'he' etc.; French doesn't distinguish these.] I assure you that the sweetest return I have had from my publications is the self-approval that your letter causes in me. It is especially precious and welcome to me because it comes from a person of your worth who is also a priest and is at the very place [the College of La Flèche] where I had the good fortune to receive my entire education in my youth, and from the home of my masters, towards whom I will never fail in gratitude.

against Fermat, 1.iii.38:

[This was presumably directed to Roberval and Étienne Pascal.] I am surprised that the treatise *Maxima and Minima*—which was sent to me a while ago and which I now learn is Fermat's work—has its defenders. It seems to me that they have *no* success in excusing it.

[Descartes now embarks on several pages of geometry, specifically rules for determining tangents to various curves: Fermat's rules are wrong, he says, and the pro-Fermat writers have misrepresented Descartes's work in order to criticise it. At the end of all that:]

As for other things that these gentlemen—·Fermat's defenders·—say that he has discovered, I would like to believe whatever they say. But I have never *seen* anything by him except •this *Maxima and Minima* and •a copy of a letter in which he claims to refute Part 2 of my *Optics*; and I found self-contradictions in each of those. I can't form opinions about his achievements except on the basis of what I hold in my hand.

I beg Fermat's defenders to believe that if they are right that there's some personal animosity between him and me, it comes entirely from his direction. I aim never to have a grudge against those who try to prove that I'm wrong about something, ·especially· in a battle where it is no disgrace to lose. When I see that Fermat has friends who work hard to defend him, I conclude that they are drawn to him by some attractive characteristics that he has. . . .

[The letter ends with a further page expressing Descartes's extreme irritation with people who criticise his work without understanding it—some of this being aimed

in Fermat's direction. He comments on the difficulty that friends sometimes have in acting as impartial judges, and remarks that Hardy and Mydorge are the only two people in Paris whom he would trust to judge properly in the present matter]

⊕ [1.iii.38: Descartes writes to Mydorge, enclosing copies of the whole Fermat-Descartes interchange and asking for his judgment on it. The dossier includes Descartes's four-page account of the main things wrong in Fermat's latest letter (to Mersenne), a letter 'to which I haven't been willing to reply, for a reason that you'll see'. He asks that all this be passed on to Hardy, with a request for his judgment.]

to Mersenne, 1.iii.1638:

I owe a reply to three of your letters, namely those of 8.i and 8 and 12.ii. The last of these I received only today, and the first only a week ago. I'll reply in due order to the particular points that call for an answer; but on a more general note, I must first •thank you for alerting me to many things that it's important for me to know, and •assure you that so far from being upset by the bad things that are said about me, I rejoice in them—the more extravagant and outrageous they are, the more I count them in my favour. . . . These spiteful people wouldn't go to such lengths to speak ill of me if there weren't others speaking well of me. Besides, truth sometimes needs to be contradicted in order to be better recognised. But I can only laugh at those who speak without reason or justification.

As for de Beaugrand, I'm surprised that you condescend to speak of him, after the way he treated you. [Descartes believed, mistakenly, that Beaugrand had retained the MS of Descartes' *Discourse on the Method*, passed on the MS of the *Optics* to Fermat without permission, held back the licence to publish, etc.] I'd be glad if you would give me an account of that affair once more;. . . .I'm not sure enough about the details to be able to 'thank' him in the way he deserves. As for the discourses written by him and his like: please treat them as *nothing*, and tell their authors that I am doing the same. Above all,

> *please* don't agree to send any writing by anyone unless its author says in writing that he agrees to my publishing it along with my reply. . . .

After seeing Fermat's last letter, which he says he doesn't want published, I very explicitly asked you not to send me any more letters of that sort. Of course if a Jesuit or a priest of the Oratory, or anyone else who was incontestably honest and level-headed, wanted to send me something, a little more caution would be needed. I'll be entirely at the disposal of such a person, but not of those spiteful characters whose aim is anything but the truth. . . .

[Two pages of epistolatory politics. •Two of Fermat's friends have persuaded Mersenne to slow down the exchanges between him and Descartes, for the worst of reasons, Descartes says. •Descartes is enclosing his reply to comments by Mydorge, and lists *five* other things that he wants passed along with it. Then:]

As for my arguments for the existence of God, in due course they will be at least as highly regarded as any other part of the book. Vatier makes it clear that he appreciates this point. His last letter shows that he fully approves of everything I have written; and that's as much as I could wish from anyone. So that what you had been told about him is improbable.

I'm surprised that you should tell me that my reputation is at stake in my reply to Fermat [letter to Mersenne of i.38 page 57]. In that reply, I assure you, there's not a single word that I would wish to change, except the slips I pointed out to you and others that you can recognise by the erasures. You should speak of noting down the points in my book that

you regard as falsified by experience; I'm surprised, because I venture to assure you that there aren't any. I made all the observations for myself, including the one you mention concerning *hot* water freezing faster than cold water. What I said in the book concerned *water that has been heated over a fire for a long time*. Take some water that has been thus treated, and some water that hasn't, with both now at the same temperature: the former will freeze faster than the latter. [Descartes follows this with some impatient remarks about people who don't—perhaps can't—perform experiments accurately.]

I am sorry to hear that Galileo's eyesight has failed. I am sure he would not think ill of my *Optics*, though I don't mention him by name in it.

[Dismissive remarks about 'your analysts', none of whom understand Descartes's *Geometry*; he names several. He asks Mersenne to send along their criticisms, subject to the (indented) condition stated earlier in this letter. 'And tell them that after I have seen their writings my level of esteem for them will be as high as they deserve.' Further remarks about individual persons and about the designing of lenses.]

⊕ [9.iii.38: Descartes writes to Huygens, a variety of remarks about people—Campanella, Fromondus, Plempius, Fermat, and others.]

to Reneri for Pollot, iv or v 1638:

Your friend need not have been so ceremonious. People of such worth and intelligence need no formal introduction, and I will always count it a favour when they do me the honour of consulting me about my writings. Please tell your friend not to hesitate to do so. This time, however, since he wanted it so, I will ask you to pass on my replies to him. [This responds to the letter of ii.38, starting on page 57.]

(i) If I had said without qualification that we should hold to opinions that we have once decided to follow, even though they are doubtful, I would indeed have been as much to blame as if I had said that we should be opinionated and stubborn. . . . But that's not what I said. I said that we must be •decisive in action even when •undecided in judgement, and that we should follow the most doubtful opinions just as steadily as if they were quite certain [*Discourse*, start of Part 3]. By this I meant that once we have settled on the opinion that P which we judge doubtful—i.e. once we have decided that P has no rivals that we judge to be better or more certain—we should act on P with as much constancy as if we knew that it was the best, which indeed it is when so considered. There is no danger that this constancy in action will lead us further and further into error or vice, since there can be error only in the intellect, which—I am supposing—remains free throughout and regards as doubtful what *is* doubtful. Moreover, I apply this rule mainly to actions in life which admit of no delay, and I use it only provisionally, intending to change my opinions as soon as I can find better ones, and to lose no opportunity to look for them. Finally, I was obliged to speak of this firmness and resolution in action for two reasons: •for the sake of ease of conscience, and •to head off a criticism that might be ·wrongly· aimed at my saying that in order to avoid rashness we should must once in our lifetime put aside all the opinions we have hitherto believed—namely the criticism that such a universal doubt could give rise to great indecision and moral chaos. Altogether it seems to me that I couldn't have been more careful about this, placing the virtue of decisiveness between its two contrary vices, indecisiveness ·in action· and obstinacy ·in belief·.

(2) [This refers to *Discourse on the Method*, early in Part 3 ('The third maxim. . . ').] It doesn't seem to me a fiction, but a truth that nobody should deny, that there's nothing **entirely** within

our power except our thoughts; at least if you take the word 'thought' as I do, to cover all the doings of the soul, so that not only meditations and acts of the will, but the activities of seeing and hearing and deciding on one ·bodily· movement rather than another, so far as they depend on the soul, are all 'thoughts'. In philosophical language, nothing is strictly attributable to a man except what is covered by the word 'thought'; purely bodily events are said to *happen in* a man rather than to *be performed by* him. Notice too the word '**entirely**' and what came after it: 'After we have done our best in dealing with matters external to us, whatever we fail to achieve is absolutely impossible so far as we are concerned.' This shows that I didn't mean that external things are not at all in our power, but that they are in our power only in so far as they can be affected by our thoughts; they aren't absolutely or entirely in our power because other powers, outside us, can frustrate our designs. To make myself clearer I even put side by side the two expressions 'absolutely' and 'so far as we are concerned', which a critic, if he did not understand the sense of the passage, might complain contradicted each other. Nothing exterior, then, is in our power except in so far as it is at the command of our soul, and nothing is absolutely in our power except our thoughts. But though this is very true, and no-one could find it hard to accept when he thinks of it explicitly, yet I did say that it's a belief one has to grow accustomed to, and that long practice and repeated meditation are necessary to do so. This is because our desires and our passions are constantly telling us the opposite. As children we found that by crying or commanding we could make our nurses obey us and get what we wanted; and this happened so often that we have gradually convinced ourselves that the world was made only for us, and that everything is our due. Those who are born to greatness and fortune are the more likely to deceive themselves in this way; they too are commonly seen to be the most lacking in patience—·i.e. in willingness to *put up with* it, to *take* it without whining·—when they have to bear misfortune. It seems to me that there's no better occupation for a philosopher than to accustom himself to believe what true reason tells him, and to beware of the false opinions that his natural appetites urge upon him.

(3) When someone says 'I am breathing, therefore I exist', if he wants to prove he exists from the fact that his breathing can't occur without his existence, he proves nothing. His 'proof' requires him first to establish that he really is breathing, which he can't do without also proving that he exists. But if he aims to prove his existence from his feeling or belief that he is breathing, so that he judges that even if the opinion were untrue he couldn't have it if he didn't exist, then his proof is sound. For in such a case the thought of breathing is present to our mind before the thought of our existing, and while we have that thought we can't doubt that we have it. [*Discourse on the Method* early in Part 4.] To say 'I am breathing, therefore I exist', in this sense, is simply to say 'I am thinking, therefore I exist.' You will find on examination that all the other propositions from which we can thus prove our existence reduce to the same one; so that we can't prove from them the existence of the body, i.e. of a nature that occupies space, etc., but only that of the soul, i.e. of a nature that thinks. Of course one may wonder whether the nature that thinks may perhaps be the same as the nature that occupies space, so that there is one nature which is both intellectual and corporeal; but by the method which I suggested, it is known only as intellectual.

(4) From the very fact that we conceive vividly [see Glossary] and clearly the natures of the body and the soul as different, we know that in reality they are different, and consequently that the soul can think without the body, even though, when

they are joined, its operation can be disturbed by the bad disposition of the bodily organs.

(5) The Pyrrhonists [= 'ancient extreme sceptics'] didn't infer any certain conclusion from their doubts, but that doesn't mean that no-one can. I would try right now to show how these doubts can be used to prove God's existence, by clearing up the remaining difficulties in what I wrote, if it weren't for the fact that someone has promised to send me soon a summary of *everything* that can be doubted on this topic, which may put me in a position to do it better. So I must ask the person who wrote these queries to let me delay my reply until I have received that summary.

(6) Most of the actions of animals resemble ours, and throughout our lives this has given us many occasions to judge that they act by an interior principle [see Glossary] like the one within ourselves, i.e. by means of a soul that has feelings and passions like ours. All of us are deeply imbued with this opinion by nature. Whatever reasons there may be for denying it, expressing this denial publicly involves exposing oneself to the ridicule of children and fools. But those who want to discover truth must above all distrust opinions that were instilled in them as children. In order to know what we ought to believe on this question, it seems to me, we should think about what answer to the question would be accepted by a possible man ·whom I'll call Homme·:

> Homme has been raised from infancy in a place where he has never seen any animals except men. He loves the study of mechanics, and has made or helped to make various automata shaped like a man, a horse, a dog, a bird, and so on, which
>
> > walk and eat and breathe and (so far as possible) imitate all the other actions of the animals they resemble, including the signs we use to express our passions, like crying when struck and running away when subjected to a loud noise.
>
> Sometimes Homme can't tell the difference between real men and automata that only have the shape of men, and has learned by experience that there are only the two ways of telling them apart (I explained these late in Part 5 of my *Discourse on the Method*): **(i)** the automata never answer in word or sign, except by chance, questions that are put to them; and **(ii)** although their movements are often more regular and certain than those of the wisest men, in many things that they would have to do to imitate us they fail more disastrously than the greatest fools.

Ask yourself: what will Homme think when he sees the animals that we have? I stipulate that he is filled with the knowledge of God, or at least has noticed how inferior the best human workmanship is to the workmanship of nature in the composition of plants. Nature has packed plants with countless invisibly tiny ducts through which certain juices gradually rise to the ends of the branches, where they intermingle and interact and dry out in such a way as to form leaves and flowers and fruits. Homme notices this, and so believes firmly that if God or nature were to make automata to imitate our actions they would •imitate them more perfectly and •be incomparably better constructed than any that men could come up with. Now when Homme sees the animals we have, and notices in their actions the same two things that make them unlike us and that he has already noticed in his automata, what will he think? He won't conclude that there's any real feeling or emotion in them; rather, he'll think they are automata which, being made by nature, are incomparably better than any of his own past productions. Then there's one last question. As between

- •the verdict he gives, with knowledge of the facts and unprejudiced by any false opinion, and
- •the judgment we made when we were children, and have retained only through habit,

which is more credible? We base our judgement solely on the resemblance between some exterior actions of animals and our own; but this is in no way sufficient to show that there's any resemblance between the corresponding interior actions.

(7) I tried to show that the soul is a substance really distinct from the body. This is sufficient, I believe, in discussion with people who believe God to be creator of all, to force the admission that our souls must be necessarily created by him. [See note on page 58.] And those who acquire certainty of God's existence in the way I have shown cannot fail to recognise him as universal creator.

(8) I didn't say that light was extended 'like a stick' but 'like the actions or movements transmitted by a stick'. And although the movement lasts through time, each of its parts can be felt at one end of the stick at exactly the same time that it is produced at the other end. And I didn't say that light is like grape juice in a vat; I likened it to the action whereby the parts of the juice at the top tend to move towards the bottom: these parts tend to move towards the bottom in a completely straight line, though they can't move exactly in a completely straight line, as I said early in *Optics*.

(9) Since I made a point of *not* explaining the foundations of my physics [Discourse, a third of the way through Part 6], I saw no need to explain subtle matter more clearly than I did.

(10) Even though water remains liquid simply because its particles are kept moving by the subtle matter surrounding them, this doesn't prevent its becoming liquid when its particles are set in motion by some other cause. This paragraph ·in the *Discourse*· should present no difficulty to anyone who knows •that fire has the power to move the particles of terrestrial bodies that it approaches (we often *see* this happening), and •that hence it must move the particles of subtle matter even more easily because they are •smaller and •less closely joined together, these being the two qualities that entitle one body to be called 'more subtle' than another.

(11) Of course I don't claim to be certain that the particles of water are shaped like certain animals, but only that they are elongated, smooth and flexible. If some other shape can be found that would explain all their properties just as well, I'll be happy to adopt that instead; but if no others can be found, I don't see what difficulty there could be in imagining them to have that ·eel-like· shape. They must have *some* shape, and the one I suggested is particularly simple. As for the constitution of air: perhaps some air-particles might also have this shape, but they can't all have it. Why not? For many reasons: •air wouldn't be as light as it is, because particles with that shape can fit closely together with little space around them, thus constituting a fairly bulky and heavy body such as water; and •air would be much more penetrating than it is, for we can see that it is hardly more penetrating than water, and in many cases even less so. . . .and so on.

(12) The point being made in this paragraph seems to me to be on a par with this:

> I say that the pain we feel when cut by a sword is not
> - •in the sword in the way it is in our sense-organs, but is simply
> - •caused by the shape of its edge or point, by the hardness of the matter the blade is made of, and by the force with which it moves.
>
> Then someone objects that •other bodies with that sort of edge could also cause pain; •that bodies with different shapes, especially those that are soft and not

> hard like a sword, can't be felt; and lastly that •the pain is nothing in the sword except its external shape, and isn't an internal quality and that •the force that prevents the sheath from breaking when the sword is inside it consists simply in the action through which it wounds, and in its shape.

This ·analogous case· makes it easy to see how I'll respond to the objection ·to what I said about the taste etc. of salt·: namely that bodies whose particles have the same size, shape, hardness, etc. as those of salt will have the same taste as salt. They won't be tasteless; for something's being tasteless consists not in its lacking a sensation of taste within itself but in its lacking the power to *cause* such a sensation. And liquids whose particles have some other shapes or sizes etc. don't taste like salt but may have a taste—a less strong or sharp one if their particles are softer, just as the pain of a bruise is not the same as that of a cut; and we can't cause as much pain with a feather as we can with a sword. Lastly, I don't see why taste is regarded as more an intrinsic quality in salt than pain is in a sword. And as for the power of salt to keep meat from rotting, this is due not to •its sharpness or •the shape of its particles but to •the hardness and inflexibility of its particles, just as it's the inflexibility of the sword that prevents its sheath from breaking.

[Descartes responds also to the objector's items **(13)–(15)**. His treatment of **(15)** spelling, is memorable:] It's up to the printer to defend himself on this score; because my only instruction to him was to follow customary usage. Just as I didn't make him take out the *p* from *corps* or the *t* from *esprits* when he put them in, so I didn't bother to get him to add them when he left them out, for I did not notice any instances where this could create ambiguity. Anyway, I'm not aiming to revise French spelling, and I wouldn't advise anyone to try to do this in a book printed in Leiden! But I do have a view about this: I think it would be much easier for foreigners to learn our language if the spelling followed the pronunciation exactly. . . .

to Huygens, 9.iii.1638:

Regarding the book by Campanella that you sent me: Fifteen years ago I saw his book on *The Meaning of Things* along with some other treatises by him, perhaps including the present book. But I found so little substance in his writings that I now can't recall anything about them. All I can say about them now is that •those who go wrong ·on their own· through fondness for the most out-of-the-way paths are worse—less excusable—than •those who go wrong in company by following the well-trodden paths.

As for Fromondus, the little disagreement between him and me wasn't worth telling you about. . . . Our dispute was conducted like a game of chess: we remained good friends once the match was over, and now we send each other nothing but compliments. Plempius also produced some objections against ·my account of· the movement of the heart; but he did this in a friendly way, his aim being to promote discovery of the truth. I try to reply to each critic in the style in which he writes to me. A Counsellor of Toulouse [Fermat] also raised some objections against my *Optics* and *Geometry*. Some friends of his in Paris wanted to act as his seconds, but if I'm not mistaken neither he nor they could get out of the duel without admitting that everything they said against me was logically defective. I didn't venture to send you any of these objections, because I didn't think it worth your while to read them; and copying them would have been a tiresome chore; and anyway they may be published quite soon. In fact I would like many of my critics to attack me in this way, and I won't complain about the time it will

take me to answer them until I have enough to fill a complete volume; for I'm sure this is a pretty good way of showing whether what I wrote can be disproved.

I would have been particularly pleased if my opponents had included some Jesuit priests; and letters from L'Isle, La Flèche, and Louvain led me to expect that they would be. I did get a letter recently from someone at La Flèche [Vatier], who writes in terms as glowing as one could wish for, and then goes on to complain not about •the explanations I gave but about •the ones I didn't give, pressing me to publish my Physics and Metaphysics. The Jesuits are in close correspondence with each other; so the testimony of just one of them is enough to make me look for them all to be on my side. But for all that, I can't see any hope of giving my *World* to the world in the near future. Without that, I can't complete the Mechanics that you wrote to me about, because that depends entirely on the other works, especially in connection with velocity. And we have to expound the laws of nature and explain how they work in ordinary events before we can adapt nature to operations that are quite out of the ordinary. I have nothing to say about Pollot's request to see the three sheets, except that you may do as you please. It is more than courteous of you to leave me some rights in something that belongs to you. . . .

[One version of this letter has a paragraph here in which Descartes thanks Huygens for sending him a book, and comments negatively on its content. Its author says that Descartes's philosophy follows that of Democritus, and Descartes says: 'I don't know whether that is right, because I don't trust the things we are told about that ancient philosopher. He seems to have had a really good mind, and not to have been capable of the irrational doctrines that are attributed to him.']

I understand that young Gillot is in The Hague. If I could recommend anyone to you, it would be him, for he was my first (and practically my only) pupil, and the one with the best head for mathematics.

⊕ [iii.38: Plempius writes to Descartes, explaining why he is not satisfied by two of the points in Descartes's answer (15.ii.1638) to his earlier objections.]

⊕ [iii.38: Ciermans writes to Descartes. He is a colleague of Plempius; and argues with Descartes through six pages, not about biological matters (as Plempius did) but about physics, especially light and colours.]

⊕ [23.iii.38: Descartes replies to Plempius, seven pages entirely devoted to theories and observations relating to the movements of the heart and of blood close to it.]

⊕ [23.iii.38: Descartes replies to Ciermans, a dozen Latin pages mainly on light and colours.]

⊕ [31.iii.38: Descartes writes to Mersenne, 17 pages responding to various comments by others, reported in two letters of iii.38 of which we now have neither. The main topics are as follows. •Beaugrand's claim that Descartes's geometry is a mere copy of Viète's. In rebutting this, Descartes gives a memorable account of what he was up to in the relevant parts of the *Geometry*: 'I was making the construction in the way architects make battlements, merely prescribing what must be done, and leaving it to carpenters and masons to do it.' •Someone's 'ignorant or malicious' accusation that Descartes in his optics has borrowed from Kepler. While rejecting this, Descartes says 'I don't deny that Kepler is my chief master in optics'. •An experiment that Descartes himself has performed with the eye of a just-killed cow, investigating the possibility of seeing in the dark. •Problems in geometry and number-theory proposed to Descartes by Fermat and his two supporters. •Scattered through the letter are messages to various of Descartes's critics—Morin, Ferrier, Petit, Desargues, Gibieuf—about what they should do and how Descartes will respond.]

⊕ [iv.38: Roberval writes against Descartes, 11 pages of scathing criticism of the *Geometry* and of Descartes's replies to Fermat.]

from Mersenne, 28.iv.38:

[He starts by crediting Roberval with many fine discoveries in geometry, and states one of them. Then:]

Please allow me to present two questions that Roberval and I are currently disputing. What would the state of affairs have been if God hadn't created anything?

> Roberval: There would have been the same real three-dimensional space that there is now. The eternal truth of geometry is based on this space, whether or not God fills it with bodies.
>
> Mersenne: There would have been no space. Otherwise space is a real being that doesn't depend on God.

[The second question is a complex one concerning the velocity, at various stages in its journey, of a bolt shot from a cross-bow. Then:]

We are also in difficulties over the question:

- Why is a cannon-ball less damaging at 15 or 20 feet from the cannon than it is at 50 feet? and
- When I throw a stone, why does it hurt you less if it meets your body just after leaving my hand than it would if you were a dozen strides away?

It seems that either **(a)** the effect of these missiles depends less on their speed than on some other factor, or **(b)** each missile speeds up in the course of its journey. You don't accept **(b)**, and neither do I. I'm sure that if you walk once gently around your room, that will give you enough time to clear up this puzzle for us.

[Mersenne then produces a problem in geometry sent by Fermat; some others of his own; and a geometrical question which he is currently arguing about with Desargues.]

⊕ [3.v.1638: Descartes writes to Mersenne, responding to his request (in a 26.iii letter that we don't have) that Descartes evaluate work of Fermat's that has been sent to him. That material isn't worth the time it takes, Descartes says, but he's afraid that his delay in responding to it may be harming his relations with Mersenne. 'So I shall tell you all my thoughts about it, once for all so that I shan't need to think about it any more.' Then ten pages of geometry.]

to Mersenne, 27.v.1638:

[Replying to Mersenne's 28.iv, Descartes starts with embarrassed gratitude for the trouble Mersenne has taken on his behalf ('26 pages in your own hand'), remarks that Roberval's reported discovery in geometry is no big thing, and says that the same is true of all he has so far seen of the work of Fermat and his defenders. He continues:] They have sent me a great Register of Fermat's discoveries; but this, rather than making me think better of him or them, has reminded me that *pauperis est numerare pecus* [Latin, from Ovid: 'It's the poor man who counts his sheep']. . . .

You ask whether there would be real space if God had created nothing. This question may seem to be beyond the capacity of the human **mind**, like infinity, so that it's not a reasonable thing to argue about; but in fact I think that it's merely beyond the capacity of our **imagination**, like the questions of the existence of God and of the human soul. I believe that our **intellect** can reach the truth of the matter, which is (in my opinion, anyway) that •there wouldn't be any space, and that •even the so-called 'eternal truths'—such as *The whole is greater than its part* wouldn't be truths if God hadn't established them as such. I think I have already written to you about this. [See the letters to Mersenne of 15.iv.30, 6.v.30 and 27.v.30 on pages 15–17.]

[On the question about the cross-bow Descartes agrees with Roberval except for one detail. Then:] I'm not yet certain about the experiment to discover whether a cannon has less

force close up than further away. I believe that the effect will vary according to the kind of material the cannon-ball hits—not having the same effect on a metal breast-plate as it has on a pine plank—although it goes faster when leaving the cannon than afterwards. . . .

You ask [in a later letter which we don't have] if I regard what I have written about refraction as a demonstration. I think Yes, at least to the extent that •demonstrations can be given in this field without first bringing in metaphysics to demonstrate the principles of physics (which I hope to do some day); and to the extent that it has ever been possible to demonstrate results in mechanics, optics, astronomy, or anything else that isn't pure geometry or arithmetic. Asking me to give geometrical demonstrations on a topic that involves physics is to ask for the impossible. And if nothing is to be called a 'demonstration' except geometers' proofs, then we'll have to say that Archimedes never demonstrated anything in mechanics, or Vitellio in optics, or Ptolemy in astronomy. Of course nobody ever says this. In such matters we're satisfied if •the authors' assumptions don't obviously conflict with experience and •their discussion is coherent and free from logical error, even if their assumptions aren't strictly true. I could demonstrate, for instance, that even Archimedes' definition of the centre of gravity is false, and that there is no such centre; and others of his assumptions are also not strictly true. The assumptions of Ptolemy and Vitellio are even less certain, but that isn't a sufficient reason for rejecting the demonstrations they have based on them. Now what I claim to have demonstrated about refraction does not depend on

•the truth about the nature of light, or on

•whether light is propagated instantaneously,

but only on

•my assumption that it is an action or power ·to act· which •gets from place to place following the same laws as movement from place to place, and •affects distant places through an intermediary, namely an extremely rarefied fluid that the pores of transparent bodies contain.

Your difficulty about affecting something in an instant arises from an ambiguity in 'instant'. You seem to take it as denying •every kind of priority, as if the light of the sun could turn up here

what comes next: *sans passer premièrement par tout l'espace qui est entre lui et nous*;

which literally means: without first passing through all the intermediate space;

but Descartes probably meant: except in consequence of passing through all the intermediate space;

but 'in an instant' excludes only •temporal priority; it is compatible with each near-to-earth part of a ray of light depending on all the further-from-earth parts, in the same way as the end of a time-taking movement depends on all its preceding parts. There are only two ways to refute what I have written: **(i)** to prove by experiments or reasoning that my assumptions are false; or **(ii)** to show that what I have deduced from them doesn't really follow. Fermat understood this very well; he tried to refute what I wrote about refraction by attempting to prove that **(ii)** it contained a logical error. As for those who settle for saying that they don't believe what I have written because I deduce it from certain assumptions that I haven't proved—they don't know what they are asking or what they ought to ask. . . .

[Descartes is exasperated by the low quality of what Petit wrote to him: a jumbled farrago of points about God and the soul, not having understood a word of what Descartes

had written on this topic. Petit is better qualified to write on optics, but there's evidence—Descartes gives some—that he is incompetent or ignorant in that area also. Then:]

My opinion of Morin is quite different. I think I would be indebted to him for his objections, as I would be to all who make a point of telling me that their aim is to see that the truth is discovered. I won't be hostile to them if they treat me as roughly as they can, and I'll try to answer them all so that none has cause to be offended.

[•A complicated paragraph about Descartes's role in helping the advancement of a favourite ex-pupil named Gillot. The complications come from the fact that the young man's parents are staunch Protestants while his best professional opportunities are in Roman Catholic countries or institutions. •A message to his critics about what's going on when they attack him roughly and he replies roughly. •Thanks to Mersenne for sending something by Gibieuf; and complex remarks about which of his critics Descartes will arrange to have published, and why. •Dismissive remarks about Fermat and Roberval. •More about Gillot, his possible role as an explainer of Descartes's work to folk in Paris. •Appreciative words about a musical theorist named Bannius. •A fast rattle of remarks about various other people. Then:]

Between ourselves, the ·social· atmosphere of Paris is the *worst* for my plans, because of the countless distractions that are inevitable there. For as long as I'm allowed to choose my way of life I shall live in the country, in a state of peace in which I can't be bothered by visits from neighbours. That's what I have now in this corner of Holland. That's my only reason for preferring this country to my own, and I am now so used to it that I have no desire to change. . . .

⊕ [vi.38: Descartes writes to Huygens. Descartes's friend Hardy has asked him to help him get permission to borrow two books in Arabic that are now owned by the Leiden Academy, and Descartes is passing this on to Huygens, presumably because the Leiden Librarian, Heinsius, is a friend of the Huygens family. He warns Huygens that Heinsius has to be handled gently, and quotes a light-hearted letter from Balzac reporting that something friendly that he wrote about Heinsius was 'received as outrageous' because Heinsius can't take a joke.]

⊕ [3.vi.38: Descartes writes to Mersenne, continuing the dispute with Fermat and Roberval, and then ten pages answering mathematical questions that had been asked by a correspondent of Fermat's named Sainte-Croix and then presumably passed on to Descartes by Mersenne. At the end of this he says 'Spare me!' and begs Mersenne not to send him any more questions taking up time that he can't afford. He adds that 'I have never claimed to know anything about numbers', and that he has forgotten much of what he used to know.]

⊕ [vi.38: Descartes writes to Hardy. He is glad that Hardy is on his side in the tussle with Fermat over a certain mathematical rule that Fermat has proposed. He then goes on to say that the rule can be corrected and given a proper foundation, and he spends three pages doing that.]

⊕ [29.vi.38: Descartes writes 22 pages to Mersenne, mostly picking over matters arising from the letters of 27.v and 3.vi. Also: 'You ask me if foreigners have made better objections than the French, to which I reply that Morin is the only French critic I have had.' He doesn't count Petit because his 'objections' were so bad and irrelevant. He alleges that Fermat and his friends have entered into a *conspiracy* to discredit Descartes's writing. And some harsh words about de Beaugrand, which Descartes will try to tone down in (17) on page 82]

to Morin, 13.vii.1638:

The objections you have taken the trouble to send me are ones I'd have been glad to get from anyone; but your rank among the learned, and the reputation your writings have earned you, make them more pleasing from you than from anyone else. My best way to show you this is (I think) by carefully answering you on every point.

You begin with my assumptions. You say:

> 'The phenomena of the heavenly movements can be deduced just as certainly from the assumption that the earth is stationary as from the assumption that it moves.'

I agree readily. I hope I'll get the same understanding of what I wrote in the *Optics* about the nature of light, so that the force of the mathematical demonstrations I tried to set out there won't ·be thought to· depend on any opinion in physics, as I said sufficiently clearly in my *Optics*. If there's some other way of imagining light that will explain all the properties of it that we know from experience, it will be seen that everything I have demonstrated about refraction, vision, and so on can be derived from that just as well as from the assumptions I made.

You say also:

> There's a vicious circle in proving effects from a cause, and then proving the cause by the same effects.

I agree: but I don't agree that it is circular to *explain* effects by a cause and then *prove* the cause by the effects—there's a big difference between *proving* and *explaining*—and I add that the word 'demonstrate' can be used to signify either, if it is used according to common usage and not in the technical philosophical sense. I should add also that there's nothing circular in *proving* a cause by several effects that are independently known, and then conversely *proving* certain other effects from this cause. I have combined these two senses in my *Discourse on the Method*: 'As my last conclusions are demonstrated by the first, which are their causes, so conversely the first are by the last, which are their effects.' But that doesn't show me speaking ambiguously, because I went straight on to explain what I meant, saying that experience renders most of these effects quite certain, that in deducing causes from them I'm not so much proving them as explaining them—indeed it's the causes that are proved by the effects. And I put 'not so much proving them' rather than 'not proving them at all' so as to make the point that if there were any doubt about any of these effects it *could* also be proved from this cause, provided the cause had already been proved from other effects. I don't see what other terms I could have used to explain myself better.

You say also that astronomers often make assumptions that cause them to fall into grave errors; as when they make wrong assumptions about the parallax, or the obliquity of the ecliptic, and so on. To this I reply that those aren't the sort of assumptions or hypotheses I was speaking of; I marked out that sort clearly when I said that one could draw very true and certain consequences from them even though they were false or uncertain. The parallax, the obliquity of the ecliptic, and so on can't be assumed as false or uncertain, but only as true; whereas the equator, the zodiac, the epicycles and other such circles are commonly assumed as false, and the movement of the earth as uncertain, and yet for all that, true conclusions are deduced from them.

Finally, you say that nothing is easier than to fit a cause to an effect. It is indeed easy in many cases to fit cause to effect, one on one; but it's often harder to fit a single cause to many different effects if it isn't the true cause that produces them. There are often cases where one can prove what is the true cause of a number of effects simply by giving *one* from which they can all clearly be deduced. I claim that all the causes I of spoke belong to this class. If you

(i) bear in mind that in the whole history of physics up to now people have only tried to *imagine* causes to explain the phenomena of nature, with virtually no success, and

(ii) compare •the assumptions others make of 'real [= 'thing-like] qualities', 'substantial forms', 'elements'

and the like with •my single assumption that all bodies are composed of parts, this being something that is visible to the naked eye in many cases and can be proved by countless reasons in others, and

(iii) compare my deductions from my assumptions—about vision, salt, winds, clouds, snow, thunder, the rainbow, and so on—with what the others have derived from their assumptions on the same topics,

this will be enough, I'm sure, to convince any unbiased person that the effects that I explain have no causes except the ones I have deduced them from; although I don't demonstrate this now, saving it up to present in another place. [Descartes builds into **(ii)** the confession that his explanations involve a further premise, namely 'that the parts of certain kinds of bodies are of one shape rather than another', but this isn't much of an addition because 'it's easy to demonstrate it to anyone who accepts that bodies are composed of parts'.]

I'm sorry that your objections all concern *light*, because I have decided not to state my views on that topic in my replies; and I don't want now to reverse that decision. So I shan't be able to answer you as thoroughly as I would have liked. But please believe me: I wasn't trying to hide behind a barricade of obscure expressions as a defence against a sneak attack, as you seem to have thought. If I have a certain skill in mathematical •demonstrations, as you do me the honour of saying I have, •they are more likely to have taught me to discover the truth than to have taught me to disguise it. I didn't speak as openly about light as about the other topics because was my decision not to include anything in these Essays that I had already tried to explain in exact detail in another treatise [namely *The World*]. . . .

You have been told that I despise the scholastics: this must have been dreamed up by people who don't know me or my *mœurs:* [see Glossary] or my temperament. In my Essays I hardly ever used terms that are familiar only to the learned, but this doesn't mean that I disapprove of such terms—merely that I wanted to use other terms so as to make myself understandable. The bottom line is this: it's not for me to select the weapons I am to be attacked with; my task is only to try to defend myself. To do that, I'll reply now to each of your points separately. [The numbering of points is Morin's and then Descartes's.]

[**(1)**–**(3)** sort out 'misunderstandings' of things Descartes said about light and subtle matter, explaining seeming inconsistencies as signs of his alertness to what needs to be said at each particular point in his exposition.]

(4) You raise two objections to a certain passage in the *Optics*. The first is that 'if light is only an action or inclination to move, it is not in that case a movement'. Where did I say it is a 'movement' without immediately adding 'or an action'? I don't believe there is any such statement in my writings, and especially not when I discussed the sort of light that can be seen in transparent bodies, which philosophers call *lumen* in Latin so as to distinguish it from the light that can be seen in luminous bodies, which they call *lux*. Now, when I say in some places that light is a movement or an action, and in another place that it is only an action, there's no contradiction in that. Also (and this is important) the meaning of the word 'action' is general: it covers not only •the power or inclination to move but also •the movement itself; when we say 'He is always in action', we mean that he is always moving. That's how I am using the word in the context you cite; so there is no ambiguity there. . . .

The second objection you make here is that 'if the action belongs to subtle matter, it does not belong to luminous bodies'. But this objection rests upon an ambiguity in the word 'light'. I readily admit that the action of subtle matter, which is *lumen*, is not an action of luminous bodies, which

is *lux*; but that isn't an admission that what I said was ambiguous, for I was very careful to distinguish between these two senses of 'light' throughout. [**(5)**–**(6)** concern purely verbal points.]

(7) I'm surprised that you cite pages 4–5 of *Optics* in order to prove that the movement of luminous bodies can't get as far as our eyes—that nothing material given off by these bodies is transmitted. All I'm trying to do in those two pages is to expound the analogy with a blind man, which I put forward primarily to show how movement can be transmitted ·from one place to another· without anything moving ·from one to the other·. I don't believe you would think that when the blind man touches his dog with his stick, he can't sense its movements unless it—the dog itself—passes along the stick to his hand! But to answer you in formal terms: when you say that there can't be movement without something that moves, I make a distinction. The movement can't indeed occur without some body, but it can be transmitted from one body to another, and thus pass from luminous bodies to our eyes through the medium of some third item, namely. . . .the air and other transparent bodies or. . . .a very subtle matter that fills the pores of these bodies and extends without a break from the stars to us. . . .

(8)–**(9)** You prove quite convincingly that the round particles of the subtle matter cannot exactly fill all the pores of terrestrial bodies. I agree; but it doesn't follow from this that the space •they don't occupy is empty; for the pores could be occupied by •something else, which I needn't go into here.

[Nine pages, mostly on points concerning light and/or subtle matter. Descartes deals with most of them by claiming that he has been misquoted or misunderstood. Then:]

At the end you ask: 'Does your view imply that the force with which a spark from a fire or a glow-worm at night must push the subtle matter towards our eyes, if we are to be able to sense the light, can be impeded by the force of a wind blowing hard in the opposite direction?' [In his reply to this Descartes travels through a detour to this conclusion:] In no case can the motion of the wind impede the action of light, except when its motion is so violent that it sets fire to the air; and then the light that is created can obliterate the less intense light of a spark. . . .

But in my view, your main objection—which is perhaps why you decided to keep it till the last—is this:

> 'If the pores of transparent bodies must be straight, it seems that they can't let the subtle matter pass through them in every direction, because a solid body can't possibly contain straight pores in every direction.'

I can clear up this difficulty by means of an analogy, if we don't take the word 'straight' in a stricter sense than I was clearly intending to take it. What I said [he gives page-numbers] is not that the pores must be perfectly straight, but that they must be only as straight as is needed for the subtle matter to flow right through without meeting any obstacle. [Descartes then gives an analogy which he thinks might help; but the explanation of what he means by 'straight' is enough on its own.]

The part of your letter that is hardest for me to reply to is its conclusion. I don't claim to deserve the kind words you have applied to me, but I am not up to rejecting them. So I can only say that like you I deplore fortune's mistake in not sufficiently recognising your merit. But as for me, thanks be to God fortune hasn't so far helped or hindered me; and for the future I don't even know whether I should •want fortune's favours or •fear them. I regard it as dishonest to borrow something from someone and not return it with interest; so I would be deeply in the red if I felt that I was in debt to the public. As for the malignant people you speak of,

I believe that other centuries have had at least as many of them as this one has; and I am positively pleased when they attack my works, because I see them as like flies or birds that always go for the best fruit. But I thank you for the good fortune you have wished me, and for the trouble you have taken to write to me.

to Mersenne, 13.vii.1638:

An investigation of the question:
Does a body weigh more when close to the centre of the earth than it does when far from it?

[In what follows, 'the Question' will always refer to the above question.] We must distinguish here between two sorts of heaviness:

- •true or absolute heaviness,
- •apparent or relative heaviness.

When we say that a staff weighs much more when we hold it at one end than when we grasp it in the middle, we're talking about apparent or relative heaviness; we're saying that in the one case it seems heavier, or rather is heavier from our point of view, not that it is intrinsically heavier. But before discussing this relative heaviness, we must define what we mean by 'absolute heaviness'. Most people take it to be a power or quality inherent in every body that we call 'heavy', making it tend towards the centre of the earth. Some think that **(a)** this quality depends upon the body's **form**, so that a portion of matter that is heavy when it has the form of water loses the quality of heaviness when it takes on the form of air ·by turning into steam·. Others hold that **(b)** heaviness depends only on the **matter**, so that every body is heavy, because every body is composed of matter. According to these **(b)**-theorists, how heavy (absolutely speaking) a given body is depends on how much matter it is composed of; they imagine that if we could weigh a mass of air and a mass of lead in a vacuum, each having the same quantity of matter, they would stay equally balanced. They also have the notion of 'relative weight': when two bodies x and y contain the same amount of matter, they say, x may seem to be heavier than y because in x the matter is more compressed—i.e. spread over a smaller space—than it is in y.

Of these two views, **(a)** is the one most commonly held in the Schools [see Glossary], **(b)** is most in favour with those who think they know more than ordinary folk. On both these views, it is obvious that a body's absolute heaviness is always intrinsic to it and thus always the same, not varying according to the body's distance from the centre of the earth.

There is also the view **(c)** that all heaviness is relative. On this view the force or power that causes the bodies we call 'heavy' to descend is not •in them but •in the centre of the earth or •in the earth's entire mass, which *attracts* them towards the centre—as a magnet attracts iron, or in some other way. Since a magnet and every other natural agent with a given sphere of action is more active at close range than at long range, this view implies that a body's weight increases as it gets closer to the centre of the earth.

My own conception of the nature of heaviness is quite different from each of those three. But I can't explain it without going into many other lines of theory that I don't plan to discuss here. I can only report that it doesn't tell me anything that bears on the Question, except that the Question is a purely factual one, i.e. a question that human beings can't definitively answer unless they can bring experiments to bear upon it. [An extremely obscure and puzzling sentence expressing pessimism about our being able to get reliable results by experiments. Then:]

An experiment that we can make requires a tall •tower with a very deep •shaft at the foot of it, a weight—•·a brick, for example·—attached to a long cord, and •a balance:

At the top of the tower we •weigh the brick and the cord with the whole thing in one pan of the balance, and then we •tie one end of the cord to the pan and let the brick hang down to the bottom of the shaft, and •compare the results of the two weighings.

The difference between them should tell us whether the brick's weight is significantly different when closer to the centre of the earth than it is when further away. But the depth of the shaft plus the height of the tower will be tiny compared to the radius of the earth, and that's one reason (there are others) why

how the sentence ends: *cette expérience ne pourra servir, si la différence qui est entre un même poids, posé à diverses hauteurs, n'est fort notable.*

which means: this experiment won't be instructive unless the difference between the results of the two weighings is very noticeable.

what Descartes should have said: the absence of any perceptible difference between the two weighings won't entitle us to infer that NO is the answer to the Question.

[The point is that Descartes hasn't said anything to justify the claim that a small difference between the two weighings wouldn't be relevant to the Question.]

Another observation provides, I think, very powerful evidence that bodies far from the centre of the earth don't weigh as much as those closer to it. The planets that have no light of their own—e.g. the Moon, Venus, Mercury etc.—are probably bodies composed of the same sort of matter as the earth; and the heavens are liquid, as most present-day astronomers hold. So one might think that the planets should be heavy and fall towards the earth, but because of their enormous distance ·from the earth· they have lost all tendency to do this. Also, we see that large birds such as cranes, swans, etc. fly much more easily when high in the air than when nearer the ground. Might it be due to the force of the wind? No, because the same thing occurs when there is no wind. So we have reason to think that these birds are made lighter by their greater distance from the ground. Paper kites flown by children, and all the snow that the clouds hold, provide further evidence for this view. There is also the observation [mentioned on page 29] that you told me you have made yourself, and that other writers have described, namely that cannon balls that are shot straight up don't fall down again. If that really is what happens, we can only suppose that the force that shoots the ball upwards sends it so far from the centre of the earth that it loses its heaviness. So much for the physics of the Question.

I turn now to the mathematical arguments, which can apply only to relative heaviness. To conduct such arguments, we need a settled value for the absolute heaviness ·of whatever body is involved in the calculation·. We can't get this by •discovering what its absolute weight is; to have a settled value we'll have to •suppose it by making an assumption. So let us pick some distance D and stipulate that the absolute weight of a body x is the force with which x tends in a straight line towards the centre of the earth when it is

•at distance D from the earth and
•in our ordinary atmosphere and
•neither pushed nor supported by any other body and
•not yet moving.

I say 'in our ordinary atmosphere' because if x is in a thinner (or thicker) air than our own it will certainly be a little heavier (or less heavy). And I say 'neither pushed nor supported by any other body' and 'not yet moving', and 'at distance D from the earth', because all these factors can affect the force with which x tends to move downwards. The 'distance D' is to be understood as a constant—the same in all our calculations.

Moreover, we shall suppose that each particle of a given heavy body always has a given force or tendency to descend, whether it is far from the centre of the earth or close to it, and no matter how it is situated. As I have already remarked, this assumption is perhaps not true; but we ought to make it in order to simplify our calculations. It's like how astronomers assume that the average motions of the stars are equal, in order to make it easier to calculate the true motions, which are unequal.

Given this assumption of the equality of •absolute heaviness, we can demonstrate that the •relative heaviness of all hard bodies when they are in the open air and not supported by anything is somewhat less when they are close to the centre of the earth than when they are far from it (although this doesn't hold for liquid bodies). If two perfectly equal bodies are placed in the opposite pans of perfectly accurate scales whose arm isn't horizontal, the body closer to the centre of the earth will weigh more; and the difference in weights will be exactly proportional to the difference in proximities to the centre of the earth. . . .

The proof of this point depends on just one principle, which is the general foundation of the whole of statics, namely that it takes neither more nor less force to raise a heavy body to a certain height than it takes to raise a less heavy body to a greater height, or a heavier body to a lesser height; and the difference in height is in both cases proportional to the difference in weight. [See page 50 above.] For example, a force that can raise a weight of 100 pounds to a height of two feet can raise a weight of 200 pounds to a height of one foot, or a weight of 50 pounds to a height of four feet, and so on. . . .

You'll have no difficulty in accepting this if you consider that an effect must always be proportional to the action that is needed to bring it about, and hence that

> if to raise a body x to a height of one foot we need a force that can raise a 100lb body to a height of two feet, this shows that x weighs 200lb.

For raising a 100lb pound body one foot twice over is the same as raising a 200lb body one foot, and as raising a 100lb pound body two feet. It obviously follows from this that •the relative heaviness of each body—which is the same as the force needed to support it and prevent it from descending—is to be measured by the beginning of the motion that the power supporting it must produce if it is to raise it. . . . So the ratio between the straight line that this force describes and the line that indicates by how much the body moves closer to the centre of the earth is equal to the ratio between the absolute weight and the relative weight. [Descartes gives three examples: the pulley, the inclined plane and the lever. His accounts of the pulley and the lever are the same as those beginning on pages 50 and 51. The account of the inclined plane is different, but it extremely hard to follow and requires a diagram that can't be provided here; so we'll have to let ourselves off from reading it, and rejoin Descartes as he sums up:]

Now these three examples are, I think, sufficient to convince us of the truth of the principle that I put forward, and to show that all the points usually discussed in statics depend on it. For the wedge and the screw are simply inclined planes; the wheels used to construct various sorts of machines are simply multiple levers; and the balance is nothing but a lever supported at its centre. Thus, all that remains for me to explain here is how the two conclusions I put forward can be derived from this principle. [Descartes now offers an obscure 'demonstration explaining the sense in which a body can be said to weigh less when nearer the centre of the earth than when further away'. After giving it, he remarks that it holds only for solid bodies, and that for liquids a different account

has to be given. He gives it, and then revisits 'the sense in which. . . ' etc. giving a different 'demonstration' of it.]

to Mersenne, 27.vii.1638:

[On 3.vi.38 [page 74] Descartes had written to Mersenne answering a series of mathematical questions that Mersenne had received from Sainte-Croix and passed on to Descartes. This letter begins with Descartes expressing appreciation for Sainte-Croix's reception of these answers, and says that he learned from it. Then eight pages of mathematics, continuing the discussion with Sainte-Croix, followed by:]

I am glad to hear that Sainte-Croix has promised to respond to the comments on his offerings that I sent to Mydorge on 1.iii.38 [page 65], because I expect that when he examines my reasons he'll come to recognise that what he now calls 'subterfuges' are really very certain truths that I have used in responding to his sophisms. And if many people don't understand my demonstration, it shouldn't be inferred that the demonstration isn't evident, but only that the material is difficult. The works of Apollonius and Archimedes contain many demonstrations that are very evident, although many honest and otherwise-able people couldn't understand them. . . .

This letter up to here has been addressed ·through you· to others. Now I turn to various items in your own letters.

(1) Petit has told you that the general assembly of the Capuchins unanimously expressed admiration for what he had written against me. I could only laugh at this; it's not likely that the devotion of these good friars makes them so simple-minded that they •can't see the irrelevancies and false judgments that appear on every line of what Petit wrote and •approve of his impieties. (Some of these are so gross that if he were in a country where the Inquisition is active he would have reason to fear going to the stake!) Also, their professed opposition to ·all· vices requires them to blame the desire to speak badly of someone, and Petit is at least as much possessed by •that desire as the most pious of them could be •by God's love. As for me, people of judgment who know me won't expect me to shrink from responding to him if I think that will do any good; but I can tell you that I would find it as shameful •to write against a man of that sort as •to interrupt my walk by chasing away a puppy barking at me in the street.

(2) This doesn't stop me from wanting to clarify the arguments I gave for the existence of God, but I'll do this in Latin.

(3) Most of the objections ·to the *Discourse*, *Optics*, etc.· that I have been sent, and that I plan to publish when enough of them have come in, are also in Latin. So I would be glad if those who intend to send me objections in future would write them in Latin.

(4) I'm inclined to think that I shall be sent some from the Jesuits of la Flèche. If so, they will prefer to write them in Latin rather than in French; so I would be glad if you would let them know ·of my preference for Latin for this purpose·; but do this as a casual passing remark, not an outright declaration, because perhaps they aren't planning to send me any.

(5) I would also like to know how they deal with my *Meteorology* in their philosophy—do they try to refute it or just keep silent about it? They certainly don't follow it; the public theses they are putting forward this season make *that* clear.

(6) I'm obliged to Desargues for taking the trouble to show that he's sorry I don't plan to continue my studies in geometry. But all I have decided to give up is *abstract geometry*, i.e. research into problems that are useful merely

as mental exercises. That will give me more time to work on another sort of geometry, where the problems concern the explanation of natural phenomena. If Desargues thinks about what I wrote about salt, snow, rainbows, etc., he'll see that my entire physics is nothing but geometry.

(7) He wants to know my views about the minute particles of bodies? Then let me tell you that I imagine them simply as being like •the stones that make up a wall or •the planks a ship is made of. That is, it's much easier to separate them from one another than to smash any one of them or put it together again or change its shape. We can of course do all of these things, provided we have the appropriate tools.

[**(8)–(16)** deal with a variety of personal and secretarial matters that needn't concern us. Then:]

(17) What I wrote about de Beaugrand [in a letter of 20.vi.38, see page 74] is nowhere near to being worth publishing; but I gather from what you tell me that there is a wish for it to be published. This doesn't matter much to me as long as my name is kept out of it and two changes are made:

- •Replace the words: 'He shows here that his ignorance is matched by his shameless impudence' by something like 'He shows here that one shouldn't put much trust in what he writes'.
- •Replace the words 'This book on is so irrelevant, so ridiculous, and so contemptible. . . ' by 'This book is so contemptible. . . '.

It's not that the first versions don't fit him; but it isn't fitting for me to write them. . . .

PS: I am enclosing with this my letter to Fermat, unsealed. Please seal it before you send it on to him.

⊕ [27.vii.38: Descartes writes to Fermat expressing (in florid terms) great pleasure in receiving from Fermat a letter offering friendship. Descartes also refers to a geometrical procedure of Fermat's that he had previously dismissed, describing it as 'very good' now that Fermat has explained it more clearly. He mentions some problems he still has with this work, but optimistically expects that Fermat will solve them. We don't have the letter of Fermat's to which this replies.]

⊕ [30.vii.38: Huygens writes to Descartes, replying to his letter of vi.38 (see page 74), saying that he wrote to Heinsius a month ago and that, after a misunderstanding was cleared up, Heinsius agreed to lend Hardy the books. Remarks about certain personal relationships. Report on the claim of the popular philosopher van der Straten to be able to bring diamonds or gold into existence on a person's palm, and to perform other wonders. Huygens asks for Descartes's opinion about whether anything in nature would permit these things to happen.]

⊕ [1.viii.38: Mersenne writes to Descartes expressing pleasure over the quality of what Descartes wrote to him and to Morin in his letter of 13.vii.1638—see page 74—and reporting that Descartes's reply to Morin had done a lot to raise him in Morin's estimation because it showed that Descartes doesn't ignorantly despise Aristotle's philosophy. 'There are people who are misled by the compactness and clarity of your style—adopted so as to be understood by ordinary folk—into thinking that you don't understand scholastic philosophy; and I tell them that you know it as well as the most self-important of the masters who teach it.']

⊕ [12.viii.38: Morin writes to Descartes in flattering terms ('the most subtle and productive mind of this century'), and explains why he had written to Descartes about light (see Descartes's letter of 13.vii.38, page 76): his own research requires him to understand light, and that he was especially anxious to get Descartes's views about light •because they are so splendidly new and •because the concept of 'subtle matter' that they involves is basic and central in Descartes's physics. Then 14 pages of responses to that letter of Descartes's—objections, requests for clarification, etc.]

⊕ [23.viii.38: Descartes writes to Mersenne, 12 pages of mathematics, and then: 'As for Fermat, I hardly know how to reply to him. After the compliments we have paid to one another I would be sorry to displease him. But it seems to me that the passion with which he •continues to

praise his own method and •to maintain that I have misunderstood it and have gone wrong in what I wrote ·in my letter of i.38—see page 57·—obliges me to set down here some truths that seem to me to go against him.' Then eight pages of that, followed by ten pages of comments on various scientific matters involving various opponents/supporters of Descartes's work.]

⊕ [viii.38: Descartes writes to Plempius, politely continuing the discussion of the movement of blood through the heart, and declaring Plempius's objections to Descartes's view about this as much better than Petit's.]

to Hogelande, viii.1638:

I have read carefully the book you kindly sent me, and I thank you for it. The author [Jan Amos Comenius] is clearly an intelligent and learned man, of great integrity and public spirit. All his criticisms of the accepted sciences and teaching methods are only too true, and his complaints are only too justified.

His plan of collecting into a single book everything that is useful in every other book would be very good if it were practicable; but I don't think it is. It is often very hard to judge accurately what others have written, and to extract from it the better parts without also taking some bad parts too. Moreover, the particular truths scattered through the books are so detached—so independent of each other—that it would take more talent and energy •to assemble them into a well-proportioned unity (which is what your author aims at) than •to create such a unified body ·of doctrine· out of one's own discoveries. I don't mean that we should neglect other people's discoveries when useful ones turn up; but I don't think that collecting them should be anyone's main occupation. If someone is capable of finding the foundations of the sciences, he oughtn't to waste his life finding scraps of knowledge hidden in the corners of libraries; and if scrap-finding is all he is good for, he won't be able to choose and order what he finds. It's true that the author says he has already started such a book, and I can well believe that he can make a better job of this than anyone else; but the specimens he presents here don't inspire confidence. The content of the aphorisms on pages 31ff is so •general that he seems to have a long road to travel to reach •particular truths—which are all we need for practical purposes.

Besides this, I find two things in his programme that I can't entirely approve. **(i)** He seems to want to combine religion and revealed truths too closely with the sciences that are acquired by natural reasoning. **(ii)** He imagines a universal science that could be learned by young scholars before they reach the age of 24. He seems not to notice that there's a great difference between the two sorts of truths:

- •Knowledge of **revealed truths** depends only on grace, which God denies to no-one, though it isn't efficacious for everyone; so that the stupidest and simplest folk can acquire it as well as the most sophisticated.
- •To have any chance of doing something extraordinary in the **human sciences** you have to have an extraordinary mind.

It's true that we're obliged to make sure that our reasonings don't lead us to any conclusions that contradict what God wants us to believe; but I think that we'll be misusing Scripture—using it for a purpose that God didn't assign to it—if we try to derive from the Bible knowledge of truths that •belong only to human sciences and •don't contribute to our salvation. . . .

⊕ [viii.38: Descartes writes to Huygens, replying to his 's letter of 30.vii.38 (see page 82). Huygens's original letters are elegantly written, with literary allusions, jokes, puns etc., and Descartes here acknowledges that fact. The favour that Huygens does for Descartes in writing

to him is supported (Descartes says) by 'all the Muses of France', but he can't in return to invoke the Muses of Leiden, and will express himself plainly. The letter deals with •some personal relationships, •Descartes's belief that some people who pride themselves on being expert geometricians are trying to suppress Descartes's work because they see it as a threat to their supremacy, and •the supposed feats by van der Straten which he says are, though 'rare', not physically impossible.]

⊕ [12.ix.38: Descartes writes to Mersenne responding to a letter of 1.ix.38 (which we don't have) reporting that objections had been raised against 'the principle I assumed in my treatment of the question of whether the earth moves'. He devotes eight pages to answering the objections.]

to Morin, 12.ix.1638:

[This responds to Morin's letter of 12.viii.38, which was an answer to Descartes's letter of 13.vii.38. The numbering of items up to **(10)** follows the numbering in both of those earlier letters.]

Given the fairness of your motives and the breadth of your courtesy, I think I am obliged to do my best to answer thoroughly all the further points that you put to me.

You begin with my reply **(4)**. I wasn't denying that the word 'action' should be taken to mean 'movement'; but the word also has a more general sense, including the sense of 'inclination to move'. Suppose two blind men are holding a wooden staff and

- •they push it with equal force against each other, so that it doesn't move at all; and then
- •each pulls it with equal force towards himself, and again the stick doesn't move.

In each case there's a force in one direction and another force in the opposite direction, the forces being so exactly equal that the staff doesn't move. The very fact that it doesn't move enables each blind man to feel that the other man is pushing it or pulling it with equal force. What each man feels in the staff—namely its lack of movement in the different cases—can be called the various *actions* that are impressed on it by the other man's exertions. ·They really are different actions·, because when one man is pulling the staff this doesn't cause the other to feel the same action as when he is pushing it, etc.

[Descartes now says a bit about points **(5)–(6)**, and then:] **(7)** One body can indeed push another body in a straight line without itself moving in a straight line. Consider for example a stone being swung around in a sling: the stone pushes the pouch in the middle of the sling, and thus pulls the attached cord in straight lines that tend in all directions from the centre of its motion towards the circumference. Now, to set out more fully what I was then trying to say, I now say that my view is this:

> Sunlight is composed solely of a highly fluid sort of matter which continually revolves around its centre at a very great speed, thus pressing on all sides the matter that makes up the heavens, which is simply the subtle matter that the sky is made of, which stretches uninterrupted from the stars to our eyes. It's through the medium of this matter that we come to feel the pressure of the sun that is called 'light'.

I think this should remove most of the difficulties that you presented. *Of course* you could immediately raise many other difficulties about this point, but I would have just as many answers to them—indeed I have them already prepared! —and we wouldn't be finished with this affair unless I set out my entire physics.

(8)–(10) To prove that subtle matter exists, I need only to get you to consider that •there are pores in many perceivable bodies (visible to the naked eye in wood, leather, paper, etc.); that •these pores don't have to be empty just because they

are too small to let air in; and that •therefore they must be full of a matter that is more rarefied [see Glossary] than the matter composing the bodies I'm talking about. The various movements of this subtle matter are shown well enough by the movements of the bodies through whose pores it passes. . . .

You say that

- •if light is nothing but the action of the sun, then there is no light in the sun's nature; and that
- •light is a more actual and more absolute being than movement is; and that
- •only God acts by his essence,

and so on. You're making difficulties in words where there are none in reality. Any more than there would be a problem than if I said that

- •a clock shows the time only by the movement of its hands, and that
- •its quality of showing the time is no more an actual or absolute being than its movement is, and that
- •this movement belongs to it by its nature and essence, because it would stop being a clock if it didn't have it.

I can hear you saying 'But the clock's form is artificial, whereas the sun's form is natural and substantial'; but I reply that this distinction concerns only the •cause of these forms, and not their •nature. And if ·you avoid going that way by saying that· the sun's *substantial form* is different from the qualities to be found in its matter, then this is a philosophical entity that's a stranger to me.

·You cast doubt on the usefulness of analogies, comparisons·. Well, it's true that the comparisons scholastics customarily use to explain

- •intellectual matters in terms of physical ones,
- •substances in terms of accidents [see Glossary], or
- •one quality in terms of a quality of a different kind

are not very instructive. But my only comparisons are of movements with other movements, or shapes with other shapes; i.e. I compare things that are too small to be perceived by the senses with other things that can be so perceived, differing from them simply as a large circle differs from a small one. I maintain that analogies of this sort are the best means available to the human mind for laying bare the truth in problems of physics. When someone says something about nature that can't be explained by any such analogy, I take that as a demonstration that what he says is false. [What comes next is addressed to Morin's challenge: Can Descartes explain how a tiny spark, seen through a telescope 50 miles away, can set in motion all the subtle matter between the spark and the telescope?] As for the analogy of a U-shaped tube that I used in my reply, I maintain that it shows that a small force can move a great quantity of highly fluid matter. . . . To get really clear about this, imagine a tube encircling the earth, with no part of it higher than any other except for a bit at each end that sticks up enough to hold a tiny quantity of water. If we pour one drop of water into one of those two openings, this will set in motion all the water in the tube, even if the water is otherwise no more inclined to move in one direction than in the other—and the quantity of water is no less than the quantity of subtle matter that a spark sets in motion. . . .

[Then Descartes deals with several points concerning transparency, defending himself against criticisms on points of detail. Finally:] At the end of your letter you remark that when you see dust in the air dancing about in a sunbeam you understand what I take the subtle matter to be. This shows that your thoughts on this matter are very different from mine. The smallest particles of dust are much larger than the particles of pure air, and the smallest particles of air are much larger than the particles that I ascribe to subtle matter, which I conceive of as a continuous liquid

occupying all the space not taken up by other bodies, and not as something composed of disconnected parts such as the particles that make up dust.

⊕ [ix.38: Descartes writes to Ferrier with some news about developments in the project of making hyperbolic lenses.]

to Debeaune, 12.ix.1638:

I am much obliged for your kind remembrance of me, and I am honoured by your wish to have my opinion about the education of your son. I would encourage you to send him to this country [the Netherlands] if I thought that your plan for his education could actually be carried out here; but philosophy is badly taught here. All that the professors do is to lecture for an hour a day for about half the year; and they don't dictate any written material, or complete the course within a set time. So those who have *any* desire to learn have to get private instruction from a tutor, as do law-students in France. I don't hold that all that is taught in philosophy is gospel truth; but it is the key to the other sciences, so I think it's worthwhile to take the complete course in philosophy as it is given in the Jesuit schools before trying to rise above mere book-learning and become genuinely knowledgeable. And to give my own teachers their due, I must say that nowhere on earth is philosophy taught better than at La Flèche. Moreover, to leave home for the first time and suddenly find oneself in a country with a different language, religion and way of life is an enormous change. The atmosphere of La Flèche, however, is very close to your own; and since young people go there from all over France, their inter-relations create a mixture of different temperaments that has almost the same educational effect as travel. Lastly, the Jesuits treat each other as equals, the high-born being treated much the same as those of humbler origin—an excellent device for removing softness and other weaknesses that the students may have acquired through being habitually pampered in the parental home. . . . If your son does come to these parts, I shall serve him in any way I can. In Leiden I have lodgings in a house that would provide him with good board; but I think that his studies would go better at Utrecht; for the university there was founded only four or five years ago, and hence hasn't had time to go bad; and there's a professor there named le Roy [Regius], who is a good friend of mine and, in my view, better than anyone at Leiden.

to Mersenne, 11.x.1638:

I'll begin this letter with my comments on Galileo's book ·*Discourses and Mathematical Demonstrations Concerning Two New Sciences*·. Generally speaking, he philosophises much more ably than most—he •does his best to abandon the errors of the Schools [see Glossary] and •tries to bring mathematics to bear on problems in physics. I am absolutely *with* him on that, because I think that that's the only way to discover the truth. But he goes wrong in continually digressing, and in not pausing to explain matters fully. This shows that he hasn't been orderly in his investigations, and has merely tried to explain some particular effects without digging down to the *primary* causes in nature; so that he is building without having any foundation to build on. . . .

Page 11. Here he introduces the topics he intends to discuss, namely: Why are large machines weaker than small ones, given that they have exactly the same structure and are made of the same material? Why is a child less seriously injured by a fall than an adult is? Why is a cat less seriously injured by a fall than a horse is? I don't think there is any difficulty about this, any reason to construct a 'new science'!

It's obvious that if a large machine's resistance to being broken up is exactly proportional to that of a small machine of the same shape, they *can't* be made of the same material; the larger must be made of material that is harder and less easily destroyed, in proportion as its size and weight are larger. There's as much difference between

- a large machine and a small one made of the same material

as between

- two large machines of the same size, one made from a much lighter and harder material than the other.

Page 17. He is right when he says that the threads of a string stay together because they press against each other; but he doesn't say why this pressure causes them to stay together, namely that minute inequalities in the shape of the strands prevent each strand from sliding between the strands pressing against it. . . .

Page 20. He presents two explanations for the fact that the parts of a continuous body hold together:

- the abhorrence of a vacuum, and
- a sort of glue or cement that holds them together,

which he explains later on in terms of a vacuum. I think that both of these are quite false. What he ascribes to a vacuum should be ascribed only to the weight of the air. If it were abhorrence of a vacuum that prevented two bodies from separating, no force would be capable of separating them. And the method he gives to distinguish between the effects of these two ·supposed· causes is worthless. . . .

All that he says about the infinite is wrong: he admits that the human mind, being finite, can't comprehend the infinite, yet he goes ahead and discusses it as if he did comprehend it.

Page 47. He says that when hard bodies liquefy they are divided into an infinity of points; but he gives no evidence for this fiction, which is easy to disprove. . . .

Page 43. His experiment to discover whether light is transmitted instantaneously is useless; for eclipses of the moon have an exact bearing on the calculation in question, and thus are clearly superior to any observations we could make on earth. . . .

Page 153. He assumes that the speed at which a weight descends always increases uniformly. I used to believe that too, but I now think I have demonstrative proof that it's not so. . . .

Page 217. He adds another false assumption, namely: bodies thrown up in the air travel at a uniform speed horizontally, but as they fall their speed increases at a rate that is proportional to twice the distance covered. It's a simple matter to infer from this that bodies thrown up in the air move along a parabolic path; but since his assumptions are false, his conclusion may also be far from the truth.

[Descartes firmly criticises some things Galileo says about the geometry of the trajectory of a cannon-ball in flight; and then:] I'll say nothing about the geometrical demonstrations that most of the book is full of: I couldn't summon the patience to read them, and I am prepared to believe they are all correct. But it did occur to me as I looked at his propositions that you don't need to be a great geometrician to discover them. And I noticed that he doesn't always take the shortest route to his conclusion, which is a blemish in his work.

I would be glad if this letter were seen by you alone. You asked for my views, and I'm so greatly indebted to you that I don't think I should deny you anything within my power. Otherwise I wouldn't have spent time raking over someone else's mistakes, for that goes completely against my grain. Also, if I had been writing for other eyes than yours, I would have given reasons for my assertions more thoroughly than

I have here, so that those who don't know me as well as you do couldn't imagine that I had arrived at my views without good reason.

I'll turn now to the separate points that you have raised in your letters; I have been slow to answer them because lately I have had trouble staying awake ·in the evenings·. First, concerning Galileo: I have never met him and have had no communication with him, so I couldn't have borrowed anything from him. Anyway, I see nothing in his books that stirs my envy, and hardly anything I would wish to acknowledge as my own. The best part is what he says about music; but those who know me would think it more likely that he got it from me than that I got it from him; for I wrote practically the same thing 19 years ago, when I hadn't yet visited Italy. What I wrote then I gave to Beeckman, who, as you know, made a great thing of it, and wrote about it in various places as if it were his own. . . .

[Then 12 more pages on lenses, oil, Fermat, Roberval, Petit, de Beaugrand, the introduction to Descartes's *Geometry*, Boulliau, places where there are echoes, and Galileo.]

⊕ [11.x.38: Descartes writes to Fermat a lavish statement about Fermat's excellence as a mathematician, with brief indications of disagreements on some points. There's a passing reference to Roberval, 'who is certainly another of the leading geometers of our century'.]

⊕ [Morin writes to Descartes ten pages of continuing resistance on the matters they have been arguing about.]

to Mersenne, 15.xi.1638:

[This 29-page letter responds to four from Mersenne that have come in since Descartes's letter 'five weeks ago'. That letter isn't mentioned in any of the four, making Descartes worry that the package with his letter may have been lost in the mail. The first dozen pages deal with many of the topics of the letter of 15.xi.38, with the main emphasis being on mathematics. He corrects an error in something he wrote, saying 'I must have been falling asleep when I wrote that' and quoting the Latin poet Horace, *quadrate bonus dormitat Homerus* = 'Even Homer sleeps sometimes'. Then:]

At last you understand 'force' in the way I do when I say that it takes as much **force** to raise a 100-pound weight one foot as to raise a 50-pound weight two feet—meaning that it takes as much **action or effort**. I can believe that I hadn't explained this well on previous occasions, given that you didn't understand it. I was so far from thinking of 'force' as the *power* that we call a man's 'force' when we say 'This man has more force than that one' etc. that it didn't enter my head that anyone would take it in that sense. And when we say that one effect requires less force than another, this doesn't mean that less power is needed, for there would be no harm in having more power; it means merely that less action is required. In that paper, I was. . . .thinking only of the action that we call the 'force' that can raise a weight, whether the raising is done by a man, a spring, some other weight, or the like. Now the only way to determine *a priori* [see Glossary] how much effect can be achieved by a given action (i.e. how heavy a weight, and of what sort, can be raised by means of such-and-such a machine) is to measure how much action causes this effect (i.e. the force required to raise such a weight). . . .

As for what Galileo writes about the balance and the lever, he expounds well •what the facts are but doesn't explain •why those are the facts, as I do by my principles. And as for those who say that I should have explained machines in terms of velocity (as Galileo does) rather than of space, between ourselves I regard them as fantasists who have no understanding of the subject. Obviously it takes more force to raise a body quickly than to raise it slowly, but it's a mere

fantasy to say that the force has to be doubled if the speed is to be doubled; it's easy to show that that's not so.

[A page of remarks regarding geometry, Fermat (respectful), Roberval (cool), and de Beaugrand (scathing). Then:]

How are we to make sound judgements about what notions can be taken as principles? The only way I know is to prepare our mind by •getting rid of all the opinions that we are preoccupied by, and •rejecting as doubtful everything that could be wrong. It is a common notion [see Glossary] that *if a thinking being doesn't depend on anything else, then it is God.* Why? Because if something's existence is due to itself, we can't •doubt that it will have given itself as many perfections as it could recognise, or •believe that *we* recognise any perfections that *it* couldn't recognise. But the statement that a purely material being doesn't depend on anything else doesn't imply that it is God.

I looked for the letter in which you quote the passage from St Augustine, but I still can't find it; nor have I managed to obtain the works of that Saint, so that I could look up what you told me about. But thank you.

[Then three pages on a variety of topics and people: whether Fermat was right in saying that Galileo had misunderstood a passage in Aristotle; Campanella's new book (what Descartes has seen of it doesn't make him want to see the rest); tiresome behavior towards Mersenne by Descartes's brother; no response to be sent to Morin because he evidently doesn't want one ('His views seem to be even further from mine than they were are the start of our correspondence'); postal arrangements for Mersenne's letters to Descartes, some very slow, others fast; a recent bit of geometry by Debeaune—not in fact correct, but better than anyone else's treatment of the same topic.]

[Mersenne's second letter is in three parts. The first describes several experiments; Descartes's says that •the experiments on 'the tube' would have been better done by a method he has described early in the present letter [omitted from this version], and that •the exploration of differences in the forces needed to break a cylindrical object across its width and along its length was a waste of time—there are no general truths to be discovered here. Then:]

In the second part of your second letter you make remarks about Galileo. I accept that what prevents the separation of contiguous terrestrial bodies is the weight of the cylinder of air resting on them. . . . But I don't accept that the force of the continuity of bodies comes from that source, because this force consists simply in the connection or union between their parts. [Here 'connection' translates *liaison*, which can also mean 'cement'. It is used in that sense on page 87 where Descartes refers to the theory that cohering bodies are held together by 'a certain glue or cement' (*colle ou liaison*), a theory that he declares to be false. If *liaison* has the same sense in both passages, they conflict. If instead we take this latest use of the word to mean the abstract 'connection', that avoids the conflict but makes the present passage vague and puzzling.] Why did I say that if something occurred because of abhorrence of a vacuum, no force could prevent it? Because the existence of empty space is ·not merely something that nature 'abhors', but is absolutely logically· impossible, just as it's impossible that there should be highlands without lowlands.

I imagine the particles of subtle matter to be as hard and solid as bodies of their size can be; but since they can't affect our senses, and the names of qualities are relative to our senses, such names can't properly be applied to them. Similarly, we don't say that powder is hard and heavy, but rather that it is soft and light compared with pebbles; yet each of its particles is of the same nature as a tiny pebble.

I don't agree that rotten wood or a candle can be motionless when it is giving off light; it couldn't give off light if its tiny particles—or rather the particles of the subtle matter

in its pores—didn't move extraordinarily forcefully. I gave a detailed account of the cause of this movement and of the whole nature of fire in my *World*, I didn't want to discuss it in my Essays; I couldn't have made it intelligible in a few words. I agree. . . .that •there can't be rarefaction in one place unless there is condensation somewhere else, and that •when a body expands in a furnace it's easy to find something that can undergo a compensating condensation, namely the surrounding air, which can easily be compressed. . . .

[Descartes now continues discussions about the velocity with which water falls through air, and other related topics. One small episode in this passage is notable: '. . . a body that moves in a vacuum, i.e. in a space containing nothing but matter that doesn't speed it up or slow it down'.]

Your third letter has to do with the *Optics*. I'm grateful for your correcting the errors in it; I'll be glad if you will kindly mark the corrections in your own copy, so that you can send it to me if there is a second printing. In choice of language and spelling I merely want to follow ordinary usage; but it's so long since I was last in France that there are many things I don't know. . . .

[The rest of the letter concerns: •subtle matter and the pores it lurks in; •Debeaune's geometrical work and the fools who don't understand it; •warnings against believing what 'charlatans' say they have achieved in lens-making; •the wrongness of Fermat's criticisms of the *Optics*, and thanks to Mersenne for having challenged them; •some geometry and physics in reply to questions Mersenne has asked; •rejection of the charge (reported by Mersenne) that the *Optics* is 'borrowed' from Roger Bacon. Descartes concludes the paragraph on Fermat by saying that his view of him is improved by the fact that 'he spoke only according to his belief'.]

⊕ [xi–xii.38: Descartes writes to some artisan (or perhaps to Ferrier) regarding details in the making of lenses. The tone is extremely respectful.]

⊕ [xii.38: Descartes writes to Huygens, a charmingly affectionate letter just to make contact, with the excuse of Descartes's having found on his shelves a book belonging to Huygens.]

to Mersenne, xii.1638:

[Descartes expresses several dissatisfactions with Fermat, summing up thus:] I have seen many of his writings, in which I have found two or three good things mixed in with many bad ones. Between ourselves, I think of them in the way Virgil thought of Ennius, when he extracted ·little bits of· gold from his works under the title *The dung of Ennius* [in the background of that slur is a Latin idiom, *aurum e stercore* = 'gold from dung']. But this is between ourselves, because I still want to be his 'Yours faithfully' if he wants that.

[Descartes next •comments on someone's objections to the *Optics*, •thanks Mersenne for his labours to get copies of Descartes's work into the hands of various Italian cardinals, •asks for news of Gassendi, especially his opinion of Descartes's work, and •answers the question 'What's so special about the octave?' Then:]

The reason why water stays in a watering-can ·that is punctured at the bottom and sealed everywhere else· is not •abhorrence of a vacuum (for as you rightly say, subtle matter might easily enter the can in place of the air) but •the weight of the air. For if water flowed out of the can and the space vacated was taken up only by subtle matter, it would have to raise the entire body of air right up to its highest level.

As for air that is forced into a balloon by a pump: it doesn't become hard, though it makes the balloon hard. What happens must be that the air-particles—which (unlike

any subtle matter that may be there) are trapped in the balloon because they are too big to pass through its pores—are pushed against one another and thus pressed out of shape, and in tending to regain their original shapes they act like tiny springs pushing outward against the sides of the balloon, thus making it hard. That is what hardness *is*, namely a disposition to resist when pushed, whatever the cause is of this disposition. . . .

I don't recognise any inertia or natural sluggishness in bodies, any more than Mydorge does; and I believe that when a man *walks* he makes the entire mass of the earth move ever so slightly, because he is putting his weight now on one spot, now on another. Yet I agree with Debeaune that when the largest bodies are pushed by a single force (e.g. the largest ships pushed by a single wind), they always move more slowly than smaller bodies do. This might be enough to confirm his arguments, without having recourse to this 'natural inertia' that can't possibly be proved. [Very approving remarks about Debeaune; discussion of burning mirrors (see Glossary); explanation of how highly polished bodies can be different colours, namely that they are never so highly polished that there aren't differences of surface-texture and thus different colours.]

⊕ [9.i.39: Descartes writes to Frénicle, a warmly respectful discussion of some problems in number-theory.]

to Mersenne, 9.i.1639:

(1) You tell me in your last letter that you and some other good people are concerned about me when two weeks pass without your getting a letter from me; on reading that, I would have to be very weary of life if I neglected to look after myself! But by the grace of God I haven't had any really serious illness during the past 30 years. Over the years I have lost the hot-headed aggressiveness that once attracted me to the army, and these days my only 'profession' is Cowardice. Moreover, I have acquired some little knowledge of medicine, and I feel very well and look after myself with as much care as a rich man with gout. So I almost think that I am now further from death than I ever was in my youth. And if God doesn't grant me the knowledge to avoid the discomforts of old age, I hope he will at least let me live long enough to have free time in which to endure them. [The thought seems to be: 'Let me live long enough to *finish my work*; then I'll be free to focus on the challenges of old age.'] Yet everything depends on God's providence, to which—joking aside—I submit myself with as much open acceptance as Father Joseph will have done ·when he died three weeks ago·. My ethical code tells me to love life without fearing death.

(2) I'm extremely grateful for your care in correcting the printers' errors in my Essays, but I'm a bit afraid that it won't be useful: given how few copies have been sold (the publisher tells me), there's not much chance that he will have to bring out a second edition. . . .

[**(3)** concerns practical problems in weighing air. Then:] **(4)** If you conceive of God removing all the air in a room without replacing it by any other body, then you had better be conceiving of the walls touching each other—otherwise you'll be thinking a contradiction. Just as we couldn't imagine God flattening all the mountains in the world while leaving all the valleys, so we can't think of him as removing every kind of body while leaving space behind. Our idea of •body, or of matter in general, is contained in our idea of •space, i.e. of something with length and breadth and depth, just as the idea of a mountain is contained in the idea of a valley.

(5) When I conceive of a body x moving in a totally non-resistant medium, I'm supposing that all the parts of the surrounding liquid body are disposed to move at *exactly*

the same speed as x does, both in •making way for it and •moving in after it. That is why every kind of liquid allows some movement or other. But to imagine matter that resisted *none* of the various movements of different bodies, you would have to suppose that God or an angel was moving its parts at various speeds to correspond with the speeds of movements in the body they surround.

I haven't yet told you what I think prevents there being a vacuum between the parts of the subtle matter. I couldn't explain it without bringing in another subtle matter, and I wanted to save that for my *World*. But I'm too much in your debt to keep secrets from you, so I'll tell you.

[Descartes is going to distinguish three kinds of matter, differing only in how finely they are divided: **(i)** what he quite often calls 'terrestrial (*terrestre*) matter'; all he means by 'terrestrial' is 'not very finely divided'; the other kinds of matter are also 'terrestrial' in the ordinary sense of the word; **(ii)** subtle matter such as has been mentioned often in previous letters and in Descartes's published works up to now; **(iii)** the 'other subtle matter', even more finely divided, which he is now announcing to Mersenne; Descartes has no name for it, but in the present version it will be called 'supersubtle matter'.]

I have proof that in addition to the ·ordinary· matter that makes up terrestrial bodies there are two other kinds:

- •One is very subtle and has parts that are round or almost round, like grains of sand; this fills the pores of terrestrial bodies and is the material of which all the heavens [see Glossary] are made.
- •The other—·supersubtle matter'·—is incomparably more subtle still, and its parts are so small and so fast-moving that they have no fixed shape but at each moment easily take the shape required to fill up all the little interstices that aren't occupied by other bodies.

There are two things you have to know if you are to understand this. **(a)** The smaller a body is, the less force is required to change its shape. If you have two balls of lead of different sizes you'll need less force to flatten the smaller than to flatten the larger; and if they collide, the shape of the smaller one will change more than that of the other. **(b)** When several bodies are shaken up together, the smaller ones will receive more of this motion, i.e. will move more quickly, than the larger ones. Both of these doctrines need the rider 'other things being equal'. From this it follows demonstratively that since there are moving bodies in the universe, and since there is no vacuum, there *must* be a type of matter whose parts are so small and so fast-moving that the force of their collision with other bodies is sufficient to change their shape and mould them to fit the places they occupy. But I have already said too much on a topic on which I didn't intend to say anything.

(6) Every experiment would be useful for *something*, if one were engaged in studying the whole of nature. But I don't know of any that strike me as *less* useful than the study of what forces are needed to break different cylinders. . . .

(7) I don't think of the movements in subtle matter differently from how I think of the movements in all visible bodies. The water of a river moves faster at some places than at others, and sometimes flows straight and sometimes in a curve, even though it is pushed along by the same force and moves with the same flow; and the same is true of subtle matter.

As for heat, it could be caused by the agitation of the particles of this subtle matter, though strictly speaking it consists only in the motion of terrestrial particles, because they are what have the most force to move the particles of other bodies and thus set them on fire. The more terrestrial particles a body has, the hotter it can be—compare iron with wood. A body's terrestrial particles can be in rapid

motion, making it very hot, while the subtle matter in its pores isn't pushed about in the way needed for it to give us any sensation of light. That's why iron can be very hot without being red-hot.

[Descartes's next claim is that any portion of matter can be •terrestrial at one time, •ordinarily subtle at another, and •supersubtle at yet another. Then in **(8)** he offers and explanation of why iron is strengthened by being thrown into cold water when it is red hot.]

(9) Why does a candle flame viewed at a distance in the dark appear much larger than it is? I can think of two answers. **(i)** Since we can't see its true distance, we imagine it to be as far away as the stars—since the image of the candle at the back of the eye is much larger than the image of the star, we judge that the flame itself is larger. **(ii)** We see not only the light coming directly from the candle but also light coming from the dense air or other neighbouring bodies that are lit up by it. It's easy to distinguish these two sorts of light at close range, but at a distance we ascribe them both to the candle; so the flame seems bigger than it is. [Note that in each case a fact about how something seems or appears is explained in terms of things that we think or believe.]. . . .

[**(10)** concerns burning mirrors. In **(11)** Descartes says that he's sorry to have led Mersenne to run certain experiments concerning the physics of fluids: he no longer thinks that the outcomes would matter much, and in any case] I find that it's almost impossible to reason well on the basis of experiments that I didn't run myself, because every experimenter has his own individual slant on what he is doing. [**(12)** An experiment that Mersenne asked Descartes to perform is judged by Descartes as not worth the trouble. **(13)** Comments on some work by Desargues: Descartes says that it hasn't been explained fully enough for him to have any judgment on it.]

For the rest of this winter I'll be engaged in a study that needs me to be free of distractions. So I humbly ask you to let me off writing anything between now and Easter (·25.iv·) unless of course something urgent comes up. But go on forwarding to me any letters that come to you addressed to me, and your own letters are always welcome. . . .

to Mersenne, 9.ii.1639:

Since you want me to respond to your letter of 28.i, I'm also going to re-read the ones before it, so as not to leave anything without a response. [Then seven pages dealing with

- •lenses: some made in Naples recently may owe something to Descartes's work on this years ago;
- •crystals: Mersenne has sent some; Descartes is puzzled by how their-cross-section differs from that of most hexagonal crystals and from the shape of the cells of honey-combs;
- •fish: what makes it possible for them to swim and steer themselves;
- •Fermat: Descartes doesn't want to revisit a certain work of his, because what it does is done better in his (Descartes's) *Geometry*;
- •behaviour of Descartes's family: deplorable;
- •Galileo: the physics of things' sinking in water;
- •Descartes's spelling mistakes;
- •subtle matter: adding something to the theory of them;
- •particles of ordinary matter: adding some things to the theory of them;
- •Petit: his objections to Descartes on refraction are merely comic;
- •centres of gravity;
- •supposed medical remedies: Descartes is sceptical

about some (which he names), but thinks that in healthy people a superficial wound can usually be cured by keeping it clean and bandaged;

- •Roberval: Descartes doesn't want to see any more of his work, and asks Mersenne to discourage others from submitting their work to him;
- •Desargues: his work on conic sections is an exception because Descartes has obligations to him;
- •Debeaune: his notes on Descartes's *Geometry* are another exception;
- •Gaudais: Descartes can't make sense of what he has written about trumpet-sounds.

Then:]

You tell me that an Italian medical man has written against Harvey's *The Motion of the Heart*, and that this makes you sorry that I have committed myself to writing on this topic. Frankly, I can't feel grateful for your concern: you must think very ill of me if, simply from being told that someone has written something that you imagine to be critical of me, you jump to the conclusion that I have gone wrong somewhere, without having seen his argument or even knowing whether he is competent. (·I say 'that you *imagine* to be critical of me' because its being against Harvey doesn't mean that it is against me·. Those who take a superficial view of things hold that what I wrote is the same as Harvey's view, simply because ·like him· I believe in the circulation of the blood; but my explanation of the movement of the heart is flatly contrary to his.) I can see from this and many other such things that good arguments have very little power to convince people of the truth. This almost persuades me to give up writing altogether and to pursue my studies exclusively for my own benefit. Still, I'm prepared to admit that if what I have written on this topic or on refraction—or on anything else that I have given more than three lines to in my published writings—turns out to be false, then the rest of my philosophy is worthless. I swear to you that it doesn't matter to me what people think of my work, especially now when all they have are samples of it that nothing could be built on. If I had given the whole thing ·to the world·, I am sure I would have regretted it.

[The last six pages of this letter contain 16 numbered items, all concerned with mathematics and/or physics and/or practitioners of these sciences. Two of them are requests to Mersenne not to send Descartes any more material from or relating to Fermat.]

⊕ [20.ii.39: Descartes writes to Debeaune, expressing great pleasure in Debeaune's notes on the *Geometry*. To show that he is capable of doing so, he points out some things in the *Geometry* that he (Descartes) thinks are defective. Lenses, briefly. Five pages on Debeaune's work on the geometry of curves ('better than Archimedes').]

to Mersenne, 20.ii.1639:

[This letter starts with remarks about •Debeaune, •a geometer who says that he and Descartes studied Viète together in Paris (Descartes doesn't know this man and doesn't think he opened Viète's book in France), and •a question about how many eggs would break if 50,000 of them were packed into a box. Then:]

The number and the orderly arrangement of the nerves, veins, bones and other parts of an animal don't show that nature is insufficient to form them, given that •in everything this *nature* acts in accordance with the precise laws of mechanics, and that •these laws were imposed on it by God. Indeed I have taken into consideration not only what Vesalius and others write about anatomy but also many things at a level of detail that they don't go into—things I have observed while dissecting various animals. I have spent much time

on dissection during the last eleven years, and hardly any medical researcher, I believe, has looked at animals as closely as I have. But I haven't found anything whose formation seems inexplicable by natural causes; I'm talking about the kind of explanation that I gave in *Meteorology* for the origin of a grain of salt or a snowflake. In my *World* I started with the fully formed body of an animal, and merely showed its functions; but if I re-wrote that work I would undertake to include also the causes of the animal's formation and birth. But with all that knowledge I still don't know enough to be able to heal a mere fever. I claim to know ·enough· about **the animal in general**, which *isn't* subject to fevers, but I don't know ·enough· about **the man in particular**, who *is*.

[The contrast here is not between 'animal' and 'man' but between 'general' and 'particular'. For Descartes, a man is an animal. He is contrasting •knowing a lot about animals in general with •knowing enough about any individual animal—e.g. an individual man (or horse)—to understand what is going on when he (or it) falls ill.]

from Regius, 9.iii.39:

I don't have words to express the joy that your admirable letter of last August brought me. The modest reputation that I already had (thanks to you and to Reneri) was enlarged by that letter. It was indeed so much enlarged that my college has attracted people—medical students, philosophers, legal theorists, theologians, and others—who come to hear the public and private lectures on medicine that I give following the principles of your philosophy, which I have picked up from your excellent works and *viva voce* from Reneri.

That should be enough, one would think, to raise my level of courage, and also to open up the ways of nature to me. Yet your goodness has led you to take other steps to help me. You have allowed me, every time Reneri has visited you, to join the company; but his health is bad, and you have now allowed me to visit you on my own. I hope to avail myself of this permission during this last week of our vacation, and if it wouldn't be a burden to you I'll spend two or three days in your vicinity, so as to be able to consult you regarding various plans that I have.

⊕ [30.iv.39: Descartes writes to Mersenne, acknowledging receipt of several books and some letters. Remarks and advice relating to using snow and salt to freeze water, why sunlight doesn't reach the bottom of the sea; also two pages of geometry in which Descartes mocks Mersenne for repeatedly making the same mistake. Then this about Petit: 'You are doing too much honour to Petit by writing against him; we ought to let such puppies snap at our heels without paying them any attention.' Then five more pages of geometry.]

to Debeaune, 30.iv.1639:

The time I have spent studying your work on curves has been well spent: I have learned a lot. . . . Thank you for your corrected measure of refractions; the previous one was so near to right that no-one but you would have seen anything wrong with it. As for the writing of Petit which ·you tell me· you have seen: I have less admiration for that—so little, indeed, that ·if he wanted something to boast about· he could boast of being the only person, out of all of those who have sent me things or written to me, that I haven't responded to!

I would like to be able to meet your request concerning your mechanics; but although my entire physics is nothing but mechanics, I have never looked closely into problems that depend on measurements of speed. [He strenuously congratulates Debeaune on the quality of his work in this area, and in geometry and the physics of sound. Then:] All that remains is for me to tell you **(i)** what it is that gives me problems about speed and, connected with that, **(ii)** what

I think about the nature of weight, which you call 'natural inertia'.

(i) I hold that in the whole of created matter there is a certain quantity of motion which never increases or diminishes. When one body moves another, it loses as much of its own motion as it gives to the other; thus, when a stone falls to earth from a high place, if it hits the ground without bouncing, that's because it jolts the earth and so transfers its motion to it; but if the ·part of the· earth that it moves contains a thousand times as much matter as the stone, when the stone transfers the whole of its •motion to it, it passes along only one thousandth of its •speed. If two unequal bodies receive the same amount of motion, the larger one doesn't get the same speed as the smaller. In this sense, then, one can say that the more matter a body contains, the more 'natural inertia' it has. One can say too that a large body is better able than a small one to transfer its motion to other bodies; and that it's harder for other bodies to move a larger body than to move a smaller one. So there's one sort of inertia that depends on the quantity of the matter, and another that depends on the extent of its surfaces. [The extent of a thing's surfaces presumably = its size.]

(ii) Here is how I conceive weight. All the subtle matter between here and the moon swirls rapidly around the earth, pushing towards the earth all the bodies that can't move as fast as it does. It pushes them with more force when they haven't yet begun to fall than when they are already falling; if they are falling as fast as the subtle matter is moving, it won't push them at all, and if they are falling faster than it is, it will actually hold them back.

So, you see, before reaching any conclusions about •speed one has many things to think about; and that's why I have always held back from investigating •it; but these principles ·of mine· enable us to explain many things that couldn't be explained before. I haven't been willing to discuss these topics elsewhere because the proof of them depends upon my *World*; and I discuss them freely with you because I am confident that you will view them in a favourable light.

⊕ [6.v.39: Descartes writes to Pollot, saying that he would be glad and honoured if Pollot paid him a visit but that he doesn't ask for this because he doesn't think such a visit would be worthwhile from Pollot's point of view. Pollot has just sent Descartes a book, but Descartes won't comment on it except viva voce when they next meet; because he doesn't think well of the book and doesn't want to upset its author because he knows that Pollot likes him. Sorrow over Reneri's death. Sympathy with Pollot over his recent time as a prisoner of war.]

⊕ [15.v.39: Huygens writes to Descartes, a friendly jokey letter urging him to present his *World* to the world.]

⊕ [28.v.39: Huygens writes to Descartes reinforcing his pleas for *The World* to be published. Descartes will die some day—with jokes about the spread of this bad habit of dying—and then if not sooner *World* will be published, without Descartes there to answer honest people's doubts and refute the logical errors of malicious critics. 'Don't you care?']

⊕ [6.vi.39: Descartes writes to Huygens, still declining to publish the *The World* at this time, and speculating that Huygens's plea is motivated mainly by his thought that publishing the work would bring pleasure to Descartes. As for his death: 'I don't think I need fear death for another thirty years unless it mounts a surprise attack.']

to Desargues, 19.vi.1639:

I have seen the frankness of your temperament, and have a sense of my obligations to you, and these two factors lead me to write freely about your *Treatise on Conic Sections*, or about what I guess to be in it judging by the Prospectus of the work that Mersenne has sent me.

You could have either of two purposes in this book—purposes that require different means. One is

(i) to write for the learned, the experts, teaching them some properties of conic sections that they don't yet know about.

The other is

(ii) to write for laymen, so as to make widely accessible (to those who study your book) a range of things that until now •have been understood only by a few and yet •are very useful for perspective, visual art, architecture, and so on.

If **(i)** is your aim, I don't think you need to introduce any new terms: the experts are used to the terminology of Apollonius, and won't easily switch to another even if it is better; your new terminology will make your demonstrations harder to follow and will discourage people from reading them.

If your aim is **(ii)** then your new terms—which are French, and have clearly been selected with intelligence and an eye to grace—will be better received by people whose heads aren't already full of the ancient terminology. And they may even attract many people to the book—people who want to read about coats of arms, hunting, architecture and so on, not aiming to *be* hunters or architects but wanting to be able to talk about such things using the proper terms. But if that is your plan, you need to embark on a really big book in which everything is explained fully and in such a vivid [see Glossary] and clear way that critics won't be able to claim that the book is 'hard to understand', by which they would mean 'harder to understand that the description of an enchanted palace in a piece of romantic fiction'! (I'm talking about people—there are plenty of them—who can't study without yawning, who can't stretch their minds enough to take in a geometrical proposition, and for whom it's too much work to turn back a page or two to check letters ·in a demonstration· against the diagram.) I think you would be helped in this if you used the terms and calculations of arithmetic, as I did in my *Geometry*, because many people who don't know what *composition of forces* is do know what *multiplication* is.

You treat parallel lines as lines that meet at an infinite distance, so as to bring them into a single genus with pairs of lines that meet at a point. That is very good, provided that in your hands the less obscure of these species [parallelism] is used (as I'm sure it is) to clarify the more obscure one [infinity], and not vice versa. . . .

to Mersenne, 19.vi.1639:

[This ten-page letter starts with comments on a perhaps-miracle that Mersenne has reported, saying that people on the spot should have looked for evidence that it *was* a miracle, because] why would God make a miracle if he didn't want people to know that that's what it was?

[He then makes remarks about •the physics of flowing water, •subtle matter and the moon, •the advantages of lenses over mirrors for magnification, •the hardness of ice, •subtle matter and agitations—trembling hands, fire, etc., •a detail in the theory of looking-glasses, •a misunderstanding between Descartes and someone named Bessy ('I interpreted his proposition on the basis of his words, not his intention'); •geometrical work by Debeaune; half a dozen other episodes involving half a dozen other people. Then:]

Concerning your remarks on weight: subtle matter pushes the falling stone **(i)** around and also **(ii)** towards the centre of the earth; but **(i)** is imperceptible because it is common to the whole earth and the surrounding air; so it can only be **(ii)** that gives rise to weight. The stone moves faster at the end of its descent than at the beginning, even though at that stage it is being propelled less forcefully by

the subtle matter; that's because this weaker impulse from the subtle matter is *added to* the impetus of the stone's preceding motion. Also: I did say that the subtle matter revolves around the earth, but there was no need for me to say whether it moves from east to west or vice versa, because the motion can't possibly be perceived by us. . . .

[Then further mopping-up operations, involving six more people.]

to Mersenne, 27.viii.1639:

I was glad to learn of your return; I had started to worry about your health, since I hadn't received any news about you. Two men you know died here recently, Heylichman and Hortensius, not to mention my good friend Reneri, who died last Lent. You don't need a war to find death.

I finally received the two copies of the book *On Truth* that you kindly sent to me [a French translation of *De Veritate* by Herbert of Cherbury]. When I can I'll give one copy to Archbishop Bannius on your behalf—I think that's what you wanted. At present I have no time to read; so all I can say is that when I read the original Latin edition there were many things near the beginning that I thought were very good; he was clearly above average in his knowledge of metaphysics, a science that hardly anyone understands. But later on he seemed to mingle religion with philosophy, which goes quite against the grain with me; so I didn't read it to the end, though I hope to do this as soon as I can find the time to read anything. . . . For the time being I'm studying without any book.

The twinkling of the stars may have to do with the liveliness of their light, which also makes them appear larger than they are; but I offer several other explanations in my *World*.

You experiment showing that water flowing from a 9-foot tube must flow *almost* three times as fast as from a one-foot tube strikes me as perfectly correct; though I add 'almost', to take account of the air and of my view of the nature of heaviness, according to which a body falling under its own weight stops speeding up once it has reached a certain speed. But I would like some time to go into the question of the motion of water in greater detail; so I shan't say anything more about it here.

My conception of

> how a candle flame or light from a glow-worm etc. presses the subtle matter towards our eyes in a straight line

is the same as my conception of

> how a stone swung round in a sling presses the pouch of the sling and pulls the cord in a straight line,

namely through the force of its *circular* motion. The subtle matter around a candle or a glow-worm also moves in a circle ·like the stone in the sling·, and tends to spread out from there leaving an empty space, i.e. a space containing only what can enter it from outside. In the same way, we can conceive how subtle matter presses heavy bodies towards the centre of the earth, simply by moving in a circle around the earth; and the earth doesn't have to be at the centre of •the universe for this to occur. As long as it's at the centre of •the circular motion of all the subtle matter between us and the moon, that's enough for it to make all the less subtle bodies between us and the moon to tend towards the earth. . . .

⊕ [ix.39: Descartes writes to Schooten about geometrical matters. He hasn't carefully studied what Schooten tells him about Debeaune's *Brief notes on Descartes's geometry* because he is sure that that work won't have significant errors. Schooten's difficulties with it, Descartes suggests, all come from Debeaune's mis-labelling one line in a diagram—an 'excusable' error.]

⊕ [x.39: Descartes writes to Huygens, three pages asking him to intercede with the Prince of Orange to get help for two Roman Catholic priests who have a problem with the authorities of their own Church. Descartes doesn't know the details, but he vouches for the good character of these two men (whom he has come to know through Huygens), and insists that helping them won't produce any political fall-out.]

to Mersenne, 16.x.1639:

[This 12-page letter starts with a few pages on hydrostatics [water in tubes etc.]; then lenses and light (how it is that light can be reflected by a seemingly pure-black surface); then this response to Mersenne's report that according to Mydorge missile can eventually go infinitely fast:] You forgot to tell me whether this is supposed to happen *in vacuo* or not, so I can't refute it. All I can say is that the idea of some natural thing's going infinitely fast is self-contradictory, unless you borrow from Desargue's work (·in which he defines parallel lines as lines that meet infinitely far off·) and say that an ordinary motionless straight line AB is the same as a point moving infinitely fast ·back and forth· between A and B. . . .

[A paragraph about how Descartes is currently assailed from all sides: protestants hate him as a catholic, and catholics don't like him because he accepts 'the heretical view that the earth moves'. Then:]

To understand how subtle matter swirling around the earth drives heavy bodies towards the centre of the earth, fill a round vessel with tiny lead pellets, and mix in some larger pieces of wood or other material that is lighter than lead. Now spin the vessel around very quickly, and you'll see that the pellets drive the pieces of lighter material towards the centre of the vessel, just as subtle matter drives terrestrial bodies towards the centre of the earth.

[There follow two pages on a miscellany of minor matters relating to science or natural history, and a message to be given to Descartes's nephew if Mersenne should see him again. Then:]

Since I last wrote, I have read the book you kindly sent me [Lord Herbert of Cherbury's *On Truth*]. Since you ask my opinion of it, and since it deals with a subject I have worked on all my life, I think I should write something about it in this letter. I find in it many good things, but they won't please everyone, because not many people can understand metaphysics. In the general plan of the book the author takes a very different route from the one I have followed. He examines *what truth is*, and I have never had any doubt about that because it strikes me as being such a transcendentally clear notion that it's impossible not to know it. There are many ways of examining a balance before using it, but there's no way to •learn what truth is if one doesn't ·already· know it by nature. When we •learn something, why would we accept the lesson if we didn't know it was true, i.e. if we didn't know truth? Of course we can explain the meaning of 'truth' to someone who doesn't know the language, telling him that 'truth', in the strict sense, refers to the conformity of a thought with its object, and that when something other than a thought is called 'true'—·e.g. 'true gold', 'true courage'·—that means only that the thing in question can be the object of true thoughts, either ours or God's. But no logical definition can be given that would help anyone to discover the nature of truth. I think the same of many other things that are very simple and are known naturally, such as shape, size, motion, place, time, and so on: if you try to define these things you only obscure them and get into difficulties. For instance, a man who walks across a room shows *what motion is* better than a man who says ·as Aristotle did· 'It is the actuality of a potential being in so far as it is potential' , and so on.

The author takes universal consent as the criterion of his truths; whereas my only criterion is the natural light [see Glossary]. The two criteria agree in part: all men have the same natural light, so you'd think they should have the same notions; but there's also a great difference between them, because hardly anyone makes good use of that light, which is why it can happen that many people—perhaps everyone we know—share the same mistaken opinion. Also there are many things that can he known by the natural light but haven't yet been thought of.

He holds that we have as many faculties as there are variations in objects of knowledge. This seems to me like saying that because a piece of wax can take on an infinity of shapes it has an infinity of faculties for taking them on. In that sense it is true, but this way of talking seems to me quite useless, and indeed rather harmful because it may lead ignorant people to imagine a host of little entities—·little *things*·—in our soul. So I prefer this way of thinking about it:

- •the wax, simply by being flexible, takes on all sorts of shapes, and
- •the soul acquires all its knowledge by reflecting either on itself (for intellectual matters) or on the various dispositions of the brain it is joined to (for corporeal matters)—dispositions that may be caused by the senses or by other factors.

But it's very useful not to accept any belief without considering what entitles us or causes us to accept it; and this comes to the same thing as his advice always to consider what faculty one is using, etc.. . . .

He recommends that one should above all follow natural instinct, from which he derives all his common notions [see Glossary]. For my part, I distinguish two kinds of instinct. There's the one we have because we are human beings, which is purely intellectual: it is the natural light or mental vision. I hold that this is the only instinct we should trust. The other belongs to us because we are animals; it's a certain natural impulse towards the preservation of our body, towards the enjoyment of bodily pleasures, and so on. This should not always be followed. . . .

What he says about religion I leave to be examined by the gentlemen of the Sorbonne. I can only say •that I found it much easier to read in French than I did before in Latin; •that he has many maxims that seem to me so pious, and so much in conformity with common sense, that I hope they'll be approved by orthodox theology; and •that although I can't agree with all the opinions of this author, I regard him as a person of quite extraordinary talent.

to Mersenne, 13.xi.1639:

[Descartes discusses •different pumping arrangements to raise water more than 100 feet; •reflections from black surfaces; •how a missile would move in empty space if there any; •getting seeds for 'sensitive plants' and exchange of garden catalogues; •someone's accusation that Descartes is moving towards being a Calvinist (indignantly denied, with a full page of evidence; and •the way a person in a painting seems to be looking straight at you when you move from one side of the picture to the other. Then:]

The opinions of your analysts—·Roberval and other geometers of Paris·—about the existence of God and the honour that is due to him, are as you say very difficult to cure; not because of any shortage of reasons strong enough to convince them, but because people like that who are convinced of their own intelligence are often less capable of reasoning than others. The part of the mind that most helps in mathematics, namely imagination, hinders more than it helps in metaphysical speculation. I am now writing a

discourse in which I try to clarify what I have previously written on this topic. It will occupy only five or six printed sheets, but I expect it to contain a great part of metaphysics. As a way of improving it, I plan to have only 20 or 30 copies printed, and to send them to the 20 or 30 most learned theologians I can find, so as to get their judgment on it and learn what should be changed, corrected or added before publication.

I believe that in empty space—if such a thing were possible—a very small force could move an enormous body just as it could move a tiny one, though not at the same speed. A force that could move a 10lb rock at a certain speed could move a 5lb rock at twice the speed.

We aren't prevented from throwing a stone very high by **(a)** the cross-current of swirling subtle matter that it goes through. There's nothing surprising in that. Our arm in throwing gets its force from **(b)** a still faster torrent of subtle matter—the one that activates our animal spirits, and differs in force and causal energy as much as fire differs from air.

[The letter ends with scepticism about what Mersenne inferred from an experiment he performed, relating •rate of water-flow to •diameter of tube; and with anxiety about Mersenne's plan to visit Italy, 'which is a very unhealthy country for Frenchmen'.

to Mersenne, 25.xii.1639:

I owe a reply to three of your letters, namely those of 12.ix, 4.xii and 10.xii; the last two arrived on the same day.

(1) You ask me why a bow or a spring loses its force when stretched wide for a very long time. This is easy to explain in terms of my principles. The pores that I earlier said have an oval shape gradually become round, because of the particles of the subtle matter that continually flow from them.

(2) This subtle matter puts limits on how high we can •throw a stone or •jump; for if this matter didn't push heavy bodies down again, when we threw a stone high up it would keep on going, and so would we when we jumped upwards.

[**(3)** Descartes says about inertia pretty much what he said to Debeaune on 30.iv.30 [page 95].]

(4) I'm not surprised that some people can demonstrate theorems on conic sections more easily than Apollonius could; his demonstrations are extremely long and tangled, while their conclusions, considered in themselves, are fairly simple. But we can look to conic sections for other results that couldn't be easily untangled by a 16-year-old. [That was Blaine Pascal's age at that time; Mersenne had told Descartes about him in a letter of 12.xi.39, which we don't have.]

(5–7) Everyone's desire to have every perfection he can conceive of, and consequently all the perfections we believe God to have, is due to God's having given us a will that has no limits. It is principally because of this infinite [here = 'unlimited'] will within us that we can be said to be created in his image.

[In **(8)** Descartes criticises a certain explanation of why a man immersed in water doesn't feel the weight of the water. In **(10)** he explains why we go upwards when we jump, and connects this with an account of how birds fly.]

(10) I have noticed that Lord Herbert of Cherbury treats as common notions many things that *aren't*. It is certain that nothing should be taken as such unless it can't be denied by anyone.

I turn to your letter of 4.xii and thank you for your advice about my *Essay on Metaphysics*. The arguments of Raymond Lull are all invalid; I don't take them seriously. As for the objections of your analysts: I'll try to *answer* them without *expounding* them. That is, I shall present the foundations from which •those who know the ·analysts'· objections can

derive their refutation, while •those who don't know the objections won't learn them from me. I think this is how one should treat the matter. And I'm not so short of books as you think; I have here Aquinas's *Summa Theologica* and a Bible that I brought from France.

[Descartes now has eight numbered items, replying to Mersenne's second letter: the mechanics of hammer-blows, techniques for raising water high, black bodies, the speed of falling stones, the offer of seeds and a garden catalogue, what must be wrong in Mersenne's experiments on water-flow, forwarding-addresses, and this:] Thank you for the affection you show me in planning to take some of my letters to you with you when you go to Italy; but I don't think that anything there is worth showing to anyone ·else·. Let me explain. I have often given you my opinions on matters that I haven't thought about before writing to you about them; and having sometimes had to respond to you on 20 or 30 different topics in an evening, I couldn't possibly think well about all of them.

[In 14 numbered items in response to Mersenne's third letter, Descartes addresses the speed of falling water, in tubes and in rivers; subtle matter and weight, and our bodies; things that do/don't move with the water they are floating in; determining the height of mountains; compasses reading differently in different countries; the intellectual misconduct of 'your geometers'; Debeaune's *Notes on Descartes's Geometry* (he is free to publish them if he wants to).]

⊕ [28.xii.39: Huygens writes to Descartes about his attempt to get a some battling mathematicians to sign a 'Compromise' document that would enable the battle to stop. At the center of the fight has been Stampioen, who refused to sign and treated Huygens discourteously. Huygens is disgusted with the whole affair. There's more about this on page 104 below.]

to Mersenne, 29.i.1640:

[Mersenne has often complained about the conduct of a man named Rivet; Descartes said in an earlier letter that he was tired of this topic; but he puts it at the start of this letter because, he says, Mersenne put it at the start of his most recent letter (which we don't have). •Descartes gives a three-page narrative about how Rivet was publicly shown up as a charlatan who knows little except some tricks for deceiving people. •A recent English book on magnetic declination doesn't amount to much; 'it offers three observations in support of its conclusion; I want thousands of them'. Also brief remarks about •other people and bits of science. Then:]

I have just re-read my notes on Galileo, where I didn't actually say that •a falling body passes through every degree of slowness; but I did say that •this can't be settled until we know what heaviness is, which comes to the same thing. I agree that your example of the inclined plane proves that all speed is infinitely divisible; but I don't agree that when a body starts to fall it passes through all these speeds. I don't think you suppose that a ball struck by a mallet starts moving more slowly than the mallet does!. . . . In my view, all there is to heaviness is the fact that terrestrial bodies are really pushed towards the centre of the earth by subtle matter—and you can easily see what follows from this. But don't infer that when these bodies start to move, they immediately move as fast as this subtle matter; for it pushes them only obliquely, and their speed—especially that of the lightest ones—is considerably reduced by the air.

I'm surprised that you hadn't heard that it's easier to hammer a lump of lead flat when it is resting on a cushion (or an anvil suspended so that it can move when struck) than when it rests on a rigidly fixed anvil. This is a matter of common knowledge; there are countless facts like it in

mechanics, all explained in the same way. To flatten a lump of lead, you need not only to •strike it with great force but to •continue that force for long enough to give the lead-particles time to change their positions. When the lead is on a fixed anvil, the hammer bounces back up at almost the moment when it strikes, so that it has less time to flatten the lead than it would if the lead were on a supporting body that could give way to the blow, thus allowing a longer period of contact between mallet and lead.

[The letter continues, addressing topics raised by Mersenne: •the physics of falling bodies, •the physics of collisions, •black surfaces, •bending several bows at once, •hoisting water. Then, 'so as to give you *some* news', Descartes reports on a recent wind-storm with strange effects; on the sudden disappearance of a sand-bank, to the advantage of a seaside town in Zealand; and on this:] When Hortensius was in Italy a few years ago he found out how to make horoscopes. Back in this country he told two young acquaintances that he would die in 1639 and they wouldn't live long beyond that date. Now, as you know he did die last summer, and this struck fear into the two young men—so much so that one of them is dead and the other (who is Heinsius's son) is so sad and so languishing that he seems to be doing his best to save astrology from being a liar. What fine science that is—bringing death to people who otherwise might not even have been ill!. . . .

to Meysonnier, 29.i.1640:

I would have written to you first if I'd known you to be such as you describe yourself in the letter you have kindly written to me [a letter that we don't now have]; for the search for truth is so essential and so daunting that it needs the co-operation of many thousands of men; and so few people join wholeheartedly in it that those who *do* should especially value each other and try to help each other by sharing their empirical data and their thoughts; and I offer you this co-operation, with every kind of affection.

To make a start I'll answer in this letter the question you asked me the function of the pineal [see Glossary] gland. I hold that this gland is the principal seat of the soul, and the place where all our thoughts are formed. I base this belief on the fact that this is the only part of the brain that isn't double. We see one thing with two eyes, and hear one voice with two ears, and in short never have more than one thought at a time; so it *must* be the case that the species [see Glossary] that enter by the two eyes or by the two ears etc. come together in some ·one· part of the body where the soul can take account of them. The only such place in the whole head is this gland; and it's situated in the best possible place for this purpose, namely in the midst of all the concavities; and it is supported and surrounded by the capillaries of the carotid arteries that bring the ·animal· spirits into the brain. As for the species preserved in the memory, I imagine them as being like the folds that this paper retains after being folded; so I think that most of them are held in the whole substance of the brain, though some of them may also be present in some way in this gland, especially in people whose minds are sluggish. In the case of very good and subtle minds, I think the gland must be free from outside influence and easy to move, as witness the fact that the pineal gland is smaller in man than in ·other· animals—the reverse of what holds for the other parts of the brain. I believe also that some of the species that serve the memory can be in various other parts of the body: the skill of a lutenist, for example, is not only in his head but also partly in the muscles of his hands. As for the likenesses of tiny dogs that are said to appear in the urine of those who have been bitten by mad dogs, I must admit that

I have always thought it was a fable, and I'll go on finding it hard to believe in them unless you tell me that you have seen very distinct and well-formed examples of this. But if this really does happen, it might be explained somehow, like the explanation of the birth-marks that children receive from the cravings of their mothers.

⊕ [1.ii.40: Descartes writes to Waessenaer a complicated letter in which he is trying to weigh in on Waessenaer's side in a long-running dispute with Stampioen concerning the value, and also the integrity, of certain mathematical work. At issue also is the view that faking results in mathematics should be legally treated as a worse crime than counterfeiting money.]

to Hogelande, 8.ii.1640:

[Descartes says that he recently returned a pamphlet and a book, both on mathematics, that Hogelande had sent him, and explains why he didn't read the pamphlet carefully when he had it. He does remember that there was nothing in it that he disagreed with much, and he approves of its general approach, which he says shows the author to be 'self-sufficient' [each occurrence of this term is given in Geek]. Then:]

I generally distinguish two parts of mathematics:

- •the historical part, consisting of everything that has already been discovered and is contained in books;
- •the scientific part, i.e. the skill to solve every problem, and thus to discover by one's own efforts everything that could be discovered in that science by means of our native human intelligence.

Anyone who has such science certainly doesn't need much outside help, and so counts as genuinely 'self-sufficient'. [Descartes here uses 'science' (in his Latin, *scientia*) in each of two senses—'**in that** science' speaks of a discipline or department of knowledge, whereas '**has such** science' is about knowledge.] It's not right to be wholly ignorant of what the books contain, but you never need more than the general acquaintance that is an automatic by-product of whipping through the principal authors. This will let you identify the passages where you can look up previous discoveries when you need them. Many things are much better kept in books than memorised—astronomical observations, tables, rules, theorems, in short anything that doesn't automatically stick in the memory at the first encounter. The fewer items we load onto our memory, the better equipped our mind will be to increase its knowledge.

It would be an excellent thing if the historical part of mathematics, which is scattered among many volumes and is still a work in progress, were *all* collected within a single book. This wouldn't involve expenses for finding or buying books, because there has been a great deal of mutual copying of material among the relevant authors, and there's nothing anywhere that can't be found in any moderately adequate library. What would mainly be needed is not so much •diligence in collecting everything as •judgement in rejecting what is superfluous, and •knowledge [*scientia*] to supply material that hasn't previously been discovered. And the only person who has all these qualities is your 'self-sufficient' mathematician. If such a book did exist, anyone could easily learn from it the whole of mathematical history and even a part of mathematical science [= could learn all of mathematics that is so far known, and even learn a bit about how to *do* mathematics']. But no-one will ever emerge as a truly 'self-sufficient' mathematician unless he is also naturally endowed with an intellectual aptitude for the subject, and has then refined it by a long course of study.

So much for theoretical mathematics. As for its practical application, if anyone wanted to possess everything relevant to this—instruments, machines, automata, and so on—he

could never succeed, even if he were a king, by spending all the treasure in the world. Anyway, there's no need for all this; it's enough to know the descriptions of these things so that when there's a need we can make them ourselves or have them made by craftsmen.

to Mersenne, 11.iii.1640:

[Descartes responds to things in several of Mersenne's letters, concerning •collisions and the flattening of lead balls, •tempering steel, •the speed of falling bodies, •the speed of missiles, and then:] I would think I knew nothing in physics if I could say how things can be but couldn't demonstrate that they can't be otherwise. Such demonstrations are perfectly possible once physics has been reduced to the laws of mathematics. I think I can provide them for the small area to which my knowledge extends; but I didn't do them in my Essays because I didn't want to present my principles there—and I still don't anything to persuade me to present them in future.

[Then •Descartes's rejection of the distinction between natural and violent [see Glossary] movements; •seeds and catalogues; •Mersenne's law-suit against Rivet (still *sub judice*, Descartes reports, but near to completion); •the convulsions of a nun (not miraculous; Descartes thinks he could cure her, but he would have to see her first); •the weather; several other small topics.]

to Mersenne, 1.iv.1640:

[This letter starts with a discussion of reports from England of changes in the direction of compass-needles: Descartes doesn't think these changes are caused by any big change in the earth itself. Then, for Meyssonnier, who has asked Mersenne about this:] After thanking him for his kindness, say this to him. I don't altogether deny that the species [see Glossary] that serve memory may be partly in the pineal gland, especially in lower animals and in humans who have coarse minds. But it seems to me that other people wouldn't be able easily to imagine countless things that they have never seen, if their souls weren't joined to some part of the brain that was just right for •receiving all kinds of new impressions and consequently no good at •storing them. This part of the brain has to be the pineal gland, because it's the only thing in the whole head that isn't double. But I think that it's the other parts of the brain—*all* of them, but especially the interior parts—that provide most of the material for memory. And all the nerves and muscles can also come into it: a lute player, for instance, has a part of his memory in his hands; the ease of various movements and positions of his fingers, which he has acquired by practice, helps him to remember musical passages where these ·movements and· positions come into play. You'll find this easy to believe if you bear in mind that what people call 'local memory' is outside us: for instance, when we have read a book, not all the species that can remind us of its contents are in our brain. Many of them are on the paper of the copy we have read. It doesn't matter that these species are not *like* the things they remind us of; the same is true of many of the species ·stored· in the brain. . . . But in addition to this memory that depends on the body, I recognise another sort of memory—intellectual memory—which depends entirely on the soul.

[Descartes then declares that he's not surprised that the pineal gland is hard to recognise in autopsies of humans; it's because the gland has time to decay during the days when the investigating scientist attends to the intestines and other parts before opening the head. Then:] The mobility of this gland is sufficiently shown by *where* it is: it is supported

only by the little arteries that surround it, so it won't take much to move it—but not, I think, to move it *far* in any direction.

[Remarks on •the newborn child's birth-marks indicating the mother's cravings, and signs in a lunatic's urine of what his mental condition is; •a passing jibe at Petit; •seeds and catalogues; then:]

So you have had a letter from England indicating that I was about to receive an invitation to go there. I have had no word of this myself; but I tell you in confidence that I would prefer that country as a homeland to many others; and when it comes to religion the King himself is said to be Catholic by choice; so please don't discourage the good intentions of your correspondents. . . .

⊕ [3.1v.40: Descartes writes to Golius, complaining of his slowness in rendering judgment on the Stampioen-Waessenaer affair, and reporting that there are many malicious rumours in the air that won't be cleared away until Golius settles the dispute.]

⊕ [7.v.40: Descartes writes to Pollot, enclosing two books by Waessenaer and a writing in which Stampioen first attacked Waessenaer without any provocation. The piece by Stampioen contains a promise of a mathematical feat which, Descartes says, 'is no more possible than whitening a Moor'. With that warning given, this work 'isn't worth the time of anyone who isn't interested in the *mœurs* [see Glossary] of this man'.]

to Regius, 24.v.1640:

I am much obliged to you and Emilius for examining and correcting the manuscript ·of the *Meditations*· which I sent you. I see that you were even kind enough to correct the punctuation and spelling. You'd have put me under an even greater obligation if you had been willing to make changes in the words and the thoughts. However small such changes were, they would have given me hope that what you had left was less at fault; but now I fear that you may have refrained from criticism because too much needs correction, or because the whole thing needs to be cancelled.

Now for your objections. In your first you say:

> 'It is because *we* have some wisdom, power and goodness that we form the idea of an infinite—or at least indefinite—wisdom, power, goodness and the other perfections that we attribute to God; similarly with our idea of infinite quantity'.

I entirely agree; I'm convinced that our only idea of God is the one formed in this manner. But the whole point of my argument is this:

> These perfections are so slight in me that my nature couldn't enable me to extend them in thought to an infinite degree unless we derived our origin from a being in which they are actually infinite.

Just as I couldn't conceive of an indefinite quantity by looking at a very small quantity or a finite body unless the world actually was or at least could be indefinitely large.

In your second objection you say: 'The truth of axioms that are vividly and clearly understood is self-evident.' I agree that this is so *while* they are vividly and clearly understood, because it's a basic fact about our mind that it can't help assenting to what it clearly understands. But because we often remember conclusions that we have deduced from such premises—remembering them while not actually attending to the premises themselves—I say that on such occasions if we don't know God we can have this thought:

> 'Those conclusions are uncertain; I remember deducing them from clear principles, but perhaps my nature is such that I go wrong even in the most evident matters; in which case even at the moment when I deduced them from those principles I didn't outright *know* them but was only *convinced* of them.

I distinguish these two as follows: when you are only *convinced* that P, there remains some reason that might lead you to doubt whether P; but you *know* that P if your conviction is based on a reason so strong that it can never be shaken by any stronger reason. Nobody can *know* ·in this sense· unless he also has knowledge of God. But once you have clearly understood the reasons that convince us that God exists and isn't a deceiver, provided you remember the conclusion 'God is no deceiver' you will continue to *know* this and not merely *be convinced of* it—and the same holds for all the other conclusions the reasons for which you remember having once clearly perceived.

In your latest objections—they arrived yesterday and reminded me to reply to your earlier ones—you say: 'All rashness of judgement depends on some state of the body, whether innate or acquired.' I flatly disagree. That would take away the freedom and scope of our will, which can remedy such rashness. If it doesn't remedy it, the resulting error is a privation [see Glossary] in relation to us but a mere negation in relation to God.

[There are four more pages, commenting on some theses which Regius was to present and defend in public quite soon. Descartes offers to come and witness this occasion from a viewpoint where no-one would recognise him. One comment includes a bit that might interest us:] I don't see why you think that the perception of universals belongs to the imagination rather than to the intellect. I hold that this activity of relating a single idea to many things is performed by the intellect alone.

⊕ [30.v.40: Regius writes to Descartes, saying that he has modified his theses in the light of Descartes's comments, and reporting that the judges in Leiden have come down in favour of Waessenaer and against Stampioen, who has been ordered to donate 600 pounds to the poor.]

to Mersenne, 11.vi.1640:

[This letter has about a dozen pages on miscellaneous scientific matters that Mersenne has written about, mostly ones that have figured in several earlier letters by both men. Two separate episodes in this material are worth recording here:]

. . . .You ask (on behalf of Desargues) how the hardness of bodies can come purely from the motionlessness of their parts. To understand this matter you have to take in that

(a) a body's movement

is different from

(b) its determination to be moved in one direction rather than another;

and that force is needed only for **(a)**, not for **(b)**; because **(b)** depends less on any **(b)**-force than on how this body's **(a)**-force is situated in relation to the **(a)**-forces of the surrounding bodies. And you need also to see that there is no vacuum in nature, and no rarefaction and condensation of the sort that philosophers describe. [That is, it never happens that the very same portion of matter occupies different amounts of space at different times.] What actually happens when a body is rarefied is that some other more subtle matter enters its pores, etc. It follows from this that no body x_1 can be moved without displacing some other body x_2 at the same instant, with x_2 displacing a third body x_3 at that instant, and so on until body x_{n-1} displaces x_n which enters the space that x_1 is leaving. So that no body can move unless a complete circle—·or, anyway, a closed ring·—of bodies moves at the same time. It's also important that any body—even one moving in a circle or along a curve—tends to continue moving in a straight line; you see this when a stone whirled around in a sling flies straight when it is released from the sling.

. . . .There's no doubt that the folds of the memory get in one another's way, and that there can't be an infinity of such

folds in the brain; but they are quite numerous. And the intellectual memory has its own separate species [see Glossary] which don't depend at all on these folds. So I don't believe that the number of folds has to be very large.

I don't explain the feeling of pain without reference to the soul. According to me, pain exists only in the understanding. I do explain all the bodily movements that accompany this feeling in us; in ·non-human· animals it's only these movements that occur, and not pain in the strict sense.

⊕ [13 and 24.vi.40: Descartes writes twice to Wilhelm about the continuing health problems of the latter's daughter, offering all possible help from Descartes's friend the physician Hogelande.]

⊕ [22.vii.40: Descartes writes to Mersenne thanking him for his support in the matter of some anti-Descartes 'Theses' adopted by the Jesuit order. He isn't surprised to be told that their author (Bourdin) is a relative of Petit, and expresses contempt for Bourdin's 'Confrontation' (*Velitation*) that appears as their preface.]

⊕ [22.vii.40: Descartes writes to Hayneuve, 'humbly' asking for corrections of any errors he has committed, and saying that nobody could do this better than the Jesuits. He asks to be shown all their reasoning that conflicts with things he has written.]

⊕ [29.vii.40: Descartes writes to Mersenne, enclosing a dozen pages of Latin addressed to Bourdin, replying to his attack mentioned two paragraphs back.]

to Mersenne, 30.vii.1640:

[Descartes refers to some views of Meysonnier's that Mersenne has sent him, saying that some of them] are well above my head, i.e. (between ourselves) they seem to be unintelligible. Then a paragraph of speculation about birth-marks and how they might be cured, all based on a view that now seems merely weird, about how events in the life of a fetus relate to events in the life of the pregnant mother. Then:]

As for brute animals, we're so *used to* thinking they have feelings as we do that it's hard to think otherwise. But suppose the following were the case:

> There are automata that perfectly imitate every one of our actions that such a machine could imitate; and we never take them to be anything more than automata.

If that were so, we would have no doubt that all the animals that lack reason are automata too, because those animals differ from us in exactly the way the automata did. In my *World* I explain in great detail how the bodies of animals contain all the organs that an automaton would need if it was to imitate those of our actions that are common to us and the beasts.

[A paragraph commenting on various anecdotes concerning medical anomalies. Then:] The letter from Villiers contains no argument to refute what I have said about the pineal gland, except that it can *alter*, like the rest of the brain. That is no reason why it can't be the principal seat of the soul; for the soul certainly must be joined to *some* part of the body, and the pineal gland undergoes less alteration than any other part of the body. Although it is very small and soft, it is in such a well-protected place that it's almost immune from illness, like the lens of the eye. It happens much more often that people become troubled in their minds without any known cause—which could be attributed to some malady of this gland—than it happens that sight is lost through a malady of the lens. Moreover, all the alterations that occur in the mind when a man sleeps after drinking or the like can be attributed to some alterations occurring in this gland.

He says that the soul can make use of double parts (I agree) and can use the ·animal· spirits, which can't all reside in the pineal gland. I agree with that too, because

I don't think that the soul is so imprisoned in the gland that it can't act elsewhere. But using a thing isn't the same as being immediately joined or united to it; and since our soul is single and indivisible, it seems to me that the part of the body it is *most immediately* joined to must also be single and not divided into a pair of similar parts. The pineal gland is the only thing in the entire brain, so far as I can discover, that is single in this way. . . .

[The letter continues by •listing and dismissing other candidates for the role of brain-singletons; •sharp comments on Villiers's idea of 'inert spirit', which Descartes compares with 'shadowy light' and 'hard liquid'; •a suggested explanation of whirlpools; and then:]

I haven't yet had my five or six sheets of metaphysics printed, though they have been ready for some time. [This is the *Meditations*.] I delayed because I don't want them to fall into the hands of pseudo-theologians—or, now, into the hands of the Jesuits whom I foresee I shall have to go to war with—before they have been read and approved by various learned men and if possible by the Sorbonne as a whole. I intended to travel in France this summer, and planned to take them there myself; and I didn't want to have them printed until I was about to depart, for fear that the publisher would—publishers *do*—steal copies to sell without my knowledge. But the summer is already so far gone that I fear I won't be able to make the journey. In that case I'll send you ten or twelve copies, or more if you think they will be needed. I will have printed only as many as are needed for this purpose, and I will ask you to distribute and guard them. Please give them only to the theologians you consider to be the most able, and the least prejudiced by (and committed to) scholastic errors—really good people who are moved more by truth and the glory of God than by envy and jealousy.

I am scandalised by Bourdin's 'Confrontation' [see first letter on 22.vii.40], because he doesn't oppose anything that I have actually said, but represents me as saying stupid things that I have never thought, and then goes on to refute them. [Descartes goes on to say that he will in due course publicly answer Bourdin's attack; he clearly enjoys the thought of Bourdin's humiliation. He then replies to three of Bourdin's points, and to some of Mersenne's. Then: a report of iron apparently suspended in the air by a single magnet (Descartes suggests that a silk thread was used); discussion of the three basic elements according to the 'chemists' (here = alchemists); the flow of water; weight; subtle matter.]

to Huygens, 31.vii.1640:

I'm surprised that you have been told that I was going to publish something on metaphysics, because I haven't yet delivered anything to the publisher, or indeed fully prepared anything that isn't too slight to be worth mentioning. In short, what you have been told about this must be quite inaccurate—apart from what I told you last winter, namely that I was proposing to clarify what I wrote in Part Four of the *Discourse on the Method*, not to publish it but merely to have a dozen or so copies printed to send to leading theologians for their verdict. ·To see what I am up to·, compare my work in this area with the demonstrations of Apollonius. Everything in these is very clear and certain, when each point is considered separately; but the proofs are rather long, and the necessity of the conclusion can't be seen unless one remembers exactly everything that has gone before; and that's why you'll hardly find a single person in an entire country who can understand them. And yet, because the few who do understand them vouch for their truth, everyone believes them. Similarly, I think I have fully

demonstrated the existence of God and the non-material nature of the human soul; but I do this through a series of linked arguments, and anyone who forgets the smallest detail won't be able to understand the conclusion. So my arguments won't bear much fruit unless I reach readers who are highly intelligent and enjoy a high reputation in the field of metaphysics; if *they* take the trouble to examine my arguments with care and state frankly what they think of them, they'll encourage the rest to follow their judgement—or at least make them ashamed to contradict them without reason. Moreover, since this treatise concerns the glory of God, I think I am obliged to take more care to do it justice than I'd be disposed to take if it concerned some other topic.

I think I'm about to go to war against the Jesuits. Their mathematician in Paris [Bourdin] has publicly attacked my *Optics* in his theses, and I have written to ·Hayneuve·, his superior ·in the Society of Jesus·, with a view to involving the whole Society in this quarrel. I have known for years that it's better not to stir up adversaries, but ·I make an exception of this case·: they will be angry with me whatever I do, and I can't avoid this anger; so I think it's better to face them all in one big battle rather than waiting for individual skirmishes that would go on for ever.

I am planning to visit France—for five or six weeks if I can manage that—to deal with family affairs. But Waessenaer doesn't want me to leave before the publication of a thing he has been forced to write by the stubbornness of his opponent ·Stampioen·; and though I am thoroughly sick of this battle, honour requires me to see it through to the end, and my duty to this country requires me to speak the truth openly. You'll see the truth in Waessenaer's preface; and I'm willing to delay the printing of it for two weeks (or more, if necessary) in order to get your judgment on it if you would be so good as to send it to me. If and when you do, we—·Waessenaer and I·—will treat your judgment as an unbreakable law. In the meantime, I solemnly assure you that •even before Stampioen went into print he knew that his book was worthless, as can be seen from the tricks he played; and that •he has the 'wisdom' of Socrates, in that he knows that he doesn't know anything, but has incredible impudence when it comes to blackening someone's name with lies and boasting of his knowledge of things that are impossible and extravagant. This last is the most dangerous and damaging quality for a man in his position—·i.e. for a young academic who isn't yet on a secure career-path·; and I think I ought to tell you what my judgment of him is.

to Mersenne, 6.viii.1640:

I left myself so little time to write to you a week ago that I didn't have time to answer all the points of your last letter, and I stopped at the one about the folds of memory. I don't think that our memories require a vast number of these folds, because a lot of things that resemble one another are served by a single fold. Also, in addition to the bodily memory whose impressions can be explained by these folds in the brain, I hold that our intellect has another sort of memory that is altogether spiritual [here = 'mental']; it is what we mainly use, and non-human animals don't have it.

It's a mistake to believe that we remember best what we did when we were young. Back then we did countless things of which we no longer remember anything. And when we do remember something from our early years, that's not only because of impressions that we received back then, but also—and mainly—because we have had those memories before and have renewed the impressions by remembering the events at various times since.

As for the tides: this is something that depends entirely on my *World*, and I can't make a good job of explaining it separately; but I can't refuse you anything, so I'll try to give a rough account here. [Descartes's account, accompanied by a diagram, is essentially this. The earth is surrounded by 'the heaven' [see Glossary], which is a fluid rotating around the earth and keeping it in place. The moon rotates too, but more slowly than the heaven, with the result that wherever the moon is at any given time the downward pressure of the heaven is a bit stronger than in other parts of the circle; so the earth is always being slightly pushed away from the moon, and that slight movement by the earth somewhat flattens the oceans on the side towards the moon and on the exactly opposite side, making the water rise a little on the other two sides. The result is the tides. Descartes adds an explanation of why the interval between two tides is slightly less than 12 hours. Then:]

Also, as I report in my *World* the heaven can't be exactly circular but must be slightly oval, and the moon is situated on the smallest diameter of the oval when it is full or new, which explains why the tides are bigger than usual at these times. The tides are also affected by variation in the shape etc. of the coastline. I would prefer this account of the tides not to be published or widely circulated, because it's a part of my *World*, and if the book ever sees the light of day I would like it to retain some novelty value.

[The remaining three pages touch on an anecdote about a magnet in England ('fable', says Descartes); the question of where in its flight an arrow is at its maximum speed; thoughts about how he will respond to various physicians whose views on his work Mersenne has reported; and an enclosure that Descartes asks Mersenne to show to anyone who is disposed to take seriously the output of an 'impudent liar' named Rivet [see first paragraph of 29.i.1640 letter to Mersenne].]

⊕ [14.viii.40: Huygens writes to Descartes, explaining his lateness in replying (he had to move with the army), and approving Waesennaer's not-yet-published Preface (see last paragraph of Descartes's 31.vii.1640 letter to Huygens). Apology for the misunderstanding about Descartes's publication plans (see opening of that letter), and speaks of how he and others are 'hungry' for more of Descartes's work. Comments on Descartes's plan to visit France, and on the activities of that 'stupid boy' Stampioen.]

⊕ [17.viii.40: Descartes writes to Wilhelm about the pay-off from Stampioen's losing his bet against Waessenaer (see Regius's 30.v.40 letter to Descartes). The money had been held by the Rector of Leiden university, Dedel; in the event of Stampioen's losing, the money was to go to the poor of the town; but Dedel has given it all to one hospital that was built by the rich people of Leiden; and, rich or poor, it shouldn't have been handed out without consulting Waessenaer.]

⊕ [viii.40: Descartes writes to Huygens, welcoming and praising a pamphlet in Flemish by Huygens on the use of organs in Dutch Churches; and making good-humoured comments on some of the mildly disparaging terms that the pamphlet uses in referring to Roman Catholics.]

⊕ [30.viii.40: Descartes writes to Mersenne about a variety of scientific matters, also commenting on the 'theses' that the Jesuits have issued against him (see the second paragraph of Descartes's 31.vii.1640 letter to Huygens). These, he says, are entirely Bourdin's work, though other Jesuits have also spoken against him.]

⊕ [30.viii.40: Descartes writes to Mersenne again on the same day, this time in Latin. The letter is a formal response to the anti-Descartes 'theses' of the Jesuits.]

to Mersenne, 30.ix.1640:

There's something on which I would be glad to have your advice and information. As I told you, I intended to have printed only 20 or 30 copies of my little treatise on meta-

physics [the *Meditations*], and to send them to 20 or 30 theologians for their opinion of it. But I don't see that can be done without the book's being seen by almost everyone who has any curiosity to see it; they'll borrow it from one of those to whom I send it, or get it from the publisher (who will certainly print more copies than I order). So perhaps I'll do better to have a public printing of it from the start. I'm not afraid that it contains anything that could displease the theologians; but I would have liked to have the approval of a number of ·learned· people so as to prevent its being picked at by ignorant contradiction-mongers. The less such people understand it, and the less they expect the general public to understand it, the more eloquent they will be—unless the authority of a number of learned people holds them back. With this in mind, I thought I might send you my treatise in manuscript for you to show to Father Gibieuf, and that I might write to him myself to ask him to examine it. Unless I'm much mistaken, he'll be kind enough to approve it. Then you could also show it to a few others, as you judge fit. Once approved by three or four such people, it could be printed; and if you agree, I would dedicate it to all the gentlemen of the Sorbonne, asking them to be my protectors in God's cause. For I must confess that Bourdin's quibbles have made me decide to do what I can to fortify myself henceforth with the authority of others, since truth by itself is so little esteemed.

I shan't travel this winter, because I'm due to receive the objections of the Jesuits some time in the next four or five months, and I think I should hold myself in readiness for them. And while I'm waiting for that I want to reread a little of their philosophy for the first time in 20 years, to see if I'll think better of it now than I did before. For this purpose, please send me the names of the authors who have written textbooks of philosophy, and tell me which of them are the most commonly used and whether there have been any new ones in the past 20 years. . . . Also, I would like to know if there is in current use any conspectus of the whole of scholastic philosophy; this would save me the time it would take to read their huge volumes. . . . And, finally, if you think it's a good idea for me to dedicate my treatise on metaphysics to the Sorbonne, please tell me what heading I should use for my open letter to them at the start of the book.

[Five pages of physics and mathematics, and then:] I entirely agree with the argument that you were sent by Father Lacombe of Blaye:

(1) Whatever we conceive distinctly to be possible is possible;

(2) We conceive distinctly that it is possible that the world was made;

therefore

(3) The world was made.

(4) It's certainly impossible to conceive distinctly that the sun or any other finite thing doesn't depend on anything, because independence—conceived distinctly—involves infinity. Nor can we conceive distinctly that any atom or other portion of matter can occupy a larger or smaller space. First of all, an atom can't be conceived distinctly because the very meaning of 'atom' involves a contradiction—namely the contradictory attributes of •being a body and •being indivisible. And any distinct thought one can have of any portion of matter necessarily involves the thought of the determinate quantity of the space occupied by it. The principal aim of my metaphysics is to show what things can be distinctly conceived.

[Then a paragraph each on the tides and on light.]

⊕ [5.x.40: Descartes writes to Wilhelm asking for guidance on what to advise Waessenaer in the matter of his dispute with Stampioen (see 17.viii.40 letter to Wilhelm).]

⊕ [7.x.40: Regius writes to Descartes, reporting on his recent public defence of his ·Cartesian· ideas against opponents in his university. We don't have this letter; only reports on it. It seems that Regius was thought to have done extremely well, except that the dishonesty of his opponents angered him, causing him to •forget the example he should be setting and •throw inappropriate jokes and sarcasm into the debate.]

to Mersenne, 28.x.1640:

[This letter opens with two pages relating to Bourdin and his allies—how they should be handled if they behave thus or so. Then brief mentions of four bits of writing that Descartes has received from Huygens: someone writing on whirlpools, Debeaune against Desargues, Fermat on tangents, someone on 'the earth's daily movement'. Then three pages on Mersenne's latest questions and comments on the physics of collisions, things that float in water, tides, someone's thesis that material things are all made of salt. Then Descartes turns to 'the letter from one of your priests at Blaye' [actually Lacombe]. Four episodes in this are worth quoting here:]

(a) I don't accept his indivisible bodies, or the natural inclinations that he attributes to them. I can't make sense of such 'inclinations' except in things that have understanding; and I don't attribute them even to animals that lack reason. Everything in them that we call natural appetites or inclinations is explained on my theory solely through the rules of mechanics. I can't accept his 'elements' either; they are at least as hard to understand as the things he tries to explain by them.

(b) If a •thing is made up out of two indivisible things, then however you go about smashing it you'll get only two parts. But before saying that a •body could be made of two indivisible things, you have to know what 'body' means. In fact it means 'thing that has length, breadth and depth'; so a body can't be composed of indivisible things, because an indivisible thing can't have any length or breadth or depth. If it did, we could divide it at least in our imagination, and that would show that it wasn't indivisible: for if we could divide it in imagination, an angel could divide it in reality. He thinks motion and shape by themselves are inadequate as principles [see Glossary] of explanation, because he doesn't see how all the properties of wine, for example, could be explained in terms of them. You can remove this difficulty by telling him that they have all been explained already, as have all the other properties perceptible by the senses. But not a word about miracles. . . .

(c) I don't see why he associates •atheism with •·the doctrine of· those who explain nature in terms of shapes and motions—as if the two were somehow alike or related.

(d) He says:

> 'The idea of a simple being, which we conceive to contain all being, couldn't be conceived if there weren't a real exemplar of this being, because we can conceive [you should add "distinctly"] only things that are possible and true.'

This makes it look as if he has read my works, which contain this very argument; but he adds many things that I cannot agree with, such as that

> this being has dimensions, and dimensions can be conceived without the thing that *has* the dimensions being divisible,

and so on. He is right in saying that if we don't conceive x distinctly it doesn't follow that x is false. He does well to apply this to the mystery of the Trinity, which is an article of faith and can't be known by natural reason alone. . . .

to Mersenne, 11.xi.1640:

Thank you for your news of Voetius. I find nothing strange in it except his not knowing that I am your friend; everyone here who knows me at all knows about that. He is the most openly and completely *pedantic* fellow in the world, and he's bursting with rage because there is a professor of medicine [namely Regius] in their University of Utrecht who openly teaches my philosophy, and even gives private lectures in physics which in a few months equip his pupils to make fun of the old ·scholastic· philosophy as a whole. Voetius and the other professors have done their best to get the magistrates to forbid him to teach, but the magistrates allow him to continue. This Voetius has also ruined Mlle de Schurmans: she had excellent gifts for poetry, painting and other fine arts, but these last five or six years he has taken her over so completely that all she cares about are theological controversies, so that no decent people want to talk to her. . . .

I don't think that the differences of opinion among the scholastics makes their philosophy hard to refute. It's easy to overturn the foundations on which they all agree, and *then* all their disagreements over detail will seem foolish. I have bought the *Philosophy* of Father Eustache of St Paul, which seems to me the best book of its kind ever made. I would be glad to know if the author is still alive. [He was, but only for another month.]. . . .

I would willingly answer your question about the flame of a candle and similar things; but I see that I can't ever really satisfy you on this until you have seen all the principles of my philosophy; and I tell you now that I'm determined to write them up before I leave this country, and to publish them perhaps within a year. My plan is to write a series of theses that will constitute a complete textbook of my philosophy. I won't waste words, but will simply put down all my conclusions with the true premises from which I derive them. I think I can do this without many words. In the same volume I plan to have printed a textbook of traditional philosophy, perhaps Father Eustache's, with notes by me at the end of each proposition. In the notes I will add the different opinions of others, and what one should think of them all, and perhaps at the end I'll compare the two philosophies. But *please* don't tell anyone yet of this plan, especially before my Metaphysics is published; because if the Regents knew of it they might do their best to steer me in other directions—whereas once the thing is done I think they'll all be pleased. Going public with my plan might also block the Sorbonne's approval ·for my Metaphysics·, which I want, and which I think may be very useful for my purposes; for the little book on metaphysics that I sent you contains all the principles of my physics.

[Several paragraphs about recent works by various writers; about Cardinal Bagné (he still remembers Descartes, who thinks he should be sent a copy of the Metaphysics when it is printed); about troubles with the postal service (some Descartes's mail arrives already opened, he thinks by 'the messenger').]

Yesterday I sent my Metaphysics to Huygens, to post on to you; but he'll delay that for a week, which I have allowed him to look at it. I haven't put any title on it, but it seems to me that the most suitable would be ***René Descartes's Meditations on First Philosophy*** [he gives it in Latin], because I don't confine my discussion to God and the soul, but deal in general with all the *first things* to be discovered by philosophising. . . .

to Gibieuf, 11.xi.1640:

The honour you did me, several years ago, of telling me that you didn't find my philosophical views incredible, and my knowledge of your exceptional learning, give me a strong desire that you would kindly look at the work on metaphysics that I have asked Mersenne to send you. The route that I take to •show the nature of the human soul and •demonstrate the existence of God is, I believe, the only one that can take us there. No doubt others could have made better use of this path than I have, and I'll have left out ·explanations of· many things that needed to be explained; but I'm sure that I can make good all the defects, provided I am alerted to them, and that I can make my proofs so evident and so certain that they can be taken as demonstrations. But one ·potential· defect remains: I can't ensure that people of every level of intelligence will be able to understand the proofs, or even that they'll take the trouble to read them attentively unless they (the proofs) are recommended by people other than myself. I know of no people on earth who can give such a recommendation more effectively than the gentlemen of the Sorbonne, or anyone that I would look to for a more sincere appraisal; so I have decided to seek their special protection. And because you are one of the leading lights of the Sorbonne Society, and have always done me the honour of giving me signs of your affection, and above all because it is the cause of God that I am defending, I look to you for help in this matter. I rely on you to advise Mersenne on how he should conduct this business, and on your kind help in securing favourable judges for me, and in being one of them. In so doing, Reverend Father, you will oblige me to be most devotedly for the rest of my life your very humble and obedient servant, Descartes.

to Mersenne, 11.xi.1640:

At last I am sending you my work on metaphysics, which I haven't yet given a title to, so as to make you its godfather and leave the baptism to you. As I said in my most recent letter to you, I think it could be called *Meditationes de Prima Philosophia*, because in it I deal not just with God and the soul but in general with all the *first* things that can be discovered by philosophising in an orderly way. And my name is so widely known that if I didn't put it under the title I would be thought to be engaging in something tricky, motivated by vanity rather than modesty.

As for the letter to the gentlemen of the Sorbonne, if my opening form of address is inadequate, or I have left out some closing salutation or other ceremony, please insert it; I don't think it will lose anything by not being in my hand-writing. I am sending you the letter to the Sorbonne under separate cover from the treatise itself, because I think that if all goes well the best plan would be this: once all the material has been seen by Gibieuf and (please!) by one or two of your friends, let the treatise be printed minus the letter, because the letter is stylistically so bad that I don't want many people to see it, and let the printed version then be presented to the Faculty of the Sorbonne, together with the letter in manuscript. [Descartes's reason for 'minus the letter' is *à cause que la copie en est trop mal écrite pour être lue de plusieurs*, which more naturally means 'because the handwriting of the manuscript is so clumsy that not many people could read it'; but that doesn't make sense as a reason for not *printing* the letter along with the treatise, so the less natural reading has been preferred.]

The fairest way of proceeding after that would, I think, be for the Faculty to delegate some of their number to examine it; so we'll need to provide them with as many copies as they need for this purpose—or rather with as many copies

as there are doctors [see Glossary] in the Faculty. If they find anything to object to, they should send me their comments for my reply, and this could all be printed at the end of the book. After that, I don't think they could refuse to give their verdict on the book, which could be printed at the beginning together with my letter to them. But things may turn out quite differently from what I expect, which is why I put myself entirely in your hands and Gibieuf's (I'm asking him by letter to help you conduct this business). The recent skirmish against me of which you are aware has made me realise that however just one's cause may be one still needs friends to defend it. . . .

⊕ [12.xi.40: Descartes writes to Huygens, asking for his judgment on the *Meditations*. He says (in effect) that properly judging the work would take 'whole days and weeks of meditation', but, aware of the other demands on Huygens's time, he only asks him to read through, at a sitting, the first five Meditations and Descartes's response to a letter that will be published with the *Meditations*.]

⊕ [18.xi.40: Descartes writes to Mersenne: about how to get things forwarded to Huygens; Desargue's defence of Descartes against Bourdin; the propriety of Mersenne's forwarding to Descartes Bourdin's latest; remarks about Mersenne's response to some theological objections to Descartes; physics of projectiles etc.]

to Colvius, xi.1640:

I am obliged to you for drawing my attention to the passage of St Augustine [*The City of God* XI:26] relevant to my ·inference· *I am thinking, therefore I exist*. I went today to the Leiden library to read it, and I find that he does indeed use it to prove the certainty of our existence, and goes on to show that there's a certain likeness of the Trinity in us because ·of the triple-fact that·

(1) we exist,
(2) we know that we exist, and
(3) we love the existence and the knowledge we have;

whereas I use the inference to show that this *I* that is thinking is *an immaterial substance* with no bodily element. These are two very different things. To infer that one exists from the fact that one doubts something is such a simple and natural thing that it could have occurred to anyone. Still, I'm very glad to find myself in agreement with St Augustine, if only to hush the little minds who have tried to find fault with this principle. My little book on metaphysics is already on the way to Paris, where I think it will be printed; all that I have left is a draft so full of crossings out that I could scarcely read it myself, which is why I can't let you have it. But as soon as it is printed, I will see that you receive a copy as soon as anyone, since you are kind enough to want to read it, and I'll be glad to have your opinion of it.

to Mersenne, 3.xii.1640:

What you report from St Augustine and St Ambrose—that our heart and our thoughts are not in our power. . . ,—applies only to the sensitive part of the soul, which receives the impressions of external or internal objects. . . . I entirely agree with them about that; I have never said that •all our thoughts are in our power but only that •*if there is anything absolutely in our power, it is our thoughts*, namely the ones that come from our will and free choice. There's no conflict here between them (·those two saints·) and me; all I wanted in writing that was to get across the point that our free will has no absolute jurisdiction over any corporeal thing, ·so that *if* it has such jurisdiction over anything it must be over thoughts·. This is true and undeniable.

[Two pages of miscellaneous material—Bourdin, Fermat, Desargues, physics, a suggested alternative to Eustache's book as a brief and accessible introduction to Scholastic philosophy. Then:] Your most recent letter tells me of the death of my father [Joachim Descartes, died 17.x.40]. This gives me great sadness; and I greatly regret not having been able to go to France this summer, to see him before he died. But since God didn't allow this, I expect to stay here until my Philosophy [here = *Principles of Philosophy*] is completed.

to Mersenne, xii.1640:

[A response of Descartes's to Bourdin's attack may have been held up by Mersenne—Descartes conjectures—because he thought it would give offence and make it hard for the two ever to become friends. Descartes tells Mersenne to forward the response, which may do some good, because:] when he sees that I have a beak and talons to defend myself, he may be more restrained in what he says about me from now on.

[More than two pages on music, the physics of subtle matter, the nature of gold, why there are no tides in lakes, and a tangle of oppositions and cross-purposes involving the librarian Heinsius [see Huygens's letter of 30.vii.38] and several other people. Then:] I'm not sorry that the ministers are thundering against the movement of the earth; perhaps this will encourage our own preachers to give it their approval! A propos of that, if you are writing to Cardinal de Baigné's physician ·Gabriel Naudé·, please tell him ·these three things·. **(i)** The only thing that has stopped me from publishing my philosophy up to now is the matter of defending the movement of the earth; I couldn't separate this from my philosophy, because the whole of my physics depends on it. **(ii)** I may soon be forced to publish my philosophy, because of the slander of people who, having failed to understand my principles, are trying to persuade the world that I have some radically false opinions. **(iii)** I would be glad if he would sound out the Cardinal on this subject, because as his obedient servant I would be very sorry to displease him, and because as an earnest Catholic I have a general respect for all the Catholic Church's leaders. I don't add that I'm reluctant to risk their censure; I have firm faith in the Church's infallibility, and have no doubts about my own arguments—I can't be afraid that one truth may conflict with another!

You are right to say that we are as sure of our free will as of any other primary notion; for this is certainly one of them.

When one candle lights another [Mersenne had asked about this], this is merely a single fire spreading from one wick to another. The particles of the flame are agitated by very subtle matter, and so have the force to agitate and separate the parts of the second wick. The fire thus grows, and then is divided into two fires when the two wicks are separated.

But I can't give a good account of fire without presenting the whole of my philosophy, and I tell you in confidence that I'm starting to make a summary of it. I propose to lay out the entire course in proper order, so as to have it printed along with a compendium of scholastic philosophy (like the one Eustache made). At the end of each Question [roughly = 'each chapter'] I will append my own notes in which I'll report the opinions of the various authors and say what one should think of them all and how useful they are. I think I can do this in a way that will make it easy to see how scholastic philosophy compares with mine; and those who haven't yet learned scholastic philosophy will learn it more easily from this book than from their teachers, because they will learn to scorn it at the same time. As for my own philosophy, even the weakest teachers will be able to teach it from this book alone. If Father Eustache is still alive, I won't use his book

without permission; but it's not yet time to request it, or even to mention this plan; I need first to see how my meditations on metaphysics are received.

[Two paragraphs about •reflection and refraction and •Bourdin.]

I shall look at St Anselm at the first opportunity. Some time ago, you drew my attention to a passage from St Augustine concerning my *I am thinking therefore I exist*, and I think you have asked me about it again since then. It is in *The City of God* XI:26.

to Mersenne, 24.xii.1640:

The difficulty you raise about the pineal gland seems to be the most urgent, and the man [Dr Villiers of Sens] who wants to defend publicly what I said about it in my *Optics* does me so much honour that I must try to answer his queries. So without waiting for the next post I will say. . . [and then two pages of mostly anatomical description whose details we needn't follow.] [An oddity in this passage should be noted. When in the present version Descartes speaks of 'the pineal gland' what he actually wrote was 'the *conarium*', which all scholars agree was his name for the pineal gland. But in the passage now being omitted he speaks both of 'the *conarium*' and (just once) of 'the *glandula pineala*'; the passage as a whole suggests that these are meant to be two names for one thing, but Descartes does not outright say so.]

I am greatly indebted to you for the care you are taking over my book of metaphysics, and I give you a free hand to correct or change whatever you think fit. But I'm astonished that you promise me the objections of various theologians within a week, because I was sure it would take longer than that just to read it carefully. . . .

You shouldn't be surprised that I haven't said a word about the immortality of the soul. I couldn't prove that •God could not annihilate the soul, but only that •it is by nature entirely distinct from the body, and therefore not bound by nature to die with it. This is all that's required as a foundation for religion, and all that I intended to prove.

You shouldn't find it strange, either, that I don't prove in my Second Meditation that the soul is really distinct from the body, but merely show how to conceive it without the body. At that point in the work I don't yet have the premises needed for that conclusion, but the conclusion does show up in the Sixth Meditation.

It should be noted that in this work I don't follow the order of the •subject-matter but the order of the •reasoning. I don't try to say in one place everything relevant to a given subject, because some of it could be defended only with reasons that aren't available until later in the work. Instead, I reason in an orderly way from what is easier to what is harder, making what deductions I can, now on one subject, now on another—this being the right way (in my opinion) to find and explain the truth. The order of the subject-matter is good only for those whose reasoning is disjointed,

the rest of the sentence: *et qui peuvent dire autant d'une difficulté que d'une autre.*

literally meaning: and who can say as much about one difficulty as about another.

perhaps what Descartes is getting at: and who are willing to tackle any question as it comes up, with no concern for whether this is the best place to tackle it.

So I don't think it would be useful or even *possible* to insert into my Meditations the answers to the objections that may be made to them. That would interrupt the flow and even destroy the force of my arguments. Most objections would be drawn from things that are perceivable by the senses,

whereas my arguments depend for their force on readers' willingness to withdraw their thought from these things. . . .

I hope that people will take their time in composing their objections; it doesn't matter if the treatise remains unpublished for two or three more years. The manuscript—·just because it is a manuscript·—can be seen by only one person at a time, and is very ill-written; so I think it would be useful to have twenty or thirty copies printed in advance. I'll happily pay whatever it costs; I would have had it done here if there were any publisher that I could trust; but I did not want the ministers [here = 'government officials'] of this country to see it before our theologians.

[A paragraph about style, and imperfections in the Latin.]

I will send you perhaps within a week an abstract of the principal points concerning God and the soul, which can be printed in front of the *Meditations* so that people can see where such matters are to be found. Otherwise many people will be annoyed at not finding in one place everything they are looking for. I shall be very glad to have Desargues added to my roster of judges, if he is willing to take the trouble; I have more trust in him than in ·any· three theologians. I won't be at all unhappy to have many objections, because I'm sure they will serve to make the truth better known. Thank God, I have no fear of being unable to reply adequately. It is time to finish.

to Charlet, xii.40:

I know that you are very occupied with work that matters more than reading letters from someone who isn't in a position to do anything for you; I hesitate to confront you with a request to do something for me, though I have no other reason for writing to you except to assure you of my great respect for you.

Several people here have told me that a number of Jesuit priests are speaking against my writings, and this has led a friend of mine to write a treatise in which he plans to make a full comparison between the philosophy that is taught in your schools and the philosophy that I have published. He aims, by showing what he thinks bad in one philosophy, to make it easier to see what he thinks is better in the other. I thought that I shouldn't go along with this plan until I had told you about it, and asked you to tell me what you think I should do about it. •My obligations to your priests for my education in my youth, •the strong inclination I have always had to honour them, and •my preference for gentle and friendly procedures as against ones that might upset people—these would all be strong enough reasons for me to ask my friend to choose some other topic to write about, a topic that doesn't involve me, if I weren't virtually *forced* to go the other way by •what I'm told about the harm it would do me if I stayed silent and by •the rule of prudence that it's much better to have declared enemies than covert ones. Especially in a matter like this, where. . . .the louder the battle is the more advantageous it will be to the one who is in the right. But the respect that I owe you, and the affection that you have always kindly showed towards me, have more force for me than anything else and cause me to wait to hear your commandments on this subject.

to Mersenne, 31.xii.1640:

Responding to points of yours that I didn't have time to cover in my letter a week ago: First, I send you an abstract of my Metaphysics, which, if you approve, can be prefaced to the six Meditations. . . . The reader will be able to see in it a short statement of everything I have proved about the immortality of the soul, and everything that I can add to that when I

publish my Physics. Without wrecking the order I could not prove that the soul is distinct from the body before proving the existence of God.

You say that 'we don't know that the •idea of a most perfect being isn't the same as that of •the corporeal world'; but in fact it is easy to know this, in the same way that we can proved that the soul is distinct from the body, namely from the fact that we conceive something altogether different in each case. But this works as a proof only if we form *clear* ideas of the things we want to judge about, and ordinary folk don't do that; ·the importance of doing· this is what I have mainly tried to teach by my Meditations. But I won't spend longer on these objections, because you promise to send me shortly *all* the objections that can be made. But I only ask that nobody be in a hurry about this: people who don't study everything carefully—who merely read the Second Meditation to see what I say about the soul, or the Third to see what I say about God—will very likely raise objections against things that I have already explained.

In the place where I put 'in accordance with the laws of my logic' please put 'in accordance with the laws of the true logic'; it's near the middle of my Replies to Caterus, where he objects that I have borrowed my argument from St Thomas. The reason why I add 'my' or 'the true' to 'logic' is that I have read theologians who follow the ordinary logic and inquire *what God is* before inquiring *whether God exists*. . . .

[Here and below, ellipses. . . .replace short passages about other suggested changes in Descartes's text, sometimes accompanied by sharp declarations that what he originally wrote is *not* obscure—'thousands of things in Cicero are more so', the point being that Cicero has always been regarded as a model of clarity.]

As for my saying 'Nothing can be in me, i.e. in my mind, of which I am not aware', I proved this in my *Meditations*; it follows from the soul's •being distinct from the body and •having thinking as its essence.

You find obscure the sentence 'Whatever has the power to create or preserve something separate from itself has *a fortiori* the power to preserve itself'. I don't see how to make it clearer without adding many words, which would be stylistically bad because I mention the matter only briefly by the way. . . .

It seems very clear to me that possible existence is contained in everything that we clearly understand, because from the fact that we clearly understand something it follows that it can be created by God.

As for the mystery of the Trinity, I share St Thomas's opinion that it is a sheer article of faith and can't be known by the natural light [see Glossary]. But I do not deny that there are things in God that we don't understand, just as even a triangle has many properties that no mathematician will ever know—and yet everyone knows what a triangle is.

It is certain that there is nothing in an effect that is not contained formally or eminently [see Glossary] in its efficient and total cause. I added 'efficient and total' on purpose. The sun and the rain are not the total cause of the animals they generate.

I was finishing this when I received your last letter, which reminds me to ask if you know •why you didn't receive my Metaphysics by the post by which I sent it, or even with the letters I wrote a week later, and •whether the packet was opened; for I gave it to the same messenger.

[He thanks Mersenne for correcting a solecism in his Latin, which he notes that several of his friends didn't notice. Then:] I have no objection to seeing what Morin has written about God, because you say he uses a mathematical method; though (between ourselves) I don't expect much from it, because I never heard before that he went in for that sort

of writing. . . . Huygens has returned, and if you send it to him with the paper by the Englishman [Hobbes] I can get them from him. But do ask him to send them on promptly, because he has so much other business that he might forget.

I won't fail to answer immediately anything you send me about my Metaphysics. But apart from that I would be glad to have as few distractions as possible, at least for the coming year, which I have resolved to spend writing my philosophy in an order that will make it easy to teach [namely the *Principles of Philosophy*]. The first part, which I am working on at present, contains almost the same things as the Meditations that you have, except for being in an entirely different style—and what is written at length in one is abbreviated in the other, and vice versa.

[The letter ends with a page on various personal matters.]

Letters written in 1641–1644

to Pollot, mid-i.1641:

I have just learned the sad news of your loss [the death of Pollot's brother], and though I'm far from sure that I can say anything in that could lessen your sadness, I can't refrain from trying, so as to let you know at least that I share in your feelings. I'm not one of those who think that tears and sadness are appropriate only for women, and that to come across as a real *man* I must force myself to put on a calm expression at all times. Not long ago I suffered the loss of two people who were very close to me [his daughter (died 7.ix.40) and his father (died 17.x.40)], and I found that those who wanted to shield me from sadness only increased it, whereas I was consoled by the kindness of those whom I saw to be touched by my unhappiness. So I'm sure that you will listen to me better if I don't try to check your tears than if I tried to steer you away from a feeling that I consider quite justified. Still, there should be some moderation in our feelings; while it would be barbaric not to be distressed at all when one has good reason to be, it would also be feeble to abandon oneself completely to grief; we do ourselves no credit if we don't do our best to free ourselves from such a troublesome passion. The profession of soldiering, to which you were brought up, accustoms men to seeing their best friends suffer untimely deaths, and being accustomed to events, however distressing they are, makes them easier to bear. The loss of a brother, it seems to me, is not unlike the loss of a hand. You have already suffered the latter without, as far as I could see, being overwhelmed; so why should the former affect you so much more? [Pollot had lost an arm in battle.] [Descartes then argues thus: •for you personally the loss of an arm is worse than the loss of a brother, because the latter can be compensated for by good friendships; and •for your brother this early death merely brings him that much faster to the joys and rewards of the afterlife. Plus a further page about lessening sadness through mental discipline and the pursuit of other activities.]

to Mersenne, 21.i.1641:

. . . .I shall be very pleased to receive yet more objections from learned critics, both philosophers and geometers, as indeed you tell me I may expect. It will be a good thing if the later critics see what the earlier ones have said, so that they don't repeat the same things. This, I think, is the best device for ensuring that any reader who finds a difficulty at any point will find it clarified in my replies; for I expect that with God's help I'll be able to give a completely satisfactory answer to all the difficulties. I'm more worried that the objections put to me will be too feeble than that they will be too powerful! But. . . .I can't open the eyes of my readers, or force them to attend to the things that must be examined to ensure a clear knowledge of the truth; all I can do is *show* them the truth—like *pointing* to it.

Yesterday, Huygens sent me Morin's book, together with the three sheets written by the Englishman [Hobbes]. I have not yet read the book, but you'll see what I say in reply to the other. I have put my comments on a separate sheet, so that you can let him see it if you see fit to do so, and so that I won't have to answer the rest of the letter, which I haven't yet done. Between ourselves, I am sure it won't be worth the trouble; but the man claims to have some regard for me,

so I would be sorry to upset him. I am not worried that his philosophy resembles mine—although he wants, as I do, to handle physics purely in terms of shapes and movements. These are indeed the true principles [see Glossary], but any errors one makes in following them will stand out clearly to anyone with a modicum of understanding—*so* clearly that if we want to succeed we mustn't go as fast as he does. I pray God to keep you in health. Several people around here have been ill also, and lately I have been wholly occupied in paying visits and writing letters of condolence.

I come back to your letter of 23.xii, which I haven't yet answered. The passage from Augustine relevant to the thesis that *God is ineffable* [see Glossary] depends merely on a small easily understood distinction. We can't encompass in words (or even **grasp** with our minds) everything that is in God, so God is ineffable and beyond our comprehension. But there are many things in God or related to God that we can **touch** with our minds and express in words—more, indeed, than in the case of any other thing. In this sense, then, God can be known and spoken of to a very great extent.

[A paragraph about refraction, and then:] You can be sure that there's nothing in my Metaphysics that I don't believe to be either •evident by the natural light or •demonstrated precisely; and I'm sure I can make it understood by any who are able and willing to meditate on it. But I can't make people intelligent, or make them see what lies on the floor of a room if they won't go in to have a look.

[A paragraph disagreeing with something Mersenne has said about the physics of magnets, and then:] The statement

•Thoughts are merely movements of the body

is as plausible as

•Fire is ice, or

•White is black.

If we have any pair of ideas that are more different than those of black and white, it's the ideas of movement and thought. Our only way of knowing whether two things are different or identical is to consider whether we have different ideas of them, or one and the same idea.

I would like to know *who* told you that I have been employing assistants here. That is so far from the truth that anyone who knows me even a little bit knows that it's false, but I would like to know who these people are who have fun lying at my expense.

[An expression of sorrow over the death of Eustache; and a message to Debeaune about lenses.]

to Mersenne for Hobbes, 21.1.1641:

I have read part of the letter that was sent to you from England and passed on to me here by Huygens. From the way he writes one can tell that the author [Hobbes] is intelligent and learned, and yet—surprisingly—he seems to miss the truth in every claim that he puts forward as his own.

I pass over the first part, about the soul and God as corporeal, the 'internal spirit' and the other matters that don't concern me. (He says that my 'subtle matter' is the same as his 'internal spirit', but I can't accept this. For one thing, he makes his 'spirit' the cause of hardness, whereas my subtle matter is the cause of softness.). . . . So I go straight to his comments on my *Optics*.

First of all, he says that I would have put things more clearly if I had spoken of *determinate motion* instead of *the determination of motion*. I don't agree with him.

[For what follows, draw a rectangle whose top corners (left to right) are A–H, bottom corners are D–G, and mid-points of the verticals C–B.]

It *can* be said that the speed of a ball going from A to B is made up of two other speeds, along the lines A–C and

A–H, I thought this way of putting it should be avoided because it might suggest that the quantity of the speeds in such composite motion. . . .remains fixed, which it certainly doesn't. Take a ball travelling horizontally from A with one unit of speed, and vertically with one unit, it will reach B with two units of speed, at the same time as another ball, moving horizontally from A with one unit of speed and vertically with two units, arrives at G with three units of speed. It would follow from this that the ratio of A–B to A–G is 2 to 3, whereas in fact it is 2 to $\sqrt{10}$.

[Using Pythagoras's Theorem, Descartes is calculating as follows:

$AB^2 = AC^2 + CB^2 = 1^2 + 1^2 = 2.$
$AG^2 = AD^2 + DG^2 = 2^2 + 1^2 = 5$
Thus, $AB : AG = \sqrt{2} : \sqrt{5} = \sqrt{4} : \sqrt{10} = 2 : \sqrt{10}.$

This note is from CSMK.]

. . . .I'm surprised that he calls my demonstration invalid, without giving any reasons except the statement that certain points are inconsistent with our experience, when in fact they square with experience and are utterly true. He seems not to have noticed the difference between •the deflection of a ball or other body falling into water and •the refraction of light. There is in fact an important twofold difference. **(i)** One deflection is towards the perpendicular while the other is away from it; and from the fact that •light rays pass more easily through water than air by a factor equal to approximately a third of their impetus it doesn't follow that •a ball must lose a third of its speed when passing through the same water; in fact there's no connection between those two. **(ii)** The angle of refraction of feeble light in a given fluid is the same as that of strong light; but when a ball is thrown into water the proportion of its speed that it loses depends on how fast it was moving when it hit the water ·and thus the angle of refraction also depends on that initial speed·. So it's not surprising that he has observed a lead ball thrown hard off a cliff entering the water at an angle of ·only· five degrees; for in such a case it probably loses less than a thousandth part of its speed ·when it hits the water·. . . .

to Mersenne, 28.i.1641:

This note is only to tell you that I can't send you by today's post my reply to the ·second set of· objections ·to the *Meditations*·. This is partly because I have had other business that has left me with hardly a day free, and partly because the objectors seem to have understood absolutely nothing of what I wrote, and merely to have read it through post-haste, leaving me with nothing to do but repeat what I have already said—which gives me more trouble than if they had put forward difficulties that gave more exercise to my mind. This is between ourselves, because I would be sorry to offend them, and you'll see by the care I take in my reply to say that I consider myself indebted to them. [Descartes didn't yet know that most of the second set of objections were by Mersenne himself.] I am also indebted to the author [Hobbes] of the ·third· set of objections, which I received the other day. . . .

I have gone quickly through Morin's book ·*God Exists and Created the World in Time*·. Its main fault is that he always discusses the infinite as if he had completely mastered it and could comprehend its properties. This is an almost universal fault which I have carefully tried to avoid—when I write about the infinite I •submit myself to it and don't •try to determine what it is or is not. Then, when he sets about proving in his sixteenth theorem that God exists, doing this before expounding any controversial points, he rests his argument on •his alleged proof that the earth doesn't move and on •the ·supposed fact that· the whole sky revolves around it—neither of which he has proved. He supposes that there can't be an infinite number, and he couldn't prove

that either. Everything that he offers right up to the end is far from the geometrical self-evidence and certainty that he seemed to promise at the beginning. This also is between ourselves, please, because I don't want to hurt his feelings.

[A page in which Descartes comments on recent work by Desargues, applying geometry and optics to the measurement of time. Descartes applauds the theory but doesn't think there will enough precision in practice.]

I claim that we have ideas not only of everything in our intellect but also of everything in the will. We can't will anything without knowing that we will it, and we can't know this except by means of an idea ·of whatever-it-is that we are setting ourselves to do·. But I don't insist that the idea is different from the act itself.

Apparently there won't be any difficulty in adapting •theology to my style of philosophising. I don't see that anything in •it needs changing except in the case of transubstantiation [see Glossary], which is clear and easy to explain on my principles. I'll have to explain it in my Physics, along with the first chapter of Genesis; I propose to send these explanations to the Sorbonne to be examined before the work is printed. If you •think there are other things that call for the writing of a whole new course of theology, and •are willing to tackle this yourself, I'll count that a favour and do my best to help you in it.

[A page in which Descartes comments on the persons and the recent work of a couple of people, and then:] I will be glad if people put to me many objections, the strongest they can find, for I look to those to make the truth stand out all the better. But if anyone wants to make fresh objections, please show him the objections you have already sent to me and my answers to them, so that he doesn't come up with things that I have already treated.

I proved quite explicitly that God was the creator of all things, and I proved all his other attributes at the same time: I did this by **(i)** proving his existence from our idea of him and also by **(ii)** arguing from the fact that we have this idea to the conclusion that he created us.

[**(i)** is a version of what came to be called 'the ontological argument' for God's existence. Simply and crudely: 'The name "God" means "item that is existent and... so on", so that "God doesn't exist" is a contradiction in terms.' **(ii)** is a causal argument: 'The *fact* that we have an idea of God-as-having-all-perfections must have been caused somehow, and certain views about how causation must work imply that the cause must itself have all perfections.']

But I see that people take more notice of chapter-headings than of anything else; which makes me think that the title of the Second Meditation, 'The nature of the human mind', could have added to it 'how it is better known than the body', so that readers won't think I was intending to prove its immortality in that place. So in the Third, the title 'God' should have added to it '—that he exists'. And in the Fifth, 'The essence of material things' should have the addition 'and again that God exists'. And in the Sixth 'The existence of material things' should have added '—and the real distinction between mind and body'. These are the things I want people mainly to notice. But I included many other things besides; and I now tell you, between ourselves, that these six Meditations contain all the foundations of my physics. But please don't tell people this, for that might make it harder for supporters of Aristotle to approve the *Meditations*. I hope that readers will gradually get used to *my* principles, and recognise their truth, before noticing that they destroy *Aristotle's*.

⊕ [7.ii.41: Hobbes writes to Mersenne for Descartes, a dozen forceful pages in Latin, in response to Descartes's 21.i.41 letter to Mersenne for Hobbes.]

⊕ [18.ii.41: Descartes writes to Mersenne for Hobbes, five Latin pages, giving as good as he got.]

to Mersenne, 4.iii.1641:

Having now had time to read the last piece by Englishman [Hobbes], I find complete confirmation of the opinion of him that I expressed to you two weeks ago. I think it would be best for me to have nothing more to do with him, and thus to refrain from answering him. If his temperament is what I think it is, it will be hard for us to exchange views without becoming enemies. It's better for us both to leave things where they are. Please don't tell him any more than you have to of what you know of my unpublished views, because I'm pretty sure that this is someone who is looking to acquire a reputation at my expense, and by sharp practice. If you have promised him that you'll get me to reply to his latest, you may—if you like—tell him that I shan't reply because I think you can defend me better than I can defend myself. And to reduce the amount of trouble this gives you, I'll give you my view on each of his ten points.

[In five pages of Latin, Descartes responds to four of Hobbes's points, and then breaks off:] I would be *ashamed* to spend more time chasing down the rest of his errors, which are distributed all through what he wrote. [He expresses regret that Debeaune and Mersenne think well of Hobbes, and predicts that this won't last, though he concedes that Hobbes's writing style is lively and expressive. Then most of two pages on a point in physics that Roberval got partly right (Descartes thinks), on the physics of missiles, and on Fermat (who 'knows mathematics but in my experience always reasons badly in philosophy'). Then:]

I sent you my book so as to get the verdict on it of the gentlemen of the Sorbonne, and *not* to take on the chore of arguing with every petty-minded critic who wants to join in the battle of fighting-Descartes-with-objections. Stiil, if some swaggering warrior wants to enter the fray, bring him on!—I shan't refuse to answer him if his comments are judged to be good enough to print. I'm grateful to those who offered the earlier comments [the Second Set of Objections by Mersenne and others; see the 28.i.41 letter on page 124]; if they want to comment further on my replies, I'll be happy to reply to those too. I'm not sending you •my replies to Arnauld yet, because I have had a lot of other things to do and I don't want to rush •them; but I expect to send them to you within a week. As soon as you receive them, I think it will be time to send all the material to the gentlemen of the Sorbonne to obtain their verdict, and then to have it printed—at least if the verdict is favourable, as I expect it to be. ·It will be time to get on with the publication rather than waiting for even more objections· because I think that adding more objections (unless they are first-rate) would merely fatten the book and spoil it.

Please don't change anything in my copy without letting me know, for it's extremely easy for a 'correction' to embody a misinterpretation—indeed, it could easily happen even to me if I were looking at the phrases in isolation, as one does to correct punctuation. [He cites an episode in which a 'correction' of his own work involved a misinterpretation.]

I must also ask you to correct these words in my reply to the objections of Caterus:

> 'When we attend to the immense power of this being, we shan't be able to think of its existence as possible without also recognising that <•there can be some power by means of which it exists, and that •this power can't be understood as residing in anything other than that same supremely powerful being; and hence concluding that> it can exist by its own power.'

The passage '. . . there can be. . . concluding that' [marked off here by <angle-brackets>] should be deleted, so that the passage reads:

> 'When we attend to the immense power of this being, we shan't be able to think of its existence as possible without also recognising that the being can exist by its own power.'

But please correct this (in all the copies) in such a way that the words I want omitted—'<that there can be . . . concluding that>'—won't be decipherable by any reader. Many people are more curious to read and examine words that have been erased than any other words; they are looking for places where the author thought he had gone wrong, finding in them some ground for objections and attacking him in the place that he himself judged to be the weakest.

Between ourselves, I think that this is why Arnauld paid so much attention to my statement that 'God derives his existence from himself in a positive sense'. I remember that my first draft of this passage was too crude; but in the later version I amended and refined it so much that if Arnauld had merely read the corrections and ignored the deleted words he might have had nothing to say. . . . I shall explain this and other matters at more length in my reply to Arnauld. I'm in his debt for his objections. I think they are the best of all the sets of objections, not because they press me harder but because he has entered more thoroughly into the sense of what I wrote. I knew in advance that few people would grasp my meaning, given how few are willing or able to pause and meditate.

[A final page, mostly about Debeaune and lens-grinding.]

to Mersenne, 18.iii.1641:

I'm sending you at last my reply Arnauld's objections, asking you to make some changes in my *Meditations*, thus letting it be known that I have deferred to his judgement; so that others, seeing how ready I am to take advice, may •tell me more openly their reasons for disagreeing with me and •be less stubborn in opposing me if they have none.

(i) In the Synopsis of the Fourth Meditation, after the words 'make intelligible what is to come later', please add

> 'But here it should be noted in passing that I don't deal at all with sin, i.e. the error that is committed in pursuing good and evil, but only with the error that occurs in distinguishing true from false. And there's no discussion of matters pertaining to faith or the conduct of life, but simply of speculative [see Glossary] truths that are known solely by means of the natural light.'

Put the words between brackets, to make it clear that they are an addition.

(ii) In the Sixth Meditation, after the words 'since I didn't yet know the author of my being' please add, again in brackets, the words 'or at least I was pretending not to know'.

(iii) In my Reply to the First Objections, where I discuss whether God can be said to be caused by himself, at the words 'Hence if I thought that nothing could somehow have the same relation to itself. . . ,' please put in the margin 'Note that these words ·cause of itself· mean only that there may be a thing whose essence is such that it needs no efficient cause in order to exist.'

(iv) A little further on, at the words 'Although God has always existed, since it is he who in fact preserves himself ', put in the margin: 'Note that this isn't a thesis about the

kind of preservation that comes about through the positive influence of an efficient cause; it's merely the thesis that the existence of God is such that he must always exist.'

(v) Three lines later there occur the words

> 'For there are some who think it is impossible for anything to be its own efficient cause, and hence. . . .

Please replace that by this:

> 'Those who attend only to the literal and strict meaning of "efficient cause" think that nothing could be the efficient cause of itself. It hasn't occurred to them that there's room for another kind of cause, *analogous to* an efficient cause ·strictly so-called·, and hence. . . .

I didn't mean to say that something could be its own efficient cause with 'efficient' taken in its strict sense; I meant only that when we ask whether anything can exist 'from itself' the question mustn't be taken to concern 'efficient causality' [see Glossary] strictly so-called (construed in that way the question would be futile, as I said). . . .

[Three minor episodes are discussed; and then Descartes, triggered by Mersenne's most recent letter, writes two pages refuting a thesis of Hobbes's about why bodies bounce back after collisions, and expressing of pleasure that Picot has come to have some liking for the *Meditations*. Then:]

I leave you to take care of the titles of my Metaphysics [here = 'the individual Meditations']—I'm appointing you as godfather, if you'll accept. As for the objections: it's a good idea to call them 'First Objections', 'Second Objections', and so on; and to speak of my 'Replies' to the objections rather than 'Solutions' of them—leaving it to the reader to judge whether my replies contain solutions. . . .

I'm not yet sending you the last sheet of my reply to Arnauld, where I explain transubstantiation in terms of my principles; I want first to read the decrees of the Council of Trent, and I haven't yet been able to obtain them.

⊕ [30.iii.41: Hobbes writes to Mersenne for Descartes, eight pages of Latin responding to Descartes's responses.]

to Mersenne, 31.iii.1641:

I am sending you the remainder of my reply to Arnauld's objections. You will see that in it I reconcile my philosophy with the councils' doctrine of the Holy Sacrament, which I maintain couldn't be satisfactorily explained by means of the traditional [here = 'ordinary scholastic'] philosophy. Indeed, I think that if my philosophy had been known first, the other would have been rejected as clashing with the Faith. I'm not joking; I really do believe this. So I'm not willing to keep silent on this matter; I shall fight with their own weapons the people who mix Aristotle with the Bible and misuse the Church's authority in order to vent their passions—I mean the ones who had Galileo condemned. They would have my views condemned in the same way if they could; but if that question ever does come up, I'm sure I can show that none of the tenets of their philosophy squares with the Faith as well as my doctrines do.

As soon as Arnauld has seen my Replies, I think it will be time to submit the complete work to the doctors [see Glossary] of the Sorbonne, so as to get their opinion and then have the work printed. I leave entirely to you such matters as the size of the volume, the type-face, the titles I have left out, and any notes for the reader that need to be added to what I have written. You have already taken so much trouble over the book that the greater part of it belongs to you. . . .

to Mersenne for Hobbes, 21.iv.1641:

The communication you sent me from the Englishman [Hobbes] says that •his 'spirit' and my 'subtle matter' are

the same thing, that •he arrived at an explanation of light and sounds using his method as early as 1630, and that •he believes that someone passed his results along to me. This is childish and ridiculous. If he is afraid that his philosophy will be stolen, let him publish it. As for me, I won't hurry the publication of my own work on his account.

His latest arguments (sent to me in your letter) are as bad as all the others I have seen from him. **(i)** *Man* and *Socrates* are not two different substances, but still the term 'Socrates' signifies something other than 'man' does, namely the individual or particular differentiating characteristics ·of the individual Socrates·. Similarly, *determinate motion* is not different from *motion*, but the determination is something other than the motion.

(ii) It isn't true that the efficient cause of *motion* is also the efficient cause of *the determination ·of motion·*. For example, if I throw a ball against a wall, the wall determines the ball to bounce back but it isn't the cause of the motion.

(iii) He employs a delicate subtlety in asking whether the determination is *in* the motion 'as in a subject'—as if the question here were 'Is the motion a substance or an accident?'

[If you find that puzzling, first see Glossary for 'accident'. Then: Descartes has distinguished a thing's *moving* from its *moving at 5mph*, saying that being-at-5mph is an accident or property or feature of the movement; Hobbes has suggested that that treats the relation of

•being-at-5mph to •the movement

as though it were on a par with the relation of

•being-in-motion to (for example) •a rolling ball,

thus treating a motion as though it were a substance like a rolling ball.]

In fact there's nothing awkward or absurd about saying that an accident is the subject of another accident, as when we say that quantity is the subject of other accidents. When I said that •the motion is to •its determination as •a flat body is to •its top or surface, I didn't mean to compare the motion and the body as if they were two substances; I was comparing them merely as one would compare two concrete things, to show that they were different from things that could be treated merely as abstractions. [Descartes is here talking about *the motion* in question as a particular individual case of motion, a 'concrete thing' as distinct from *movingness* or *being-in-motion*, which is abstract.]

(iv) It is very inept of him to infer that if one determination is altered, so must the others be, on the grounds that (as he puts it) 'all the determinations are merely one single accident under different names'. On his view, then, *man* and *Socrates* are just a single thing under different names, implying that no individual characteristic of Socrates could perish—for example his knowledge of philosophy—without his simultaneously ceasing to be a man.

[Descartes •makes another point of the same general kind, •complains that Hobbes made a great fuss over what was obviously a printer's error, and •ends the letter thus:] He is also wrong when he says that I approve of the parts of his work that I don't criticise, parts that I haven't said a word about! The fact is that I haven't seen in them anything that makes me think that refuting them would be time well spent.

to Mersenne, 21.iv.1641:

[Mersenne is asked to settle any last-minute questions that come up over the publication of the *Meditations* in an edition including the Objections and Replies. Descartes gives two reasons for this delegating of editorial control:] You are more careful about these matters than I could be; and you can judge what is prudent better than I can, because you are on the spot.

I'm surprised at the objection of your doctors, namely that according to my philosophy we have no certainty that

the priest is holding the sacramental bread at the altar, or that he has water for the baptism etc. Who, even among scholastic philosophers, ever said that there's any more than moral certainty [see Glossary] about such things? Theologians say that it's a matter of faith to believe that the body of Jesus Christ is in the Eucharist, but they don't say that it's a matter of faith to believe that it is in this particular piece of bread. For that you have to suppose, as a matter of ordinary human belief, that the priest intended to consecrate ·the bread·, and that he pronounced the words, and is duly ordained, etc.—which are by no means matters of faith.

Those who say that God continually deceives the damned, and that he might similarly be continually deceiving us, contradict the foundation of faith and all our belief, which is that *It isn't possible that God lies*. This is said in so many places in St Augustine, St Thomas and others that I'm surprised that any theologian denies it. They will have to abandon all certainty if they don't admit as an axiom that *It isn't possible that God deceives us*.

I wrote that in our case indifference [see Glossary] is a defect rather than a perfection of freedom; but it doesn't follow that the same is the case with God. Still, I don't know that it is an article of faith to believe that God is indifferent; and I'm confident that Father Gibieuf will do a good job of defending my position on this matter, because I wrote nothing that isn't in accord with what he says in his book *The Liberty of God and Man*.

I didn't *anywhere* deny God's immediate concurrence [see Glossary] in all things; indeed I explicitly affirmed it in my reply to Caterus.

There was no need for me to reply at greater length to the Englishman, I thought, because his objections struck me as so implausible that a longer answer would have given them too much importance.

The doctor who says that we can wonder *whether we are thinking* as well as we can wonder anything is flatly in conflict with the natural light—so much so that surely no thinking person will agree with him. . . .

The sense in which I include imaginations in the definition of *cogitatio* or 'thought' differs from the sense in which I exclude them. The forms or corporeal species [see Glossary] that must be in the brain for us to imagine anything are not thoughts; but when the mind imagines or turns towards those impressions, its operation is a thought.

The earlier letter in which you wrote me objections about the pineal gland must have been lost, unless you forgot to write them. The only objections that have reached me are your more recent ones, namely that the gland **(i)** has no nerve running to it and **(ii)** is too mobile to be the seat of the common sense [see Glossary]. In fact, these two things tell entirely in my favour. **(i)** Each nerve is assigned to a particular sense or movement, some going to the eyes, others to the ears, arms, and so on. If the pineal gland specially connected with one in particular, that would show that it is *not* the seat of the common sense, because that must be connected to all of them in the same way. The only way for them all to be connected with the pineal gland is by means of the spirits, and that is how the connection is in fact made. **(ii)** It is certain too that the seat of the common sense must be •very mobile (to receive all the impressions coming from the senses) but •of such a kind that it is movable only by the spirits (which transmit these impressions). Only the pineal gland fits this ·double·-description.

Anima in good Latin signifies air, or breath; it is in a transferred sense, I think, that it means mind. That's why I said that it is 'often taken for a corporeal thing'.

The axiom 'Whatever can do the greater can do the lesser' applies only where the greater and the lesser •are operations

of the same general kind or •involve the same power or ability. Who doubts that a human being who couldn't make a lantern might be able to make a good speech?

[In a final paragraph Descartes rebuts two charges of having lifted results from other writers without acknowledgment. The one that stings more concerns Gassendi; Descartes denies having stolen anything from him and suggests that there has been theft in the other direction.]

to Regius, v.1641:

Our entire dispute over *the threefold soul* is more verbal than real.

(i) A Roman Catholic ·such as I am· isn't allowed to say that the human soul is *threefold*; and I'm afraid that people will impute to me the views expressed in your thesis, so I'd be glad if you would, ·although you aren't a Catholic·, avoid this way of talking.

(ii) Although the powers of growth and sensation may be *basic* acts in the case of the lower animals, it's not like that in the case of man, because

the rest of the sentence: *mens prior est, saltem dignitate.*

which means: mind is prior [to such acts], at least in respect of status.

what he is getting at: mind is more basic than such acts; they may not be *preceded* by acts of the mind, but they owe their status to the mind's involvement—when you arm goes up, for example, you count as *raising your arm* only because of the role of your mind (specifically, your intention) in this event.

(iii) •Although the items having something in common can be regarded by logicians as belonging to a single genus, not every such group is a true genus. •And a classification isn't sound unless it divides the members of a true genus into true species. And although the divisions have to be opposed and different, for the classification to be sound they mustn't be too different. Consider this classification of the parts of the human body:

•the nose

•everything but the nose.

That classification is faulty, as yours is, because of the excessive inequality of the divisions.

(iv) I don't admit that the powers of growth and sensation in animals deserve the name 'soul' [Latin *anima*], as does the mind in human beings. People have thought otherwise because they didn't know that animals lack a mind. So the term 'soul' is ambiguous as used of animals and of human beings.

to Regius, v.1641:

It would be wrong for me to *complain* that you and ·your pupil· de Raei had the honesty to place my name at the head of your theses; but I don't know how I can *thank* you for this. All I see in it is more work for me: from now on people will believe that my opinions are the same as yours, and I'll be trapped into having to defend your propositions as best I can. So I'll have to examine with extreme care everything you have sent me to read, for fear of letting pass something that I wouldn't want to defend.

The first thing I don't agree with is your claim that 'men have a threefold soul'. In my religion that's a heretical thing to say; and quite apart from religion, it goes against logic to conceive *soul* as a genus whose species are •mind, •vegetative power, and •locomotive power of animals. . . . ·This is all wrong, because· this locomotive power is not even of a different species from vegetative power, and it belongs to

a totally different genus from *mind*. But since we don't disagree about the reality, ·as distinct from the terminology·, I'll tell you how I would explain the matter.

There is only one soul in human beings, the rational soul; for any human action—properly so-called—depends on reason. The vegetative power and the power of moving the body, which are called the vegetative and sensitive 'souls' in plants and animals, exist also in human beings; but in humans they shouldn't be called 'souls' because they aren't the basic source of human actions and belong to a totally different genus from *rational soul*. [Then some clipped, obscure bits about uses of 'soul'.]

Finally, where you say

> 'Willing and understanding differ only as different ways of acting in regard to different objects',

I would prefer

> 'Willing and understanding differ only as the activity and passivity of one and the same substance.'

For strictly speaking, understanding is the passivity of the mind and willing is its activity; but because •we can't will anything without understanding what we will, and •we hardly ever understand something without at the same time willing something, we don't easily distinguish passivity from activity in this context.

Voetius's criticism on this point in no way tells against you. Theologians do indeed say that no created substance is the immediate principle [see Glossary] of its own operation; but by this they mean that no created thing can operate without the concurrence [see Glossary] of God. They don't mean—*absurdly*!—that the created thing has a faculty distinct from itself to operate by, so that although the created thing couldn't cause its own operation this faculty that it has could do so. . . .

When you discuss colours, I can't see why you exclude blackness, because the other colours are also merely modes. I would simply say: 'Blackness too is commonly counted as a colour, yet it is nothing but a certain arrangement. . . '.

[A paragraph in which Descartes recommends replacing 'necessarily' by 'easily' in one place, and contracting 'and therefore' to 'and' in another.]

To say that the passions have their seat 'in the brain' is paradoxical, and I don't think it is actually your own view. It's true that the spirits that move the muscles come from the brain, but the seat of the passions has to be the part of the body that is most affected by them, which is undoubtedly the heart. So I would say: 'The principal seat of the passions, considered as corporeal, is in the heart, because that is what is principally affected by them; but considered as also affecting the mind, their seat is solely in the brain, because the brain alone can directly act upon the mind.'

It is also paradoxical to say that 'reception is an action', when in fact it is merely a passion [see Glossary], quite contrary to action. But you could perhaps retain what you have written, by saying this: 'Reception is an automatic animal action, or rather passion, whereby we receive the movements of things; for here we are linking passions with actions so as to include under one category everything that occurs in man.'

[Another page of suggestions, corrections, warnings, encouragement. Then finally:] I don't agree with your definition of actions as 'operations that a man performs by the power of his soul and his body'. I'm in the camp of those who deny that man understands by means of the body, and I'm not impressed by your argument to prove the contrary. It's true that the mind can be •hindered by the body, but when it's a matter of understanding immaterial things it can't be •helped by the body, only harmed.

⊕ [19.v.41: Gassendi writes to Mersenne for Descartes, two Latin pages of philosophical criticisms.]

to Mersenne, 16.vi.1641:

In the two little sheets of objections that you sent me [part of the Sixth Objections to the *Meditations*] someone asks what I meant by 'idea', and seems to promise more objections; and the way he begins makes me look to him for the best and strongest objections that can be made. If he wants my answer to his question now, without waiting for me to reply to all of this set of objections, you can tell him the gist of it, namely:

> I use the word 'idea' to mean everything that can be in our thought. And I distinguish three kinds. •Some are **adventitious** [= 'caused from outside the person'], such as our everyday idea of the sun; •others are **constructed** or made up, e.g. the idea of the sun that the astronomers construct by their reasoning; and •yet others are **innate**, such as the ideas of *God*, *mind*, *body*, *triangle*, and in general all the ideas that represent true, immutable and eternal essences.

Now, if from a constructed idea I infer what I explicitly put into it when I was constructing it, I would obviously be begging the question [see Glossary]; but it's different when I draw out from an innate idea something that was implicitly contained in it without my having noticed it. Thus I can draw out from the idea of a triangle that its three angles equal two right angles, and from the idea of God that he exists, etc. So far from being a begging of the question, this method of demonstration is the most perfect of all—even Aristotle says so!. . . .

to Mersenne, 23.vi.1641:

I am sending you the remainder of Gassendi's objections, together with my reply. If possible please have the objections printed before their author sees my reply; because I find (between ourselves) that they contain so little good argument that I don't think he'll want to allow them to be printed once he has seen my reply. I on the other hand very much want them printed: •I would be sorry to have wasted my time in composing my reply; and •some people would think that it was I who refused to have them published because I couldn't deal with his objections. I'm also happy for his name to go at the head of the objections, just as he has put it. If he is unwilling to allow this, he's entitled to prevent it because the other objectors haven't given their names; but he can't prevent his objections from being published.—Please give the publisher the same copy that I have seen, for printing, so that there are no discrepancies.

[Four pages concerning •arrangements for the publishing of the Objections and Replies, •a recent medical book 'which I have no great need to see', •changes to some possibly tactless wording in the letter to the faculty of the Sorbonne, •a correction to a misunderstanding of what he meant when writing of 'the surface of the bread' in the Eucharist (not a part of the bread, or a part of the surrounding air, but *what separates* the bread from the air); •the pleasure of having Gibieuf on his side; Picot's presence in Leiden (where Descartes now is). Then:]

You'll see that I have done my best to deal with Gassendi in an honourable and considerate way. But he has given me so many grounds to despise him, and to point out his lack of common sense and his inability to argue rationally, that I'd have been failing to stand up for my own just cause if I had said any less than I did—and I could have said much more!

to Mersenne, vii.1641:

The author the Latin letter to you that you passed on to me ·on 19.v.41·—[we don't know who that author was]—hasn't yet taken a side in the judgment that we want to make. He expresses himself so well when presenting his own views that I can't believe that he has misunderstood others. I'm convinced that after getting clear about his own opinions he has worked to get a sense of ·the frame of mind of· those who disagree with him. So I predict that this won't be the last time he and I clash with one another. This first letter from him is like a *challenge to a duel*, presented so as to see how I take it, and ·to see· whether I, after taking the battlefield and challenging all comers, will make a show of trying my weapons against his, my strengths of mind against his. I would really enjoy engaging with people with intellects like his, if they didn't go—as he has—too far to one side from the outset. I'm afraid that •the work I put in on him will be wasted: however hard I try to satisfy him and to extract him from the unhappy battle he's engaged in, I fear that he'll plunge back in, looking for new ways to contradict me.

He says that he doesn't understand what I mean by 'the idea of God', 'the idea of the soul', and 'the ideas of imperceptible things'—can we believe him? All I mean is what *he* must have meant when he wrote to you that he didn't understand my meaning. He doesn't say that he has no conceptions corresponding to 'God', 'soul', and 'imperceptible things'; he just says that he doesn't know what he's supposed to understand by 'the idea of' these things. But if he had any conception corresponding to these expressions (as he surely did), then he knew at the same time what was to be understood by 'the ideas of' those things, namely the conception that he himself had. I don't call the images painted in the physical imagination 'ideas'; by 'idea' I mean in general everything that is in our mind when we conceive something, no matter how we conceive it.

But I realise that he isn't one of those who think they can't conceive something if they can't imagine it. He grasps that I don't think of •imagining as our only way of •thinking or •conceiving, and he shows well enough that he doesn't think so either—as witness his saying that God can't be conceived by the imagination. But if its not by the imagination that God is conceived, then when we speak of God either

- •we conceive *nothing* (which would show a terrible blindness), or
- •we conceive him in some other way.

And whatever way that is, it must involve our having the idea of him; if we express *anything* by our words, when we understand what we're saying, we must we have in us the idea of the thing that is signified by our words.

Thus, if he takes 'idea' in the way I explicitly said that I took it ·in the Third Meditation·, and isn't confused by those who restrict it to the images of material things formed in the imagination, it will be easy for him to understand what I mean by 'the idea of God', namely what all men habitually understand when they speak of him. He *must* have understood the phrase in that way himself—otherwise how could he have said that God is infinite and incomprehensible and can't be represented by our imagination? How could he affirm that •God has these attributes and countless others that express his greatness to us, unless he had the idea of •him? [Descartes then goes on hammering this point home.]

In the case of the soul, things are even clearer. As I have shown, the soul is nothing but *a thing that thinks*; so we can't possibly think of anything

x

without at the same time having the idea of

our soul as a thing capable of thinking of x.

It's true that a soul can't be imagined, i.e. represented by a corporeal image. But that isn't surprising, because our imagination can only represent objects of sense-perception; so we can't imagine it—or form an image of it—because our soul has no colour or smell or taste, or anything that belongs to the body. But that doesn't make it any less conceivable; on the contrary, since it's by means of the soul that we conceive all other things, it is more conceivable on its own than all other things taken together.

I have to tell you next that your friend has *entirely* missed my meaning when he distinguishes two kinds of ideas thus:

- ideas in the corporeal imagination are expressed by names, and
- ideas in the mind are expressed by propositions.

Whether an idea belongs to the mind or the imagination doesn't depend on whether it can be expressed by a name or by a proposition; it could be expressed either way. What makes the difference ·that we are trying too pin down here· is *how* an idea is conceived. Thus:

- if we conceive something with no image coming into it, that's an idea of pure mind;
- if we conceive something through an image, we're using an idea of the imagination,

Our mind has hardly any limits, whereas our imagination is severely limited: there are very few things, even corporeal things, that we can •imagine, though we can •conceive them. As for the entire science that considers only sizes, shapes and movements—you might think it is most under the sway of our imagination, but those who have looked into it even in a fairly shallow way know that this science rests not on the phantasms of our imagination but only on the vivid and clear notions of our mind.

He thinks I am committed to the view that the idea of God must be expressed by the proposition 'God exists', and concludes that my main argument to prove God's existence is a mere begging of the question [see Glossary]. How can he get *that* out of anything I have written? He must be very sharp-eyed to see something there that I never meant to say and that never entered my mind before I saw his letter! I based the proof of the existence of God on the idea that I find in myself of *a supremely perfect being*, which is the ordinary notion we have of God. It's true that merely thinking of such a being leads us to the knowledge of his existence, doing this so easily that conceiving of God is almost the same thing as conceiving that he exists; but still our idea of God, or of a supremely perfect being, is quite different from the proposition *God exists*, so that the one can serve as a means or premise to prove the other.

In the same way, anyone who comes to know the nature of our soul by the steps I used, and thus recognises that it is a spiritual substance—because he sees that it has all the attributes that belong to spiritual substances—doesn't have to be a great philosopher to conclude that the soul isn't corporeal! On the other hand, to •see that the conclusion *doesn't* follow from the premises and to •find some flaw in this argument—that *does* require a mind that is open, an *unusual* sort of mind. That is what I ask him to show me, and I expect to learn from him if he is willing to take the trouble to teach me. I for my part will not refuse him my little clarifications, if he needs them and is willing to proceed in good faith.

⊕ [vii.41: Hyperaspistes writes to Descartes, responding to his replies to Gassendi's objections to the *Meditations*. This person was probably a friend of Gassendi's, but Descartes didn't know his identity and nor do we. 'Hyperaspistes' was his own chosen *nom de plume*; it is Greek, meaning 'defender' or 'shield-bearer'. The main points in his letter will be given in notes on Descartes's viii.41 letter in reply.]

⊕ [17.vii.41: Huygens writes to Descartes enclosing a back-up copy of the printers' proofs of the *Meditations*; he asks to be allowed to have this back for slower and more careful reading; and rapturously applauds what he has read of the work.]

to Mersenne, 22.vii.1641:

I'm returning the Sixth Objections to you, with my replies. The objections were made up of various papers that you sent me at different times, so I have copied them out in my own writing in the way it seemed they could most conveniently be combined. . . .

As regards printers' errors, I realise that they aren't very important, and I assure you that I'm as much in your debt for your care in correcting them as I would be if every single one had been eliminated. I know how much work you have put into this, and I also know that it's morally impossible [see Glossary] to pick up every error, especially when proof-reading someone else's writings.

I very much approve your cutting out what I said at the end of my reply to Arnauld, especially if this can help us to get a formal approval for the book [see page 133]. But even if we don't get it, I'm sure I won't be very upset.

As for Gassendi: I think it would be very unfair for him to take offence at what I have said, for I have taken great care to keep things on a level—matching his compliments by compliments, and his attacks by attacks. ·And that still involves a tilt in his favour, because· I have always heard it said that the first blow is worth two, so that things would have been fair if I had *doubled* his attacks. [He conjectures that misunderstandings helped to create the stand-off between Gassendi and himself, lists several, which he says are 'not my fault'.]

[He reports having read 'your Hyperaspistes' and is willing to reply; but all this is intended for publication, and readers will be wearied by repetitions and irrelevances; so Descartes asks Mersenne to get Hyperaspistes to trim and cleanse his document before Descartes replies to it. [This evidently didn't happen.]]

You ask 'Are our ideas expressed by a simple term?' I don't understand the question. Words are human inventions, so it's up to us whether we use one word or several to express the same thing. But I explained in my Reply to the First Objections how a triangle inscribed in a square can be taken as a single idea or as several. Altogether, I think that all the ideas that involve no affirmation or negation are *innate* in us; because when such an idea arises in us, the sense-organs don't bring us anything like it, so the idea must have been in us already.

to DeLaunay, 22.vii.1641:

. . . .At the end of the last set of ·replies to· objections that I sent to Mersenne I only spoke in a general way about the reason why *most* people have trouble seeing that the soul is distinct from the body. It is as follows. Our earliest childhood judgements have accustomed us to attribute to the body many things that belong only to the soul, and to attribute to the soul many things that belong only to the body, a tendency that has been strengthened in us by the influence of traditional philosophy. So people commonly mingle the two ideas of body and of soul in constructing the ideas of •real qualities [see Glossary] and •substantial forms [see Glossary], ideas that I think should be altogether rejected. If you examine physics carefully you'll find that everything in it that the intellect can deal with is reducible to a set of kinds that are •so few in number and captured by notions

that are •so clear and •so distinct from one another, that I don't think you can fail to recognise whether in conceiving one thing apart from another you're doing this only by a mental abstraction or because the things are truly distinct. When things are separated only by a mental abstraction, you can't help noticing, when you bring them together in a single thought, that they are conjoined, unified; and with soul and body you can't see any such conjunction provided you conceive them in the right way—one as *what fills space* and the other as *what thinks*. Indeed I don't know any other pair of ideas in the whole of nature that are as different from each other as these two (except for pairs of which one member is our idea of God). But here I'm merely putting forward my own opinion; I don't have such a high regard for it that I wouldn't be ready to change it if I could learn better from those whose light is brighter than mine.

to Hyperaspistes, viii.1641:

The objections I received before the arrival of yours ·of vii.41· have been sent to the printer, and I decided that any further objections that came in should be reserved for a second volume. But your objections are presented as covering all the remaining ground, so I gladly hasten to reply to them so that they can be printed with the others. [They arrived too late for that.]

[The 14-point defence matches Hyperaspistes' 14-point attack. In this presentation each defence is preceded by a very short statement of the attack, within quotation-marks but not always a precise quotation.]

(1) ['It is more important to avoid going wrong in everyday life than to avoid error in metaphysics; so why do you suppose or demand a lesser truth in morals than in science?'] It would indeed be desirable to have as much certainty for the conduct of our lives as is needed for the acquisition of knowledge; but it can't be had. This can be shown *a priori* [see Glossary] from the fact that a human ·body·, as a composite entity, is naturally corruptible, while the mind is incorruptible and immortal. It can be shown even more easily *a posteriori* from the consequences that would follow. Consider a case like this:

> A man decides to eat nothing, because he's never certain that his food hasn't been poisoned, and he thinks that •he isn't obliged to eat when it isn't transparently clear that the food will keep him alive, and that •it is better to wait for death by abstaining than to kill himself by eating.

Such a man would be rightly regarded as mad and as responsible for his own death. ·Of course it's right to think that the man should steer by the probabilities·: even if *in fact* the only food he can get is poisoned, and *in fact* he is in some strange way helped rather than harmed by not eating, if the probabilities he knows favour his eating, he should eat. This is so self-evident to everyone that I'm surprised that anyone could think otherwise.

(2) ['You wrote "From the fact that the mind doesn't work as perfectly when it is in the body of an infant as when it's in an adult's body, it doesn't follow that it is made more or less perfect by the body." But nor does it follow that it is not.'] I nowhere said 'because the mind acts less perfectly in infancy than in adulthood it follows that it is no less perfect'; so I can't be criticised on that account. But it doesn't follow either that it is more imperfect, and I had a right to criticise anyone who assumes that it is. And I had reason to assert that the human soul is always thinking, even in the unborn child. What more certain or evident reason could be wished for than the one I gave? I proved that the nature or essence of the soul consists in its thinking, just as the essence of the body consists in its being extended. Nothing can be deprived of its own essence; so it seems to me that someone who says

> At the times when (my memory tells me) I wasn't aware of my soul's thinking it *wasn't thinking*

deserves no more attention than someone who says

> At the times when (my memory tells me) I wasn't aware of my body's being extended it *wasn't extended*.

This doesn't mean that I believe that the mind of an infant meditates on metaphysics in its mother's womb! ·'Well,' you'll want to know, 'what *is* it thinking about?' I have a conjecture about that·, assuming that it's legitimate to make **conjectures** about something one doesn't see clearly. ·The background fact is this·: We know by experience that our minds are so closely joined to our bodies as to be almost always acted upon by them; when the mind is thriving in an adult and healthy body it has some liberty to think of things other than the ones presented by the senses, but we know those who are sick or asleep or very young don't have the same liberty, and the younger they are the less liberty they have. So it seems most reasonable to **conjecture** that a mind newly united to an infant's body is wholly occupied in feeling—i.e. perceiving in a confused way—the ideas of pain, pleasure, heat, cold and other such ideas that arise from its union and intermingling (so to speak) with the body. Still, even at that time it has in itself the ideas of God, of itself and of all the truths that are called self-evident, just as adult human beings have these ideas when they aren't attending to them; for it doesn't *acquire* these ideas later on, as it grows older. I have no doubt that if it—·the child's soul·—were released from the prison of the body it would find them within itself.

This view doesn't involve us in any difficulties ·such as you find in conceiving the relation between incorporeal thoughts in the mind and corporeal traces in the brain·. Though the mind and the body are distinct things, the mind is none the less joined to the body and is affected by traces impressed on it, and is able to impress new traces on the body on its own account. This is no harder for us to understand than it is for those who believe in *real accidents* [see Glossary] to understand that such accidents act on a corporeal substance while being quite different in kind from it. ('Different in kind'? Yes, because no real **accident**—if there were any such things—could be 'corporeal' in the proper sense of that term, namely 'made up of the **substance** called body'; so they are no more corporeal than minds are.) Thus, when a mind joined to a body thinks of a corporeal thing, certain particles in the brain are set in motion, sometimes by the action of external objects on the sense-organs, sometimes by animal spirits [see Glossary] that have risen from the heart to the brain, and sometimes by the mind's own action when it is impelled of its own free will to a certain thought. The motion of these brain particles leaves the traces that memory depends on. Where purely intellectual things are concerned, memory in the strict sense is not involved: something comes to mind just as readily the first time as it does the second—unless, as often happens, they are associated with certain names, for then it is genuine memory because the names are corporeal. There are many other points to be noted on this topic but I can't explain them in detail here.

(3) . . . .['You teach that one should not believe anything unless one clearly sees that it is true. This would erase the distinctions between knowledge and belief, and between belief and faith.'] In the passage you are referring to, I said 'when we are supernaturally illumined by God, we are confident that what is put forward for us to believe has been revealed by God himself'; but there I was speaking not of human knowledge, but of faith. And I didn't assert that by the light of grace we clearly know the very mysteries of faith—though I would not deny that this too may happen—but only that we are confident that they

are to be believed. No-one who really has the Catholic faith can doubt or be surprised that it is most evident that what God has revealed is to be believed and that the light of grace is to be preferred to the light of nature. . . .

(4) Your fourth objection rests on something I nowhere say, namely 'that the highest point of my certainty is when we think we see something so clearly that the more we think about it, the truer it seems'. So there is no need for me to answer what follows; though an answer could easily be given by anyone who sees that the light of faith is different from and preferable to the natural light.

(5) ['You say that *you are a thinking thing*, but you aren't t entitled to think you can make sense of that. You can't understand a proposition without understanding its subject or predicate; and you *don't* know what is meant by "thing", by "exist", or by "thought". If you did, you would explain those terms so clearly that I too would clearly perceive the truth of that proposition.'] I flatly deny that we don't know what a thing is, or what thought is, or that I need to teach people this. It is so self-evident that there is nothing that could serve to make it any clearer. . . .

(6) It's quite true that we don't understand the infinite by the negation of limitation; and this argument [which Hyperaspistes said Descartes was committed to]—

- •Limitation involves the negation of infinity, therefore
- •the negation of limitation involves knowledge of the infinite

—is invalid. What makes the infinite different from the finite is something real and positive; but the limitation that makes the finite different from the infinite is •non-being or •the negation of being; and that-which-is-not can't bring us to knowledge of that-which-is; on the contrary, •the negation of a thing has to be grasped on the basis of knowledge of •the thing itself. When I said that to understand the infinite all we need is to understand a thing that isn't bounded by any limits, I was following a very common usage. Similarly, when I kept the term 'infinite' rather than 'greatest being', which would more closely fit the reality, I was conforming to common usage which required me to use the negation of a negation. . . .

['You say that the mind's power of amplifying perfections must have come from God; but couldn't it come from instead the mind itself, as an eternal and independent substance?'] I didn't deny that the mind has a power of amplifying the idea of things; but I kept insisting that neither •the ideas thus amplified nor •the power of so amplifying them could be in the mind unless the mind itself came from God, who really does have all the perfections that can be reached by such amplification. I proved this from the principle that there can be nothing in an effect that wasn't previously in the cause. And no subtle philosopher in this field thinks that atoms exist of themselves, for it is obvious by the natural light that there can be only one being—the supreme being—that is independent of everything else.

['You say that a spinning top is an example of something's acting on itself. I object. What acted on it was the whip.'] When you say that a spinning top doesn't act on itself but is acted upon by the absent whip, I wonder how one body can be acted on by another that is absent, and how activity and passivity are to be distinguished. For I admit that I'm not subtle enough to grasp how something can be acted upon by something else that isn't present—indeed by something that doesn't exist any more (the whip could be destroyed while the top is still turning). And I don't see why we couldn't as well say that there are now no *actions* in the world but only *passive effects* of the actions that happened when the world began. I have always thought that a single event is called an •activity in relation to where it is heading, and a •passivity in relation to where it came from. If that is right, it is

contradictory—·logically impossible·—that there should be a passivity without an activity for even a single moment. Finally, I agree that the ideas of corporeal things—indeed of everything in the whole visible world, though not (as you say in your objection) of the visible world itself—could be produced by the human mind; but it doesn't follow that we cannot know whether there is anything corporeal in nature. Difficulties ·about this· are produced not by my views but by wrong inferences from them. I proved the existence of material things not from •the fact that we have ideas of them but from •the fact that these ideas come to us in such a way as to make us aware that they aren't produced by ourselves but come from elsewhere.

(7) ['You say that created things couldn't be kept in existence without a continuous action of God, just as light would fail if the sun stopped shining. But phosphorescent substances like Bologna spar could shine in a closed room, i.e. with no input from the sun.'] I say first that in Bologna spar the light of the sun is not preserved, but the sun's rays kindle a new light that can afterwards be seen in the dark. Secondly, ·even if the objection involving Bologna spar were correct·, it wouldn't follow that anything can be kept in existence without God's influence; this would merely be a case where something true was illustrated by a bad example. It is *much* more certain that •nothing can exist without being kept in existence by God than •that there can be no sunlight without the sun. There's just no doubt about this:

> If God withdrew his continuing support for things' continued existence, everything that he has created would immediately go out of existence;

because these things were nothing until God created them and gave them his continuing support. This does not mean that they shouldn't be called 'substances', because when we call a created **substance** 'self-subsistent' we aren't ruling out God's support, which it needs in order to subsist. All we mean is that it's the kind of thing that can exist without any other created thing; and that is not true of the **modes** of things, like shape and number. It's not the case that God would be showing the infinitude of his power if he made things that could exist without him later on; on the contrary, this would show his power to be finite, since created things, once they were in existence, would have no further need of him. I agree that it is impossible that God should destroy *anything* except by withdrawing his support; if he destroyed something in some other way he would be engaging in a positive activity tending towards non-being. . . . There's a great difference between what happens by God's positive activity and what results from the cessation of his positive activity: the former can't be anything but excellent, while the latter includes evils and sins and any destruction of beings that occurs.

['You hold that God freely created the eternal truths, i.e. *made* them be true. But let God do whatever he can; let us suppose *per impossibile* that he never thought of a triangle, if you were in the world as you now are wouldn't you agree that the three angles of a triangle equal two right angles?'] There is no force in what you say about the nature of a triangle. As I have insisted in several places, when •God or •the infinite is in question, what we must consider is not

- •what we can comprehend—·intellectually embrace, get our minds around·—because we know that we can't do that with God or infinity, but only
- •what we can conceive regarding them, i.e. what we can learn about them by arguments that are certain.

To find what kind of causal dependence these truths have on God, see my replies to the Sixth Objections, article 8.

(8) I don't remember ever having written, or even thought, that an infinite series of subordinate causes is impossible. ·So I have nothing to reply to here·.

(9) ['What makes you so certain that you have the idea of God? Others deny that they have such an idea; and you can't be sure that you will always think as you do now.'] I don't remember that I ever expressed surprise 'that not everybody is aware of the idea of God in himself'; for I have often observed that what men •judge doesn't square with what they •understand. I don't doubt that everyone has within himself an implicit idea of God, i.e. a disposition to have it consciously in his mind; but I'm not surprised that not everyone is aware that he has it or notices that he has it. Some people might not notice it even after reading my *Meditations* a thousand times. In the same way, people •judge that so-called empty space is nothing, and yet they •conceive it as a positive thing. Similarly, when people think that accidents are real [see Glossary] they're representing them to themselves as substances, even though they don't judge them to be substances; and in many other matters people's judgements disagree with their perception. But if we never make any judgement except about things we clearly and distinctly perceive—a rule that I always keep as well as I can—then we'll be incapable of making different judgements at different times about the same thing. It's true that things that are clear and beyond doubt appear more certain to us the more often and the more attentively we think of them; but I don't remember that I ever put this forward as the criterion of clear and indubitable certainty. I don't know where the word 'always' occurs in the way mentioned here; but I do know that when we say we 'always' do something we usually mean that we do it whenever the occasion presents itself, not that we do it eternally!

(10) ['You deny that we can know God's purposes as easily as we can know other causes. But it's perfectly clear that what God aims at is that everything that happens should contribute to his glory.] It is self-evident that we can't know God's purposes unless God reveals them. From the human point of view adopted in ethics, it's true that everything was made for God's glory, meaning that we must praise God for all his works; and it's true that the sun was made to give us light, meaning that we see that the sun does give us light. But it would be childish and absurd for a metaphysician to say that God, like some vainglorious human being, made the universe solely in order to win men's praise; or that the sun, which is many times larger than the earth, was created solely in order to give light to man, who occupies a very small part of the earth.

(11) [In this paragraph, italics are used for 'will' as a verb, not as a noun.] [Hyperaspistes makes some hard-to-translate remarks about intellect and will, leading Descartes to respond:] There's a confusion here between the functions of the intellect and of the will. The function of the will is not to understand but only to *will*; and though (as I agreed earlier) we never *will* anything that we don't in some way understand, experience shows clearly that about any given thing our will can extend further than our knowledge. Again, falsehood is never apprehended as truth. Those who deny that we have an idea of God may

- •affirm this,
- •believe it, and
- •argue for it,

but they don't really

- •apprehend it.

As I remarked in **(9)** above, people's judgements often don't square with their perception or apprehension.

(12) ['You say that a child can have the idea of a triangle before ever seeing one. This puts you on a collision path with Aristotle's dictum that there's nothing is in the intellect that wasn't first in the senses.'] I don't have to do work hard on any answer to this, because nothing is objected against me except the authority of Aristotle and his followers; and I make no secret of the fact that I trust him less than I trust reason.

['Has anyone born blind ever perceived anything of light and colour? Of course not, as our three hundred blind men in Paris will testify, including a philosopher who, when I asked him, said he could not conceive of colour or light.'] It does not matter whether a man born blind has the ideas of colours or not, and it is pointless to cite the testimony of a blind philosopher. Suppose he has ideas *exactly* like our ideas of colours: he can't know that they are like ours, or that they are called ideas of colours, because he doesn't know what ours are like.

['If you were right in saying that the senses are a hindrance rather than a help to the intellect, we should be able to perform great intellectual feats in our sleep.'] It's not surprising that in sleep the mind doesn't construct demonstrations like those of Archimedes, because even in sleep it is still united to the body and is no freer than during waking life. Staying awake for a long time doesn't make the brain more fit to retain the traces impressed on it. In sleep and waking life alike, traces are better retained the more strongly they are impressed. And so sometimes we remember even dreams, but we remember better what we have thought in waking life. The reasons for this will be clear in my *Principles of Philosophy*.

(13) ['You say that God's essence can't be thought without including existence, in the way a triangle can be thought about without thinking of it as existent, the reason being that God *is* his own existence. What is this "his existence"? And are we to say that a triangle is not its own existence but the existence of something else?'] When I said that God is his own existence, I was using the regular theological idiom, which means that it belongs to God's essence to exist. The same can't be said of a triangle, whose whole essence can be correctly understood even if it is supposed that in reality there is no such thing.

['You say that the sceptic couldn't doubt the truths of geometry if he acknowledged the existence of God.' (And Hyperaspistes goes on at some length to question this.)] I said that the sceptics wouldn't have doubted the truths of geometry if they had recognised God, because: since those geometrical truths are very clear, the sceptics would have had no occasion to doubt them if they had known that *whatever is clearly understood is true*. We learn this last proposition from having a sufficient acquaintance with God, and that's the premise that the sceptics don't have ready at hand.

['Is a line made up of an infinity of sizeless points or rather a finite number of segments? Either answer leads to absurdity; so scepticism about geometry can have a basis that has nothing to do with God.'] That question is irrelevant and need not be answered here. In the place cited, I wasn't talking about •any and every geometrical topic but only about •demonstrations that the sceptics doubted even though they clearly understood them. You can't have a sceptic saying 'Let the evil demon deceive me as much as he can, he will never deceive me about this geometrical proposition', because anyone who says this doesn't doubt everything, which means that he isn't a sceptic. Certainly I have never denied that the sceptics themselves, as long as they clearly perceive some truth, spontaneously assent to it. It is only in name, and perhaps in intention and resolve, that they adhere to their heresy of doubting everything. But I was dealing only with things that we remember having clearly perceived earlier, not with those that we clearly perceive at the present moment. . . .

(14) ['You deny that the mind is extended, yet you say that it is unified with the body. How can this be?'] A mind can be co-extensive with an extended body even though it has itself no real extension in the sense of occupying a place and excluding other things from it. I explained how this can be by the illustration of heaviness conceived as a real quality. I also showed above that when Ecclesiastes says that man has no advantage over a beast of burden, he is speaking only of the body; for he goes straight on to deal separately with the

soul—'Who knows if the spirit of the sons of Adam. . . ,' and so on.

[The opening of the final paragraph is too condensed to be easily followed. The core of it is as follows. Suppose that

(i) We can't conceive the mind without the body; and
(ii) We can conceive the mind as a complete thing apart from the body (and vice versa).

Of these, **(ii)** counts in favour of Descartes's view of mind and body as distinct substances, whereas **(i)** seems to count against it. Hyperaspistes has asked which of the above two supposed facts shows us in a worse light, displaying •a weakness in our thinking rather than •a metaphysical truth. Descartes's answer is that **(ii)** comes from a positive faculty that we have, whereas **(i)** comes from our lacking that same faculty:] It is through a real faculty of the mind that it **(ii)** perceives two things separately as complete things; and it's through a lack of the same faculty that the mind **(i)** apprehends these two things merely in a confused manner, as a single thing. In the same way, eyesight is more perfect when it accurately distinguishes the different parts of an object from one another than when it perceives them all together as a single thing. Of course someone whose eyes are unsteady may mistake one thing for two, as people often do when drunk; and philosophers do the same. . . .when they distinguish a body's •matter from its •form and various accidents, as though these were so many different *things*. In such cases their perception is obscure and confused in a way that makes it easy for them to realise that it arises not only from a positive faculty but also from a defect of some faculty; if they had attended more carefully they'd have realised that they don't have completely different ideas of the things they are supposing to be distinct from one another. . . .

to Mersenne, ix.1641:

I'm much in your debt for all the trouble you have taken for my sake, and for your zeal in ·locating and passing along· anything that concerns me. But since I don't care about that as much as you do, I would be guilty of an injustice if I didn't beg you to ignore completely whatever you may hear against me—don't write to me about it or even bother to listen to it. I have long known that there are fools abroad in the world, and I care so little about what *they* think that I would be extremely sorry to lose a single moment of my free time or my peace and quiet on their account.

As for my Metaphysics [the *Meditations*], I haven't given it a thought since the day I sent you my answer to Hyperaspistes—I haven't even picked up the work since then. So I can't answer a single one of the queries you sent me in your letter last week—I merely beg you not to give them any more thought than I do. In publishing the book I did what I thought I had to for the glory of God and to satisfy my conscience. If my project has failed, and there are too few people in the world capable of understanding my arguments, that's not my fault and doesn't make my arguments less sound. But it *would* be my fault if I became angry, or used up more time answering the irrelevant objections of those who have been in touch with you.

[A paragraph about the recently deceased Beaugrand, some of whose anti-Descartes mathematical pieces Mersenne has forwarded to Descartes. Don't send any more, Descartes says, because we already have plenty of scrap paper, which is all they are good for.]

I beg you once more not to send me any more objections against my Metaphysics, or regarding my Geometry or similar matters, or at least don't expect me to compose any more replies addressed to people who aren't able to learn.

⊕ [ix.41: Descartes writes to Regius, two short letters urging Regius to be more gentle in his replies to Sylvius's criticisms of what he has written about the circulation of blood.]

to Mersenne, 17.xi.1641:

I must tell you that my *Meditations* are being printed in this country. A friend had told me that several firms wanted to publish them, and that I couldn't stop it because Soli's licence to publish is valid only for France; even if he did have a licence for Netherlands, that wouldn't deter other publishers—that's how uncontrolled they are in this country. So I preferred to have just one publisher who would undertake it with my approval and my corrections, and who by announcing the project would stop the plans of others, rather than letting an edition come out without my knowledge and thus inevitably full of mistakes. So I'm having it printed by one of the Elzevirs in Amsterdam, on condition that he doesn't infringe on Solti's rights by sending copies to France. Not that I have reason to be satisfied with Soli: the book was printed three months ago, and he still hasn't sent me any copies. [The complaints against Soli continue, and then:]

I have a few questions for you. Do you think it appropriate that I should restore the cuts you made from the end of my reply to Arnauld regarding the Eucharist? Should I include the objections of Hyperaspistes with my reply? Also, should I put under the title 'Second Edition, with corrections and additions to the first edition published in Paris'? The new edition won't be ready for two months, and if the 100 copies that you told me Soli would be sending are already on their way, they can easily be sold during that time; if they aren't on their way, he can keep them if he wishes.

[Descartes now asks to be sent a plan of the gardens of Luxembourg, for 'a close friend' of his [presumably Huygens]; asks for the plans to be done by 'the young man [Schooten] who did the diagrams for my *Optics*'; and says he is willing to pay up to eight pistoles for this, if it can't be done for less. He then winds up with brief remarks on some vaguely scientific matters raised in Mersenne's recent letters.]

to Regius, xii.1641:

I have received your theses, and I thank you; I find nothing in them that I don't agree with. What you say about actions and passions [see Glossary] presents no difficulty, I think, provided the terms are understood correctly. In corporeal things, all actions and passions consist simply in motion; we call it 'action' in relation to the body that supplies the motion and 'passion' in relation to the body that is moved. It follows from this that when we want to extend these terms to immaterial things we have to find something in them that is analogous to motion. So we should apply 'action' to what plays the role of a moving force, like *volition* in the mind, and apply 'passion' to what plays the role of something moved, like intellection and vision in the same mind. As for those who think that perception should be classified as 'action': they seem to be willing to call any real power 'action', and to use 'passion' to refer to the mere negation of a power. . . .

[The letter corrects some mistakes in Regius's theses.]

⊕ [xii.41: In this same month Descartes writes two more (short) letters to Regius, one Latin and the other French, both dealing with medical matters. Then still in the same month:].

to Regius, xii.1641:

[Regius had recently defended a number of theses that gave offence to Voetius and other orthodox thinkers at the University of Utrecht.] In your theses you say that a human being is an *ens per*

accidens [see Glossary]. You could scarcely have said anything more objectionable and provocative. The best way I can see to remedy this is for you to say that in your thesis 9 you were thinking about •the whole human being in relation to the parts of which it is composed, while in 10 you were concerned with •the parts in relation to the whole. Say too that when in 9 you said that a human being comes into being *per accidens* out of a body and a soul, your point was to indicate that it is *in a way* accidental for a body to be joined to a soul and vice versa, because the body can exist without the soul and the soul without the body. For the term 'accident' means anything that can be absent without its possessor ceasing to exist;. . . . Tell them that in spite of this you didn't say that •a human being is an *ens per accidens*, and you showed sufficiently in thesis 10 that you understood •it to be an *ens per se* [see Glossary]. You said there that the body and the soul, in relation to the whole human being, are incomplete substances; and it follows from their being incomplete that what they constitute is an *ens per se*. It's possible for something to come into existence *per accidens* yet be an *ens per se*; you can see this in the fact that mice are generated (i.e. come into being) *per accidens* from dirt, and yet they are *entia per se*. It may be objected that

> 'It's the very nature of a human body to be joined to a soul; it's not "accidental". If a body has all the dispositions required to receive a soul (which it must have to be strictly a human body), then it would take a miracle for it *not* to be united to a soul. Furthermore, what is accidental to the soul is not its being joined to the body but only its being separated from it after death.'

You shouldn't outright deny this, for fear of giving further offence to the theologians; but you should reply that these things can still be called accidental, because when we consider the body alone we perceive nothing in it demanding union with the soul, and nothing in the soul obliging it to be united to the body; which is why I said above that it is accidental *in a way*, not that it is *absolutely* accidental.

[The letter ends with •an obscure paragraph about the difference between alteration and generation, •advice on how to handle a colleague, and •a note about a missing word. Then:] I have nothing to say about the rest. There's hardly anything here that you haven't put forward elsewhere; that's something I am glad to see, because the project of always coming up with something new would be laborious.

If you come here, I will always be pleased to see you.

⊕ [22.xii.41: Descartes writes to Mersenne in Latin, a letter protesting the Jesuits' taking seriously Bourdin's attacks on Descartes's work, and responding to some of the attacks. Each of its eight paragraphs begins *Miror*. . . = 'I am surprised. . . '.]

⊕ [22.xii.41: Descartes writes another letter to Mersenne, this time in French, asking for his help in keeping out of any trouble that Regius and his friends may be stirring up, and saying that he had dropped his plan of launching a critical attack on scholastic philosophy because 'it is so clearly and absolutely refuted simply by the establishment of my philosophy'. He expresses his hope that his Latin letter of this date will be shown to Dinet, who is Bourdin's superior in the Society of Jesus = the Jesuits.]

to Gibieuf, 19.i.1642:

[The letter opens with a strenuous expression of pleasure in Gibieuf's understanding of what Descartes was up to in the *Meditations*, and of hope that eventually there may be more acceptance of his philosophy in the learned world. Then:] I have never aimed to get the approval of the learned as a body. I have known for years—and said so—that my views wouldn't be to the taste of the multitude, and that they

would be readily condemned in any context where a majority held sway. And I haven't wanted the approval of individuals either, because I would be sorry if anyone did anything on my account that his colleagues might dislike; and also because books that are no less heretical than mine have generally gained approval so easily that I don't think I would have anything to fear from a judicial inquiry into whether I am a heretic. [What Descartes wrote means 'more heretical' rather than 'less heretical', but that was obviously a slip.] But this didn't stop me offering my *Meditations* to your Faculty for thorough scrutiny; for if such a celebrated body could not find any good reason to criticise the work, this would give me further assurance of the truths it contained.

You ask what principle is guiding me when I seem to know that some idea of mine is 'not made inadequate by an abstraction of my intellect'. I derive this principle purely from my own thought or awareness. I am certain that all my knowledge of what is outside me comes through ideas I have within me; so I take great care not to relate my judgements immediately to *things*, and not to attribute to them anything positive that I don't first perceive in the ideas of them. But I think also that whatever is in these ideas must also be in the things themselves. So, to tell whether an idea of mine has been made incomplete or inadequate by an abstraction of my mind, I merely look to see whether I have derived it, not from •some thing outside myself, but by an intellectual abstraction from •some other, richer or more complete idea that I have in myself. This intellectual abstraction consists in my turning my thought away from one part of the contents of this richer idea the better to apply it to the other part with greater attention. Thus, when I consider a •shape without thinking of the •substance or the •extension whose shape it is, I make a mental abstraction. I can easily recognise this abstraction afterwards when I look to see whether I have derived this idea of the shape on its own from some other, richer idea which I also have within myself, to which it is joined in such a way that although one can think of the one without paying any attention to the other, it is impossible to deny one of the other when one thinks of both together. For I see clearly that the idea of the shape in question is joined in this way to the idea of the corresponding extension and substance, because we can't conceive a shape while denying that it has an extension, or to conceive an extension while denying that it is the extension of a substance. But the idea of a substance with extension and shape is a complete idea, because I can conceive it entirely on its own and deny of it everything else that I have an idea of. Now it seems to me very clear that •my idea of a thinking substance is complete in this sense, and that •I don't have any other idea that is prior to it and joined to it in such a way that I can't think of the two together while denying the one of the other; for if I had any such idea I would have to know it. You may say:

> The difficulty is still there, because although you conceive the soul and the body as two substances that you can conceive separately, and can even deny of one another, you still aren't certain that they are such as you conceive them to be.

But remember the rule already stated, that *we can't have any knowledge of things except by the ideas we conceive of them*; so that we mustn't judge of them except in accordance with these ideas, and we must even think that whatever conflicts with these ideas is absolutely impossible and involves a contradiction. Thus our only reason to affirm that *there's no uphill without a downhill* is that we see that the ideas of these things can't be complete when we consider them apart—though of course by abstraction we can obtain the idea of an upward slope without considering that the same slope can be travelled downhill.

In the same way we can say that the existence of atoms—material things that are extended but indivisible—involves a contradiction, because you can't have the idea of an extended thing without also having the idea of half of it, or a third of it, and so conceiving it as being divisible into two or three ·parts·. From the simple fact that I consider the two halves of a part of matter, however small it may be, as two complete substances *the ideas of which are not made inadequate by an abstraction of my intellect* I conclude with certainty that it really is divisible. You may say:

> Though you can conceive them apart, you have no reason to deny their inseparability because for all you know God may have united or joined them together so tightly that they are entirely inseparable.

I reply that however he may have joined them, I'm sure that he can also disjoin them; so that absolutely speaking I have reason to call them separable, because he has given me the power to conceive them as such. I say the same about the soul and the body and in general all the things of which we have different complete ideas—namely their being inseparable involves a contradiction. But I don't deny that the soul and the body may have many properties of which I have no ideas; I deny only that they have any properties that are inconsistent with the ideas of them that I do have, including the idea that I have of their distinctness ·from one another·; for otherwise God would be a deceiver and we would have no rule to make us certain of the truth.

I believe that

•the soul is always thinking

for the same reason that I believe that

•light is always shining,

even when there are no eyes to see it, and that

•heat is always warm,

even when no-one is being warmed by it, and that

•body, i.e. extended substance, always has extension,

and in general that whatever constitutes the nature of a thing *always* belongs to it, as long as it exists. If you told me that a certain soul •ceased to think at a certain time, I would find it easier to believe that it had •ceased to exist than that it •continued to exist but without thinking. There's no difficulty here except for someone who thinks it *superfluous* to believe that the soul thinks at times when no memory of the thought remains. But think about it: every night we have a thousand thoughts (and while awake we have a thousand thoughts an hour) of which no trace remains in our memory; and these thoughts seem no more useful—·no less 'superfluous'·—than thoughts we may have had before we were born. That should help you to find my view more convincing than the thesis that a substance whose nature is to think can exist while not thinking at all.

I don't see any difficulty in understanding •that the faculties of imagination and sensation belong to the soul, because they are species of thoughts, and yet that •they belong to the soul only in so far as it is joined to the body, because we can conceive the soul in all its purity without bringing in thoughts of those kinds.

We see animals moving in ways that we move because of our imaginations and sensations, but that doesn't mean that we see that they have imaginations and sensations. On the contrary, these same movements can be made without imagination, and we have arguments to prove that that's what happens in animals, as I hope to show clearly by describing in detail the structure of their limbs and the causes of their movements.

But I fear I have already wearied you by writing at such length. I will count myself very happy if you continue to honour me with your kindness and grant me the favour of your protection.

to Mersenne, 19.i.1642:

As for the Jesuits, I still see no signs of straightforwardness, openness, on their part. The writings of Bourdin that have reached me show that they're only looking for indirect ways ·to oppose me·; and as long as they act against me only through him, I won't believe they want peace and I'll feel free to go public with the facts about what is going on between them and me. You can assure them that I have no plans to write against them—i.e. to use insults and slanders to try to discredit them, as Bourdin has done against me; but please *don't* tell them that I won't be taking one of their textbooks on philosophy so as to point out its errors; on the contrary, I would like them to know that I *will* do so if I judge that that would contribute to making the truth known. They shouldn't take this amiss if they prefer the truth to the vanity of wanting to be thought wiser than they are. But I shan't decide what to do about their objections until I see them. . . .

[Five paragraphs concerning •an aspect of the physics of collisions, •Descartes's refusal to tackle any of Roberval's puzzles in geometry, •a critic's reasonable request for more help with the physics of subtle matter, •a point in optics, and •the weather (cold and snowy). Then:

I have recently found a successful way to weigh air. I took a small very light glass phial with a long spout that had an extremely small hole at the end. The weight of this, when cold, was 78.5 grains. I then heated it over a coal fire, and replacing it on the balance with the spout pointing downwards I found that it weighed just under 78 grains. I then immersed the spout in water and let it cool; as it cooled the air condensed, so that a quantity of water entered the opening spout that was equal to the quantity of air previously expelled by the heating process. Finally, I weighed the phial, including the water it now contained, and found that it weighed 72.5 grains more than it did before. I conclude from this that the weight of the air expelled by the heat stands in relation to the water that took its place in the ratio $\frac{1}{2}$ to $72\frac{1}{2}$, or 1 to 145. My calculation could be wrong, since it's very difficult to be exact, but I'm sure that the weight of air is detectable in this way, and I have described my procedure at length so that you can repeat it if you are interested in doing the experiment. . . .

⊕ [i.42: Descartes writes to Regius urging that they get together to decide how best to counter the attacks of their intellectual enemies. He thinks it best just to laugh at them, but if Regius wants to go further he will have Descartes's support.]

to Regius, i.1642:

[Relevant background facts: Voetius, now Rector of the University of Utrecht, tried and failed to have Regius removed from his Chair; and his partisans publicly attacked Regius's theses •that a human being is an *ens per accidens*, •that the earth moves around the sun, and •that substantial forms are to be rejected.] I have had here all afternoon a distinguished visitor, M. Pollot, who discussed the Utrecht affair with me at length in a friendly and prudent manner. I agree with him entirely that you should refrain from public disputations for some time, and should be careful not to annoy people by harsh words. I would like it best if you never put forward any new opinions, but retained all the old ones in name, and merely brought forward new arguments. No-one could object to this, but those who understood your arguments would work out for themselves what you want them to understand. For instance, what need was there for you to *openly* reject substantial forms and real qualities? Don't you remember that in my *Meteorology* I said explicitly that I *didn't* reject or deny them, but simply found them

unnecessary in setting out my explanations? If you had taken this course, all your audience would have rejected them when they saw they were useless, and in the meantime you wouldn't have been so unpopular with your colleagues.

But what is done can't be undone. Now you must try to defend as moderately as possible the truths you have put forward, and not to be obstinate about correcting any errors or inaccuracies that you are guilty of. Remind yourself that there is nothing more praiseworthy in a philosopher than a candid acknowledgement of his errors. For instance, when you said that a human being is an *ens per accidens* I know that you meant only what everyone else admits, that a human being is made up of two things that are really distinct. But that's not how the scholastics use the expression *ens per accidens*; so if you can't use the explanation I suggested in a previous letter (and I see that in your latest paper you have departed from it somewhat, and let your ship drift onto the rocks), then •openly admitting that you misunderstood this scholastic expression is better than •trying and failing to cover the matter up. You should say that you agree with the others except in the wording you choose. And whenever the occasion arises, in public and in private, you should say openly that you believe that a human being is a true *ens per se*, and not an *ens per accidens*, and that the mind is united in a real and substantial manner to the body. You must say that they are united not by •position or disposition, as you assert in your last paper—for this too is open to objection and is, in my opinion, quite untrue—but by •a true mode of union. Everyone agrees about this, though nobody explains what the mode of union *is*, so you don't need to either. Still, you *could* explain it as I did in my sixth Meditation, by saying that we perceive that sensations such as pain are not pure thoughts of a mind distinct from a body, but confused perceptions of a mind really united to a body. If an angel were in a human body, he wouldn't have sensations as we do, but would simply perceive the motions that are caused by external objects, and in this way would differ from a real man.

As regards your ·latest· writing: although I don't have a firm grasp of what you mean to be saying in it, it seems to me (to speak candidly) that it won't serve your purposes and is out of tune with the times. In it you say many things that are hard to swallow, and you don't clearly set out the reasons that would enable you to defend the good cause. One gets the impression that grief or indignation have driven you into a state of depression. It would be much harder for me to •comment separately on each item in your document than to •sketch a model ·of how I think you should proceed·, so the latter is what I shall do; and although I am swamped in other duties I'll give a complete day or two to this task. I hope you'll excuse my freedom in speaking my mind.

I think it would be worth your while to answer Voetius's appendix in an open letter; for if you ignored it, your enemies could crow over your supposed defeat. But you should reply so gently and modestly as to offend no-one—yet so firmly that Voetius realises he is beaten by your arguments, and pulls out of the contest so as to avoid a further defeat. I will now sketch the reply I would think I should make if were in your position. I will write partly in French and partly in Latin, depending on which phrases come to mind more easily. . . .

[There follows a long piece of advice about tone and wording: ways of expressing respect for Voetius; flattered pleasure over the fact that the Rector of the University has concerned himself particularly with the department of medicine, and so on. The aim must be to have a calm, civilised confrontation of views and reasons, not dominated by a passionate desire to *win* and not tempting students to get into the act and turn it into a shouting-match. Then Descartes presents a

12-page document against Voetius, suggesting that Regius might use it after first changing its style to something that reads like him rather than Descartes. A few small portions of that material will be presented here. Descartes sometimes has Regius saying 'we' and 'our'; there seems to be no good reason for this, and in the present version the first-person singular is used all the way.]

'I readily admit that since I employ only arguments that are very evident and intelligible to people who have no more than common sense, I don't need many foreign terms to make them understood. It thus takes very little time ·for a reader· to learn the truths I teach, and find that his mind is satisfied on all the principal difficulties of philosophy—much less time than he would need to learn all the terms that others use to explain their views on the same problems. And even with all that, those others never manage to produce this kind of satisfaction in minds that make use of their own natural powers of reasoning; they merely fill them with doubts and mists. . . .

'I fully agree with the learned Rector that those "harmless entities" called *substantial forms* and *real qualities* should not be rashly expelled from their ancient territory. And I haven't outright rejected them; I merely say that they aren't needed in explaining the causes of natural things; and I think it's a positive merit in my arguments that they don't depend at all on uncertain and obscure notions of that sort. Now in matters like this, saying "I'm not willing to use these ·supposed· entities" is very close to saying "I do not accept them", because the only reason anyone accepts them is the belief that the causes of natural effects can't be explained without them. So, all right, I confess that I do wholly reject them. . . .

'Voetius asks "Can the denial of substantial forms be reconciled with Holy Scripture?" Well, these philosophical entities are unknown outside the Schools [see Glossary], and never crossed the minds of the prophets, apostles and so on who composed the sacred Scriptures at the dictation of the Holy Ghost. No-one who knows this much will need to ask that question. To prevent any ambiguity, please note that when I deny "substantial forms" I am using that phrase to refer to

> a certain substance joined to matter, making up with it a merely corporeal whole, which is a true substance or self-subsistent thing.

It deserves that status even more than matter does, because it is called an actuality and matter only a potentiality. I don't think you'll find anywhere in Holy Scripture any mention of such a substance or substantial form, present in purely corporeal things but distinct from matter. . . .

'He fears that if we deny substantial forms in purely material things, we may also doubt whether there is a substantial form in man, and may thus be in a less happy and secure position than the adherents of forms when it comes to silencing the errors of those who imagine there is a universal world-soul, or something similar. It can be said in reply to this that on the contrary the easiest slide down to the opinion that the human soul is corporeal and mortal is provided by the view that there are substantial forms—·a slide down to there but also a blocker·. If •the soul is recognised as merely a substantial form, while other such forms consist in the configuration and motion of parts, this very privileged status •it has compared with other forms shows that its nature is quite different from theirs; and this difference in nature opens the easiest route to demonstrating that the soul is immaterial and immortal, as can be seen in the recently published *Meditations on First Philosophy*. Thus one can't think of any opinion on this subject that is more congenial to theology.'

[Then a dense and difficult paragraph in which Descartes, like a juggler, has in the air all at once •substantial forms, •real qualities [see Glossary], •principles [see Glossary] of actions, •physical structures, and •states of faith.]

'All the arguments to prove substantial forms could be applied to the form of a clock, which nobody says is a substantial form.

'The arguments or physical proofs that would (I think) force a truth-loving mind to abandon substantial forms are mainly the following two *a priori* metaphysical or theological ones. It is inconceivable that a substance should come into existence in any way other than being created by God; but we see that so-called "substantial forms" come into existence all the time; yet the people who think they are substances don't believe that they're created by God; so their view is mistaken. This is confirmed by the example of the soul, which is the true substantial form of man. The only reason why the soul is thought to be immediately created by God is that it is a substance. Hence, since the other "forms" are not thought to be created in this way, but merely to emerge from the potentiality of matter, they shouldn't be regarded as substances. It is clear from this that it is not those who deny substantial forms but those who affirm them who "can be forced by solid arguments to become either beasts or atheists". . . .

'The second proof is drawn from the purpose or use of substantial forms. They were introduced by philosophers solely to account for how natural things behave—they were supposed to be the principles and bases for the behaviour. But no natural action can be explained by these substantial forms, because their defenders admit that they are "occult" and that they themselves don't understand them. Their saying that some action proceeds from a substantial form amounts to saying that it proceeds from something they don't understand—which doesn't explain anything! So these forms are not to be introduced to explain the causes of natural actions. Essential forms explained in my fashion, on the other hand, give manifest and mathematical reasons for natural actions, as can be seen with regard to the form of common salt in *Meteorology*.' And at this point you can bring in what you say about the movement of the heart,

'I affirm that human beings are made up of body and soul, not by the mere presence or proximity of one to the other, but by a true substantial union. (This does naturally require the body to have an appropriate positioning and arrangement of the various parts; but the union doesn't consist in mere positions and shapes—mere ·*inter-locking*·—because it involves not only the body but also the soul, which is incorporeal.) The idiom I used is perhaps unusual, but I think it is not a bad way of getting across my meaning. When I said that a human being is an *ens per accidens*, I meant this only in relation to its parts, the soul and the body; I meant that for each of these parts it is *in a way* accidental for it to be joined to the other, because each can subsist apart, and that's what we all mean by "accident"—something that can be present or absent without the subject ceasing to exist. But if a human being is considered in himself as a whole, we say of course that he is a single *ens per se* and not *per accidens*; because the union joining a human body to a soul is not accidental but *essential* to the human being, because without it he wouldn't be a human being. But of the two mistakes that can be made in this area—

(i) thinking that the soul is not really distinct from the body,

(ii) admitting that they are distinct while denying their substantial union,

—many more people are guilty of **(i)** than are guilty of **(ii)**. Thus, to refute those who believe souls to be mortal it's more

important to teach the distinctness of parts in a human being than to teach their union. So I thought I would please the theologians more by saying that a human being is an *ens per accidens* to make the distinction than by saying that he is an *ens per se* to emphasize the union of the parts.'

to Huygens, 31.i.1642:

A few days ago I received the Jesuits' paper [the seventh set of objections, by Bourdin]. It is now a prisoner in my hands, and I want to treat it as courteously as I can; but I find it so guilty that I see no way of saving it. Every day I call my council of war about it, and I hope that before long I'll be able to show you the transcript of the trial.

Perhaps these scholastic wars will lead to my *World*'s being brought into the world. It would be out already, I think, if it weren't that I want to teach it to speak Latin first. I shall call it *Summa Philosophiae*—·echoing Aquinas's *Summa Theologica*·—to ease its acceptance by the scholastics who are now persecuting it and trying to smother it before its birth. The ·Protestant· ministers ·in Holland· are as hostile as the Jesuits.

⊕ [2.ii.42 and 7.ii.42: Regius writes to Descartes two letters that we don't have, though we know their content. The first says that Regius had adopted an extremely moderate tone in writing against Voetius, and is surprised by Descartes's tone. He is sure that any response to Voetius would be badly received, and thinks that the mild manner recommended by Descartes would be read as mockery. When someone has risked his career in the defence of Descartes's philosophy, Regius says, it would be imprudent and unjust of Descartes to leave him dangling in the wind [not his phrase]. He adds three bits of anecdotal evidence that Voetius is plotting against him. The second letter reports that Regius's response to Voetius is about to be published, and that two copies of it will be sent to Descartes.]

[Regius's reply to Voetius was published on 16.ii.42. Voetius prevailed on the magistrates of Utrecht to order the work to be suppressed and to forbid Regius to teach anything but medicine.]

to Regius, late ii.1642:

As far as I hear from my friends, everyone who has read your reply to Voetius praises it highly—and very many have read it. Everyone laughs at Voetius and says he has become desperate, as witness his calling on your magistrates to help in his defence. As for substantial forms: everyone is denouncing them, and it's being openly said that if all the rest of our philosophy were explained in the manner of your reply, everyone would embrace it. You shouldn't be upset that you are forbidden to lecture on physics; indeed, I would prefer it if you had been forbidden even to give private instruction ·on physics·. All this will bring honour to you and shame to your adversaries. If I were one of your magistrates and wanted to destroy Voetius, I would act exactly as they are acting—and who knows what they have in mind? [Further words of encouragement, and advice to follow carefully the commands and advice of Van der Hoolck.]

⊕ [5.iii.42: Regius writes to Descartes, reporting on the various legal devices Voetius is resorting to in an attempt to block the publication of Regius's defence of Descartes's philosophy. He begs Descartes to use his influence with Van der Hoolck to 'turn aside this tempest that is threatening our philosophy and my person'.]

⊕ [iii.42: Descartes writes to Regius, six pages of Latin, offering congratulations on being one of those who suffer in the interests of the truth, and expressing firm confidence that eventually Regius and the truth will triumph.]

to Mersenne, iii.1642:

. . . .On the matter of my bearing public witness to my being a Roman Catholic, it seems to me that I have already done so very explicitly several times, for example in the dedication of my *Meditations* to the gentlemen of the Sorbonne, in my explanation of how the forms remain in the substance of the bread in the Eucharist, and elsewhere. I hope that my residence in this country isn't going to give anyone grounds for thinking badly of my religion, seeing that this country is a refuge for Catholics—as witness the Queen who arrived here recently and the Queen who is said to be returning to here shortly. [That refers to Henrietta Maria, wife of Charles I of England and Scotland, and Marie de Medici, Queen Mother of France.]

I'm sending you the first three sheets of Bourdin's objections [the seventh set]. I can't yet send you the rest because of the publisher's negligence. Please keep the manuscript copy that you have, so that he can't say that I have changed anything in his copy, which I was careful to have printed as accurately as possible. You may be surprised that I accuse him of such duplicity; but there's worse to come, as you'll see. I have treated him as courteously as I possibly could, but I have never seen a paper so full of faults. I hope to keep his cause separate from that of his colleagues, so that they can't bear me any ill-will unless they want openly to declare themselves enemies of the truth and partisans of slander.

I have looked in St Augustine for the passages you mentioned about Psalm 14; but I can't find them, or anything about that Psalm. I have also ransacked the errors of Pelagius, to discover why people say that I share his opinions, about which I have known nothing until now. I'm surprised that those who want to slander me should seek such false and far-fetched pretexts. Pelagius said that it was possible without grace to do good works and merit eternal life, and this was condemned by the Church; I say that it's possible to know by natural reason that God exists, but I don't say that this natural knowledge by itself, without grace, merits the supernatural glory we expect in heaven. On the contrary, it's evident that since this glory is supernatural, more than natural powers are needed to merit it. I have said nothing about the knowledge of God except what all the theologians also say. It should be noted that what is known by natural reason—that he is all-good, all-powerful, all-truthful, etc.—may well serve to prepare infidels to receive the Faith, but it isn't enough to enable them to reach heaven. For that it is necessary to believe in Jesus Christ and other revealed matters, and that belief depends upon grace.

I see that my writings are easy to misunderstand. Truth is indivisible, so the slightest thing that is added or taken away falsifies it. Thus, you quote as an axiom of mine: *Whatever we clearly conceive is or exists*. That's not my view. What I *do* hold is that whatever we perceive clearly is true, and so it

- does exist if we perceive that it can't *not* exist; and
- can exist if we perceive that its existence is possible.

For although the objective [see Glossary] being of an idea must have a real cause, it is not always necessary that this cause should contain it formally [see Glossary], but only eminently.

[A paragraph about the doctrine of transubstantiation. Mersenne had told Descartes that in 1418 Wycliffe was condemned by the Council of Constance for denying that doctrine. Descartes says that this doesn't touch him because. . . well, the reason he gives is obscure, but at the heart of it is this: the only negative thing he has said about transubstantiation is that it shouldn't be interpreted in terms of 'real accidents' [see Glossary] passing into or out of the sacramental bread and wine; and the Church's Councils have never taken any stand on real accidents. Then a final paragraph about the 'impudence' of Voetius.]

⊕ [iii.42: Descartes writes to Pollot about recent events at the University of Utrecht. He doesn't believe rumours that Regius has been fired, but he knows that the situation is bad: there's now a law that no philosophy but Aristotle's may be taught in the University. Descartes's friends should be careful not to write to him anything that couldn't be seen by everyone, and he will do the same. 'Above all, I beg you not to make enemies on my account; I am already too indebted to you without that.']

⊕ [31.iii.42: Regius writes to Descartes about events at the University of Utrecht.]

⊕ [iv.42: Descartes writes to Regius in reply, urging him to stay cheerful: his enemies at the University are making public fools of themselves; Regius can make them look even worse by dealing with any requests to explain his views by saying that his lips are 'sealed by university law', and before long he'll be restored to a properly free teaching position and a place of greater honour than he had before.]

⊕ [4.iv.42: Regius writes to Descartes: more of the same.]

to Huygens, 26.iv.1642:

I have asked van Surck to present you with a copy of the Amsterdam edition of my *Meditations*. The book isn't worth your reading more than once, and I know that you have seen it already, but still I wouldn't be happy with myself if I failed to send you a copy. Also, this edition is more correct than the Paris one, and even a little larger, chiefly at the end of my reply to the Fourth Objections, where I let myself go so far to say that the common view of our theologians about the Eucharist is less orthodox than mine. This was a passage that Mersenne had cut out ·of the first edition· so as not to offend our learned doctors.

⊕ [26.v.42: Huygens writes to Descartes, wanting to interest him in trying to think up a good design for an inexpensive way of raising water, this being 'a matter of great importance in these Netherlands'.]

to Regius, vi.1642:

I am delighted that my account of the Voetius affair has pleased your friends. [That was in a letter to Dinet, published along with the Objections (and Replies) to the *Meditations*.] I haven't seen anyone, even among the theologians, who doesn't seem to approve of the thrashing ·I gave him·. My account can scarcely be called too hard on him: everything I recorded is simple fact, and I wrote at much greater length against one of the Jesuit fathers [Bourdin].

I have briefly read what you sent me; it is all excellent and highly pertinent, except for the following few points.

First, in many places the style is not sufficiently polished.

Apart from that, where you say 'matter is not a natural body' I would add 'in the view of those who define "natural body" in this way'. For since we believe it is a true and complete substance, I don't see why *we* would deny that matter is a natural body.

You seem to imply that •living things are more unlike •lifeless things than •clocks or other automata are unlike •keys or swords or other non-self-moving appliances. I don't agree. But just as 'self-moving' is a genus that includes all machines that move of their own accord and excludes others that are not self-moving, so also 'life' can be taken as a genus that includes the forms of all living things.

[A paragraph on a minor point, and another advising a little more caution in how things are said. Then:]

As for the difficulty you raise concerning the idea of God, it's important to bear in mind that what's at issue here is not

(i) the essence of the idea considered only as a mode of the human mind, but

(ii) the idea's objective [see Glossary] perfection.

·There's nothing specially glorious about **(i)**: it's a mode or state of a human being and is therefore· no more perfect

than a human being. ·But **(ii)** is indeed glorious—it's the perfection that the idea of God *represents*—and· the principles of metaphysics teach us that this must be contained formally or eminently [see Glossary] in the cause of the idea. If someone said 'Anyone can paint pictures as well as Apelles, because they're only patterns of paint and anyone can make those', the right reply would be that when we talk about Apelles' pictures our topic is not a mere pattern of colours, but a pattern skillfully made to represent reality, such as can be produced only by those very practised in this art.

My reply to your second point is this. You agree that thought is an attribute (of a substance) that contains no extension, and conversely that extension is an attribute (of a substance) that contains no thought. [The parentheses are added so as to make sure that the 'which contains. . . ' clause refers back to the attribute, not the substance.] So you must also agree that a thinking substance is distinct from an extended substance. Our only sign that one substance differs from another is that we understand one apart from the other; ·and this *does* show that they are two substances, not one; because· God can surely bring about whatever we can clearly understand. The only things that are said to be impossible for God to do are ones that involve a conceptual contradiction, i.e. that are not intelligible. But we can clearly understand a thinking substance that isn't extended, and an extended substance that doesn't think, as you agree. So however strongly God conjoins and unites them, it's not possible for him to deprive himself of his omnipotence and lay down his power of separating them; so they remain distinct.

[Finally, Descartes mentions a literary reference of Regius's that he doesn't get, and signs off with warm good wishes to Regius and his wife and daughter.]

⊕ [summer 42: Regius writes to Descartes with a long recital of the series of events at the University of Utrecht.]

⊕ [7 ix.42: Descartes writes to Bourdin, expressing surprise at the tone of Bourdin's latest response, and saying that if Bourdin publishes that response he should publish with it the texts of Descartes's that it responds to, as Descartes did with the Seventh Objections to the *Meditations*.]

to Pollot, 6.x.1642:

I have already heard so many remarkable reports of the outstanding intelligence of the Princess of Bohemia that I'm less •surprised to learn that she reads books on metaphysics than I am •proud that she has read and approved of mine. Her judgement means much more to me than does that of those learned doctors whose rule is to accept the truth of Aristotle's views rather than the evidence of reason. I shan't fail to come to The Hague as soon as I hear that you have arrived, so that with your help I may have the honour of paying my respects to the Princess and putting myself at her disposal. Since I hope that this will be soon, I will put off till then the opportunity of engaging in further discussion with you, and expressing my thanks for all the ways in which I am bound to you. [A considerable correspondence between the philosopher and the princess began, with a letter by her, exactly one year after this. None of these 60 letters are included here; they constitute a separate item on the website at www.earlymoderntexts.com,]

⊕ [7.x.42: Huygens writes to Descartes, enclosing a book which he had been asked to send on to Descartes, and reporting the recent death of his brother.]

to Huygens, 10.x.1642:

I spent yesterday reading ·Thomas White's· dialogues entitled *On the World*, which you kindly sent me; but I haven't noticed any passages where he seems to be trying to contradict me. In the passage where he says that better telescopes than the

ones we have *can't* be constructed, he speaks so favourably of me that it would be bad-tempered of me to object. It's true that some of his views are very different from mine, but he doesn't seem to have me in mind when he expresses them, any more than he does when expressing views that agree with what I have written. I'm happy to allow every writer the freedom that I want for myself—the freedom to write frankly whatever he believes to be the most true, without worrying about whether it agrees or clashes with anyone else's views. I find many good things in his third dialogue; but in the second, where he tries to imitate Galileo, I think all the material is too complicated to be true, because nature employs only means that are very simple. I wish there were many books like this; they could prepare people's minds to accept other opinions than those of the Schoolmen, without (I think) harming my own.

For the rest, I am doubly obliged to you, Sir, because neither your personal distress nor the many occupations that I'm sure it has given you has prevented you from thinking of me and taking the trouble to send me this book. I know that you have a great affection for your family and that the loss of any of them must be extremely painful for you. I know also that you have great strength of mind and are familiar with all the remedies that can lessen your sorrow. But I can't refrain from telling you of one that I have always found most powerful, not only to •enable me to bear the death of those I have loved but also to •prevent me from fearing my own death—though I love life as much as anyone. It consists in *thinking about the nature of our souls*. They last longer than our bodies, and are born to enjoy pleasures and felicities much greater than those we enjoy in this world; I think I know this so clearly I can't conceive that those who die don't pass to a sweeter and more tranquil life than ours. We shall go to find them some day, while retaining our memory of the past (I think we have an intellectual memory that is certainly independent of the body). And although religion teaches us much on this topic, I confess to having a weakness that most of us have: although we want to believe all that religion teaches—although we think we *do* firmly believe it—we are not usually so moved by •it as by •what we are convinced by very evident natural reasons.

⊕ [13.x.42: Descartes writes to Mersenne: troubles with the mail; books and papers received; White's book with its praise of Descartes ('I blushed'); regret over the news that the philosopher Kenelm Digby 'has been arrested by the parliament in England'; criticisms of the diagrams in Descartes's *Optics* ('ignorance or puerile hostility'); a few other things.]

⊕ [20.x.42: Descartes writes to Mersenne, two pages on the physics of smoky chimneys; water-spouts ('answering your question would require experiments that I haven't done'); 'You haven't told me anything about what is being said in Paris about my reply to Bourdin's Seventh Objections.']

⊕ [17.xi.42: Descartes writes to Vatier, expressing gratitude for Vatier's support, and saying that he hopes to be on good terms with the Jesuits generally, despite Bourdin.]

⊕ [17.xi.42: Descartes writes to Mersenne, reporting that Vatier had been wrongly reported as opposed to him, and has written to him saying 'I must confess that you have, using your principles, clearly explained the mystery of the Holy Sacrament without resorting to any "real accidents"'; some ideas about what happens when water is poured into wine; and about the physics of projectiles.]

⊕ [7.xii.42: Descartes writes to Mersenne about Voetius's just-published book attacking him. It doesn't merit a reply, he says, except that many good people would be unhappy and perplexed if they read this attack and had nothing to put up against it. He accuses Voetius of telling lies about—among other things—Mersenne's own attitude to Descartes. Then a few remarks about some questions in physics.]

⊕ [4.i.43: Descartes writes to Mersenne with thanks for a letter Mersenne has written to Voetius on Descartes's behalf, comments on a friendly letter from Dinet, and remarks about an experiment Mersenne has conducted to determine the relative weights of air and water. Regarding this last, many more experiments are needed; it would be helpful if 'the Cardinal [Richelieu, who died a month earlier] had left you two or three of his millions to pay for them!']

⊕ [14.i.43: Descartes writes to Huygens about a book Huygens has sent him, which he doesn't admire, and about a reported kind of stuff that turns towards the sun, night and day.]

⊕ [2.ii.43: Descartes writes to Mersenne with comments on a heat experiment Mersenne has conducted and questions about the force needed to rarefy and to condense air; an explanation of why air rushes into bellows when they are opened; permission for Mersenne to make, in his own writings, what use he pleases of anything that Descartes has written; comments on the physics of speed; no need to see Fermat's latest geometrical work; printing of the *Principles of Philosophy* will start this summer, but when it will be finished is up to the publishers.]

to Picot, 2.ii.1643:

I hope you will find Touraine to your liking. That is a beautiful countryside, though I'm afraid that the minor nobility will be intrusive there, as it is in most of France. For myself, I would rather acquire property in a bad region than in a good one, because for the same money I could have a much bigger property, which would help to protect me from being inconvenienced by my neighbours. But, that aside, it's very nice to have neighbours who are good people [*honnêtes gens*], and as an example of that I cite M. de Touchelaye, whom you will surely find to be an excellent neighbour.

⊕ [18.ii.43: Descartes writes to Huygens, responding to his 26.v.42 request for help with the problem of raising water. 'I don't much trust experiments that I haven't done myself, so I have had a 12ft pipe made for this purpose; but I have so few hands, and the workers are so bad at doing what they are told to do, that I haven't been able to learn anything except. . . '—followed by a dozen pages of detailed discussion of the theory and possible practice of pumping water. AT [see Glossary] say that this letter is 'especially remarkable because it presents the theory of liquid-flow that is ordinarily credited solely to Torricelli'.]

⊕ [23.ii.43: Descartes writes to Mersenne, wanting to ensure that the head gardeners at Luxembourg and the Tuileries are paid for the designs they have produced, and that the money ultimately comes from Descartes. Then five pages on the physics of the movement of water.]

⊕ [23.iii.43: Descartes writes to Mersenne, with an initial page of exasperated comment on the erratic performance of the mail system, connected with his not knowing who has read what, which letters have been replied to, etc. Then six pages of physics, and a PS about the foolishness of Bourdin.]

to Colvius, 23.iv.1643:

I'm most grateful for the astronomical news that you have kindly sent me; it was all new to me; I hadn't heard a word about it before your letter came. But since then I have heard from Paris that Gassendi, who has inherited Galileo's famous (good) telescope, used it in exploring these five new planets of Jupiter and concluded that really they are five fixed stars which the good Father Rheita had mistaken for planets. It won't be hard to discover the truth about that. ·And the answer won't be overwhelmingly big news, because· the previous discovery of four planets of Jupiter caused so much amazement that it hardly be increased by the discovery of five more!

When your letter arrived I was engaged in a description of the heaven [see Glossary] and especially of the planets, but I had to set that aside for a few days. For one thing, I was

on the point of moving from here to a place close to Alcmar op de Hoef, where I have rented a house; also, I had in my hands a book *On the Cartesian Philosophy* (you may have heard of it), which is said to be written by Voetius, and I scrawled away trying to defend myself against the insults that are launched at me from all over the place. I'm sure that people with honour and conscience will find my cause so just that I'm not afraid to submit it to your judgment, although I am in a struggle with a member of your profession.

to Mersenne, 26.iv.1643:

[This letter responds to Mersenne's question whether two missiles of equal matter, size and shape must travel the same distance if projected at the same speed in the same direction through the same medium.] I have to set out two principles of physics before I can answer your questions. ·Strictly speaking: one view of mine about the principles of physics, and one principle·.

The first is that I don't suppose there are in nature any *real qualities* [see Glossary] that are •attached to substances like so many little souls to their bodies and •separable from them by divine power; so I don't attribute to motion, and all the other modifications of substance that are called 'qualities', any more reality than is commonly attributed by philosophers to *shape*, which they call only a 'mode' and not a 'real quality'. My main reason for rejecting these 'real qualities' is that I don't see that the human mind has any notion or specific idea to conceive them by; so that when we talk about them and assert their existence we don't understand what we are saying. A secondary reason is that the philosophers posited these real qualities only because they thought they needed them to explain all the phenomena of nature, whereas I find on the contrary that the phenomena are better explained without them.

The other principle is that whatever is—whatever exists—remains in the same state unless and until some external cause changes it; so that I don't think there can be any *quality* or *mode* that perishes of itself. If a body has a certain shape, it keeps it unless it loses it through a collision with some other body; and in the same way if a body is moving, it must continue to move unless it is stopped by some external cause. I prove this by metaphysics, thus:

> God, who is the author of all things, is entirely perfect and unchangeable; so it strikes me as logically absurd to suppose that any simple thing that exists, and so has God for its author, should have in itself the principle [see Glossary] of its own destruction.

Qualities such as heat and sound aren't a difficulty for this view; they are only motions in the air, where they encounter various obstacles that make them stop.

Since motion is not a *real quality* but only a *mode*, it can be conceived only as the change by which a body leaves the vicinity of some other bodies; and there are only two kinds of change to consider—change in its •speed and change in its •direction. This change can come from various causes, but if these causes impel it in the same direction with the same speed, it's impossible that they should give it any difference of nature.

That's why I believe that

> if two missiles that are equal in matter, size and shape set off with the same speed in the same medium and along the same line in the same direcion, neither could go further than the other'

[The letter continues with three pages on the physics of collisions.]

to Huygens, 24.v.1643:

Mersenne seems to think that I'm still a soldier and am on active service with you: he has written letters to you and addressed them to me! The one I'm sending with this has been a long time reaching me, and I don't know when it will get to you. The main thing is that there's nothing of importance in it (it was open when it reached me, so I took the liberty of reading it). I see that it is mainly about the properties of magnets; I'll add my advice to Mersenne's on this topic, so that this letter will have some content.

I think I have already told you that I explain all the properties of magnets by means of a very subtle and imperceptible kind of matter which •emerges continuously from the earth, not just from the pole but from every part of the Northern hemisphere, and •moves southward and immediately re-enters the earth in every part of the Southern hemisphere. There's a corresponding kind of matter that emerges from the earth in the Southern hemisphere and re-enters the earth in the north. The particles of these two kinds of matter are shaped in such a way that

- •they can't easily pass through the gaps in air or water or many other kinds of body; and
- •the pores of earth and of magnets that let through the particles coming from one hemisphere can't be entered by those from the other.

I think I demonstrate all this in my Physics [*Principles of Philosophy*], where I explain the origin of those kinds of subtle matter, and the shapes of their particles, which are long and spiralling like a screw—the northern ones twisting in one way and the southern ones in the other. [He then goes on to apply this theory in explaining the behaviour of compass-needles.]

to Voetius, v.1643:

[This open letter, published in Latin and in Flemish, was about 200 pages long. The present version will present the parts selected for translation by CSMK, with gratitude to its editors for making the selection.]

. . . .Even if the philosophy that you are raging against were unsound—which you haven't shown and never will—how could it possibly be bad enough to require that its author be slandered with such atrocious insults? The philosophy that its other devotees and I are working on is nothing but knowledge of the truths that can be perceived by the natural light and can benefit mankind; so that no study can be

- •more honourable,
- •more worthy of mankind, or
- •more beneficial in this life

than this one. In contrast with that, the philosophy ordinarily taught in the Schools and universities is merely a collection of opinions—mostly *doubtful* opinions, as is shown by the continual debates in which they are thrown back and forth. They are quite useless, too, as long experience has shown to us: no-one has ever derived any practical benefit from 'prime matter', 'substantial forms', 'occult qualities', and the like. It's just not reasonable for those who have learned such opinions, which even they admit are uncertain, to condemn others who are trying to discover more certain ones. It is certainly bad to want to innovate in matters of religion; everyone says he believes that his own religion was instituted by God, who cannot err; so he believes that any innovation must be bad. But philosophy ·is different·; everyone readily admits that men don't yet know enough in philosophy, and its scope can be expanded by many splendid discoveries; so in philosophy there is nothing more praiseworthy than to be an innovator. . . .

You say that any prospective disciple of mine must first 'forget all he has learned from others'. Yet in all the passages you cite there's not a word of 'forgetting' but only of removing prejudices—nor is 'forgetting' talked about anywhere else in my writings; so the reader will easily judge how much faith to place in your citations. It is one thing to set aside prejudices, i.e. to **stop assenting to** opinions that we rashly accepted on a previous occasion; this depends merely on our will—·i.e. it's something we can effectively *choose* to do·—and it is wholly necessary in order to lay the first foundations of philosophy. But it is something else entirely to **forget** such opinions, which is hardly ever in our power. . . .

I have read many of your writings, but have never found any reasoning in them, or any thought that isn't base or commonplace—nothing that suggests someone who is intelligent or wise.

I say 'wise', not 'learned', for if you take 'learning' to cover everything learned from books, good or bad, I'll gladly agree that you are the most learned of men. . . . By 'wise' I mean the man who has improved his intelligence and character by careful study and cultivation. Such education is, I am convinced, to be acquired not by indiscriminately reading book after book, but by •reading only the best books and re-reading them *often*, by •taking every opportunity for discussion with those who are already wise, and by •continually contemplating the virtues and pursuing the truth. Those who seek wisdom from standard texts and indexes and concordances can cram a lot into their memories in a short time, but this doesn't make them wiser or better people. There's no chain of reasoning in such books; everything is decided either by appeal to authority or by short summary syllogisms; and those who try to learn from these sources become accustomed to placing equal trust in the authority of any writer; so little by little they lose the use of their natural reason and put in its place an artificial and sophistical reason. For notice that the true use of reason, which is the basis of all education, all intelligence and all human wisdom, consists not in isolated syllogisms but only in scrupulously and carefully taking account of everything required for knowledge of the truths we are seeking. This can hardly ever be expressed in syllogisms, unless many of them are linked together; so those who use only isolated syllogisms are bound to leave out some part of what needs to be looked at as a whole, and thus grow careless and lose the use of a mind that is in good order. . . .

·You claim that in my philosophy· God is thought of as a deceiver. This is foolish. Although in my First Meditation I spoke of a supremely powerful deceiver, I wasn't there working with the conception of the true God because—as you yourself say—it is impossible that the true God should be a deceiver. If I ask you how you know this to be impossible, you must answer that you know it from the fact that 'God is a deceiver' implies a conceptual contradiction, i.e. can't be conceived. So the very point you made use of to attack me is sufficient for my defence. . . .

You deny that anyone can rightly argue 'I am thinking, therefore I exist'; all the sceptic can conclude, you say, is that he *seems to himself* to exist—as if anyone using his reason, however sceptical he might be, could 'seem to himself' to exist without at the same time understanding that he really exists whenever this seems to him to be the case. You are denying what is the most evident proposition there could possibly be in any science. . . .

You claim that my arguments to prove God's existence have force only for those who already know he exists, because they depend entirely on notions that are innate within us. But when the knowledge that P is said to be naturally implanted in us, this doesn't mean that we explicitly and

openly know that P; all it means is that we can come to know that P by the power of our own intellect, without any sensory experience. All geometrical truths are of this sort—not just the most obvious ones, but all the others, however abstruse they appear. Plato reports Socrates asking a slave boy about the elements of geometry, thereby getting the boy to dig out certain truths from his own mind—truths that he hadn't realised were there. . . .

You say that my way of philosophising opens the way to scepticism. . . .because I won't accept as true anything that isn't so clear that it leaves no room for doubt; and you say that not even truths known by faith meet this standard, since we very often have occasion to doubt them. [The next sentence goes beyond Descartes's wording in ways that can't be shown by ·small dots· etc.; but it is true to the point he is making.] If you are equating 'P is open to doubt' with the possibility that one might have doubts about P at some particular time when it comes into one's conscious mind, then you are destroying all faith and all human knowledge, because it's impossible ever to have any cognition that isn't 'open to doubt' in *that* sense; so it's you who are the sceptic! Of course someone who at one time has true faith or evident cognition of some natural thing may at another time not have it—this merely shows the weakness of human nature, since we don't always remain fixed on the same thoughts. It doesn't follow that there's any doubt in the knowledge itself. So you don't establish anything against me; for I was speaking not of any certainty that would endure throughout an entire human life, but only of the kind of certainty that is achieved at the moment when some piece of knowledge is acquired. . . .

You say that 'René may rightly be compared with that cunning champion of atheism, Cesare Vanini, because he uses the very same techniques to erect the throne of atheism in the minds of the inexperienced.' Everyone will marvel at the absurdity of your impudence!. . . . Even if it were true (and I strongly deny that it is) that I replace the common traditional arguments by ones that have been found to be invalid, it still wouldn't follow that I should be even suspected—let alone guilty—of atheism. Anyone who claims to refute atheism and produces inadequate arguments should be accused of incompetence, not face a summary charge of atheism. . . ,

Your approach to all this implies that Thomas Aquinas (who was further than anyone from the slightest suspicion of atheism) should also be compared with Vanini, because his arguments against the atheists have turned out on close examination to be invalid. Indeed (if I may be forgiven for saying so) comparing him with Vanini would be more apt than comparing me with him, because my arguments have never been refuted as his have. . . .

I don't doubt that some day my arguments, despite all your snarling, will have the power to call back from atheism even those who are too slow-witted to understand them; because they'll know that •the arguments are accepted as the most certain demonstrations by all those who understand them properly, i.e. by all the brightest and wisest people, and that •although they are looked at askance by you and many others, no-one has been able to refute them. . . .

It won't do you any good to call me 'a foreigner and a papist'. You don't need me to tell you that the treaties between my King and the rulers of the Netherlands are such that, even if this were my first day in your country, I would be entitled to enjoy the same rights as those who were born here. But I have spent so many years here, and am so well known by all the more honourable citizens, that even if I had come from a hostile country I would have stopped being regarded as a foreigner long ago. Nor do I need to appeal to the freedom of religion that is granted us in this republic. I merely declare that your book contains such criminal lies,

such scurrilous insults and atrocious slanders, that a man couldn't launch them against his enemies, or a Christian against an infidel, without standing convicted of wickedness and criminality. I may add that I have always experienced such courtesy from the people of this country, have been received in such a friendly manner by all those I have met, and have found everyone else to be so kind and considerate and so far removed from the coarse and impertinent freedom with which you indiscriminately attack people whom you don't know and who have done you no harm, that I'm sure the people will feel more aversion towards you, their compatriot, than they would towards any foreigner. . . .

⊕ [30.v.43: Descartes writes to Mersenne about mailing arrangements now that Descartes is living in Amsterdam, and about recent experiments with magnets and pendulums.]

⊕ [6.vi.43: Huygens writes to Descartes about Mersenne's mistake in mailing things to Huygens via Descartes, his 'indignation' that Descartes has used some of his precious time to copy a recent contribution by Huygens to a literary controversy, and Descartes's letter to Voetius. It gave Voetius a whipping, he says, and it was deserved; but he warns Descartes that he will have opponents because theologians tend to stick up for one another.]

⊕ [9.vi.43: Colvius writes to Descartes expressing admiration, and outraged indignation over Descartes's treatment by Voetius and others.]

to Vorstius, 19.vi.1643:

[Vorstius has written asking for Descartes's views about spirits in the human body. Descartes, pleased with this letter, says he will respond 'in a few words'.]

You know that in my physics everything is done in terms of the sizes, shapes, positions and movements of the particles that bodies consist of. ·I use the notion of *particle* because· although every body is infinitely divisible ·so that there are no atoms·, there's no doubt that a body is more easily divided into some parts than into others. Medical men are well aware of this; they often say that some bodies have thin parts, and others thick parts, and so on.

You also know that from the fact that

- a vacuum is impossible

and the further fact that

- many small pores are to be seen in all terrestrial bodies,

I infer that

- those pores are filled with a certain subtle matter.

And I hold that this subtle matter differs from terrestrial bodies only in being made up of much smaller particles that •don't stick together and •are always moving very fast. And as a result of this, when they pass through the pores in terrestrial bodies and collide with the particles the bodies are composed off, they often make the particles vibrate, or even push them apart and sweep some of them away.

The particles that are swept away by the subtle matter in this fashion make up •air, •spirits and •flame. Air is very different from flame in that the. . . .particles that make up flame move much faster than those that constitute air. The spirits are intermediate between the two: they are more agitated than the particles in calm air, and less than those of flame. And since there are infinitely many intermediate steps between a slow motion and a fast one, we can take 'spirit' to apply to every body consisting of terrestrial particles that are swimming in subtle matter and are more agitated than the ones that make up air, but less agitated than those that make up flame.

It's easy to demonstrate that the human body contains many such spirits. First, in the stomach there's a solution of nutrients subjected to heat; and heat is nothing but a greater

than usual agitation of material particles, as I explained in *Meteorology*. And the spirits are created from the particles of terrestrial bodies that are the easiest to pull apart. So there must be a large quantity of spirits from the food contained in the stomach passing into the veins along with the chyle; these are called *natural spirits*.

These spirits are increased in the liver and in the veins by heat—i.e. by the agitation occurring there. While the chyle is turning into blood, many of its particles separate off, creating more spirits. When this blood then comes into the heart, which is warmer than the veins, it immediately becomes rarefied and dilates. This is the source of the beating of the heart and the arteries; and this rarefaction causes yet more particles of blood to separate off, thus converting them into the spirits that the medical men call *vital spirits*.

The particles of blood leaving the heart by the great artery are agitated in the highest degree and travel straight through the carotid arteries toward the middle of the brain, where they fill its cavities and—once they are separated from the rest of the blood—form the *animal spirits*. What separates them from the rest of the blood (I think) is the fact that the gaps through which they enter the brain are so narrow that the rest of the blood can't get through.

These animal spirits flow from the cavities of the brain through the nerves to all the muscles of the body, where they serve to move the limbs. Finally they leave the body by transpiration [= something like sweating] that can't be detected. Not merely the spirits that passed along the nerves, but also those that merely travelled in the arteries and veins. Whatever leaves the animal's body by this undetectable process of transpiration has to have the form of spirits. So I am very surprised that anyone denies the existence of spirits in animals, unless he is making a merely verbal point and objecting to giving the name 'spirits' to particles of terrestrial matter that are separated from each other and driven about at great speed.

These are my present thoughts on the origin and movement of the spirits; their varieties and relative strengths and functions can easily be inferred from what I have said. There's virtually no difference between *natural* and *vital* spirits, neither of which are separated from the blood. Only the *animal spirits* are pure; but they vary in their effects depending on differences in the particles that make them up. Thus spirits derived from wine and reaching the brain in excessive quantities cause drunkenness; those derived from opium cause sleep, and so on. This is made clearer in chapters 1–3 of my *Meteorology*; that treatment of vapours, exhalations and winds can easily be applied to spirits.

Thank you very much for the friendly role (others have told me about it) that you have played in opposing my detractors. . . .

⊕ [5.vii.43: Descartes writes to Colvius about his troubles with Voetius and the University of Utrecht.]

⊕ [6.vii.43: Descartes writes to the Governors of the University of Utrecht about the troubles Voetius is making for him.]

⊕ [17.x.43: Descartes writes to Graswinckel, passionately thanking him for his support ('I see you as a good angel sent by God to help me'), and asking Graswinckel, as an official of the royal court, to speak to 'the Ambassador' and 'his Highness' the Prince of Orange on Descartes's behalf, so that he can get help in 'escaping the traps that have been set for me'.]

⊕ [17 and 21 and 23.x.43: Descartes writes to Pollot, all three letters concerning the Voetius matter. Similarly the letter of 30.xi.43.]

⊕ [7.xi.43: Descartes writes to Wilhelm, Counsellor of the Prince of Orange, thanking him for help, and expressing anxiety about whether the University of Utrecht is legally able to have Descartes arrested and charged in other parts of the country.]

to Buitendijk, 1643?:

You have asked me with three questions that so clearly indicate the strength and sincerity of your desire for learning that it gives me pleasure to answer them.

[The first sentence of this next paragraph equates a question about what is permissible [*liceat*] with a question about what is naturally permissible [*naturaliter liceat*]. It's a strange equation, and its second term doesn't obviously mean anything. Let us whip past this without worrying; it is Descartes's lead into a discussion in which he cleanly distinguishes what is permissible [*liceat*] from what is possible [*possit*].]

(1) Your first question is whether it is ever permissible to doubt about God, i.e. whether it is naturally permissible to doubt of the existence of God. I think we have to distinguish **(i)** doubt involving the intellect from **(ii)** doubt involving the will. **(i)** The intellect is not a faculty of choice, so we mustn't ask whether something is permissible for it but only whether something is possible for it. Now, there are certainly many people whose intellect *can* doubt ·the existence· of God. This includes all those who can't give an evident demonstration of his existence, even though they have the true faith; for faith belongs to the will, and with that set aside a person with faith can use his natural reason to examine whether there is a God, and thus doubt about God. **(ii)** With the will we have to distinguish doubt as an end from doubt as a means. Anyone who sets out to doubt about God with the aim of persisting in doubt is committing a serious sin by wanting to remain in doubt on a matter of such importance. But someone who embarks on doubt as a means to getting a clearer knowledge of the truth is acting piously and honourably, because nobody can will the end without willing also the means, and in Scripture itself men are often invited to seek this knowledge of God by natural reason. And if someone for the same purpose temporarily puts out of his mind all the knowledge of God that he can have, he isn't committing a sin. We aren't bound to be always having the thought that God exists: that wouldn't permit us to sleep or to do anything else, because every time we do something else we put aside for that time all our knowledge of the Godhead.

(2) Your second question is whether it is permissible to suppose anything false in matters pertaining to God. Here we must distinguish the true God who is clearly known from false gods. Once the true God is clearly known, it's not only not permissible—it isn't even *possible*—for the human mind to attribute anything false to him. (I have explained this in my *Meditations*). But it's not like that with •false divinities,

> i.e. evil spirits, idols, or other such gods invented by the error of the human mind—all these are called 'gods' in Holy Scripture—

or with •the true God, if he is known only in a confused way. Saying something false about any of these as a hypothesis can be either good or bad, depending on whether the purpose of formulating the hypothesis is good or bad. Attributing something hypothetically isn't voluntarily affirming it as true; it's merely proposing it to the intellect as something to be thought about; so it's not strictly good or bad—or if it is, that's because of the purpose for which the hypothesis was framed. Thus, take the case of a person who imagines a deceiving god—even the true God, but not yet clearly enough known this person or to the others for whom he frames this hypothesis. Suppose that he doesn't misuse this fiction for the evil purpose of persuading others to believe something false of the Godhead, but uses it only to enlighten the intellect, and bring greater knowledge of God's nature to himself and others. Such a person absolutely isn't sinning in order that good may come. There is no malice *at all* in his action; what he does is good in itself, and no-one can rebuke him for it except slanderously.

(3) Your third question concerns •the motion which you think I regard as •the soul of brute animals. I don't remember having written that motion is the soul of animals; indeed I have not publicly revealed my views on the topic. But because we usually mean 'soul' as the name of a kind of •substance, and because I think that motion is a •mode of bodies, I wouldn't want to say that motion is the soul of animals. (By the way, I don't admit various kinds of motion, but only local motion, ·i.e. change of place·, which is common to all bodies, animate and inanimate alike.) I would prefer to say with Holy Scripture (Deuteronomy 12:23) that blood is their soul, for blood is a fluid body in very rapid motion, and its more rarefied parts are called spirits. These move the whole mechanism of the body as they flow continuously from the arteries through the brain into the nerves and muscles.

to Father ****, 1643:

[The date and addressee of this letter are in doubt. Clerselier notes that it is addressed to a 'Reverend Jesuit Father'. The phrases 'your Society' and 'your Company' both refer to the Jesuits, 'the Society of Jesus'.]
[Descartes starts this letter by expressing intense pleasure at being allied with such a person as the addressee, because of 'your merit, your Society, and your being a real mathematician'—not merely someone who wants to appear to be a mathematician. That reminds Descartes of Bourdin; he would ask the addressee to reconcile Bourdin to him if he thought there was any chance of success, but there isn't. He continues:] All I want to say to you about him is that I don't regard what has happened between him and me as having *anything* to do with your Company, my infinite obligations to which utterly outweigh the small harm he has done to me. I am even more obliged to you than to the others because of the *alliance* with my brother. [The French *alliance* meant relatedness-by-marriage. Evidently the addressee of this letter was a brother-in-law of one of Descartes's brothers.] For that reason. . . ., I would gladly give you my thoughts about the rise and fall of the tides, but. . . [and he explains that his account requires suppositions that might seem incredible to someone who didn't know the fundamentals of Descartes's physics].

All I can say about the book *De Cive* is that I believe its author [Hobbes] wrote the Third Objections against my *Meditations*, and that I find him to be much abler in moral philosophy than in metaphysics or physics. Not that I could in any way approve his principles or his maxims. They are extremely bad, extremely dangerous, because he supposes that all men are wicked, or gives them reason to be so. His whole aim is to write in favour of the monarchy; but this could be done more effectively and soundly by adopting maxims that are more virtuous and solid than his. And he writes so fiercely against the Church and the Roman Catholic religion that I don't see how he can prevent his book from being censured unless he has someone very powerful on his side.

* * * * * *

[We have about 20 letters that Descartes wrote or received in the second half of 1643; they are variously in Latin, French and Flemish; are mostly from or to his usual correspondents; and mostly concern the legal battle with Voetius. Also 13 letters that he wrote early in 1644. Six are to Pollot; they and some others mainly concern Descartes's troubles with Voetius and the University of Utrecht, though other things also come in—including magnets and a borderline dispute between the Netherlands and France. The present version, like CSMK, skips all these and goes immediately to May 1644.]

to Mesland, 2.v.1644:

I know that it is very difficult to enter into another person's thoughts, and experience has taught me how difficult many people find mine. So I am all the more grateful to you for the trouble you have taken to examine them; and I cannot help thinking highly of you when I see that you have taken such full possession of them that they are now more yours than mine. The difficulties you were kind enough to put to me come rather from •the subject-matter and •defects in my writing than from •lack of understanding on your part. You have in fact provided the solution to the main ones. Still, I'll tell you my views on all of them.

I agree that many physical and moral causes that are **particular and limited** can produce a certain effect but can't produce many others that appear to us less remarkable. Thus one human being can produce another human being, but no human being can produce an ant; and a king who makes a whole people obey him can't always get obedience from a horse. But in the case of a **universal and indeterminate** cause, it seems to be a common notion [see Glossary] of the most evident kind that whatever can do the greater can also do the lesser; this is as evident as the maxim that the whole is greater than the part. Rightly understood, this notion applies also to all particular causes, moral as well as physical. For it would be a greater thing for a human being to be able to produce human beings and ants than to be able only to produce human beings; and a king who could command horses as well would be more powerful than one who could command only his people.

It doesn't matter much whether my second proof, the one based on our own existence, is seen as different from the first proof or merely as an explanation of it. Just as it is an effect of God to have created me, so it is an effect of him to have put the idea of himself in me; and his existence is proved by *any* of his effects. Still, it seems to me that all these proofs based on his effects are reducible to a single one; and also that they are incomplete if •the effects aren't evident to us (that's why I considered my own existence rather than that of heaven and earth, of which I am not equally certain) and if •we don't add to them our idea of God. For since my soul is finite, the only way I can know that the order of causes is not infinite is through the idea I have in myself of the first cause; and even if we admit a first cause that keeps me in existence, I can't say that it is God unless I truly have the idea of God. I hinted at this in my reply to the First Objections; but I did it very briefly so as not to brush aside too briefly the arguments of others who think that a series can't go on for ever. I don't accept that principle; on the contrary, I think that in the division of the parts of matter there really is an endless series, as you will see in my *Principles of Philosophy* II.20, which is now being printed.

I do not know that I laid it down that God always does what he knows to be the most perfect, and it doesn't seem to me that a finite mind can make a judgment about that. But I tried to solve the difficulty about the cause of error on the *assumption* that God had made a perfect world; without that assumption the difficulty about error disappears altogether.

Thank you for pointing out the places where St Augustine can be quoted in support of my views. Some other friends of mine had already done so, and I'm delighted that my thoughts agree with those of such a great and holy man. I'm not one of those who want their views to appear novel; on the contrary, I make my views conform with those of others so far as truth permits me.

The soul differs from its ideas, I hold, in just the way a piece of wax differs from the various shapes it can have. When the wax acquires a certain shape, that is not something

that it actively does but something that it passively has done to it. In the same way, the soul passively receives its various ideas; its only activities are its volitions. It receives its ideas partly from objects that come into contact with the senses, partly from impressions in the brain, and partly from prior dispositions in the soul and from movements of the will. Similarly, the wax owes its shapes partly to the pressure of other bodies, partly to shapes or other qualities that it already possesses (e.g. heaviness or softness), and partly also to its own movement—given that it has in itself the power to continue moving once it has been started.

The difficulty we have in •learning the sciences and in •thinking clearly with the ideas that are naturally known to us arises from the false preconceptions of our childhood, and other causes of error that I have tried to explain at length in *The Principles of Philosophy* I.71–4.

As for memory, I think that the memory of •material things depends on the traces remaining in the •brain after an image has been imprinted on it; and that the memory of •intellectual things depends on other traces remaining in the mind itself. But these are utterly different from the brain-traces, and I can't explain them accurately by any illustration drawn from corporeal things. The traces in the brain, on the other hand, ·are easy to describe schematically·: they dispose the brain to move the soul in the same way as it moved it before, and thus to make it remember something—like the folds in a piece of paper that make it easier to fold again in that way.

The moral error that occurs when we believe something false with good reason—for instance because someone whose authority we trust has told us—doesn't involve there being something missing ·from our make-up·, provided it is affirmed only as a rule for practical action and there's no moral possibility of knowing better. So it isn't strictly an error; it would be one if it were asserted as a truth of physics, because in that context the testimony of an authority is not sufficient.

As for free will, I haven't seen what Petau has written about it in his recently published book; but judging by your account of your opinion on the topic, you and I seem not to be far apart on this topic. First, *please* take in that I didn't say

> •a person is indifferent only if he lacks knowledge,

but rather that

> •the fewer reasons a person knows that impel him to choose one side rather than another, the more indifferent he is;

and I don't think anyone can deny this. I agree with you that we can suspend our judgement; but I tried to explain *how* we can do this. It seems to me certain that

> a great light in the intellect is followed by a great inclination in the will;

if we see very clearly that a thing x is good for us and go on thinking about it, it's hard—actually, in my view it's *impossible*—for us to stop the course of our desire ·for x·. But the nature of the soul is such that it doesn't focus on any one thing for long—hardly for more than a moment—and the result of that is that

> as soon as our attention turns from the reasons that show us that x is good for us, and we have only a memory that it *did* appear desirable to us, we can bring into our mind some other reason to make us •doubt that x is good for us it and thus •suspend our judgement and perhaps even •form a contrary judgement.

Thus, since you regard freedom not simply as indifference but rather as a real and positive power to determine oneself, the difference between your view and mine is a merely

verbal one—for I agree that the will does have such a power. But I don't see that it makes any difference to that power whether it •is accompanied by indifference, which you agree is an imperfection, or •is not so accompanied, when there's nothing in the intellect except light, as in the case of the blessed who are confirmed in grace. I call 'free' in the general sense whatever is voluntary, while you want to restrict the term to the power to determine oneself at a time when one is indifferent. But in matters of wording I wish above all to follow usage and precedent.

As for animals that lack reason, it's obvious that they aren't free because they don't have this **positive** power to determine themselves; what they have is a pure **negation**, namely the power of *not* being forced or constrained.

Why didn't I discuss the freedom that we have to follow good or evil? Simply because I wanted to stay within the limits of natural philosophy, avoiding theological controversies as much as I could. But I agree with you that wherever there is an occasion for sinning, there is indifference; and I don't think that in order to do wrong it is necessary to see clearly that what we are doing is bad. All it takes is to see confusedly that it is bad, or merely to remember that we once judged it to be bad without in any way seeing it, i.e. without attending to the reasons that prove it to be bad. If we saw its badness clearly, it would be impossible for us to sin as long as we went on seeing it in that fashion; that's why they say that *omnis peccans est ignorans* [Latin: 'whoever sins does so in ignorance']. And if we see very clearly what we must do and therefore do it infallibly and without any indifference—as Jesus Christ did throughout his earthly life—there is still merit in that. We can't always attend perfectly to how we ought to act; so when we *do* pay attention to that, so that our will follows the light of our understanding so strongly that there's no longer any indifference at all, that is a good action. Also: I didn't write that grace •prevents indifference, but simply that it •makes us incline to one side rather than to another, and so diminishes indifference without diminishing freedom; from which it seems to me to follow that this freedom doesn't consist in indifference.

I turn to the difficulty of conceiving how God has been free—with no pull either for or against—to make it false that the three angles of a triangle are equal to two right angles, or in general to make it the case that some pair of contradictories are both true. It's easy to dispel this difficulty by considering that **(i)** God's power can't have any limits, and that **(ii)** our mind is finite and created in such a way that it can

- •conceive as possible the things God has wanted to be in fact possible,

but cannot

- •conceive as possible things that God could have made possible but has wanted to make impossible.

From **(i)** we learn that •nothing could *make* God make it true that contradictories can't be true together, and therefore that he could have done the opposite, ·i.e. made it false that contradictories can't be true together·. From **(ii)** we learn that even though this is true, we should not try to comprehend it, because our nature is incapable of doing so. And granted that God has willed that some truths should be necessary, this doesn't mean that he willed this necessarily; for it's one thing to •will that they be necessary and quite another to •will this necessarily, i.e. to •be necessitated to will it. I agree that there are contradictions that are so evident·ly contradictory· that we can't put them before our minds without judging them to be entirely impossible, like the one which you suggest: 'God might have brought it about that his creatures didn't depend on him.' But we shouldn't try to grasp the immensity of his power by putting these

thoughts before our minds. Nor should we think of God's intellect as prior to his will, or vice versa, because ·either of those thoughts distinguishes God's intellect from his will, whereas· our idea of God teaches us that there is in him only a single activity, entirely simple and entirely pure. This is well expressed by Augustine: 'They are so because you (God) see them to be so'; because in God seeing and willing are one and the same thing.

When I distinguish lines from surfaces, and points from lines, I'm distinguishing one mode from another mode; but when I distinguish a body from its surfaces, lines and points, I'm distinguishing a substance from its modes. And there's no doubt that at least one mode belonging to bread remains in the Blessed Sacrament, since its outward shape, which is a mode, remains. As for the extension of Jesus Christ in that Sacrament, I gave no explanation of it because I wasn't obliged to, and I do my best to keep away from questions of theology, especially as the Council of Trent has said that Jesus Christ is present 'with a form of existence that we can scarcely express in words'. I quoted that phrase towards the end of my reply to the Fourth Objections, precisely to excuse myself from giving an explanation. But I venture to say that if people were a little more used to my way of philosophising, they could be shown a way of explaining this mystery that the enemies of our religion couldn't find fault with; it would shut them up.

There's a great difference between abstraction and exclusion. If I said simply that the idea I have of my soul

- doesn't represent it to me as being dependent on the body and identified with it,

this would be merely an abstraction, from which I could form only a negative argument which would be unsound. But I say that this idea

- represents it to me as a substance that can exist even though everything belonging to the body be excluded from it;

and from this I form a positive argument, and conclude that my soul can exist without the body. ·That implies that my soul is not extended·, and this conclusion can be clearly seen in the nature of the soul, as you have observed, from the fact that one can't think of a half of a thinking thing.

to Grandamy, 2.v.1644:

I was extremely pleased to learn of the kind memories you have of me, and to receive Mesland's excellent letters. I shall try to reply to him with the utmost honesty, and without concealing any of my thoughts. But I can't give as much attention to my reply as I would have wished, because the place where I am now [Leiden] gives me many distractions and little spare time. (I have left my previous home so as to arrange passage to France, where I plan to go shortly.) I'll call on you there if at all possible; for I shall be delighted to return to La Flèche, where I spent eight or nine years during my youth. That is where the first seeds of everything I have ever learned were implanted in me, and I am wholly obliged to your Society for this.

If Debeaune's testimony is enough to get my *Geometry* to be respected, although few others understand it, I'm confident that Mesland's testimony will do the same for my *Meditations*, mainly because he has taken the trouble to adapt them to the style that is commonly used for teaching, and I'm deeply obliged to him for doing this. I'm sure that experience will show that nothing in my views should cause teachers to be nervous about them and to reject them; on the contrary, I think they will be found very useful and acceptable

The printing of my *Principles of Philosophy* would have been completed two months ago if the publisher had kept his word. But the drawings have delayed him, for he couldn't get them engraved as soon as he thought he could. But I hope to send you a copy quite soon, unless the wind carries me away from here before they are finished.

⊕ [4.vi.44, and again shortly thereafter: Regius writes to Descartes; we don't have these letters, but Baillet's biography of Descartes reports on their content—issues about the printing of the *Principles of Philosophy*, the translation into Latin of the *Discourse on the Method* and its accompanying essays, facts and rumours about who is on which side in the contest between Descartes and many of his contemporaries, and so on.]

⊕ [29.vii and 18.viii and 11.ix.43: Descartes writes to Picot, mainly about his (Descartes's) travels, including visits to several members of his family.]

to ***, 1644:

[The date and addressee of this letter are in doubt.]
You advise me to refer to Aristotle's *Meteorology* I:7 in my own defence. I was delighted to find this advice in the letter you did me the honour of writing, for I referred to just this passage in my *Principles* 4:204—it is, indeed, my only reference to Aristotle. I see it as a mark of your affection that you advise me to do exactly what I thought I should do!

As for any censure by Rome regarding the movement of the earth, I see no likelihood of that, for I explicitly deny this movement. No doubt people will at first think that because I uphold the system of Copernicus my denial that the earth moves must be a mere verbal trick adopted to keep me out of trouble. But I'm confident that when my arguments are examined it will be found •that they are serious and sound, and •that they show clearly that followers of Tycho Brahe's system are more obliged to say that the earth moves than those who follow the Copernican system—when that is expounded in the way I expound it. Now, if we can't follow either of these systems then we must return to Ptolemy's, and I don't think the Church will ever require us to do this, since it is manifestly contrary to experience. And all the Scriptural passages that go against the movement of the earth are concerned not with the system of the world but only with the manner of speaking about it. Consequently, since I prove that if you follow my system then it isn't strictly correct to say that the earth moves, my account agrees entirely with those passages. Still, I'm much obliged to you for your warning about what may be said against me. . . .

You have understood very well what I wrote concerning the extent of surfaces—namely that the resistance of the air to a given quantity of matter is proportional to the area of its surface. For I don't think there is any such thing as *inertia*, absolutely speaking, i.e. as a property that an individual body can have just in itself; a body's inertia always depends on how it relates to the bodies that surround it. Thus, when I say that the larger a body is, the better it can transfer its motion to other bodies and the less it can be moved by them, my reason is that it pushes them all in one direction; whereas the small bodies surrounding it can never work together well enough to push it at the same instant in the same direction. So their effect on its movement is lessened by the fact that some are pushing it in one way and some in another.

to Charlet, x.1644:

Now that I have finally published the principles of my philosophy—to the annoyance of some people—you are one of those to whom I most desire to offer it: •because I am obliged to you for all the benefits I can get from my studies,

thanks to the care you devoted to my early education; and also •because I know how much you can do to prevent my good intentions from being wrongly interpreted by members of your Society who don't know me. I'm not afraid of my writings' being criticised or scorned by those who examine them; for I'm always very ready to admit my mistakes and to correct them when anyone is kind enough to tell me about them. But I want to avoid, as much as possible, the false preconceptions of those who will form a bad opinion of a bit of philosophy simply on the basis of their knowledge that it was I who wrote it (and did so without completely following the ordinary style). And because I already see that my writings have had the good fortune to be accepted and approved by quite a lot of people, I don't have much reason to fear that my views will be refuted. Indeed I see that those whose common sense is good enough, and who aren't already awash in contrary opinions, are strongly drawn to accept my views. So it seems that with the passage of time these views are sure to be accepted by most people—and, I venture to say, by those with the most sense. I know that people have thought •that my views are new; yet it can be seen here that I don't use any principles that weren't accepted by Aristotle and by everyone who has ever concerned himself with philosophy. People have also imagined •that my aim was to refute the received views of the Schools, and to try to make them absurd; but they will see that I don't discuss them *at all*—I write as though I had never learned them. And people have hoped •that when my philosophy saw the light of day they would find numerous faults in it that would make it easy to refute; for myself, on the contrary, I hope that all the best minds will think my philosophy so reasonable that those who undertake to condemn it will be repaid simply by shame. . . .

⊕ [x.44: Descartes writes to Dinet, sending him a copy of 'the Principles of that unhappy philosophy that some tried to snuff out before it was born'. He thanks Dinet warmly for bringing it about that he and Bourdin have met and that Bourdin seems willing to be friendly.]

to Bourdin, x.1644:

When I had the honour of meeting you, you favoured me with an assurance of continuing good-will, and that leads me to write to you with a request. It is that will receive a dozen copies of my ·*Principles of* Philosophy·, keep one for yourself, and be so good as to distribute the others to those of your colleagues who know of me. I specially ask you to send one or two copies to Father Charlet, and the same to Father Dinet, along with the letters I have written to them; and the others, please, for Father F. (who was once my teacher) and Fathers Vatier, Fournier, Mesland, Grandamy, and so on.

Letters written in 1645–1650

to Charlet, 9.ii.1645:

I'm greatly obliged to Father Bourdin for enabling me to have the good fortune to receive your letters. I'm overjoyed to learn from them that you share my interests and don't find my endeavours displeasing. I was also delighted to see that Bourdin was disposed to view me with favour, which I'll try to deserve in all sorts of ways. Being deeply obliged to the members of your Society—and especially to you for having acted like a father to me throughout my youth—I would be extremely sorry to be on bad terms with any members of the Society that you are the head of in France. I am intensely anxious to have their friendship, from my own inclination and also from my regard for my duty. And there's another reason. In publishing a new philosophy I have followed a path that makes it possible for me to derive so much benefit from their goodwill and so much disadvantage from their lack of interest that anyone who knows that I'm not out of my mind will be sure that I'll do all I can to make myself worthy of their favour. This philosophy is so firmly based on demonstrations that I'm sure •the time will come when it is generally accepted and approved; but since your Jesuit colleagues constitute the largest part of those who are competent to judge it, if *they* weren't interested enough to read it I couldn't expect to live long enough to see •the time of its success. If on the other hand their goodwill leads them to examine it, I venture to predict that they'll find so many things in it that they will think true—things that can explain the truths of the Faith better than the usual accounts do, doing this without contradicting anything that Aristotle wrote—that in a few years this philosophy will gain as much credence as it otherwise would in a century. I care about this, I admit. I am a man like any other, and not one of those self-possessed people who don't allow themselves to be affected by success. So this also a matter in which you can do me a great favour; but I venture to think the public has an interest in it as does, especially, •your Society, which shouldn't tolerate a situation where important truths get a better reception from others than from •it. Please excuse the freedom with which I express my feelings. I'm aware of the respect that I owe you, but I also regard you as if you were my father, and I don't think you'll be offended by my discussing things with you in the way I would with him if he were still alive.

⊕ [9.ii.45: Descartes writes to Dinet, fervently thanking him for the role he thinks Dinet had in getting the Jesuits to take a favourable view of Descartes's work.]

⊕ [9.ii.45: Descartes writes to Bourdin, thanking him for passing on letters from Charlet ('He was Rector of the College of la Flèche when I was a student there'), and expressing pleasure at the thought of the ongoing friendship between himself and Bourdin.]

to Mesland, 9.ii.1645:

Having finally received your letter of 22.x.44 I write to tell you how grateful I am to you

- •not for taking the trouble to read and examine my *Meditations*,

because since we had never met I would like to think that it was the content that attracted you; and

- •not because you have made such a good abstract of it,

because I'm not so vain as to think that you did that for my sake, and I think well enough of my arguments to believe that you thought it worthwhile to make them intelligible to many (the new form you have given them will help greatly with that); but

- because in explaining the *Meditations* you have been careful to make them appear in their full strength, and to interpret to my advantage many things that others might have distorted or concealed.

This is what mainly makes me recognise your candour and your desire to do me honour. In the manuscript that you were good enough to send me I haven't found *anything* that I don't entirely agree with; and although it contains many thoughts that are not in my *Meditations*—or at least aren't proved there in the same way—there's not one that I wouldn't be willing to accept as my own. When I said in the *Discourse on the Method* that I didn't recognise the thoughts that people were attributing to me, I wasn't thinking of people who have examined my writings as carefully as you have, but only of those who had tried to gather my opinions from what I said in informal conversation.

In discussing the Blessed Sacrament I speak of the surface that is intermediate between two bodies, i.e. between the bread (or the body of Jesus Christ after the consecration) and the air surrounding it. By 'surface' I don't mean any substance or real nature that could be destroyed by God's omnipotence, but only a mode or way of being that can't be changed without a change in the thing in which (or through which) it exists; just as it involves a contradiction for the square shape of a piece of wax to be taken away from it without any of the parts of the wax changing their place. Now, this **surface between the air and the bread** doesn't differ in reality from the **surface of the bread**, or from the **surface of the air surrounding the bread**; what we have here are three ways of thinking about a single thing. When we call it **(i)** 'the surface of the bread' we mean that even if the air surrounding the bread is changed, the surface remains always numerically [see Glossary] the same (provided the bread doesn't change; if it does, the surface changes with it). And when we call it **(ii)** 'the surface of the air surrounding the bread' we mean that it changes with the air and not with the bread. And finally, when we call it **(iii)** 'the surface between the air and the bread' we mean that it doesn't change with either, but only with the shape of the dimensions that separate one from the other. . . . If the body of Jesus Christ is put in the place of the bread, and other air comes in place of that which surrounded the bread, **(iii)** the surface between that air and the body of Jesus Christ is still numerically the same as the surface that was previously between the other air and the bread, because its numerical identity does not depend on the identity of the bodies between which it exists, but only on the identity or similarity of the dimensions. Similarly, we can say that the Loire is the same river as it was ten years ago, although it is no longer the same water, and although

the rest of the sentence: *peut être aussi il n'y ait plus aucune partie de la même terre qui environnait cette eau.*

literally meaning: there may no longer be any part of the same earth that surrounded that water.

perhaps Descartes's point is: since that earlier time there may have been a complete turn-over in the material composing the banks of that river.

As for the question '*How* can the body of Jesus Christ be in the Blessed Sacrament?'—it's not for me to answer this because Council of Trent teaches that he is there 'with a form of existence that we can scarcely express in words'. I quoted these words on purpose at the end of my reply to

the Fourth Objections, so as to be excused from saying any more about this topic, and ·I wanted this excuse· because I'd have been afraid that anything I could write about the Blessed Sacrament would get a less warm welcome than things written by professional theologians. Still, since the Council doesn't say 'that we cannot express in words' but only 'that we can scarcely express in words', I'll take a risk: I'll give you here *in confidence* an account of the Sacrament that seems to me quite elegant and very useful for avoiding the slander of heretics who object that our belief on this topic is entirely incomprehensible and self-contradictory. I do so on condition that •you don't communicate it to anyone unless you judge it to be altogether in accord with what the Church has laid down, and that •if you do communicate it to anyone you won't say that I am its author. ·Here it is·.

What exactly *is* the body of a man? When we try to answer this, the word 'body' turns out to be very ambiguous. When we speak of **a body in general**, we mean a determinate portion of the matter the universe is composed of. In this sense, if the smallest amount of that portion were removed, we would automatically judge that the body had been lessened and was no longer complete; and if there were a turnover of material in the body—with one particle of it being replaced by another from outside the body—we would at once think that what was left was not numerically the same body that we started with. But when we speak of **the body of a man**, we don't mean a determinate portion of matter, or one that has a determinate size; we mean simply the whole of the matter that is united with the soul of that man. So even when that matter changes—more matter joins it from outside, or some of its matter is lost—we still believe that it is numerically the same body so long as it remains joined to and substantially •united with the same soul; and we think that this body is whole and entire so long as it has in itself all the dispositions needed to preserve that •union. No-one denies that we have the same bodies that we had in our infancy, although

•they have become much bigger

and although—according to the common opinion of physicians, who are surely right about this—

•one's adult body doesn't contain *any* of the matter that belonged to it at birth,

and even though

•one's body has changed shape since birth,

it is numerically the same body only because it is informed [see Glossary] by the same soul. Personally, I go further. I have examined the circulation of the blood, and I believe that nutrition takes place by a continual expulsion of parts of our body that are driven from their place by the arrival of others. Consequently I don't think that any particle of our bodies remains numerically the same for a single moment, although our body remains always numerically the same human body so long as it is united with the same soul. [The first half of that sentence doesn't follow from what went before; this striking non-sequitur is in the original, and not an artifact of this version.] In that sense it can even be called indivisible; because if an arm or a leg of a man is amputated, we think that it is only in the first sense of 'body' that his body is divided—we don't think that a man comes to be less a man by losing an arm or a leg. . . .

Moreover, I hold that when we eat bread and drink wine, the tiny particles of bread and wine dissolve in our stomach, and pass at once into our veins; so that they *naturally* 'transubstantiate' themselves and become parts of our bodies simply by mixing with the blood. But if we were sharp-sighted enough to distinguish them from the other particles of the blood, we would see that they are still numerically the same particles that previously made up the bread and the wine; so that setting aside their union with the soul we could still call them bread and wine as before.

This transubstantiation takes place without any miracle, but it can help us to think about what is miraculous in the transubstantiation that occurs in the Blessed Sacrament. I can't see any problem in the following view:

> If the particles of bread and wine had been informed *naturally* by the soul of Jesus Christ, they would have had to mingle with his blood and dispose themselves in certain specific ways; but what actually happens is that they are *miraculously* informed by his soul simply by the power of the words of consecration.

. . . .In this way it is easy to understand how the body of Jesus Christ is present only once in the whole portion of bread when it is undivided, and yet is whole and entire in each of its parts, when it is divided; because all the matter, however large or small, which as a whole is informed by the same human soul, is taken for a whole and entire human body.

No doubt this explanation will shock those who have always thought that the body of Jesus Christ can't be in the Eucharist unless all its parts are there with their same quantity and shape, and with numerically the same matter as they were composed of when he ascended into heaven. But they will easily free themselves from these difficulties if they bear in mind •that none of that has been decided by the Church, and •that the integrity of a human body doesn't require it to possess all its external parts with their quantity and matter. *That* kind of 'sameness' isn't useful or appropriate in this Sacrament, in which the soul of Jesus Christ informs the matter of the bread in order to be received by men and to be united more closely with them. This doesn't detract in the least from the veneration due to the Sacrament. Moreover, it should be noted that it is impossible—seems plainly to involve a contradiction—that these bodily parts should be present in the Sacrament. Why? Because what we call a man's 'arm' or 'hand' is what has the external shape, size and use of one; so that whatever one might imagine in the bread as the hand or the arm of Jesus Christ, it flouts all the dictionaries and entirely changes the use of the words to call it an 'arm' or a 'hand', since it has neither extension, nor external shape, nor use.

I would be most grateful to hear your opinion of this explanation, and I would be glad also to know what Father Vatier thinks of it, but I don't have time to write to him.

[The rest of this letter exists in the archives as a second letter, in Latin, on the same date. Here it is:]

On free will, I entirely agree with what Gibieuf wrote about this. Here's an even more compact statement of my view about it. It seems to me that the word 'indifference' [see Glossary], when used properly, stands for **(i)** the state the will is in when it isn't carried in any one direction by the person's knowledge of what is true or what is good; and I was using it in that sense when I wrote that the lowest degree of liberty—the poorest kind of freedom—consists in the power to steer ourselves towards upshots between which we are entirely indifferent. But there may be people who understand 'indifferent' in another sense, namely as **(ii)** a positive faculty ·or ability· to choose to do x or not to do x, to affirm P or deny it. I haven't denied that the will has this faculty. Indeed I'm so far from denying it that I reckon that it is present not only whenever

> it picks on an action in the absence of any *reason* to choose one action rather than another,

but even when

> it is so greatly mixed in with all the other actions that it can't be put to use in any way.

When a strong evident reason carries us towards something, so that *morally speaking* it's hard for us to turn away from it, speaking *absolutely* we can do this. We are always free to

prevent ourselves from pursuing something that we clearly know to be good, or to refuse to accept an evident truth—just as long as we think that it's a good thing to show in this way the freedom of our will.

And another thing: bear in mind that freedom can be thought of as coming into play **(a)** before the relevant act of the will or **(b)** at the very moment when that act is performed.

Now, it's certain that freedom considered as **(a)** preceding the action brings with it *indifference* only in **(ii)** the second of the senses that I have distinguished, but not in **(i)** the first. In **opposing our own judgment to the commandments of others**, we usually say that we're more free to

> do things that aren't commanded or forbidden, i.e. ones where we are allowed to follow our own judgment

than we are to

> do things that we are forbidden to do.

But now **opposing some to others among our own judgments**, it is *not* all right for us to say that we're more free to

> do things that don't seem to us to be good or bad, or in which we see as much bad as good

than we are to

> do things that we can see contain much more good than bad.

For you to be *more free* than I am is either **(**α**)** your •being able more easily to determine yourself [= make up your mind] than I am to determine myself, or **(**β**)** your •having a greater use of the positive power we both have to following the worse while seeing the better. If we follow the course that appears to have the most reasons in its favour, we **(**α**)** determine ourselves more easily; but if we follow the opposite, we **(**β**)** make more use of that positive power; and thus we can always act more freely in cases where we see more good than evil than in cases that are called *adiaphora* [Greek] or 'indifferent'. In this sense too when others command us to do x which we wouldn't otherwise have done, we do x less freely than we do y which no-one has ordered us to do; because the judgement that x is difficult to do is opposed to the judgement that it is good to do (y) what is commanded; and the more equally these two judgements move us the more sense-**(i)** indifference they confer on us.

But freedom considered in the acts of the will at the moment when they occur doesn't entail any indifference in either of the two senses; for what is done cannot remain undone as long as it is being done. Freedom consists simply in ease of operation; and at that point freedom, spontaneity and voluntariness are the same thing. That was the sense I had in mind when I wrote that I moved towards something all the more freely when there were more reasons driving me towards it; for it is certain that in that case my will moves itself more easily and with greater force.

⊕ [9.ii and 17.ii.45: Descartes writes to Picot, expressing pleasure in the quality of the French translation of the *Principles of Philosophy*, reporting on the good reception the work has been getting, and explaining a few details in it.]

⊕ [17.ii.45: Descartes writes to the Rector of the University of Groningen, mainly expressing indignation over having been called an atheist by some of his opponents.]

⊕ [17.ii.45: Descartes writes to Clerselier explaining the rules that constitute his physics of collisions in *Principles of Philosophy* II.49. These explanations are defeatingly hard to understand, and Descartes admits that the rules are not trouble-free. (They were considerably improved in the French version of the work that appeared a couple of years later.)]

⊕ [iv.45: Descartes writes to Cavendish, responding to four biological questions that he is flattered to have received from this nobleman: •the cause of sleep, •the cause of heat in animal bodies, •two questions about the role of animal spirits.]

⊕ [18.v.45: Descartes writes to Pollot, who has written saying that Princess Elisabeth is ill. Descartes won't visit to her: Pollot says she is recovering, and also the trip would be a serious burden ('since my visit to France I have become 20 years older'). And a couple of other topics.]

to Mesland, v.1645:

I am obliged that you have favoured me with your opinion of my *Principles*; but I wish you had been more specific about your difficulties. I can't think of any problem regarding rarefaction. Nothing is easier to conceive, I think, than the way a sponge swells up in water and shrinks as it dries out.

As for the question of *how* Jesus Christ exists in the Holy Sacrament: accepting the explanation I sent you isn't a price that has to be paid for this doctrine to agree with my principles. I put it forward not •for that purpose but •as a useful way dodging the objections of the heretics who say that the Church's articles of faith contain impossibilities and contradictions. Do what you please with my letter; it's not worth keeping, so please simply destroy it rather than returning it to me.

I wish you had time to examine my *Principles* in more detail. I venture to think you would find that it hangs together, logically speaking, so that one must either reject the whole content of Parts 3 and 4—taking it as a mere hypothesis or even as a fable—or else accept the whole of it. And even taking it as merely a hypothesis, which is how I presented it, it still shouldn't be rejected until one has found some other, better explanation of all the phenomena of nature.

So far, however, I have no reason to complain about my readers. Since this last treatise was published I haven't heard of anyone trying to find fault with it, and it seems that I have at least succeeded in making many people suspect that what I wrote might after all be true. But I don't know what is said behind my back; and I'm living in a corner of the world where I would live peacefully and happily even if the verdict of the entire learned world were against me. I have no feelings about those who hate me, only for those who wish me well, whom I want to serve whenever I can.

to * * * , vi.1645:

It is a mark of your friendship, for which I am greatly obliged, that you have taken the trouble to inquire into what people in your circle think about my writings. Authors of books are always glad to know what readers say about them, this is not something I care about much. Indeed, I am so familiar with the intellectual scope of most of those who pass for learned that I would think badly of my thoughts if I saw them being approved by such men.

I'm not saying that the person whose opinion you send me is one of those; but I don't think he has read much of my work—witness his saying that my account of rainbows is common, and that my principles of physics are drawn from Democritus. His objections against ·my views on· rarefaction confirm this view; if he had attended to what I have written about the rarefaction that occurs in the hollow balls called aeolipyles, or in machines where the air is forcibly compressed, or in gun powder, he wouldn't tell me about the rarefaction that occurs in his artificial fountain! And if he had taken in how I explained our idea of body in general (i.e. of matter) as being the same as our idea of space, he wouldn't have tried to make us conceive the interpenetration [see Glossary] of dimensions through the example of motion. For we have a very clear idea of the various speeds of motion; but it is self-contradictory and inconceivable that two spaces should interpenetrate one another.

I'm not replying to the critic who says that demonstrations are missing in my *Geometry*. I have indeed omitted many; but you know them all, and you also know that those who hold this against me because they can't produce the demonstrations for themselves are showing by this that they are not very talented geometers.

What I find most strange is this person's conclusion that what will prevent my principles from being accepted in the Schools is that •they aren't sufficiently confirmed by experience, and that •I haven't refuted the arguments of others. I have reported in detail almost as many observations as there are lines in my writings, and after giving general explanations in my *Principles* of all the phenomena of nature I explained in the same manner all the observations that can be made regarding inanimate bodies; whereas the principles of the ordinary ·scholastic· philosophy have never provided any good explanations of any of this. So I am amazed that the followers of that philosophy still complain about a lack of observational evidence in *my* work!

I find it very strange too that they want me to confront the arguments of the scholastics; if I did that, I would be doing them a bad turn! A long time ago the malicious actions of some of them gave me cause to do this, and perhaps they'll force me to do it again. But those who have most at stake here are the Jesuit fathers; and because of my respect for Father Charlet (who is a [very distant] relative of mine, and now leader of the Jesuits), Father Dinet, and several other senior members of that Society whom I believe to be genuinely my friends, I have till now held back. That's why I composed my *Principles* in such a way that it can be said to be not at all in conflict with the ordinary philosophy, but actually to have enriched it with many things that were missing from it. Since these philosophers accept countless other opinions that are contrary to one another, why couldn't they also accept mine? Still, I'm not willing to *ask* for their acceptance: if my views are false I'll be sorry to have led these folk astray; and if they are true then they can gain more from examining them than I can from recommending them.

⊕ [7.vii.45: Huygens writes to Descartes in a tone of rapturous admiration, expressing pleasure at the news that the authorities in Groningen University have come down on Descartes's side in the dispute with Voetius and the University of Utrecht; and asking Descartes to send him a short clear account of the fundamentals of chemistry, comparable with the account of mechanics that he sent on 5.x.1637 (see page 50).]

to Regius, vii.1645:

When I sent you my last letter, I had read only a few pages of your book. They led me to think that your style of writing is appropriate only for presenting theses, where it is customary to present one's opinions in the most paradoxical fashion, so as to get more people to join in the battle. As for myself, I work very hard to make my opinions *not* seem paradoxical, and I would never want them to be the subject of intellectual battles; I regard them as so certain and evident that they won't be opposed by anyone who rightly understands them. I accept that they can be correctly presented through definitions and divisions, proceeding from the general to the particular, but I don't agree that in that case proofs ought to be omitted. I know of course that people (like you) who are more mature and well versed in my doctrines don't need such proofs; but please consider how few of you there are! Of the many thousands who practise philosophy it's hard to find *one* who understands my doctrines. Those who understand the premises will know what follows from them, so they don't need ·written proofs and thus· don't need your book. [That translation assumes that *probationes* = 'proofs' was a slip for something meaning 'premises'.]

But when •others read the conclusions without the proofs, along with wholly paradoxical definitions that talk about 'ethereal globules' and other such things without explaining them anywhere, •they will make fun of them and hold them in contempt. Thus what you have written will very often be harmful, and never beneficial.

That is the judgement I formed when I read the first pages of your book. But when I came to the chapter on Man, and saw there your views about the human mind and God, not only did I find my first judgement confirmed, but I was completely astounded and saddened •because you seem to believe such things and •because you can't refrain from writing and teaching them even though they expose you to danger and censure without bringing you any praise. Please forgive me if I open my heart to you as freely as if you were my brother. If these writings fall into the hands of malicious people (as they easily may, via some of your pupils), they'll use them to argue—convincingly, in my opinion—that you hold views similar to those of Voetius, etc. To stop all this from flooding over into my territory I'm going to have to keep telling people that in metaphysics there's as much difference between you and me as there could possibly be; and I'll even put this declaration into print if your book gets published. Thank you for showing me the work before going public with it; but I don't thank you for teaching its contents privately behind my back. I wholly agree, now, with those who would like you to confine yourself to medicine. Why must you mix metaphysical and theological matters into your writings, given that you can't touch on them without heading off into error in one direction or another? At first, in considering the mind as a distinct substance from the body, you write that a man is an *ens per accidens* [see Glossary]; but then, when you observe that the mind and the body are closely united in the same man, you take the mind to be only a mode of the body—a much worse error. Again, please excuse me: I assure you that I wouldn't have written to you so freely if I weren't genuinely fond of you.

I would have returned your book with this letter, but I was afraid that if it should fall into hostile hands, the severity of my censure might harm you. So I'll keep it until I learn that you have received this letter.

⊕ [23.vii.45: Regius writes to Descartes, saying that Descartes has misunderstood what he wrote about the human mind and body, and that Descartes's proposed announcement about the metaphysical gap between them will harm himself rather than Regius, because Descartes gets advantage from having a highly respected academic on his side. He reports that many honest and able people are puzzled about what Descartes is up to in the *Principles of Philosophy*—'you promised nothing but clarity and certainty. . . .but what you offer there is obscure and uncertain'. He thanks Descartes for writing so frankly, and for taking the trouble 'to read my book—or, more accurately speaking, your book'.]

⊕ [30.vii.45: Descartes writes to Regius, continuing his warnings and advice about publishing his book, and declaring himself insulted by the idea that he is 'up to' something.]

⊕ [4.viii.45: Descartes writes to Huygens, saying that he can't produce anything new in compliance with Huygens's request (7.vii.45, page 178) for a crash-course in chemistry, because the little chemistry that he knows is in *Principles* 4. To know more he would have to perform experiments for which he lacks the materials or equipment. He has sworn off all enquiries in which he would need the help of others; he has enough go-it-alone projects to keep him busy for the rest of his life.]

to Cavendish, x.1645:

The treatise on animals that I began work on more than fifteen years ago can't be finished until I have conducted many experiments that are needed for its completion. I haven't

yet had the opportunity to do these and I don't know when I shall. So I don't expect to publish it for a long time yet. Nevertheless, I will obey you in everything you command me; I am flattered by your wish to know my opinions on several philosophical problems.

I'm convinced that hunger and thirst are felt in the same way as colours, sounds, smells, and in general all the objects of the external senses, i.e. by way of nerves stretched like fine threads from the brain to all the other parts of the body. Whenever one of these parts is moved, the place in the brain where the nerves originate moves also, and its movement arouses in the soul the sensation that is attributed to that part. I have tried to explain this at length in my *Optics*. I said there that the various movements of the optic nerve make the soul aware of all the varieties of colours and light; and similarly I believe that the sensation •of hunger is caused by a movement of the nerves that go to the base of the stomach and that the sensation of •thirst is caused by a different movement of those same nerves and of the nerves that go to the throat. What makes these nerves move in this way? My answer is this: Just as one's mouth waters when one has a good appetite and sees food on the table, so normally a large quantity ·of water-like liquid· comes into the stomach in the same circumstances. It is carried there by the arteries whose ends have narrow openings that are shaped so as to allow this ·watery· liquid to pass ·into the stomach· while keeping out the other parts of the blood. It's like a kind of acid that mingles with the small particles of the food one has eaten, dissolves them into chyle, and then returns with them through the veins into the blood. But if this liquid on entering the stomach finds no food to dissolve, it exerts its force on the wall of the stomach, stimulating the nerves there in such a way as to make the soul have the sensation of hunger. [Then some remarks about special cases—hunger accompanied by illness, the eventual lack of hunger-pangs in people starving to death, etc.]

Here is how I think thirst is caused. The watery part of the blood that usually goes through the arteries to the stomach and the throat in liquid form and thus moistens them sometimes travels there in the form of vapour that dries them up and thus agitates their nerves in the manner needed to arouse in the soul the desire to drink. So there's no more difference between •this vapour that gives rise to thirst and •the liquid that causes hunger than there is between •sweat and •what is exhaled from the whole body without our noticing it.

The only general cause of all the movements in the world, I think, is God. At the first instant of his creation of matter, he made all its parts start to move in different ways; and now, by the same action by which he keeps matter in existence, he also preserves as much movement as he put into it back then. As for •the matter the sun is composed of and •the nature of fire: I have given my views about these (in *Principles* 2:54 and 4:80 respectively) in such detail that anything I could add now would be harder to understand than what I wrote then. And I said explicitly in 2:18 that I think the existence of a vacuum involves a contradiction, because we have the same idea of matter as we have of space. If we said that space is empty, i.e. that something we conceive as a real thing is not real, we would be contradicting ourselves, asserting the contrary of what we think.

The preservation of health has always been the main goal of my studies, and I'm sure there are ways of getting much *new* knowledge about medicine. But the treatise on animals that I am planning but haven't yet been able to complete is only an introduction to the acquisition of this knowledge, so I'm careful not to boast that I already have it. All I can say at present is that I agree with the Emperor Tiberius, who

held that everyone over 30 had enough experience of what was harmful or beneficial to be his own physician. Indeed it seems to me that anyone who has any intelligence and is willing to pay a little attention to his health can better observe what is good for it than the most learned doctors.

⊕ [The correspondence between Descartes and Princess Elisabeth is not included here (see introductory paragraph at the head of this text), but it gets this mention: between 22.vii.45 and 27.xii.45 he wrote at least seven good-sized letters to her and she wrote at least eight to him.]

to Mesland, 1645 or 1646:

I have read with much emotion the last farewell that I found in the letter that you took the trouble to write me. [A note (by Clerselier?) in the margin of a manuscript copy of this letter says: ' This Father was banished to Canada because of his close relations with Descartes, and he died there. He had made some learned remarks and commentaries on Descartes's *Meditations*.'] It would have affected me even more if I weren't living in a country where every day I meet people who have returned from the Antipodes. These commonplace occurrences prevent me from losing all hope that I shall see you back in Europe some day. Your aim of converting the savages is very noble and saintly; but I imagine that this requires only zeal and patience, and not much intelligence and knowledge, so that it seems to me that your God-given talents could be applied more usefully in converting our own *European* atheists, who pride themselves on their intellect and won't surrender to anything but the evidence of reason. . . . [Mesland never returned to Europe, and died in Canada in 1672. (CSMK note)]

You will find enclosed some brief replies to the objections that you so kindly sent me regarding my *Principles*. I would have made them longer except that I'm sure that most of the difficulties you first encountered when you began reading the book will vanish of their own accord when you have finished it. [We have a text which seems to be a part of the 'brief replies' that Descartes has just mentioned. That material is not included here, because the preparer of this version agrees with the editor Ferdinand Alquié that 'it is confused, seems to have been hastily written, and obscures rather than clarifying *Principles* 1:60–65. Perhaps what we have isn't exactly what Descartes wrote.']

The difficulty you find in my explanation of the Blessed Sacrament is easy to resolve, I think. It's quite true that I have the same body now as I had ten years ago, although the matter it is composed of has changed, because the identity through time of a human body depends not on its matter but on its form, which is the soul. So our Lord's words are still quite true: 'This is my body, which is given for you.' I don't what else he could have said to signify transubstantiation in the sense in which I have explained it.

Next: *How* was the body of Jesus Christ in bread that was consecrated during the time when he was dead? I don't know whether the Church has settled anything about this. It seems to me that we should be careful to distinguish •the views determined by the Church from •the views commonly accepted by the learned, which are based on a shaky physics. Anyway, even if the Church had determined that the soul of Jesus Christ was *not* united to his body in bread that was consecrated while he was dead, we can still say that •the matter of this bread would be as strongly *disposed* to be united to the soul of Jesus Christ as was •the matter of his body lying in the sepulchre; and that implies that this ·bread·-matter was truly his body, because the only reason for calling the matter in the sepulchre 'the body of Jesus Christ' is its strong disposition to receive his soul. And if

> the matter of the bread had the dispositions of the body without the blood, and the matter of the wine had the dispositions of the blood without the flesh,

then it follows that

> the body alone, without the blood, was in the bread, and the blood alone was in the chalice.

. . . .I don't see any shadow of a difficulty in all this. But like you I willingly accept the words of the Council ·of Trent· that 'He is there with a form of existence that we can scarcely express in words'.

⊕ [2.iii.46: Descartes writes to Mersenne a two-part letter mainly about physics.]

⊕ [12.i.46: Descartes writes to Clerselier, who had asked for replies to objections by Gassendi that Descartes had neglected; this letter has Descartes complying with that request. Parts of it are included in the final section of the Fifth Objections and Replies as given in the website from which the present text comes.]

⊕ [2.iii.16: Descartes writes to Clerselier, about Clerselier's acting as a mail-drop for Descartes's sister Anne to get letters to him, and about what is going on in the Eucharist.]

⊕ [6.iii.46: Descartes writes to Chanut about the weather (the worst winter in the Netherlands since 1606) and the difficulty of performing enough experiments to get good scientific results. And another complaint: The world is much bigger than is needed for it to house all the honest people that there are; if they were all herded into one town, Descartes might go and live there instead of pursuing solitude as he does.]

⊕ [30.iii.46: Descartes writes to Cavendish about the physics of pendulums. Cavendish has done experiments which don't square with Descartes's published physics, and Descartes acknowledges and discusses them, saying 'I can't yet see anything wrong with them'. He submits his present thoughts on the topic to Cavendish and humbly asks for his judgment on them.]

to * * * , iii.1646:

[This is an excerpt—all we have—of a letter to an unknown correspondent.]

As for the difficulty you speak of, I don't see that it is more of a difficulty for my philosophy than for the philosophy of the Schools [see Glossary]. There are two principal questions about this mystery. **(1)** How it can come about that all the accidents of the bread remain in a place where the bread is no longer present, having been replaced by another body? **(2)** How can the body of Jesus Christ have the same size and shape as a piece of bread?

My reply to **(1)** had to differ from that given by the scholastic philosophers because I don't accept their view about the nature of accidents. As for **(2)**, I don't need to look for any new explanation; and even if I could find one I wouldn't want to divulge it, because in these matters the most common opinions are the best. Thus one may ask all theologians as well as myself: 'When one corporeal substance is changed into another and all the accidents of the former remain, what is it that has changed?' And they must reply, as I do, that there is no change that the senses could detect, and hence no change in any basis for giving different names to these substances. Why not? Because the only reason we can have for giving different names to two substances is that our senses have detected different qualilties in them.

to Mersenne, 20.iv.1646:

[He opens with remarks about the physics of musical triangles, then moves on to a number of mainly personal matters. The criticisms by Roberval aren't good enough to require any revisions in Descartes's work; he has made some revisions, but those were in the interests of his readers, not of the likes

of Roberval. The rest of the letter is in Latin.]

[About four pages of physics, and then:] Finally, it is a most absurd suggestion that **(i)** all the particles of the matter of the universe have a property in virtue of which they attract one another, and that **(ii)** each particle of terrestrial matter has a similar property in respect of other terrestrial particles, with no interference between **(i)** and **(ii)**. [He is thinking of **(i)** as a force that pulls (for example) the earth and the moon towards one another, and of **(ii)** as a force that pulls the parts of the earth together so that it is a single cohering lump.] To make sense of this, one has to suppose not only that •each particle of matter has a soul, and indeed several different souls that don't get in one anothers' way, but also that •these souls are capable of thought—and indeed that they are *divine*, because each of them x is supposed to exercise its powers in distant places, which requires it to know what is going on there, and to know this without any intermediary, ·i.e. without any signal being carried across from the distant place to x·.

[Then three more pages, with details about how the supposed two powers would threaten to interfere with one another.]

⊕ [15.v.46: Descartes writes to Cavendish about triangles again (see letter of 30.iii.46), this time less patiently.]

⊕ [v.46: Roberval writes to Cavendish for Descartes, seven pages of highly technical objections to what Descartes has written to Cavendish.]

⊕ [15.6.46: Descartes writes to Cavendish for Roberval, saying that Roberval's latest was much longer than it needed to be, and didn't merit much in the way of a reply.]

⊕ [15.vi.46: Descartes writes to Wilhelm, thanking him to taking the trouble to update him about the doings of various people. He implies that there was no need to do this, and in particular 'As for Voetius, I no longer give any thought to him'—followed by a page about him.]

to Chanut, 15.vi.1646:

I was glad to learn from your letter that Sweden is near enough for news to take only a few weeks to get here. So I'll sometimes have the happiness of conversing with you on paper, and sharing in the results of the studies that I see you are planning to make. Since you are good enough to examine my *Principles*, I'm sure you'll notice many obscurities and faults that I'll need to know about, and I know no-one who can inform me of them better than you. I'm only afraid that you'll soon grow tired of reading the book, because it is only distantly connected with moral philosophy, which you have chosen as your principal study.

I entirely agree with you that the best way to find out how we should live is to discover first what we are, what kind of world we live in. and who is the creator of this world—the master of the house we live in. I don't claim that all I have written is true, and anyway ·I haven't written about this·. I have tried to convey in my *Principles* •the general notion of heaven and earth; but that is a long way from •detailed knowledge of the nature of man, about which I haven't yet said anything. However, so as not to seem to be trying to divert you from your plan I shall tell you (this is in confidence) •that the notion of physics that I have tried to acquire has—without any special preparation—greatly helped me to establish sure foundations in moral philosophy; and •that I have found it easier to reach satisfactory conclusions on this topic than on many topics in medicine that I have spent much more time on. So instead of finding ways to preserve life, I have found another much easier and surer way to deal with death, which is *not to fear it*. But this doesn't depress me, as it commonly depresses people whose wisdom is drawn entirely from the teaching of others, and rests on foundations that depend only on human prudence and authority.

I'll also tell you that while I'm waiting for the plants in my garden to grow—plants that I need for some experiments to push my physics forward—I spend some time thinking about particular problems of morality. This past winter I sketched a little treatise on the nature of the *Passions of the Soul*, without any idea of publication; and I would now be in a mood to write more about this, if I weren't made slack by seeing how depressingly few people condescend to read what I write.

To Clerselier, vi or vii 1646:

My hope of soon being in Paris makes me careless about writing to those whom I hope to see there. So it is already some time since I received the letter you were kind enough to write; but I thought that you couldn't care much about my answer to your question 'What should be taken as the first principle?', because in that same letter you answered it better than I could.

I will only add that the word 'principle' can be taken in several senses. It is one thing to look for

(1) a common notion [see Glossary] so clear and so general that it can serve as a principle for proving the existence of all the beings—entities—to be discovered later;

and another thing to look for

(2) a *being* whose existence will be known to us better than that of any other, so that it can serve as a principle for discovering the others.

[A 'principle' in either of these senses is a proposition; so both senses belong on one side of the line that is drawn in the Glossary entry on **principle**.]

The proposition that *It is impossible for the same thing both to exist and not exist at the same time* can be called a 'principle' in sense **(1)**, not as making known the existence of anything but simply, when something is known to exist, to *confirm* that it does. How? By the following reasoning:

- •It is impossible that something that exists doesn't exist;
- •I know that item x exists; so
- •I know that it is impossible that x doesn't exist.

This is of very little importance, and makes us no better informed.

The proposition that *our soul exists* is the first principle in sense **(2)**, because there is nothing whose existence is better known to us.

For something to count as the first principle all that is needed is that •it can be useful for the discovery of many other propositions, that •it doesn't depend on any other proposition, and that •there is no other proposition that is easier to discover than it is. It doesn't have to be a proposition that all other propositions can be reduced to proved by. It may be that there isn't any principle to which everything can be reduced. When other propositions are reduced to the principle *It is impossible for the same thing both to exist and not exist at the same time*, this ·sense-**(1)**· procedure is superfluous and useless. Whereas the ·sense-**(2)**· procedure in which the consideration of your own existence convinces you first of the existence of God and then of the existence of all creatures is very useful indeed. . . .

Zeno's Achilles paradox is not hard to solve if you bear the following in mind. If you start with a quantity $\underline{Q}$ and then create the series

$\underline{Q}_1$, which is $\frac{Q}{10}$,
$\underline{Q}_2$, which is $\frac{Q_1}{10}$,
$\underline{Q}_3$, which is $\frac{Q_2}{10}$,
$\underline{Q}_4$, which is $\frac{Q_3}{10}$. . .

and so on ad infinitum, all these tenths add up only to a finite quantity, namely $\frac{Q}{9}$. [Suppose that Q is the length of a finite line, and that •from one end of the line we mark off a series of segments

Q_1,
Q_2,
Q_3,
Q_4,...

and so on, while •from the other end we mark off a series of segments

$8 \times Q_1$,
$8 \times Q_2$,
$8 \times Q_3$,
$8 \times Q_4$,...

and so on. If each of these operations is performed infinitely many times, Descartes says, they will meet at a point that is one ninth of the way along from one end of the line and eight ninths of the way from the other end. But after any finite number of operations from each end there will always be a distance between their end-points. He continues:]

This provides an answer to anyone who says that a tortoise that has ten leagues' start can never be overtaken by a horse that goes ten times as fast as it does, because while the horse travels these ten leagues the tortoise travels one more, and while the horse travels that league the tortoise goes ahead another tenth of a league, and so on for ever [this being a version of Zeno's 'Achilles paradox']. The answer is that it is true that the horse won't overtake the tortoise while traveling 10 leagues plus 1 league plus $\frac{1}{10}$ of a league plus $\frac{1}{100}$ of a league, and so on; but it doesn't follow that it will never overtake the tortoise, because that entire infinite series of distances adds up to $11\frac{9}{10}$ leagues, at the end of which the horse will start to be in the lead. People are puzzled by this because the think of this $11\frac{9}{10}$ league as an infinite quantity because they divide it in their imaginations into infinitely many parts.

⊕ [vii.46: Clerselier writes to Descartes, sending something Descartes had asked for, namely Le Conte's objections to the *Principles of Philosophy*. The occupy 17 pages of small print Latin which AT describes as 'a long controversy among Le Conte, Picot and Clerselier, and not really addressed to Descartes'. But see next item.]

⊕ [29.viii.46: Descartes writes to Clerselier with a 'brief' (eight pages) reply to the Le Conte objections.]

⊕ [7.ix.46: Descartes writes to Mersenne: •pleasure at Mersenne's safe return from travels; •Regius's book is said to be near to publication, despite Descartes's urging him not to release it until Descartes has checked it out (see letter of vii.1645, page 178), 'for his sake, not mine'; •acknowledges that a new book by Fabri opposes Descartes's work and is generally preferred to the latter, and will comment on it when he has read it; •a request not to send anything more by Roberval, because that would only waste Descartes's time; •a brief version of his treatment of Zeno's paradox; •physics of sounding triangles.]

⊕ [ix.46: Roberval writes to Cavendish against Descartes, but it was Mersenne who passed it on to Descartes—see his reply on page 188. The letter is about physics; Roberval accuses Descartes of contradicting himself and misrepresenting his own views.]

to Mersenne, 5.x.1646:

A few days ago I saw a book that will make me from now on much less free in communicating my thoughts than I have been until now; it's a book by a professor at Utrecht, Regius, entitled *Foundations of Physics*. In it he repeats most of the things I put in my *Principles of Philosophy*, my *Optics*, and my *Meteorology*, and dumps in everything he has been able to get from me ·directly· in private, and even things that must have come to him by indirect routes—things that I

didn't want him to be told. And he spells all this out in such a confused way, and provides so few arguments, that his book can only make these opinions look ridiculous, and expose me to two lines of attack. •Those who know that he has paraded his friendship with me and blindly followed all my opinions will think that all his faults are mine. •And if I ever decide to publish the views that I haven't yet published, it will be said that I have borrowed them from him, because they will have some resemblance to what he has written. But the worst is that while in matters of •physics he has tried (not always successfully) to follow my views, in matters of •metaphysics he has done the exact opposite—there are four or five examples of this when he is talking about my *Meditations*. I warn you of this so that if the book falls into your hands you'll know my opinion of it, and know that it was published against my wishes and without my knowledge, and that I don't regard its compiler as my friend. If you don't yet have it, save your money.

[There are three more pages, •on reports of a new kind of reading-glasses by an artisan named Bourgeois, •on the physics of sounding triangles, •on Descartes's willingness to enter into correspondence with Torricelli, and his reluctant consent to be sent some things about geometry by Carcavi though he hasn't thought about mathematics for a long time—'and I wish Roberval could convince everyone that I have forgotten mathematics entirely'.

⊕ [5.x.46: Descartes writes to Huygens, •thanking him for sending Wendelin's new book on 'red rain' and suggesting some new experiments the author might conduct to strengthen his conclusions, •deploring Regius, and commenting on a publication by Bourgeois (see preceding letter). After discussing how this relates to things in his *Optics*, Descartes says that this is the work of a charlatan: if Bourgeois had really had the success he claims, he would be *selling* the reading-glasses says he has made, not merely *praising* them.]

⊕ [12.x.46: Descartes writes to Mersenne, a letter summed up in the declaration that he no longer wants to read anything except by friends giving their news—friends whom Descartes may be able to help. He especially doesn't want anything more by Roberval.]

to Chanut, 1.xi.1646:

If I didn't place a singularly high value on your knowledge, and didn't have a great desire to increase mine, I wouldn't have taken the liberty of urging you to look at my writings. I'm not in the habit of begging people to do this, and indeed I have published things before they were ready and before they had any of the decorations that might attract the gaze of the public. For I wanted my writings to be seen not •by those who attend only to external things but •only by certain people with good intelligences—people who would take the trouble to examine them with care, so that I could learn something from them. Although you haven't yet done me this favour, you have obliged me greatly in other ways. In particular, I learn from reliable witnesses that you have spoken favourably about me to many people; and Clerselier has written that you are expecting to receive from him the French version of my *Meditations* so as to present it to Queen Christina of Sweden, where you are living. I have never been so much a climber as to want my name to be known by persons of that rank. Indeed if only I had been as wise as the savages are said to believe monkeys are, no-one would have known of me as a writer of books; they are said to believe that monkeys could speak if they wanted to, but abstain from speaking in order to avoid being forced to work. Because I haven't taken the same care to abstain from writing, I don't have as much free time or peace as I would if I'd had the wit to keep quiet. But since the error has already been committed and I am known by countless Schoolmen who

look askance at my writings and try from every angle to find in them the means of harming me, I have good reason to want to be known also by persons of greater distinction whose power and virtue might protect me.

Moreover, I have heard that this Queen is held in such high esteem that—although I have often complained about people wanting to introduce me to some grand person—I can't forbear to thank you for having spoken so kindly to her about me. I have seen de la Thuillerie since his return from Sweden, and he has given such a glowing description of her qualities as to make *being a Queen* seem to be one of the least of them! I wouldn't have believed half of what he said if I hadn't seen in the Princess ·Elisabeth of Bohemia·, to whom I dedicated my *Principles of Philosophy*, that men and women of high birth don't need to be very old to be able to go far beyond other people in learning and virtue. But I'm afraid that my published writings are not worthy of being read by the Queen and that accordingly she won't be grateful to you for having recommended them to her.

If I had dealt with moral philosophy I might have had reason to hope she would find my writings more agreeable; but that's a subject that I must not get involved in. The Regents ·of the University of Utrecht· are so worked up against me because of the harmless principles of physics they have seen, and they are so angry at finding in them no pretext for slandering me, that if I had dealt with morality after all that they would never have given me any peace. A certain Father Bourdin thought he had good reason to accuse me of being a sceptic, because I refuted the sceptics; and a certain minister maintained that I was an atheist, his only reason being the fact that I tried to prove the existence of God! So what *wouldn't* they say if I undertook to answer these:

- •What is the true value of all the things that can be desired or feared?
- •What is the state of the soul after death?
- •How far ought we to love life?
- •What ought we to *be* if we are to have no reason to fear losing our life?

It would be pointless for me to have only those opinions that •agree as closely as possible with religion and •are as beneficial as possible for the state: for my critics would still try to convince people that I had opinions opposed to both. So the best thing I can do henceforth is •to abstain from writing books, and •to pursue my studies only for my own instruction and communicate my thoughts only to folk I can converse with privately. [Descartes associates the second of these with his having adopted as his motto some lines by Seneca: *Illi mors gravis incubat /Qui, notus nimis omnibus,/Ignotus moritur sibi*, meaning: 'Someone who is known to everyone else but gets through life without knowing himself has a hard, painful death.'] I would count myself extremely fortunate, I assure you, if I could do this with you; but I don't think I'll ever go to the places where you are, or that you'll retire to this place. All I can hope for is that after some years you may do me the favour of stopping at my hide-away en route back to France, and that I shall then have the opportunity to talk with you with an open heart. A lot can be said in a short time, and I find that long associations aren't needed for establishing close friendships, when these are based upon virtue. From the moment I had the honour of meeting you, I felt entirely at one with you.

A final point: you seem to conclude from the fact that I have studied the passions that I must no longer have any. On the contrary, in examining the passions I have found almost all of them to be good, and to be so useful in this life that our soul would have no reason to wish to remain joined to its body for even one minute if it couldn't feel them. I do

hold that we should guard against feeling anger at insults we receive; to do this we must try to elevate our mind so high that the insults of others don't get through to us. In place of anger, though, I believe it is right to feel indignation, and I confess to having often felt indignant at the ignorance of those who want to be taken as learned, when I see this ignorance joined with malice.

⊕ [2.xi.46: Descartes writes to Mersenne against Roberval: nine indignant pages, not retreating an inch.]

⊕ [2.xi.46: Descartes writes to Mersenne, commenting on his reply to Roberval (see preceding item), praising a geometrical result by Torricelli that was messed up by Roberval, and pleading again not to be sent anything by Roberval. Mersenne has been told that Fabri has written a book covering the same ground as Descartes's, but better and in better order. Descartes thinks Fabri is fronting for the Jesuits, and says that he had better see the book, but there's no hurry. Then remarks about some recent empirical results in physics.]

⊕ [2.xi.46: Descartes writes to Cavendish, with a complicated account of how Cavendish innocently got into the Roberval exchange, and introducing a four-page account of everything he (Descartes) has said on the topic that he and Roberval are disagreeing about. He is doing this 'so that you won't think that a desire to contradict a man whom I have never admired as some do, and whom I have known for years not to be devoted to my welfare, has led me to write anything that I don't believe.']

to Mersenne, 23.xi.1646:

The news you sent me of our friends' illnesses upset me, but I'm grateful to you for telling me. I'm quite unable to bring them any remedy, but I think that one of the duties of friendship is to share in the ills of those we are fond of. Picot had already told me of the trouble with his eyes, but since he didn't make a big fuss about it I would have expected it to have improved by now. Clerselier's illness gave me more of a shock; but it's a common enough malady, and going by your description of it I judge that it isn't life-threatening or incurable. My only fear is that the ignorance of the physicians may lead to treatments that harm him further. They were right to prescribe bleeding to begin with, and I am sure that this will have lessened the severity and frequency of the fits; but they are great ones for bleeding in Paris, and I'm afraid that when they see the benefits of one blood-letting they will keep on with the treatment, weakening the brain without improving his bodily health. You tell me that his illness began with a kind of gout in a toe. If he isn't yet cured and continues to have epileptic fits, I think it would be good to make an incision right to the bone in the toe where the trouble began, especially if he is known to have been injured in that area; there may still be some infection there that is the cause of this illness and needs to be cleared out before he can recover properly. But I would be most embarrassed if it were known that I am giving medical consultations, especially on an illness that I don't know much about. So if you think it right to pass on my suggestion to one of his physicians, please make sure that he doesn't *in any way* learn that it comes from me.

You are right in thinking that I don't share Regius's opinion that 'the mind is a corporeal principle' or his view that 'we know nothing except by appearance'; for in my writings I have said exactly the opposite. As for his way of explaining the movement of the muscles: this comes from me, and has pleased him so much that he repeats it twice, word for word; but it is entirely worthless because, not having understood what I wrote, he has forgotten its main point; and not having seen my diagram, he has drawn his own very badly, in such a way as to contradict the rules of mechanics. About a dozen years ago I described all the functions of the

human or animal body; but the manuscript is in such a mess that even I would find it hard to read. Nevertheless, four or five years ago I couldn't stop myself from lending it to a close friend, who made a copy that was then recopied by two more people, with my permission but without my rereading or correcting the transcripts. I asked them not to show it to anyone, and I have never wanted Regius to see it because I knew his character, and thinking that I might publish my views I didn't want anyone else detracting from their novelty. But behind my back he got hold of a copy—I can't think how—and extracted from it his *lovely* account of the movement of the muscles. He could have lifted much else besides so as to fill out his book, but I'm told that he didn't get hold of my manuscript until the printing of his own work was almost completed.

[Then three short paragraphs on semi-personal matters.]

to Cavendish, 23.xi.1646:

I agree entirely with your Excellency's judgement about the chemists. I think they use words that aren't in common use only so as to seem to know more than they do. I think also that what they say about reviving flowers with their 'salts' is only a baseless fancy, and that the powers of their 'extracts' are quite different from those of the plants they come from. This is clear empirically because wine, vinegar and brandy, three extracts made from the same grapes, have quite different tastes and powers. In my view, the chemists' salt, sulphur and mercury are no more different from each other than the four elements of the ·Aristotelian· philosophers, and not much more different from one another than water is from ice, foam and snow. I base all this on my view that all these bodies are made of the same matter and that any differences amongst them come from differences in the shapes or arrangements of their tiny parts. I hope you will soon be able to see this explained at some length in my *Principles of Philosophy*, which is about to be printed in French.

[A long paragraph about the differences amongst stones, pieces of metal, bones, etc. Then one about the properties of liquid mercury. To understand these properly, Descartes says, he would have to do some experiments, but even without those he is pretty sure of this much:] What makes this mercury so fluid is that its small parts are

- so unified and slippery that they can't catch onto one another, and
- so big (bigger than the small parts of water) that they hardly make room for

  the subtle matter that I call 'matter of the second element'

  to get in among them, but only

  the *very*-subtle matter that I call 'matter of the first element'.

It seems to me that all the properties of liquid mercury that I know of can be explained by those same facts about its small parts. [He gives the explanations: the stuff is opaque and cold because it contains so little matter of the second element; it settles into round drops when you put some on a table-top because its small parts are so much bigger than those of air or other bodies; and that same fact explains why it doesn't cling to our hands as water does. . . .

[A short paragraph about a book by Kenelm Digby. Not knowing English, Descartes hasn't read it. but he has a few bits translated, and is optimistic about the chances of his being in complete agreement with Digby. Then:]

I can't agree with Montaigne and others who attribute understanding or thought to lower animals. I'm not relying here on the common belief that human beings have absolute

dominion over all the other animals; ·that is too blunt an instrument·, for I acknowledge that some of the lower animals are stronger than us, and I believe that some of them may have a natural cunning that can deceive the shrewdest human beings. But I hold that they imitate or surpass us only in actions of ours that aren't guided by our thought. We often walk or eat without giving the least thought to what we are doing; and we often—without using our reason—reject things that are harmful for us and fend off the blows aimed at us. Indeed, even if we expressly resolved not to put our hands in front of our head, when we fall we can't help doing just that. If we had no thought then we would walk, as the lower animals do, without having learned to; and it is said that sleep-walkers sometimes swim across rivers in full flood that would drown them if they were awake. As for the movements of our passions: in us they are accompanied by thought because we have the faculty of thinking, but it's very clear that they don't depend on thought, because they often occur against our will. So they might also occur in lower animals, even more violently than in human beings, without licensing the inference that those animals have thoughts.

In fact, the only external actions of ours that could show someone who examines them that our body is not just a self-moving machine but contains a soul with thoughts are

> **(i)** spoken words or other signs, **(ii)** made with reference to states of affairs that come up, **(iii)** without expressing any passion.

I say **(i)** 'spoken words *or other signs*' because deaf-mutes use signs as we use speech; **(ii)** I speak of these ·words or· signs as having reference to something, so as to exclude the 'speech' of parrots (without excluding the speech of madmen, which has reference to particular topics, though it doesn't follow reason); and **(iii)** I add that these words or signs mustn't express any passion, so as to exclude not only cries of joy or sadness and the like, but also things that animals can be trained to do. If you teach a magpie to say 'hullo' to its mistress when it sees her approach, this can only be by making the uttering of this word the expression of one of its passions—e.g. it will express its wish to eat if it has always been given a titbit when it says 'hullo'. Similarly, all the things that dogs, horses and monkeys are taught to do are only expressions of their fear, their hope or their joy; which is why they can be performed without any thought. I am struck by the fact (as it seems to be) that the use of words, so defined, is something that only human beings have. It's all very well for Montaigne and Charron to say that some human beings differ from others more than a human being differs from a lower animal; but there has never been known an animal so perfect as to use a sign to make other animals understand something that doesn't relate to its passions; and there's no human being so imperfect as *not* to do so, because even deaf-mutes invent special signs to express their thoughts. I regard this as very strong evidence that the reason why animals don't speak as we do is not that they lack the organs but that they have no thoughts. It can't be said that they speak to each other but we don't understand them; dogs and some other animals express their •passions to us, and they would express their •thoughts also if they had any.

I know that lower animals do many things better than we do, but this doesn't surprise me. It is evidence that they act naturally and mechanically, like a clock that tells the time better than our judgement does. When the swallows come in spring, surely they are operating like clocks. The actions of honeybees are all like that, as is the orderly pattern of cranes in flight. . . . The instinct ·of some animals· to bury their dead is no stranger than that of dogs and cats that scratch the earth to bury their excrement; they hardly ever

actually bury it, which shows that they act only by instinct and without thinking. The most one can say is this:

> Although the lower animals don't perform any action that shows us that they think, still, since the organs of their bodies are not very different from ours it may be conjectured that attached to these organs there's some thought such as we experience in ourselves, but of a very much less complete kind.

All I can say to this is that if they thought as we do, they would have an immortal soul as we do. This is unlikely, because there's no reason to believe it of some animals without believing it of all, and many of them—e.g. oysters, sponges—are too imperfect for this to be credible.

⊕ [1.xii.46: Chanut writes to Descartes, assuring him that the good things he has heard about Queen Christina of Sweden are all true, praising her competent involvement in political affairs and her devotion to high culture. [She was 20 years old at this time.] He reports that she asked him for his opinion on a certain matter, and he is passing the question on to Descartes. It is **(3)** of the trio in Chanut's letter on 1.ii.47. Questions **(1)** and **(2)** don't appear in the copy we have of the present letter, which is presumably incomplete.]

⊕ [14.xii.46: Descartes writes to Noël, a miscellany of remarks about his (Descartes's) intellectual friends and enemies.]

⊕ [14.xii.46: Descartes writes to Charlet, responding gratefully to advice Charlet has given regarding the conduct of public disagreements on intellectual matters. Descartes comments on the difficulty of getting one's allies to toe this line—he clearly has Regius in mind.]

to Chanut, 1.ii.1647:

I can't rest until I have replied to your most welcome letter that has just reached me. The problems you set would be difficult for wiser men than me to discuss in a short time, and I know that however long I spent I could not solve them fully. Consequently, I prefer to write at once what my enthusiasm dictates rather than to think things through more slowly and after all write nothing any better.

You ask on Queen Christina's behalf for my opinion about three things.

(1) What is love?

(2) Does the natural light by itself teach us to love God?

(3) Which is worse if immoderate and misused, love or hatred?

(1) [This will run until page 193.] I distinguish **(a)** the love that is purely intellectual or rational from **(b)** the love that is a passion. The first seems to be what we have when our soul perceives some present or absent good that it judges to be appropriate for itself, and joins itself to it *de volonté* [see Glossary], i.e. considers itself and the good in question as forming two parts of a single whole. Then **(i)** if the good is present—i.e. if the soul possesses it, or is possessed by it, or is joined to it not only by its will [*volonté*] but also in fact and reality in the appropriate manner—in that case, the movement of the will that accompanies the knowledge that this is good for it is **joy**; and **(ii)** if the good is absent, then the movement of the will that accompanies the knowledge of its lack is **sadness** and the movement that accompanies the knowledge that it would be a good thing to acquire it is **desire**. All these movements of the will that constitute love, joy, sadness and desire, in so far as they are rational thoughts and not passions, could occur in our soul even if it had no body. For instance, if a soul perceived that there are many fine things to be known about Nature, its will would be unstoppably led to •love the knowledge of those things, i.e. to consider that knowledge as belonging to itself. And if in addition it was aware of having that knowledge, it would have •joy; if it realised that it didn't have the knowledge, it

would have •sadness; and if it thought it would be a good thing to acquire it, it would have •desire. Nothing in all these movements of its will would be obscure to the soul—it would be perfectly aware of it all—provided it reflected on its own thoughts.

But while our soul is joined to the body, this rational love is commonly accompanied by **(b)** the other kind of love, ·the passion· that can be called sensual or sensuous. This (as I said briefly of all passions, appetites and sensations in my *Principles*) is nothing but a confused thought, aroused in the soul by some motion of the nerves, which disposes it to have the other thought—the clearer one—that constitutes rational love. In love a strange kind of heat is felt around the heart, and a great abundance of blood in the lungs, which makes us open our arms as if to embrace something, and this inclines the soul to join itself *de volonté* to the object presented to it. But the thought by which the soul feels the heat is different from the thought which joins it to the object. (It's like what happens in thirst: the sensation of the dryness of the throat is a confused thought that disposes the soul to desire to drink, but it isn't identical with that desire.) It sometimes happens, indeed, that the feeling of love occurs in us without our will [*volonté*] being led to love anything, because we don't encounter any object we think worthy of love. It can also happen, on the other hand, that we are aware of a most worthwhile good, and join ourselves to it *de volonté*, without having any corresponding passion, because the body is not appropriately disposed.

Commonly, however, these two loves occur together; for they are so linked that when **(a)** the soul judges an object to be worthy of it, this immediately disposes the heart to make **(b)** the motions that arouse the passion of love; and when **(b)** the heart is disposed in that way by other causes, that makes the soul **(a)** imagine lovable qualities in objects in which at other times it would see nothing but faults. It's not surprising that certain motions of the heart should be naturally connected in this way with certain thoughts that they in no way resemble. Because the soul is naturally fitted to be united with a body, it also has this property:

> Each of its thoughts can be associated with certain motions or conditions of this body in such a way that •when the same conditions recur in the body, they induce the same thought in the soul, and conversely •when the same thought recurs, it disposes the body to return to the same condition.

In the same way when we learn a language, we connect the sight or sound of certain words, which are material things, with their meanings, which are thoughts, so that when we later hear the same words we conceive the same things, and when we conceive the same things we remember the same words.

But the bodily conditions that first accompanied our thoughts when we came into the world must have become more closely connected with them than any ·bodily conditions· that accompany them later. This helps to explain the origin of the heat felt around the heart and of the other bodily conditions that also accompany love. It is probable, I think, •that at the first moment of the soul's union with the body it felt joy, and immediately after that felt love, then perhaps also hatred, and sadness; and •that the bodily conditions that caused those passions back then have ever since naturally accompanied the corresponding thoughts. I think that the soul's first passion was joy because it isn't credible that the soul was put into the body at a time when the body was not in a good condition; and a good condition of the body naturally gives us joy. I say that love followed because the matter of our body perpetually flows out of it—flows like the water in a stream—and there's always need

for new matter to take its place; so that it's hardly likely that the body would be in a good condition if there weren't within reach some matter suitable for food. The soul, uniting itself *de volonté* [see Glossary] to that new matter, felt love for it; and later, if the food happened to be lacking, it felt sadness. And if its place was taken by some other matter unsuitable as food for the body, it felt hatred.

Those are the four passions that we had first (I think), and they're the only ones we had before our birth. Back then they were (I also think) only sensations, or very confused thoughts, because the soul was so attached to matter that its only way of attending to anything else was by receiving various impressions from it. Some years later the soul began to have other joys and other loves—ones that don't depend only on the body's being in a good condition and suitably nourished—but **(a)** the intellectual element in its joys or loves has always been accompanied by **(b)** the first sensations that it had of them and even by the motions or natural functions that occurred in the body on those early occasions.

Before birth, love was caused only by suitable nourishment which, entering in abundance into the liver, heart and lungs, produced an increase of heat; that's why a similar heat still always accompanies love, although it comes from very different causes. If I weren't afraid of being long-winded I could show you—item by item—how all the other bodily conditions that occurred along with these four passions at the beginning of our life *still* accompany them. I'll merely say that it's because of these

> **(b)** confused sensations of our childhood that remain joined with **(a)** the rational thoughts by which we love what we judge worthy of love

that it is hard for us to know what the nature of love is. And it is also made hard for us by the fact that many other passions—e.g. joy, sadness, desire, fear, hope, etc.—mingle in various ways with love. This is especially noticeable in the case of *desire*, which is so commonly mistaken for *love* that people have distinguished two sorts of love: one called 'benevolent love', in which desire is less apparent, and the other called 'concupiscent love', which is simply a very strong desire based on a love that is often weak.

A full account of love would take a big book; and though its nature is to make one very apt to communicate •as much as one can, so that it incites me to try to tell you •more than I know, I restrain myself for fear that this letter may become tediously long.

(2) So I pass to your second question [the first began on page 191; this will run to page 195]:

> Does the natural light by itself teach us to love God?
> And can one love him by the power of that light alone?

I see two strong reasons for doubting that one can. The first is that the attributes most commonly attributed to God are so high above us that we don't see they can possibly be fitting for us; so we don't join ourselves to them *de volonté*. The second is that nothing about God can be visualised by the imagination, which makes it seem that although one might have **(a)** an intellectual love for him one could not have **(b)** any sensuous love, because it would have to pass through the imagination if it were to reach the senses by way of the intellect. So I'm not surprised that some philosophers are convinced that •the only thing that enables us to love God is the Christian religion, which teaches the mystery of the Incarnation in which God came down to our level and made himself like us; and that •those who appear to have had a passion for some divinity without knowing about the mystery of the Incarnation haven't loved the true God but only some idols to which they gave his name. . . . Despite all this, I have no doubt that we can truly love God solely by the power of our nature. I don't assert that there's any *merit* in this love

when it occurs without grace—let the theologians sort that out—but I make bold to say that with regard to the present life it is the most delightful and useful passion possible; and it can even be the strongest, though only if we meditate very attentively, because we're continually distracted by the presence of other objects.

In my view, the way to reach the love of God is to consider that he is a mind, or a thing that thinks; and that •our soul's nature is sufficiently like his for us to come to believe that •it is an emanation of his supreme intelligence, a 'breath of divine spirit'. Our knowledge seems to be able to grow by degrees to infinity, and since God's knowledge is infinite it is at the point that our knowledge is aiming at; and if we focussed on this to the exclusion of everything else we might arrive at the absurdity of wishing to be gods, thus making the disastrous mistake of •loving divinity instead of •loving God. But **the infinity of God's knowledge** isn't the whole story. We should also take account of

- **•the infinity of his power**, by which he has created so many things that of which we are only a tiny part; of
- **•the extent of his providence**, which makes him see with a single thought all that has been, all that is, all that will be and all that could be; of
- **•the infallibility of his decrees**, which are altogether immutable even though they respect our free will; and (finally) of
- **•the greatness of the created universe** balanced against our smallness, observing how all created things depend on God, and regarding them in a manner proper to his omnipotence instead of enclosing them in a ball as do the people who insist that the world is finite.

Someone who meditates on these things and understands them properly will be filled with extreme joy. Far from being so insulting and ungrateful to God as to want to take his place, he will think that the knowledge that God has favoured him with is already enough to make his life worthwhile. Joining himself *de volonté* entirely to God, he loves him so perfectly that he desires nothing at all except that God's will should be done. And from now on, knowing that nothing can happen to him that God hasn't decreed, he will no longer fear death, pain or disgrace. He so loves this divine decree, regards it as so just and so necessary, and knows that he must be so completely subject to it, that even when he expects it to bring death or some other evil he won't will to change it even if *per impossibile* he could do so. He doesn't shun evils and afflictions because they come to him from divine providence; still less does he shun the permissible goods or pleasures he may enjoy in this life, since they too come from God's decree. He accepts them with joy, without any fear of evils, and his love makes him perfectly happy.

It's true that the soul must be very detached from the traffic of the senses if it is to represent to itself the truths that arouse such a love. That's why it appears that it can't pass this love on to the imaginative faculty so as to make it a passion. But I don't doubt that it does do this. For although we can't imagine anything in God, who is the object of our love, we *can* imagine our love itself, which consists in our wanting to unite ourselves to some object and, when God is the object, that amounts to wanting to consider ourselves as a minute part of all the immensity of the created universe. Objects vary, so there are various ways of uniting oneself to them or joining them to oneself; and the mere idea of such a union produces heat around the heart and causes a violent passion.

Ordinary usage and the courtesy of good manners forbid us to tell those whose condition is far above ours that we 'love' them; we may say only that we respect, honour, esteem

them, and that we have zeal and devotion for their service. I think this is because reciprocal love between two human beings makes them in some way equals, so that if while trying to make myself loved by some great person I said that I 'loved' him, he might think I was doing him wrong by treating him as an equal. But philosophers usually don't give different names to things that share the same definition, and the only definition of *love* that I know is that it is

> a passion that makes us join ourselves *de volonté* to some object,

no matter whether the object is equal to or greater or less than us. So it seems to me that if I am to speak philosophically I must say that it is possible to love God.

[Descartes adds that he is sure Chanut loves Queen Christina, though he wouldn't say so to her openly.]

[The symbol * , below, marks the place where Descartes moves from *nous* to *on*—i.e. from 'we' to 'one'—and then the place where he moves back again. Repeated uses of 'one' are now burdensome to Anglophone ears, so the present version ignores the switch to *on*.]

The love we have for objects above us isn't *less* than the love we have for other objects; indeed, such love has a nature that makes it *more* perfect, and makes * us embrace with greater ardour the interests of that which we love. It is the nature of love to make us consider ourselves and the object we love as a single whole of which we are only a part, and to transfer the care we previously took of ourselves to the preservation of this whole. We keep for ourselves only a part of our care, a part that is large or small in proportion to whether we think we are a large or a small part of the whole to which we have given our affection. So if we are joined *de volonté* to an object that we regard as less than ourselves—for instance, if * we love a flower, a bird, a building or some such thing—the highest perfection that this love can *properly* reach can't make us risk our lives for the preservation of such things. That is because, considered as parts of the whole that we and they constitute, they're no nobler than are our nails and our hair considered as parts of our body; and it would be preposterous to risk the whole body for the preservation of our hair. But when two human beings love one another, charity leads each of them to value his friend above himself; so their friendship is not complete unless each is ready to say in favour of the other: 'It is I who did the deed, I am here, turn your swords against me' [Descartes quotes this in Latin; it is from an episode in Virgil's *Aeneid* where one hero tries to protect his friend from the enemy]. Similarly, when an individual is joined *de volonté* to his ruler or his country, if his love is complete he's bound to •regard himself as only a very small part of the whole that he and they constitute, and •be no more afraid to go to certain death in the interests of that whole than he would be afraid to draw a little blood from his arm to improve the health of the rest of his body. Every day we see examples of this love, even in persons of low condition who give their lives cheerfully for the good of their country or for the defence of some great person whom they love. From all this it is obvious that our love for God should be, beyond comparison, the greatest and most perfect of all our loves. [This started on page 193; the next ends on page 197.]

(3) I pass to your third question: 'As between immoderate love and immoderate hatred, which is worse?' I find this harder to answer this question than the other two because it is ambiguous. One passion might be called 'worse' than another because

> **(i)** it makes us less virtuous, or
> **(ii)** it is more of an obstacle to our happiness, or
> **(iii)** it carries us to greater excesses and disposes us to do more harm to other people.

These three versions of the question should, I think, be examined separately.

(i) I have no straightforward answer to the first version of the question. •If I attend to the definitions of the two passions, I consider that love for an undeserving object can make us worse than can hatred for an object we should love, because there's more danger in being joined to a bad thing and being as it were transformed into it than there is in not being joined *de volonté* to a good thing. [What Descartes wrote means 'than in being separated *de volonté* from a good thing', but he hasn't provided a meaning for that phrase.] •On the other hand, if I take into account the inclinations or habits arising from these passions, I change my mind. Love, however immoderate, always has the good for its object, so it seems to me that it can't corrupt our morals as much as hatred, whose only object is evil. We see by experience that ·even· the best people gradually become malicious if they can't help hating someone; for even if their hatred is just, they so often call to mind the evils they receive from their enemy, and the evils they wish him, that they gradually become accustomed to malice. By contrast, those who give themselves over to love, even if their love is immoderate and frivolous, often become more decent and virtuous than ·they would be· if they turned their mind to other thoughts.

(ii) I have no trouble with the second version of the question. Hatred is always accompanied by sadness and grief; and if some people take pleasure in doing harm to others, I think their delight is like that of the demons who (according to our religion) continually imagine themselves to be getting revenge on God by tormenting men in hell but are nevertheless damned. Love, on the other hand, however immoderate it may be, gives pleasure; and though the poets often complain of it in their verses, I think men would naturally give up loving if they didn't find it more sweet than bitter. All the afflictions that are blamed on love come solely from the other passions—rash desires and ill-founded hopes—that accompany it.

(iii) But if the question concerns which of the two passions carries us to greater excesses and makes us capable of doing more harm to others, I think I must say that it is *love*. It has by nature much more power and strength than hatred; and affection for a trivial object often causes incomparably more evils than the hatred of a more valuable object could do. To see that hatred has less vigour than love, consider the origin of each. As I said earlier, our first feelings of love arose because our heart was receiving suitable nourishment in abundance, whereas our first feelings of hatred were caused by harmful food reaching the heart; and the same bodily events still accompany the same passions. If I was right about that, it's evident that when we love,

> all the purest blood in our veins floods towards the heart, sending a great quantity of animal spirits to the brain and thus giving us more power, vigour and courage;

whereas when we hate,

> the bitterness of gall and the sourness of the spleen mixes with our blood and diminishes and weakens the spirits going to the brain, and so we become feebler, colder and more timid.

Experience confirms what I say, for heroes like Hercules and Roland love more ardently than other men, whereas weak and cowardly people are more inclined to hatred. Anger can indeed make people bold, but it borrows its strength from the *self*-love that is always its foundation, and not from the hatred that is merely an accompaniment. Despair also calls forth great efforts of courage, and fear can lead to great cruelties; but these passions are not the same as hatred.

I still have to show that immoderate love for an unimportant object—being ungoverned—can cause more evil than can hatred for something more valuable. My argument for

this is that •the evil arising from hatred extends only to the hated object, whereas •immoderate love spares nothing but its object, which is usually very slight in comparison with all the other things that it is ready to abandon and destroy to serve as seasoning for its immoderate passion. You might say:

> Hatred is the immediate cause of the evils attributed to love, because if we love something we thereby hate whatever is contrary to it.

But even so, love is more to blame than hatred for the evils that come about in this way, •because it is the *first* cause and •because love for *one* object can give rise in this way to hatred for *many*. Moreover, love's greatest evils don't have hatred as their immediate sources; the chief and most dangerous are the evils that are done or permitted for the sole pleasure of the loved object or for oneself. As a poet said, 'Noble Paris put all Troy to fire / To quench his own heart's flame.' This shows that even the greatest and most tragic disasters can be, as I have said, seasoning for an immoderate love, and make it more delicious the more they raise its price.

⊕ [15.iii.47: Descartes writes to Mersenne, sorting out a misunderstanding over what Descartes had said about the sounds of suspended (musical) triangles.]

⊕ [26.iv.47: Descartes writes to Mersenne, replying sharply to his request for an opinion about a recent book by Fabri, and brushing off a request for explanations of certain supposed empirical facts.]

to the Curators of Leiden University, 4.v.1647:

[This 10-page Latin letter is a protest at the libels that have been directed at Descartes in a formal public debate about his work at Leiden University. The first four pages recapitulate the history of this conflict, and highlight the charge that Descartes is guilty of 'a horrible and impious blasphemy' because, allegedly, he says that God is a deceiver. Then he gets down to some details:]

I have been told that at the ·formal· disputation, when my defender asked the attacker and the chairman what passage in my writings showed that I hold God to be a deceiver, the first passage they cited (and they kept bringing it up) was this from the first Meditation:

> 'So I shall suppose that some malicious, cunning demon with the highest power has done all he can to deceive me—rather than this being done by God, who is supremely good and the source of truth.'

My defender pointed out that in that passage I expressly distinguished •the supremely good God, the source of truth from •the malicious demon. He denied that I meant to hold. . . .or even to suppose the supremely good God to be a deceiver, and said that I had supposed this instead about the evil demon. I had to go about it this way, he said, because I had added that God is 'the source of truth', displaying an attribute of his that is incompatible with deception. They replied that I had called the deceiver 'supremely powerful', and that the only supremely powerful being is the true God. I could exclaim that following that line of argument they must hold all the demons, idols, and gods of the heathen are the true God or gods, because the description of any one of them will contain some attribute that in reality belongs only to God. And I could turn their own words against them by saying that their treatment of me *is* 'a horrible and impious blasphemy', especially given that it isn't a mere supposition but is an assertion scandalously taught in a public lecture-hall in support of a libel. [Descartes was a little carried away there. He can't have soberly thought that the mistreatment of him was impious and blasphemous.] But I will merely say that since the context demanded the supposition of an extremely powerful deceiver, I distinguished the good God from the

evil demon, and taught that if *per impossibile* there were such an extremely powerful deceiver, it would not be the good God. . . .and could only be regarded as some malicious demon. My use of this supposition can't be criticised on the grounds that 'evils are not to be done so that good may come'; my supposition has no moral evil in it, and no goodness either through the purpose it serves, because it is an act of the intellect and not of the will, which reinforces the claim that I don't believe the supposition to be true and don't want anyone else to believe it either. My purpose was excellent, because I was using the supposition only •to make a better job of overthrowing scepticism and atheism, •to prove that God is no deceiver, and •to establish this as the foundation of all human certitude. Indeed I dare to boast that no-one can less justly and less plausibly be accused of holding God as a deceiver than I myself; because nobody before me whose writings have survived has so expressly, earnestly and carefully demonstrated that the true God is no deceiver. [The protest continues for nearly three more pages.]

⊕ [11.v.47: Chanut writes to Descartes about his long letter to Queen Christina. He read it to her, and was amazed at the speed of her uptake. He passes on (at her request) the admiring terms in which she has spoken of Descartes. She asks for re-assurance that Descartes's notion of the world as infinite doesn't clash with Christianity, and Chanut throws in a question of his own, about friendship.]

⊕ [v.47: Descartes writes to the Curators of the University of Leiden, continuing in the same vein as his letter of 4.v.47.]

⊕ [12.v.47: Descartes writes to Servien, a representative of the French king in the Netherlands, describing his trouble with the University of Leiden, alleging (with convincing detail) that the University's conduct in all this has been extremely unfair to him, and protesting that what they really want is to deliver him into the hands of the Spanish Inquisition, though he is a Frenchman who has carried arms in the fight to chase the Inquisition out of France. He asks to intercede on his behalf with the Prince of Orange.]

⊕ [v.47: the Curators of the University of Leiden write to Descartes, acknowledging his letter of 4.v.47 and saying that the professors who had attacked Descartes in their lectures had been ordered to confine themselves to teaching what they believed to be true and not to discuss Descartes 'for or against'.]

⊕ [27.v.47: Descartes writes to the Curators of the University of Leiden, a letter in which 'he replied testily that the issue was not about what should or should not be discussed but about the fact that he needed an apology and retraction' (Richard Watson, *Cogito Ergo Sum*, page 234.]

⊕ [27.v.47: Descartes writes to Wilhelm, asking for his help in the Leiden matter. Some of the colleagues of Descartes's attackers are friends of Wilhelm's, and have seemed to Descartes to be reasonable and decent, and he asks Wilhelm to speak to them on Descartes's behalf.]

to Chanut, 6.vi.1647:

I avidly read your latest letters, finding in them great proofs of your friendship and your tact. I was alarmed when I read in the first pages that du Rier [physician to the Queen] had spoken to the Queen about one of my letters and that she had asked to see it. Later, when I reached the place where you say that she heard it with some satisfaction, I was greatly relieved. I don't know whether I was more overcome with •admiration at her so easily understanding what the most learned men find obscure, or with •joy that she didn't find it displeasing. But my admiration doubled when I saw the force and weight of the objections that Her Majesty made regarding the size I attributed to the universe [see Chanut's letter of 11.v.47]. I wish that your letter had found me in my normal abode. The problem is difficult and judiciously posed, and if I had been in a place where I could collect my thoughts

I might have unravelled it better than I can in a hotel room. Still, I don't want to use this as an excuse; I'll try to write all I can say on this topic, provided I'm allowed to think that I am writing to you alone, so that my imagination won't be too confused by veneration and respect.

In the first place, I recollect that the Cardinal of Cusa and other theologians have supposed the world to be infinite without ever being censured for this by the Church; on the contrary, representing God's works as very great is thought to be a way of doing him honour. And my opinion is easier to accept than theirs, because I say not that the world is infinite but only that it is *indefinite*. There's a quite notable difference between the two: because if we say that something is infinite we should have a reason that tells us that it is so; and we can't have such a reason except in the case of God; but to say that a thing is indefinite, all we need is *not* to have a reason showing that it has bounds. That there are bounds to the matter of which the world is composed seems to me impossible to conceive, let alone to prove. The nature of this matter, when I examine it, turns out consist merely in its being extended in length, breadth and depth, so that whatever has these three dimensions is a part of this matter; and there can't be any completely empty space—i.e. space containing no matter—because we can't conceive such a space without conceiving it as having these three dimensions and consequently as being matter.

> Now, in supposing the world to be finite we are imagining that beyond its bounds there are some spaces that are three-dimensional and therefore not purely 'imaginary', as the philosophers' jargon has it. These spaces contain matter; and there's nowhere for this matter to be but in the world; so the world extends beyond the bounds we had tried to assign to it.

Thus, having then no reasons that show the world to have bounds—and not even being able to conceive its having them—I call it *indefinite*. But I can't deny that there may still *be* some reasons that are known to God though incomprehensible to me, which is why I don't say outright that it is *infinite*.

When I think about the world's duration and compare it with the world's extension (considered in this way), the only thought I come up with is the following. [What follows *looks* clear but is extraordinarily hard to follow. It has three main claims. **(a)** Descartes's argument for the impossibility of a spatial bound to the world (indented in the preceding paragraph) is not matched by a valid argument for the impossibility of a beginning bound to the time the world has existed. When we think of the world as coming into existence at time T, we aren't compelled to imagine something about pre-T time that implies that the world existed back then. (The difference comes from this: a supposed spatial boundary of the world involves the thought of *space* beyond it, and (according to Descartes) that is the thought of *matter* beyond it, i.e. some part of the *world* beyond it; but even if the thought of a supposed backwards temporal boundary of the world involves the thought of *time* before that, Descartes has no reason to say that this involves the thought of any *world* back then.) **(b)** However, although metaphysics gives us no reason to **deny** that the world began only a finite length of time ago, it gives us no reason, either, to *affirm* that the world began only a finite length of time ago. For any time T before the actual time at which the world was created, God *could* have created the world at T if he had wanted to. Descartes then turns to the future:] Faith teaches us that although •heaven and earth will pass away (i.e. will change their appearance) •the world (i.e. the *matter* of which the earth and the heavens are composed) will never pass away. This is clear from the promise of eternal life for our bodies

after the Resurrection, and consequently for the world in which they will exist. . . .

The special advantages that religion attributes to human beings need some explanation, because they seem difficult to believe in if the spatial extent of the universe is taken to be indefinite. We may say that •all created things are made for us, in the sense that we can make use of them; I don't know that we're obliged to believe that man is what the creation is *for*. On the contrary, it is said that 'all things are made for God's sake', and that God alone is the final as well as the efficient cause of the universe. ·The 'made for us' talk doesn't mean anything so grand·. Created beings can be of service to each other; and when x finds that y and z are useful to it, it may ascribe to itself a privileged position and consider that y and z are 'made for me'.

It's true that the Genesis account of the six days of the creation make it look as though man is what the creation is principally *for*. But it can be said that the Genesis account was written for man, and that the Holy Spirit •focussed the narration of things that concern mankind and indeed •didn't speak of anything except in its relationship to man. Preachers, whose role is to spur us on to the love of God, commonly present us with the various benefits we derive from other creatures and say that God made them for us; they don't bring to our attention the other ends for which God might be said to have made those other creatures, because this would be irrelevant to the preachers' purpose; and the upshot of this is that we're inclined to believe that God made all these other things for us alone. But preachers go even further: they say that each person in particular owes gratitude to Jesus Christ for *all* the blood that he shed on the cross, as if he had died merely for a single person. What they say is indeed true; but it doesn't rule out his having redeemed many other **people** by that same blood. In the same way I don't see that the mystery of the Incarnation, and all the other favours God has done to man, rule out his having done countless other great favours to countless other **creatures**.

I don't infer from this that there are intelligent creatures in the stars or elsewhere, but I don't see any argument to show that there aren't. I always leave questions of this kind undecided, rather than denying or asserting anything about them. The only remaining difficulty, I think, is that we have long believed that man has great advantages over other creatures, and it looks as if we lose them all when we change our opinion ·about what thinking beings there are in the universe, the fear being that if there are countlessly many of them on other planets we may lose all our privileges because we're outranked by them. I now allay that fear·. [The addition of the last four lines is required if we're to make sense of this paragraph in relation to what follows.]

Our goods, benefits, advantages can be sorted into two groups: **(a)** those that can be lessened through others' having goods like them, and **(b)** those that cannot.

> **(a)** A man who has only a thousand pistoles would be rich if no-one else in the world had as much; and he would be poor if everyone else had much more. Similarly, all praiseworthy qualities bring more glory to those who have them, the fewer the people who share them.

Those examples explain why we commonly envy the riches and glory of others.

> **(b)** Virtue, knowledge, health, and in general all other goods considered in themselves without regard to glory, are not lessened in us through being found in many others.

That is why we have no grounds for being distressed because others have them too.

Now the goods that could belong to all the intelligent creatures in an indefinitely large world belong to class **(b)**; they don't diminish *our* goods. On the contrary, when we love God and through him unite ourselves *de volonté* to all the things he has created, then the greater, nobler and more perfect we reckon them, the more highly we esteem ourselves as being parts of a more perfect whole, and the stronger our grounds for praising God on account of the immensity of his works. Holy Scripture entirely confirms this view in the many places where it speaks of the innumerable multitude of angels, for we think that the least of the angels is incomparably more perfect than human beings. It is also confirmed by the astronomers when they measure the size of the stars and find them to be very much bigger than the earth. For if the indefinite extent of the universe gives ground for inferring that places other than the earth are inhabited, so does the extent that all the astronomers attribute to it; for every one of them judges that the earth is smaller in comparison with the entire heavens than a grain of sand in comparison with a mountain.

·So much for Her Majesty's question·. I now pass to *your* question about the causes that often impel us to love one person rather than another before we know the worth of either. I can discover two, one belonging to the mind and one to the body. The one in the mind presupposes so many things concerning the nature of our souls that I'm not up to explaining it in a letter; so I will speak only of the one in the body. It consists in the arrangement of the parts of our brain that is produced by objects of the senses or by some other cause. The objects that strike our senses act, via the nerves, to create as it were *folds* in our brain. Such a fold flattens out when the object stops acting on the senses, but the place where it was made has a tendency to be folded again in the same way by another object resembling the original object even if not completely. Here's an example: When I was a child I loved a little girl of my own age who had a slight squint. The •impression made by sight in my brain when I looked at her not-quite-focussed eyes became so closely connected to the simultaneous •impression that aroused in me the passion of love that for a long time afterwards when I saw persons with a squint I felt a special inclination to love them simply because they had that defect; and I didn't know that that was why. But as soon as I reflected on it and saw that it was a defect, I was no longer affected by it. So, when we're led to love someone without knowing why, we may conjecture that it's because he has some similarity to someone we loved earlier, even if we can't say what the similarity is. What attracts our love in this way is more often a perfection than a defect, but it *can* be a defect—as in the case of my youthful self—so a wise man won't altogether yield to such a passion without first considering the worth of the person to whom he feels drawn. But because we can't *love* equally all those whom we observe to be equally worthy, I think that our only obligation is to *esteem* them equally; and since the chief good of life is friendship, we have reason to prefer those to whom we are joined by our secret inclinations, provided we also see worth in them. And when these secret inclinations are aroused by something in the mind, not in the body, I think they should always be followed. How are we to know which is which? Mainly by this: the inclinations that come from the mind are reciprocated, whereas the others usually aren't. . . .

⊕ [ix.47: Descartes writes to Mersenne about something in Galileo's physics which Descartes says is, when properly understood, clearly false.]

to Queen Christina, 20.xi.1647:

I learn from M. Chanut that you wish me to have the honour of expounding to you my view of *the supreme good* understood in the sense of the ancient philosophers. This command is such a great favour that my desire to obey it turns away all other thoughts; so without making excuses for my inadequacy I will put in a few words all that I have come to know on this topic.

The goodness of each thing can be considered in itself without reference to anything else, and in this sense it's evident that God is the supreme good, since he is incomparably more perfect than any created thing. But goodness can also be considered in relation to ourselves, and in this sense I don't see anything we can regard as good unless •it somehow belongs to us and •our having it is a perfection. Thus the ancient philosophers, whose minds were not bathed in the light of faith and who knew nothing about supernatural blessedness, considered only the goods we can have in this life; and they were trying to discover which of *these* is the supreme good.

We should not consider anything as good in relation to ourselves unless we possess it or have the power to acquire it. Given this, it seems to me that the supreme good of *all men together* is a total or aggregate of all the goods—those of the soul as well as those of the body and of fortune—that can be shared by two or more people; whereas the supreme good of *each individual* is quite different from that, and consists only in a firm will to do good and in the contentment that this produces. My reason for saying this is that I don't see any other good that seems so great or so entirely within each man's power. For the goods of the body and of fortune ·aren't entirely within our power, because they· don't depend absolutely upon us; and the goods of the soul. . . well, let's look at them. They all come down to one of two things: **(i)** knowing what is good, and **(ii)** willing what is good. But knowledge is often beyond our powers; so there remains only our will, the use of which is absolutely up to us. And I don't see that it can be better used than by a firm and constant resolution

- to carry out exactly all the things that one judges to be best, and
- to employ all the powers of one's mind in finding out what these are.

All the virtues come down to this pair; this alone really deserves praise and glory; and this alone produces the greatest and most solid contentment in life. So I conclude that it's this that constitutes the supreme good.

In this way I think I can reconcile the two most opposed and most famous opinions of the ancient philosophers—that of Zeno, who thought *virtue or honour* to be the supreme good, and that of Epicurus, who thought the supreme good was *contentment*, which he called 'pleasure'. Just as all vices arise simply from the uncertainty and weakness that go with ignorance and lead to regret, so virtue consists only in the resolution and vigour that we put into doing the things we think to be good—provided that this vigour stems not from stubbornness, but from our knowing that we have examined the matter as well as we're morally able to do. What we do after this examination may turn out badly, but still we can be sure of having done our duty; whereas if we perform a virtuous action thinking we're doing wrong or not caring whether we are doing right or wrong, we are not acting like a virtuous person. Honour and praise are often awarded to the other goods, the goods of fortune; but I'm sure that you, Your Majesty, care more about virtue than about your crown, I don't hesitate to express my opinion that nothing but virtue really deserves praise. All other goods deserve only

to be esteemed, not to be honoured or praised, unless they are thought to have been bestowed by God as a reward for the good use of free will. For honour and praise is a kind of reward, and only what depends on the will provides grounds for reward or punishment.

I still have to prove that the greatest and most solid contentment in life comes from the good use of free will. This doesn't strike me as hard to do, and here is why. When I consider carefully what constitutes pleasure, or delight, and in general all the sorts of contentment we can have, I observe three things. **(1)** All of these states are entirely within the soul, though many of them depend on the body (just as the soul sees by means of the eyes). **(2)** Nothing can bring contentment to the soul except its belief that it possesses some good, and this belief is often only a very confused representation. The soul's union with the body commonly causes it to represent certain goods as being incomparably greater than they are; whereas if it had clear knowledge of their true value •its contentment would always be in proportion to the greatness of the good from which •it proceeded. **(3)** How good something is *for us* should be measured not only by its intrinsic value but also—and principally—by how it is related to us. Now free will is intrinsically the noblest thing we can have, because it puts us (in a way) on a par with God and seems to exempt us from being subjected to him; so its correct use is the greatest of all our goods, and the one that is most utterly *ours* and that matters to us most. From all this it follows that nothing but free will can produce our greatest happiness. Moreover, the peace of mind and inner satisfaction felt by those who know they always do their best to discover what is good and to acquire it is a pleasure incomparably sweeter, more lasting and more solid than all those that come from elsewhere. . . .

to Chanut, 20.xi.1647:

It is true that usually I refuse to write down my thoughts about morality, for two reasons. **(a)** There's is no subject in which malicious people can more easily find pretexts for vilifying me; and **(b)** I believe only that sovereigns and people authorised by them have the right to get involved in regulating the *mœurs* [see Glossary] of other people. But in the present situation—where you have honoured me by writing, on behalf of the incomparable Queen whose court you are attending, that she would like me to write down for her my views on the supreme good—neither of those reasons applies, because **(b)** her wish does authorise me, and **(a)** I hope that what I write will be seen only by Her Majesty and by you. I so ardently desire to obey her that, far from holding back, I would like to be able to cram into one letter everything I have ever thought on this topic. In fact, in the letter I ventured to write her I to put in so much that I'm afraid I haven't explained anything well enough. To make up for this fault, however, I'm sending you a collection of other letters in which I have explained these matters at greater length. I have also included. . . .a little treatise on the passions, because they are what we must primarily try to be acquainted with if we are to attain the supreme good as I have described it. If I had gone so far as to include the replies I had the honour of receiving from the Princess [Elisabeth of Bohemia] to whom those letters were written I could have sent you a more complete collection—and I could have added another two or three of my letters, ones that aren't intelligible without hers. But for that I'd have needed to get her permission, and she is now quite far from here.

By sending letters that I have written to a third person instead of writing to Her Majesty what I judge she will find agreeable, perhaps I'm not showing the respect and

veneration that I owe to her. Because I fear that that may be so, I ask you not to present this collection to the Queen straight away. But if you think it proper to speak to her about them, saying that I sent them to you, and if she then wants to see them, my worries about this will be removed. I think she may find it more agreeable to see what I have written for someone else than to see something addressed to her; for she may then be sure that I haven't changed or concealed anything for her sake. But I beg you, if possible, to see that these writings don't fall into other hands.

⊕ [4.xii.47: Brasset writes to Descartes, giving a kind of running commentary on various events, mostly illnesses but also one miracle.]

to Mersenne, 13.xii.1647:

It is already some time since Huygens sent me the publication by Pascal—for which I must thank the author, since it was sent to me at his request. In it he seems to want to attack my subtle matter, and I wish him well in this, but beg him •not to forget to advance all his best arguments on this subject, and •not to be upset if in due course I defend myself by expounding all the points that I believe to be relevant.

You ask me to write something on the experiments with mercury, but you don't tell me what they are, leaving me to guess! But I mustn't take the risk of guessing: if I get it right, people might think that I had done the experiment here; and if I guessed wrongly, they would have a poorer opinion of me. But I'll be grateful if you would give me a plain account of everything you have observed, and if eventually I use these observations, I shan't forget to say whom I got them from

I had advised Pascal to do an experiment to see whether the mercury rises as high at the top of a mountain as at its foot, and I don't know whether he has done it. But to enable you and me to know whether a change in the weather or place has any effect on the result [i.e. on how high the mercury rises], I'm sending you a long piece of ruled paper marked up as a scale, and am keeping an exactly similar piece here, so that we can ·record· our observations ·and see whether they· agree. Please try to observe the point on this scale that the mercury rises to when the weather is cold and when it is hot, when the wind blows from the north and when from the south. To enable you to know if there is any difference, and to encourage you to tell me plainly what you observe, I shall tell you that last Monday the height of the mercury was exactly 2' 3" on this scale, and yesterday (Thursday) it was a bit above 2' 4"; but today it came down quite a lot. To make these observations I keep a tube fastened in the same place day and night. I can't see any reason for us to rush into publishing our findings; it would be better to wait till Pascal's book is published.

I would also like you to try to light a fire in your 'vacuum', and observe whether the smoke goes up or down and what shape the flame is. You can perform this experiment by suspending a bit of sulphur or camphor at the end of a thread in the vacuum, and lighting it through the glass with a burning mirror or a burning glass. I can't do it here because the sun isn't hot enough. . . .

I'm surprised that you (like Pascal) have kept quiet about this experiment for four years, without ever reporting anything about it to me or telling me that you had begun it before this summer. For as soon as you told me about it, I reckoned that it was important, and that it could strongly confirm what I have written on physics.

⊕ [xii.47: Descartes writes to Hogelande, sending his just-completed 'Notes Against a Certain Broadsheet' and asking for Hogelande's judgment on them. The broadsheet had appeared anonymously, but Descartes knew that its author was Regius.]

⊕ [31.i and 7.ii.48: Descartes writes to Mersenne about various aspects of the experiments (with a tube containing mercury) conducted by the 'protectors of the vacuum'.]

⊕ [7.ii.48: Descartes writes to Pollot: sorry to have missed connecting with him in The Hague and looking forward to their meeting in Paris; also, remarks about the Utrecht University affair.]

⊕ [21.ii.48: Descartes writes to the Curators of the University of Leiden defending one of their teachers who has been badly treated by the University because of his support for Descartes's works.]

⊕ [21.ii.48: Descartes writes to Chanut, ecstatic at the thought of Queen Christina's interest, anxious to know her opinion of the things of Descartes's that she reads, and enjoying the thought that by helping her develop her mind Descartes may be helping the world, in which she is 'one of the most important people'. Also some complaints and regrets.]

to Cavendish iii or iv 1648:

[This letter opens with thanks to Cavendish for his part in bringing it about that Descartes had been promised a pension by the French government. Then lavish declarations of friendship etc., after which Descartes answers two questions that Cavendish had put to him:]

(1) I hold that there's a certain quantity of motion in the created material world as a whole, a quantity that doesn't grow or shrink; so that when body x makes body y move, x loses as much motion as it gives to y. If a rock falls to the earth and doesn't bounce, I take this to come from the rock's passing all its motion on to the earth when it disturbs it. But if the earth that x moves contains a thousand times more matter than x does, x transfers to it only a thousandth of its speed. So if two unequal bodies each receive the same amount of motion, this quantity of motion gives less speed to the larger than it does to the smaller; so it can be said in this sense that the more matter a body contains, the more natural inertia it has. Also: A large body can transfer its motion more easily to other bodies than a small one can, and can less easily be moved by them. So there's one sort of inertia that depends on the quantity of the matter and another that depends on the area of the surfaces. [•This relies on tying *size* to *area of surfaces*. •Descartes doesn't explain is how bodies of the same size can contain different quantities of matter.]

(2) Your other question, about the nature of our knowledge of God in the beatific vision, is a topic far away from any of my usual areas of study. Anyway, it seems to me that you have given a good answer to it yourself. You say that this knowledge is intuitive, ·though you don't use that word·, and that that's what marks it off from our present knowledge of God. Perhaps your position is this:

> The term 'intuitive' doesn't capture what's special in the beatific knowledge of God. If we come to have intuitive knowledge of God, it will be on a par with our actual knowledge of him, differing only in *how much* is known and not in the ·basic· *kind* of knowledge.

If that is your view, then in my opinion that's where you go wrong. Intuitive knowledge is an illumination of the mind, by which it sees in the light of God whatever it pleases him to show it by a direct shining of the divine brilliance on our understanding, which in this is not considered as actively *doing* anything but simply as ·passively· receiving the rays of divinity. Whatever we can know of God in this life, short of a miracle, is the result of reasoning and discursive inquiry. It has only two sources: •the principles of ·our· faith, which is obscure; and •the ideas and notions we naturally have, which even at their clearest are only gross and confused ways of thinking about God. Consequently, whatever knowledge we have or acquire by way of reason is •as dark as the principles from which it is derived and •infected with the uncertainty

we find in all our reasonings.

Now compare these two kinds of knowledge to see if there is any similarity between •such a troubled and doubtful perception that costs us much labour and is enjoyed only momentarily once acquired and •a pure, constant, bright, certain, effortless and ever-present light.

Can you doubt that our mind, when it is detached from the body, or has a glorified body that will no longer hinder it, can receive such direct illumination and knowledge? Even in our present body the senses give it such knowledge of corporeal and sensible things, and our mind already has some direct knowledge of the beneficence of its creator without which it wouldn't be capable of reasoning. I agree that the latter knowledge is somewhat obscured by the mind's mingling with the body; but still it gives us a primary, unearned and certain awareness that we touch with our mind with more confidence than we give to the testimony of our eyes. You will surely admit that you're less certain of the presence of the objects you see than of the truth of the proposition 'I am thinking, therefore I exist'. Now this knowledge isn't the work of your reasoning or information passed on to you by teachers; it is something that your mind sees, feels and handles; and although your imagination pushes into your thoughts and lessens the vividness of this knowledge by trying to clothe it with shapes, it is nevertheless a proof of our soul's capacity for receiving intuitive knowledge from God.

Your doubt seems to come from your view that an intuitive knowledge of God is one in which we know God by himself. On this foundation you have built the following argument:

•I know that God is unique, because I know that he is a necessary being;

and

•this form of knowledge uses nothing but God himself;

therefore

•I know by God himself that God is unique;

and consequently

•I know intuitively that God is unique.

It doesn't take much work to dismantle this line of thought. **(i)** Knowing God by himself, i.e. by his directly flooding our mind with light (which is what 'intuitive knowledge' ordinarily means), is quite different from. . . .**(ii)** using your natural knowledge of one of God's attributes to construct an argument leading to another. (Remember that the knowledge of kind **(ii)**, just by being natural, is a rather dark affair, at least in comparison with knowledge of kind **(i)**.) So you must admit that in this life your belief that God is unique is not •something you see, *in God and by his light*, but •something based on a proposition you have made about him, inferred from it by the power of argument, which is a machine that often breaks down.

⊕ [4.iv.48: Descartes writes to Mersenne: the reported results of Mersenne's experiments with mercury/'vacuum' etc. don't surprise Descartes, who thinks they can all be explained on his principles; he is angry at Mersenne's asking him to comment on the latest attack on his geometry, an attack by Schooten with Roberval in the background. Descartes declines to read Schooten and repair his errors 'because if I started correcting his work I couldn't help making it clearer than it is, and I don't want to do that.']

[Descartes's Conversation with Burman is included by AT and CSMK at this point, because it occurred on 30.iv.1648. It can be found as a separate item on the website from which the present text came.]

⊕ [v.48: Descartes writes to Chanut from Paris, expressing anxiety about Queen Christina's having read something by Descartes and not yet expressed any opinion of it to Chanut. He is encouraged by the news that she plans to re-read it. If Chanut thinks he is unduly concerned about this, Descartes says, 'blame it on the Paris air', which must be bad

for people's intellects because people there are awash in error. 'I can't wait to get out of this place and back to my rural solitude.']

⊕ [3.vi.48: Arnauld writes to Descartes, six pages of Latin, following up on some of his published Objections to the *Meditations*. Things he says that Descartes replies in the next letter, are as follows. (This material is partly gathered from CSMK and Alquié's edition of Descartes's works, vol. 3, footnotes on page 855.) **(1)** Because an infant has no pre-judgments = prejudices, it can have ideas that are vivid and clear. It's surprising that it doesn't as an adult recall these by an act of intellectual memory. **(2)** It isn't necessary that the soul always thinks. All that is necessary is that it always has the ability to think, just as a body always has the ability to be divided but isn't always divided. **(3)** Descartes's treatment of the duration of the soul is wrong; the duration of a spiritual being is not successive. **(4)** A challenge to Descartes's use of the thesis that a thing that is capable of doing x is capable of doing things that are less than x. **(5)** A question about *where* the body of Christ is in the Eucharist. **(6)** Challenging Descartes's denial of the possibility of empty space: given a barrel full of wine, God could annihilate the wine while not allowing any other changes, and in that case the barrel would have a concavity, a vacuum.]

for Arnauld, 4.vi.1648:

The author of the objections that reached me yesterday has chosen to conceal his person and his name: but the better part of him, his mind, cannot remain unknown. This I find to be acute and learned, so that I shall not be ashamed to be worsted in argument or to learn from him. But because he says that he is moved by desire to discover the truth, and not by zeal for disputation, I shall reply to him here only briefly, and save some things for discussion face to face. In my experience it's safer to deal with argumentative people by letter, but pleasanter to deal with seekers of truth by word of mouth.

(1) I agree that there are two sorts of memory; but I'm convinced that infants have never had any pure conceptions but only confused sensations. These leave in the brain traces that remain there for life; but those don't suffice to enable us to observe that the sensations that come to us as adults are like the ones we had in our mother's womb, because that would involve *remembering* the ones we had in the womb, and that in turn would require a certain reflective act of the intellect—a certain intellectual memory—which wasn't in use in the womb.

(2) It seems necessary that the mind should always be actually engaged in thinking; because thought constitutes its essence, just as extension constitutes the essence of a body. Thought isn't conceived as an attribute that can be present in or absent from the mind, in the way that division of parts and motion can be present in or absent from a body.

(3) What is said here about duration and time rests on a scholastic opinion that I strongly disagree with, namely that the duration of motion is of a different kind from that of motionless things. I have explained this in *Principles* 1:47. Even if no bodies existed, it still couldn't be said that the duration of the human mind is entirely simultaneous, like the duration of God; because our thoughts display a successiveness that can't be found in the divine thoughts. We clearly understand that it is possible for me to exist at this moment, while I am thinking of one thing, and yet not to exist at the very next moment, when, if I do exist, I may think of something quite different.

[That last sentence is puzzling at first, but can be understood. Descartes is stressing the *successive* nature of minds, as follows. My mind thinks of mountains at t_1 and of rivers at t_2, and the status of these times as different periods in the history of mind is reinforced by the obvious fact that my mind could exist at t_1 and not exist at t_2.]

(4) The axiom 'Anything that can do the greater can do the lesser' seems to be self-evident in the case of first causes that are not otherwise limited; but in the case of a cause determined to a particular effect we commonly say that it is a greater thing for it to produce some effect other than that to which it is determined and adapted. In that sense it is a greater thing for a man to •move the earth than to •perform an act of understanding. It is also a greater thing for a man to keep himself in existence than to give himself some of the perfections he perceives that he lacks; and this is enough to validate the argument, although it may well be less than to give oneself omnipotence and the other divine perfections.

(5) Since the Council of Trent itself was unwilling to explain how the body of Christ is in the Eucharist, and wrote that it was there 'in a manner of existing that we can scarcely express in words', I shan't risk reaching any •conclusion about this for fear of being accused of rashness; and such •conjectures as I make I would prefer to communicate by word of mouth rather than in writing.

(6) I have hardly anything to say about vacuum that isn't already to be found in my *Principles of Philosophy*. What you call the 'concavity' in the barrel, and explain in terms of the sides of the barrel as though it weren't anything different from them, seems to me to be a body with three dimensions ·*within* the barrel·.

But all these things can be more easily discussed at a meeting, which I would gladly arrange, being the most respectful servant of all men who love honesty and truth.

⊕ [vi or vii.48: Descartes writes to Mersenne , reluctantly commenting, at Mersenne's request, on a recent publication by Roberval. He says that the part he was urged to read is partly absurd and for the rest stolen from Descartes.]

⊕ [vii.48: Arnauld writes to Descartes, explaining that he isn't in Paris (where Descartes currently is, so that the hoped-for conversation can't take place (see Descartes's letter of 4.vi.48). He devotes three pages of Latin replying to some of Descartes's points.]

for Arnauld, 29.vii.1648:

Recently I was given some objections that appeared to come from an inhabitant of this city [Paris]. I answered them briefly, thinking that any omission could easily be remedied in conversation. But now that I realise the writer lives elsewhere, I hasten to reply to his second most courteous letter. . . .

(1) It seems to me very true that the mind, as long as it is united to the body, can't withdraw itself from the senses when it is stimulated with great force by external or internal objects. I add that it can't withdraw itself ·from the senses· whenever it •is attached to a brain that is too soft or damp, as in children, or •is otherwise in poor condition, as in those who are lethargic, apoplectic or frenetic, or as in all of us when we are deeply asleep. . . .

(2) [In the course of this next paragraph and the one following it, Descartes silently moves from A to B to C:

A: 'M recognises that x has occurred to it earlier'
B: 'M recognises that x has earlier occurred to it for the first time',
C: 'At some earlier time M recognised that x was occurring to it for the first time'.

Read carefully and you'll see it happening.] If we are to remember something, what is needed is not only •for the thing to have been before our mind previously and to have left some traces in the brain that prompt it to occur in our thought again, but also •for us to [A] recognise, when it occurs the second time, that this is happening because it has already been perceived by us earlier. Thus poets often think of verses that •they don't remember having read in other authors but that

•wouldn't have occurred to them unless they had read them elsewhere.

For memory to occur, therefore, there must be in the brain traces of preceding thoughts, traces that the mind [B] recognises as not having always been present to it but as having earlier been impressed on the mind for the first time. Now for •the mind to recognise this, I think that when these traces were first made •it must have used pure intellect—·i.e. thinking that owed nothing to the mind's attachment to a body·—to [C] be aware that the thing then being presented to it was new and hadn't been presented before; for there can't be any corporeal trace of this novelty. Consequently, if I wrote somewhere that children's thoughts of leave no *traces* in their brain, I meant *traces sufficient for memory*, i.e. *traces that were, at the time they first occurred, observed by pure intellect to be new*. Compare that with this: We could say ' There are no human tracks on this beach' on the grounds that the sand shows no unevennesses made by human feet; but what we would ordinarily mean is that this sand shows no impressions shaped like a human foot. Finally, just as we distinguish •direct vision (depending on the first impact of the sun's rays) from •reflective vision (depending on the second impact), I also distinguish •direct thoughts from •reflective thoughts. The first, simple thoughts of infants are *direct* in my sense—I mean such mental events as the pain they feel from wind in their intestines, or the pleasure they feel when nourished agreeably. But when an adult feels something and simultaneously perceives that he hasn't felt it before, I call this second perception *reflection*, and attribute it to the intellect alone, in spite of its being so linked to sensation that the two occur together and appear to be indistinguishable from each other.

(3) I tried to remove the ambiguity of the word 'thought' in *Principles* 1:63–64. Just as extension, which constitutes the nature of body, differs greatly from the various shapes or modes of extension that it assumes, so thought—i.e. the thinking nature—which I hold constitutes the essence of the human mind, is very different from any particular act of thinking. It's up to the mind to decide whether to produce this or that particular act of thinking, but it doesn't decide whether to be a thinking thing; just as what goes on in a flame determines its shape and size etc. but doesn't determine whether it is an extended thing. So by 'thought' I don't mean some universal that includes all modes of thinking, but a particular nature that takes on those modes, just as extension is a nature that takes on all shapes.

(4) Being conscious of our thoughts •when we are thinking is not the same as remembering them •later. Thus, we don't have any thoughts in sleep without being conscious of them when they occur, though we usually forget them immediately. We aren't conscious of *how* our mind sends the animal spirits into particular nerves, because that depends not on the mind alone but on its union with the body. We are conscious, though, of every action by which the mind moves the nerves, in so far as such action is in the mind, where it is simply the inclination of the will towards a particular ·bodily· movement. This inclination of the will is followed by everything needed for the flow of the spirits into the nerves, and then by the flow itself. This happens because of **(a)** the appropriate way the body is constructed and **(b)** the union of the mind with the body. The mind may not be aware of **(a)**, but it is certainly conscious of **(b)**—if it weren't, it wouldn't incline its will to move the limbs.

That the incorporeal mind can set the body in motion is shown to us not by any reasoning or comparison with other matters, but by the surest and plainest everyday experience. It's one of those self-evident things that we only make obscure when we try to explain them in terms

of other things. Still, here is a comparison. ·It doesn't aim to show how our minds moves our bodies, but merely to show that plenty of other philosophers are not in a position to mock or criticise us for not being able to say how this is done.· Most of the philosophers who think that a stone's heaviness is a real quality [see Glossary] distinct from the stone also think they understand well enough how this quality can impel the stone towards the centre of the earth, because they think they have a manifest experience of such an occurrence. I, however, am convinced that there is no such quality in nature, and that consequently there is no real idea of it in the human intellect; and I think that in order to represent this heaviness to themselves they are using the idea they have within them of an **incorporeal substance**. So it's no harder for us to understand how the mind moves the body than it is for them to understand how such heaviness moves a stone downwards. Of course they deny that heaviness is a **substance**, but in fact they conceive it as a substance because they think that it is real [= thing-like] and that God could make a stone's heaviness exist without the stone. And they would deny that heaviness is **incorporeal**, regarding it as corporeal because it relates to a body although it isn't of the same nature as body; but by that standard the mind can be called 'corporeal' on the strength of its union with the body! In fact we don't count anything as corporeal unless it has the nature of body, and by that standard this heaviness is no more corporeal than the human mind is.

(5) I understand the successive duration of things in motion, and of the motion itself, in the same way that I understand the duration of things that are not in motion. What I know of earlier and later in *any* duration comes from the earlier and later of the successive duration that I detect in my own thought, with which the other things co-exist.

(6) The difficulty in recognising the impossibility of a vacuum seems to arise primarily from our not sufficiently considering that *nothing can have no properties*. If we bore that in mind then, seeing that there is true extension—and thus all the properties necessary for the nature of body—in the space we call 'empty', we wouldn't say that it is wholly empty, i.e. is a mere nothing. Another source of the difficulty is our way of appealing to divine power: knowing this power to be infinite, we attribute an effect to it without noticing that it involves a contradictory conception, i.e. is inconceivable by us. But ·I am not saying that because something is impossible, God couldn't make it happen·. I don't think that we should ever say of anything that it can't be brought about by God. For since every basis of truth and goodness depends on his omnipotence, I wouldn't risk saying that God can't make an uphill without a downhill, or bring it about that $1 + 2 \neq 3$. I merely say that he has given me a mind such that I can't conceive an uphill without a downhill, or a sum of 1 and 2 that is not 3; such things involve a contradiction in my conception. I think the same should be said of a wholly empty space, i.e. an extended nothing; and of a ·spatially· limited universe, because no limit to the world can be imagined without its being understood that there's extension beyond it; just as no barrel can be conceived to be so empty that it has inside it no extension and therefore no body, for wherever extension is, there must body be also.

⊕ [6.ix.48: Descartes writes to Picot. We don't have this letter, but are told a little about its contents. Mersenne had died on 1.ix.48, but news of that couldn't have reached Amsterdam (where Descartes is at the time of this letter) in a mere five days.]

to Pollot, 1648:

[Both AT and CSMK offer the *guess* that this letter is written to Pollot. The addressee is a military man who has wondered whether his poor health should lead him to retire early from the military, and asked for Descartes's advice. The advice was 'Don't do it', though said less plainly than that; Pollot (if that's who it was) replied, and Descartes is now acknowledging that.]

I am glad you weren't displeased that I took the liberty of giving you my opinion; and I'm obliged to you for indicating that you mean to follow it, even though you have reasons for not doing so—reasons that I admit are very strong . For I don't doubt that your mind could provide you with better things to occupy you than the world's conflicts. Custom and example have given the profession of arms the reputation of being the noblest of all; but for myself, considering the matter as a philosopher, I accord it only the value it deserves, and indeed find it difficult to count it as one of the honourable professions, seeing that the main motives that lead most men to take it up are idleness and debauchery. So I would be exceedingly sorry if things turned out badly for you. In any case, I acknowledge that a man with an illness ought to regard himself as older than other men, and it's better to retire when one is winning than when one is losing. But in the 'game' we are talking about I don't think there is any risk of *losing*, but only of *not winning*; and it seems to me that one needn't retire from it until one is no longer winning. I have met plenty of old men who have told me that in their youth they were less healthy than other men who had died before them; so it seems to me that whatever weakness or ill-health we may suffer, we ought to live our lives and perform our tasks in the way we would if we were certain to reach a ripe old age. But on the other hand, however energetic or healthy we may be, we ought also to be prepared to meet death without regret when it comes, because it may come at any time, and *anything* we do may cause it—we eat a piece of bread that may be poisoned, we walk down the street and may be flattened by a falling roof-tile, and so on. Accordingly, since we are surrounded by so many unavoidable hazards, it seems to me that wisdom doesn't forbid us to expose ourselves to the hazards of war when obliged by a fine and just cause—provided that it doesn't involve downright rashness, and provided that

the next clause: *nous ne refusions de porter des armes à l'épreuve, autant qu'il se peut.*

which means: we do not refuse to put our arms to the test so far as we can.

what Descartes is getting at: ??

In fact, I believe •that the occupations we are obliged to undertake by some duty don't make us think about difficulties and risks any more than do the pastimes we choose for ourselves, however agreeable they may be; and •that our body becomes so used to the style of life we lead that when we change this style our health usually worsens rather than improves, especially when the change is too sudden. That is why I think it best to pass from one extreme to another only gradually. In my case, before coming to this country in search of solitude I spent a winter in France, in the district where I had received my early education. And if I were leading a style of life that my indisposition didn't allow me to continue for a long time, I wouldn't try to hide this indisposition; instead I would try to make it seem greater than it was, thus enabling me to avoid, openly, any activity that might make it worse. And so, by increasing my leisure-time little by little, I would gradually achieve complete freedom.

⊕ [11.xii.48: More writes to Descartes, on topics that can be gathered from Descartes's reply of 5.ii.49.]

⊕ [12.xii.48: Queen Christina writes to Descartes, thanking him for his letter of 20.xi.47 and for *Passions of the Soul*, which have confirmed the good things Chanut has said to her about Descartes.]

⊕ [12.xii.48: Chanut writes to Descartes, reporting that Queen Christina has engaged the services of a 'learned and honest' member of her court to study Descartes's philosophy and then help her in her reading of it. He suspects that she may have thoughts of inviting Descartes to Sweden.]

⊕ [1648 or 1649: Descartes writes to * * *, a correspondent who has asked about the movements of the planets and the moon, and about Descartes's work in animal anatomy. Descartes gives two pages to the first topic, and says that he is starting afresh on the second. After a period of pessimism about it, he says,'I am now almost certain that I can complete my entire physical science provided I get the free time and the means needed to perform certain experiments.']

⊕ [1648: Descartes writes to Huygens, asking him to intervene with the Prince of Orange on behalf of 'a poor peasant in my neighbourhood who has had the misfortune to kill someone', specifically his step-father who was a wife-beater. Rigorous punishment of crimes is a good thing, Descartes says, but 'our passions aren't always in our power and may drive a good man to do something very bad'; and in those cases mercy should trump the law.]

to More, 5.ii.1649:

The praises you heap on me are proof of your kindness rather than of my merit, which could never equal them. But such generosity, based on the mere reading of my writings, shows so clearly the candour and nobility of your mind that although we have never met I am entirely *yours*. So I'll willingly respond to your comments.

(1) Why did I define *body* as 'extended substance' rather than 'perceptible, tangible or impenetrable substance'? Because putting 'perceptible' into the definition would be defining *body* by its relation to our senses—i.e. in terms of •one of its properties rather than •its whole nature. This nature doesn't depend on our senses, because there could be bodies even if there were no men. I don't see why you say that all matter must be perceptible by the senses. On the contrary: any portion of matter can be made completely *im*perceptible by being divided into fast-moving parts that are much smaller than the particles of our nerves.

You describe as 'cunning and almost sophistical' my argument ·showing that extension is the *whole* essence of matter·. I used that argument only to refute the opinion of those who hold, as you do, that every body is perceptible by the senses; and I think it does clearly and conclusive refute that view. For a body can retain its whole bodily nature without being soft or hard or cold or hot to the senses—indeed without having any perceptible quality.

[Descartes continues on this topic for a further (extremely obscure) paragraph. Then:]

Let us see next whether body is more appropriately called 'impenetrable or tangible substance', in the sense you explained.

Now tangibility or impenetrability in body is like the ability to laugh in man. . . .—not a true and essential property such as I claim extension to be. Consequently, just as •*man* is defined not as 'an animal capable of laughter' but as 'a rational animal', so •*body* should be defined not by impenetrability but by extension. This is confirmed by the fact that tangibility and impenetrability involve a reference to parts and presuppose the concept of division or limitation; whereas we can conceive a body that is

•continuous, and thus has no parts, and

•indefinitely large, and thus has no limits;

and this would be a body in which there's nothing to consider but extension.

'But', you say, 'God, or an angel, or any other self-subsistent thing is extended; so your definition is too broad.' I don't usually argue about words; so if someone wants to say that God is in a sense 'extended' because he is everywhere, I won't object. But I deny that

God or
angels or
our mind or
any substance that isn't a body

is 'extended' in the ordinary meaning of that word, because when people talk of an extended being they mean something imaginable. In this being—never mind whether it's a real being or a conceptual fiction—they can distinguish by the imagination various distinct parts with definite sizes and shapes. Some of these parts can be imagined as moved into the location of others, but no two can be imagined as simultaneously in a single place. None of this can be said about God or about our mind; they can't be grasped by the imagination, but only by the intellect; and they can't be distinguished into parts, let alone parts with definite sizes and shapes. Again, we easily understand that the human mind and God and several angels can all be at the same time in one and the same place. So we clearly conclude that no incorporeal substances are in the strict sense 'extended'. I conceive them as sorts of powers or forces that can act on extended things but aren't themselves extended—just as fire is in red-hot iron without itself being iron. Why do some people confuse the notion of *substance* with that of *extended thing*? Because of their false prejudice that nothing can exist or be intelligible without being also imaginable, and because it is indeed true that nothing falls within reach of the imagination without being in some way extended. Now just as we can say that health belongs only to human beings, though by analogy medicine and a temperate climate and many other things also are called 'healthy', so too I call 'extended' only what is imaginable as having parts lying outside one another, each with a definite size and shape—though other things are also called 'extended' by analogy.

(2) About this extended being that I described: if we examine what it *is* we'll find that it is space—the space that is popularly regarded as full in some places and empty in others, as real in some places and imaginary in others. [That's because some philosophers held that if the world is spatially finite then the space outside it is 'imaginary'.] For in a space—even an imaginary and empty space—everyone easily imagines various parts with definite sizes and shapes; and some of the parts can be transferred in imagination to the location of others, but no two of them can be conceived as penetrating each other at the same time in the very same location, since it is contradictory for this to happen without some part of space being removed. Now, because I considered that such real properties could exist only in a real body, I boldly asserted that there can be no completely empty space, and that every extended being is a genuine body. I wasn't deterred by the fact that this view put me at odds with great men such as Epicurus, Democritus and Lucretius, because I saw that what guided them was not any solid reason but rather a false preconception that we were all taught in our earliest years. Our senses don't always show us external bodies exactly as they are, but only in so far as they are related to us and can benefit or harm us (I warned of this in *Principles* 2:3). Despite this, we as children all decided that there's nothing in the world except what the senses show us, so there are no bodies that aren't perceivable by the senses, and if we don't perceive

anything in a certain location, that's because it is empty. Since Epicurus, Democritus and Lucretius never overcame this ·childish· prejudice [see Glossary], I'm not obliged to follow their authority.

I'm surprised that a man as sharp as you are, having seen that he can't deny that there is some •substance in every space because all the •properties of extension are truly found in it, avoids concluding that there can't be space without body by saying that there is space in which there are no bodies and that they are filled with the divine extension. For as I said earlier, the alleged extension of God can't have the genuine properties that we perceive very distinctly in all space: God can't be imagined or distinguished into parts that are measurable and have shape.

But you're quite ready to admit that vacuum never occurs *naturally*; you are concerned about God's power, which you think can annihilate the contents of a container while preventing its sides from meeting. Well, I know that my finite intellect can't set limits to God's infinite power; so the only question I can consider here is 'Can I conceive this?', and I'm careful to ensure that my judgements square with my conception. So I assert outright that God can do anything that I conceive to be possible, but I'm not so rash as to assert the converse, namely that he cannot do what conflicts with my conception of things—I merely say that it involves a contradiction. Now, seeing that it conflicts with my way of conceiving things for all body to be taken out of a container and for there to remain an extension which I conceive exactly as I previously conceived the body contained in it, I say that it involves a contradiction that such an extension should remain there after the body has been taken away, from which I infer that the sides of the container must come together. . . .

(3) In the same way I say that it involves a contradiction that there should be any atoms that are conceived as both extended and indivisible. God might make them such that no created thing could divide them, but we can't make sense of the suggestion that he might deprive himself of the power to divide them! Your comparison with things that have been done and can't be undone is not to the point. For we don't take it as a mark of impotence when someone can't do something that we don't understand to be possible, but only when he can't do something that we distinctly conceive to be possible. Now we certainly conceive it to be possible for an atom to be divided, since we suppose it to be extended; so if we judge that it can't be divided by God we'll be judging that God can't do one of the things that we conceive to be possible. But we don't in that way conceive it to be possible for what is done to be undone—on the contrary, we conceive it to be altogether impossible, so that it's no defect of power in God not to do it. It's different with the divisibility of matter: though I can't count all the parts into which a portion of matter is divisible (which is why I say they are indefinitely numerous), I can't assert that their division by God could never be completed, because I know that God can do more things than I can get my thought around. Indeed I agreed in *Principles* 2:34 that such indefinite division of certain parts of matter sometimes actually takes place.

(4) When I say that some things are indefinite rather than infinite, this isn't a display of modesty [as More suggested] but an upshot of necessary caution. The only thing I positively understand to be infinite is God. As for other things like these:

- •the world's extent,
- •the number of parts a lump of matter can be divided into,

I admit that I don't know whether they are outright infinite; I merely know that I know no end to them, and on that basis I call them 'indefinite'.

Our mind is not the measure of reality or of truth, but it should be the measure of what we assert or deny. What is more absurd or thoughtless than to make judgements about matters that we admit our mind can't conceive? I'm surprised to see you doing this when you •say 'If extension is infinite only in relation to us then it will in fact be finite' and •imagine some divine extent that stretches wider than the extent of the material world. That ·fantasy about God's *size*· involves you in supposing God has parts lying outside one another, and is divisible, and indeed in attributing to him all the essence of a corporeal thing.

To remove any worries that you may still have about this, let me explain that in calling the extent of the material world 'indefinite' I'm trying to block the fiction that there's a place outside the material world into which bits of material things might escape; that's a fiction, I maintain, because wherever such a place is conceived, there is some matter. When I say that the material world is 'indefinitely extended', I'm saying that it extends further than anything a human being can conceive.

Nevertheless, I think that the vastness of •this bodily extent is very different from the vastness of •the divine substance or essence; so I call the latter simply 'infinite', and the former 'indefinite'. (Note that I don't speak of the vastness of the divine *extent*, because God isn't extended.)

It's kind of you to concede that the rest of my opinions could stand even if what I have written about the extent of the material world were refuted; but I don't agree, because my view about the extent of the material world is one of the most important—and, I believe, one of the most certain—foundations of my physics; and I confess that no reasons satisfy me even in physics unless •they can be known by experience alone (e.g. that there is only one sun, and only one moon around the earth) or •they involve the kind of necessity that you call 'logical', i.e. the kind where Q follows necessarily from P because *P and not-Q* is not just false but self-contradictory. Since you are well disposed to my other views, I hope that you'll come to agree with these too, if you reflect that it's a mere prejudice that makes many people think that •an extended being in which there's nothing to affect the senses is not a true corporeal substance but merely an empty space, and that •all bodies are perceivable by the senses, and that •every substance falls within the reach of the imagination and is consequently extended.

(5) But there's no prejudice that we are all more accustomed to from our earliest years than the belief that dumb animals think.

Why do we think this? It's because we see that many of the animals' organs are quite like ours in shape and movements. Since we believe that there's a single principle within us that causes these movements—namely the soul, which both moves the body and thinks—we confidently assume that animals also have some such soul. I came to realise, however, that two different principles are causing our movements: **(i)** a purely mechanical and corporeal principle that depends solely on the force of the spirits and the structure of our organs, and can be called 'the corporeal soul'; **(ii)** an incorporeal principle, the mind or soul that I have defined as a thinking substance. So I investigated carefully whether the movements of animals originated from both these principles or from one only. I soon saw clearly that they could all originate from **(i)** the corporeal and mechanical principle, and I regarded it as certain and demonstrated that we can't prove the presence of **(ii)** a thinking soul in animals. I'm not shaken by the cunning of dogs and foxes, or by all the things animals do when they are drawn by food or sex or driven by fear. I can easily explain them all as originating from the structure of the animals' bodily parts.

But though I regard it as established that we can't prove there is any thought in animals, I don't think we can prove that there isn't, since the human mind doesn't reach into their hearts. But when I investigate what is most probable in this matter, the only argument I can find for animals having thoughts is this one: since they have eyes, ears, tongues and other sense-organs like ours, it seems likely that they have sensation like us; and since our kind of sensation includes thought, it seems that similar thought is attributable to the animals. This very obvious argument has taken possession of the minds of all men from their earliest age. But there are other arguments, stronger and more numerous though not so obvious to everyone, which strongly urge the opposite. One is that it is more probable that worms, flies, caterpillars and other animals move like machines than that they all have immortal souls.

It is certain that in the bodies of animals, as in ours, there are bones, nerves, muscles, animal spirits and other body-parts so arranged that they can by themselves, without any thought, give rise to all the movements we observe in animals. This is very clear in convulsions, when the mechanism of the body moves despite the mind, and often moves more vigorously and in a more varied manner than usually happens when it is moved by the will.

Second, since art copies nature, and people can make various automata that move without thought, it seems reasonable that nature should produce its own automata, much more splendid than artificial ones—namely the animals. This is especially likely since we know no reason why thought should always accompany the sort of bodily structure that we find in animals. That no animal contains a mind isn't as astonishing as the fact that every human body contains one.

But of all the reasons for holding that animals lack thought the main one, in my opinion, is the following. Within a single species, including our own, some individuals are more perfect than others; you can see this in horses and dogs, some of which learn what they are taught much better than others; and all animals easily communicate to us their natural impulses of anger, fear, hunger, etc., doing this by sounds and movements. Yet it has never been observed that any brute animal has attained the perfection of using real speech, i.e. of indicating by sound or gesture something relating solely to •thought and not to •natural impulse. Speech is the only certain sign of thought hidden in a body. All human beings use it, however stupid or insensate they may be, even if they have no tongue or vocal organs; but no animals do. So this can be taken as a real specific difference between humans and animals.

For brevity's sake I omit the other reasons for denying thought to animals. Please note that I'm speaking of thought, and not of life or sensation. I don't deny life to animals, since I regard life as consisting simply in the heat of the heart; and I don't deny sensation, in so far as that depends on a part of the body. Thus my opinion is not as hard on animals as it is kind to human beings—at least to those who aren't given to the superstitions of Pythagoras—because it clears them from even a suspicion of crime when they eat or kill animals. . . .

to Chanut, 26.ii.1649:

[The opening paragraph is a flowery encomium for Queen Christina of Sweden. Then:] Although the letter which that matchless Princess [see Glossary] condescended to write to me came as an altogether undeserved favour, and although I'm surprised that she should take the trouble to write it, I am not so surprised that she took the trouble to read my *Principles*, because I'm convinced that it contains many truths that aren't easily found elsewhere. It might be said

that they're only unimportant truths in physics, apparently having nothing in common with the things a queen ought to know. But because there are no limits to the scope of her mind, and because these truths of physics are part of the foundations of the highest and most perfect morality, I allow myself to think she will get satisfaction from learning them. I would be delighted to learn that she had chosen you, in addition to Freinshemius, to help her in this study; and I would be most grateful if you would take the trouble to tell me about the places where I haven't explained myself adequately; I would always make a point of replying to each letter on the day it reaches me. But this would only be helping *me*; it is so far from here to Stockholm, and the letters go through so many hands before arriving there, that you'll have solved each difficulty for yourself before you could have had the solution from here. [AT says that a letter took five weeks to get from Stockholm to Descartes in Egmond.]

In this letter I will merely observe two or three things that experience has taught me about the *Principles*. **(a)** Though Part 1 is only an abridgement of what I wrote in my *Meditations*, a preliminary reading of that work isn't needed for understanding this one. (·I mention this because· many people find the Meditations much more difficult, and I would be afraid that Her Majesty might become bored with them.) **(b)** There's also no need to spend much time examining the rules of motion that start in II.46; they aren't needed for understanding the rest. **(c)** It must be remembered, while reading this book, that although I consider nothing in bodies except the sizes, shapes and motions of their parts, I claim to be explaining the nature of light and heat and all other sensible [see Glossary] qualities; for I take it that these qualities are only in our senses, like pleasure and pain, and not in the objects we perceive by the senses, in which there are only certain shapes and motions that cause the sensations we call 'light', 'heat', etc. I didn't explain and prove this until the end of Part 4, but the whole book will be better understood by someone who knows it from the start.

⊕ [26.ii.49: Descartes writes to Queen Christina, rapturously exclaiming over the great favour she has done for him in sending him a question, liking the answer, and now writing to him.]

⊕ [27.ii.49: Chanut writes to Descartes, presenting an invitation from Queen Christina to visit her in Stockholm,.]

⊕ [2.iii.49: Brasset writes to Descartes about the current antagonism between King and Parliament in France. He wishes that the calm of The Hague would spread to Paris, and congratulates Descartes on his prudence in getting out of Paris at the right time.]

⊕ [5.iii.49: More writes to Descartes, 18 Latin pages responding to Descartes's letter of 5.ii.49 (see page 212); this letter will be replied to—very sketchily—in Descartes's letter of 15.iv.49.]

⊕ [10.iii.49: Schooten writes to Descartes, enclosing two books, discussing the attitude to them of 'the late Father Mersenne', remarking on the difficulty of expressing a certain numerical value, and asking Descartes if he could solve 'two paradoxes' in applied arithmetic.]

⊕ [27.iii.49: Chanut writes to Descartes about Queen Christina's wishes concerning when she might see Descartes in Stockholm; she is flexible about this, and has thoughts about timing Descartes's visit to Stockholm so as to enable him to escape the rigours of the Swedish winter.]

⊕ [31.iii.49: Descartes writes to Chanut, replying to his letter of 27.**ii**.49, expressing more than mere gratitude for the Queen's invitation to visit Stockholm. He accepts, of course ('Her least wish is my absolute command'), but suggests a later date for the visit to start. It had been proposed that he would go quite soon, and return home at the end of the summer; but he thinks he would need longer than that to 'give much satisfaction to Her Majesty', and suggests that he arrive in mid-summer and stay throughout the winter.]

to Chanut, 31.iii.1649:

I shall give you, if I may, the trouble of reading two of my letters on this occasion. For I assume that you'll want to show the other to Queen Christina, and I have saved for this one something that I thought she needn't see—namely that I'm finding it much harder to decide about this visit than I had imagined I would. I do of course have a great desire to serve this Princess: my confidence in your words, and my admiration and esteem for the *mœurs* [see Glossary] and intellect you ascribe to her, are such that I would be willing to undertake an even longer and more arduous journey—even if she didn't occupy such an exalted place and had only a common birth—in order to have the honour of doing what I could to contribute towards the satisfaction of her wishes, as long as I had some chance of being useful to her. But experience has taught me that very few people, even ones with excellent minds and a great desire for knowledge, can spare the time to enter into my thoughts; so that I have no grounds for expecting this from a Queen who has countless other occupations. Experience has also taught me that although my views are found surprising at first because they're so different from received opinions, once they are understood they appear so simple and commonsensical that they are no longer objects of wonder or regarded as important. It's a fact about human nature: people value only things that they wonder at and don't completely possess. Health is the greatest of all the goods relating to our bodies, but it's the one we reflect on and savour least. The knowledge of truth is like the health of the soul: once a man has it, he thinks no more of it. My greatest desire is to communicate openly and freely to everyone all the little that I think I know, but I hardly ever encounter anyone who condescends to learn it. But I see that those who boast of having secrets—e.g. in alchemy or astrology—however ignorant and impudent they may be, never fail to find curious people who buy their impostures at a high price.

I have never knowingly *waited for my luck to change*; I have tried to live in a manner that gives •Fortune no power over me. This seems to have made •her jealous, for she takes every opportunity she has to let me down. That's what I found in each of the three visits I have made to France since retiring to this country, but especially in the last one. The invitation was a virtual royal command. To get me to make the journey, they sent me elegantly sealed letters on parchment, containing a eulogy more extravagant than I deserve and the gift of a decent pension. And those who sent these letters from the King also wrote privately and promised me much more as soon as I arrived there. But once I was there unexpected difficulties cropped up: instead of seeing any sign of what had been promised, I found that a relative of mine had had to pay for the letters to be sent to me, and that I was obliged to pay him back. So it seems that I went to Paris only to buy a parchment—the most expensive and most useless that I have ever held in my hands. I don't mind that very much; I would have seen it simply as one of those unfortunate things that happen in public affairs, and would still have been satisfied, if I had found that my visit achieved something for those who had summoned me. But none of them (this is what most disgusted me) showed the slightest sign of wanting to know anything about me except what I look like. So I have reason to think that they wanted to have me in France like an elephant or a panther—interesting as a rare specimen but not as something that could be useful.

I don't imagine anything like that happening in the place where you are; but the poor outcome of every visit I have made in the last twenty years makes me fear that on this one I'll simply find myself being robbed by highwaymen or

involved in a shipwreck that will cost me my life. But this won't deter me if you believe that this incomparable Queen •does still want to examine my views and •can find the time to do so. If that is so, then I shall rejoice in the happiness of being able to serve her. But if it isn't so, and she merely had a passing curiosity about my views, then I beg and urge you to arrange it so that, without displeasing her, I may be excused from making this voyage.

⊕ [31.iii.49: Descartes writes to Brasset about the Swedish invitation, and about the King/Parliament trouble in France.]

⊕ [9.iv.49: Descartes writes to Schooten, replying to his letter of 10.iii.49. The numerical value Schooten had asked about is not hard to work out, but it's a long calculation (and he jokes about his shortage of pens). The two 'paradoxes' are briskly dealt with.]

to More, 15.iv.1649:

Your welcome letter of 5.iii.49 reaches me at a time when I am distracted by so much other business that I must either write in haste this very minute, or put off replying for many weeks. I have decided on haste: I would rather seem to lack skill than to lack courtesy. [This letter had cross-headings relating to parts of More's letter. Their places are marked by the bold letters **A–E**; the actual headings couldn't tell us anything unless we had More's letter in front of us, and wouldn't tell us much even then; this letter of Descartes's was obviously written in haste.]

A. **(1)** [More proposed defining *body* in terms of perceptibility rather than extension.] Describing a thing as 'perceptible' or 'sensible' seems to me to be giving a merely extraneous description of it—one that says how it relates to something else. And in any case 'sensible' doesn't accurately cover all and only the things it is meant to cover:

- [not all:] Understood in terms of *our* senses, it doesn't apply to the smallest particles of matter; and
- [Not only:] understood in terms of *any* senses, even ones that we might imagine God to construct, it might well apply also to angels and souls.

For •sensory nerves so fine that they could be moved by the smallest particles of matter are no more intelligible to me than •a faculty enabling our mind to sense or perceive other minds directly. Although in extension we easily understand how the parts relate to each other, it seems to me that I perceive extension perfectly well without thinking of the inter-relations of these parts. You should admit this even more readily than I do, because you conceive extension as something that God has, though you deny that he has parts.

(2) [More wrote that 'It hasn't been shown that tangibility or impenetrability are essential properties of extended substance.'] If you conceive extension in terms of the relation of the parts to each other, it seems that you can't deny that each of its parts touches its immediate neighbours. *This* tangibility is a real property, **intrinsic** to the thing that has it, unlike the tangibility that is named after the sense of touch ·and is purely **relational**·. Moreover, if you try to conceive of one part of an extended thing penetrating another equal part, you'll be forced into the thought of half the total extension being taken away or annihilated; and what is annihilated doesn't penetrate anything else! In my opinion this conclusively proves that impenetrability belongs to the essence of extension and not to that of anything else.

(3) [More wrote: 'You tie extension to tangibility and impenetrability, which leads you to deny extension to God and angels and the human mind. But there is another extension that is equally genuine.'] At last here's something we agree about! That is, we agree about the **fact** that this is 'another extension' ·from the one that

geometry studies·, but there is still a **verbal** question: Should this second sort of extension be called 'equally genuine'? Speaking for myself, the only extension I can conceive of in God and angels and our mind is extension not of •substance but of •power. An angel can exercise power at different times over different amounts of corporeal substance; but I can't conceive of any space that an angel or God would be co-extensive with if there were no bodies. Crediting a substance with extension when it's only an extension of power—that's an effect of the same prejudice that regards every substance, God included, as imaginable.

B. **(1)** [More wrote about circumstances where 'some parts of empty space would absorb others'.] I say it again: if they are absorbed, then half the space is destroyed, goes out of existence; but what doesn't exist doesn't penetrate anything else; so impenetrability must be admitted in every space.

(2) [More wrote 'If God annihilated this universe and much later created a new one out of nothing, the interval between worlds would have its own duration.'] I think it involves a contradiction to conceive of any duration intervening between the destruction of an earlier world and the creation of a new one. To 'explain' this duration in terms of a succession of divine thoughts or the like would simply be an intellectual error, not a genuine perception of anything. . . .

C. **(1)** [More equated God's being 'positively infinite' with his 'existing everywhere'.] I don't agree with this 'everywhere'. You seem here to make God's infinity consist in his existing everywhere, which is an opinion I cannot agree with. I think that God is everywhere in virtue of his power; yet in virtue of his essence he has no relation to place at all. But ·it's hard to think this through· because in God there is no distinction between essence and power. So I think it is better to argue in such cases about our own mind or about angels, which are more on the scale of our own perception, rather than to argue about God.

The difficulties that follow all seem to me to arise from the prejudice that makes us too accustomed to •imagine all substances as extended, including the ones that we don't think are bodies, and to •philosophise extravagantly about beings of reason [*entibus rationis* = conceptual entities], attributing the properties of a *being* or a *thing* to items that aren't *beings* at all. It is important to remember that non-being can have no true attributes, nor can it be understood in any way in terms of part and whole, subject, attribute, etc. And so you are perfectly right when you conclude that when the mind considers logical fictions it is 'playing with its own shadows'.

(2) [More wrote: 'Your physics has no need for an indefinitely large world. A definite and finite number of miles across would suffice.'] It conflicts with my conception to attribute any limit to the world; and I have no measure of what I should affirm or deny except my own perception. I say that the world is indeterminate or indefinite because I can't discover any limits to it; but I wouldn't be so rash as to call it infinite, because I perceive that God is greater than the world, not of course in extension but in perfection.

D. **(1)** [More seemed optimistic about Descartes's eventually completing his scientific account of the human body.] I am not certain that the continuation of my *Principles of Philosophy* will ever see the light of day, because it depends on many experiments which I may never have the opportunity to do. But I hope to publish this summer a small treatise on the passions, in which it will be seen how all the bodily movements that accompany our passions are caused not by the soul but simply by the machinery of the body. The wagging of a dog's tail is only a movement accompanying a •passion, so it's to be sharply distinguished from speech, which is the only

thing that shows the •thought hidden in the body.

(2) [More wrote that Descartes's reasons for denying that non-human animals have thoughts are also applicable to infants.] Infants are in a different case from animals: I wouldn't judge that they were endowed with minds if I didn't see that they have the same nature as ·human· adults; whereas animals never develop to a point where any certain sign of thought can be detected in them.

E. (1) ['According to you, *could* the world have been finite in size if God had so chosen?'] It conflicts with my conception—i.e. it involves a contradiction—to think of the world as finite or bounded; because whatever bounds you assign to the universe I can't help conceiving a space beyond them; and such a space is a genuine body. Some people call it 'imaginary', and thus regard the world as finite; but I'm not shaken by that because I know what prejudices gave rise to this error.

(2) ['If someone were at the boundary of the world, could he thrust his sword out beyond the boundary, up to the hilt, so that the blade of his sword was outside the world?'] When you imagine a sword going through the limits of the universe, you show that also don't conceive the world as finite; for in reality you conceive every place the sword reaches as a part of the world, though you call it 'vacuum'.

(3) [More challenged the account of motion in *Principles* 2:29, especially Descartes's claim that 'for a body x to be transferred from contact with a body y is for y to be transferred from immediate contact with x; the same force and action is needed on both sides.] The best way I have of explaining this matter is to suppose:

> A small boat, nearly afloat, resting on the sand on the bank of a river; and two men, one in the boat and the other on the shore. The one in the boat reaches down and pushes against the sand; the one on the shore leans over and pushes against the boat. The two men could exert equal forces, so that they contribute equally to the separation of boat from shore. . . .

(4) [Question and answer concerning the movements of the moon]

(5) [More wrote: 'When one of the particles that you call 'striated'—·i.e. shot through with little canals·—is twisted into a corkscrew shape, how can this happen without the particle crumbling into countless smaller pieces?'] The coherence ·or holding-together· of a particle depends on the motion and rest of its parts; and I don't suppose that very tiny particles are less coherent than big visible ones. It's important to understand that these striated particles are made out of supersubtle matter [see note on page 92], so they are divided into countless tiny parts that join together to compose them. I think of each very small particle as having more parts than the man in the street would attribute to a pebble.

(6) [More devoted two pages to a constellation of questions and challenges concerning the relations between the body and the mind.] In my treatise on the passions I have tried to explain most of what you here ask. All I will add here is that I haven't yet met anything in the nature of material things for which I couldn't easily think up a mechanical explanation. It's not disgraceful for a philosopher who doesn't regard God as corporeal to believe nevertheless that God can move a body; so it's no more of a disgrace for him to think that other incorporeal substances can do something like this too. Of course, in these two truths:

- •My mind acts on my body,
- •God acts on matter,

'acts on' is not being used in exactly the same sense; but I confess that I can't find in my mind any idea that represents how God or an angel can move matter other than the one that shows me how I can move my body through my own thinking, as I am aware of doing.

(7) [More wrote (in effect): 'If the world had existed from eternity, all the collisions amongst the particles in it would have reduced them to indefinitely small parts, so that the whole universe would have been reduced to a *single immense fire* ages ago.'] Not so. In the infinitely long history of the universe there would be many splittings-apart but also many joinings-together.

(8) [More asked if the particles that constitute water have pores in them. His comments on this shows him thinking of those particles as simple, ultimate, *atoms*.] From my account of the formation of our earth . . . .it obviously follows that the particles of water have pores and so do all the other terrestrial particles. The matter out of which all this is composed is indefinitely divided, so there can't be any lower limit on the size of particle that can have pores in it.

(9) [More's ninth inquiry elicited from Descartes •a repetition of his one-boat-two-men example from **(3)** and •a complaint that he doesn't understand one of More's sentences.]

⊕ [23.iv.49: Descartes writes to Brasset, •congratulating him good-humouredly on his coming move from a lovely climate to a harsh one, Sweden, with the latter compensated for by the presence of Queen Christina, 'who has more knowledge, intelligence and reason than all the learned churchmen and academics I have encountered'; and •rejoicing in the news of peace's being restored in France.]

⊕ [23.iv.49: Descartes writes to Chanut about delays in the mail, delays in his visit to Stockholm, and the connections between these two.]

to Clerselier, 23.iv.1649:

I shan't spend long in thanking you for all the care and precautions you have taken to ensure that the letters. . . .from that northern country should reach me; for I'm already so obliged to you, and have so many other proofs of your friendship, that this is nothing new to me. I will only say that none have gone astray, and that I'm resolved to make the journey to which the latest letters invite me, though I was at first more reluctant than perhaps you can imagine. My journey to Paris last summer discouraged me; and I can assure you that my enormous esteem for Chanut, and my confidence in his friendship, are among my principal reasons for deciding to go.

I don't expect the treatise on the passions to be printed before I arrive in Sweden, because I have been slack about revising it and adding the things you thought should be added—which will increase its length by a third. [He then describes its three-part structure.] I shall now address the eight difficulties that you put to me ·concerning things in the third Meditation·.

(1) My purpose was to base a proof of the existence of God on the idea or thought that we have of him, and so I thought that I was obliged first of all to classify all our thoughts so as to observe which ·kinds of· thoughts can deceive. By showing that not even chimeras [see Glossary] contain falsehood in themselves, I hoped to get in ahead of the opinion of those who might reject my reasoning on the grounds that our idea of God is a chimera. I also had to distinguish •the ideas that are born with us from •the ideas that come from outside us or are made by us, in order to get in ahead of those who might say that the idea of God is made by us or acquired by hearing others speak of him. Why did I insist on the shakiness of the beliefs we derive from all the ideas that we think come from outside us? To show that no single idea from outside us gives us knowledge as certain as what we get from our idea of God. . . .

(2) It seems to me that I see clearly that there can't be an infinite regress in the ideas I possess, because I feel myself to be finite, and in the place where I say this I'm not crediting myself with anything that I don't *know* I have. Later, when I

say that I daren't exclude an infinite regress, I'm referring to the works of God, whom I know to be infinite, so that it's not for me to set any limits to his works.

(3) To the words 'substance', 'duration', 'number' etc. I could have added 'truth', 'perfection', 'order' and many others—it's not easy to mark them off precisely. With each of those others it's up for discussion whether it is really distinct from ·one or other of· the first three, because there's no distinction between truth and the thing or substance that is true, or between perfection and the thing that is perfect, and so on. That's why I merely said '. . . and anything else of this kind'.

(4) By 'infinite substance' I mean a substance that has actually infinite and immense, true and real perfections. This is not a contingent property that the substance merely happens to have; it is the very essence of the substance, taken absolutely and not limited by any defects. In any substance, defects are contingent properties, but infinitude is not. It should be noted that I never use the word 'infinite' to signify a mere lack of limits (that's something negative, for which I have used the term 'indefinite') but always to signify something real that is incomparably greater than anything that is in any way limited.

(5) Why do I say that the notion I have of *the infinite* is in me before that of *the finite*? It's because, by the mere fact that I think of *being*—i.e. of that which *is*—without thinking whether it is finite or infinite, what I am thinking of is *infinite* being. To think of a finite being I have to work through this general notion of being, by taking something away from it; and I can't do that unless the general notion, i.e. the thought of infinite being, is there to be worked through.

(6) I say 'This idea is true in the highest degree' etc., because truth consists in *being*, and falsehood only in *non-being*, so that the idea of the infinite, which includes all being, includes all that there is of truth in things and can't contain anything false—even if it's being supposed that it's not true that the infinite being exists.

(7) 'It is enough that I understand the infinite.' I mean that to understand God, in very truth and as he is, all I need is to understand that God is not *grasped* by me, provided that I also judge that he has all the perfections that I clearly understand and also many more that I cannot grasp.

(8) 'As regards my parents, even if it's all true etc.'—that is, even if everything we ordinarily believe about them is true—namely that they engendered our *bodies*—I still can't imagine that they made *me*, considered only as a thing that thinks, because I can't see how •the physical act by which I'm accustomed to believe they engendered me has anything to do with •the production of a substance that thinks.

(9) That every deception depends on some defect is obvious to me by the natural light; for a being that has no imperfection can't tend towards non-being, i.e. can't have non-being as its end or purpose (or non-good, or non-true; these three are the same). It's obvious that in every deception there is falsehood, and that falsehood is something nontrue. . . .

to Freinhemius, vi.1649:

[With Chanut absent from Stockholm, Descartes turns to Freinhemius for help. His journey to Stockholm has been delayed; he hasn't been able to keep it secret; and he is afraid that his enemies—'of whom I have many, not because of myself personally but because of my new philosophy'—may write to people in Stockholm decrying the intended visit, stirring people up so as to make difficulties for Queen Christina. 'I would rather die on the voyage than have that happen.' He asks Freinhemius to form an opinion on whether anything

like that is going on, and to report back to Descartes. Then:]

I have one more favour to ask of you. I have been urged by a friend to give him the little treatise on the passions that I had the honour of offering to Her Majesty some time ago. I know that he plans to have it published with a preface of his own, but I haven't yet risked sending it to him because I don't know whether Her Majesty will approve of something that was presented to her in private being published without a dedication to her. But because this treatise is too small to deserve to bear the name of so great a Princess, to whom I will some day be able to offer a more important work if that sort of homage isn't displeasing her, I thought that perhaps she won't object to my granting this friend's request. That is what I humbly ask you to tell me. . . .

to Carcavi, 11.vi.1649:

I am greatly obliged to you for your offer to enter into correspondence with me on scholarly matters: I accept this offer as a favour that I'll try to deserve by serving you in every way that I can. During the life of the good Father Mersenne I had the advantage of always being informed in great detail about everything that was happening in the learned world, although I never made any inquiries about such matters. So that if he sometimes asked me questions, he richly repaid me for my answers by advising me about all the observations that he and others had made, all the curious devices that people had discovered or were seeking, all the new books that enjoyed any favour, and all the controversies that the learned were engaged upon.

I fear I would be tiresome if I asked you for all this. But I'm sure you won't mind my asking you to tell me the outcome of an experiment that Pascal is said to have done—or to have had done—in the mountains of Auvergne, order to discover whether and by how much higher mercury rises in a tube at the base of a mountain than it does further up. I ought to have heard about this from him rather than from you, since it was I who advised him to do this experiment two years ago, and who assured him that I had no doubt about the outcome although I hadn't done it myself. [He goes on to speculate that Pascal's behaviour comes from his being a friend of Roberval, 'who declares himself to be no friend of mine'; and accuses Roberval of sharp practice in the matter of a mathematical discovery.]

⊕ [9.vii.49: Carcavi writes to Descartes, reporting on the outcome of Pascal's experiment, giving various bits of other news, and trying to calm the relations between Descartes and Roberval.]

⊕ [23.vii.49: More writes to Descartes, six Latin pages raising five distinct issues. Descartes's reply in viii.49 will get to only one of them.]

to Carcavi, 17.viii.1649:

I am greatly obliged to you for the trouble you have taken to tell me about the outcome of Pascal's experiment with mercury, showing that it rises less in a tube up on a mountain than in one lower down. I had some interest in learning this because it was I who had asked him to try the experiment two years ago, and I had assured him of what its outcome would be, because it agrees completely with my principles; without these principles he wouldn't even have thought of it, since he was of the opposite opinion. Previously he sent me a pamphlet in which he described his first experiments on vacuum, and undertook to refute my thesis that there is subtle matter; and if you see him I would like him to know that I am still waiting for this refutation, and that I'll receive it in good part, as I have always received objections made against me that are not accompanied by libels.

[Then a couple of pages of comments, mostly mathematical, on other items in Carcavi's 9.vii letter. After which Descartes rather frostily thanks Carcavi for his good-hearted wish to make peace, but says that he has some evidence that Roberval hates him and none that he doesn't. There follow six more pages against Roberval, five of them geometrical.]

to More, viii.1649:

When I received your letter of 23.vii I was just on the point of sailing to Sweden.

'Do angels have sensations in the strict sense, and are they corporeal or not?"

I reply that the human mind separated from the body does not have sensations, strictly so called; but unaided natural reason doesn't tell us whether angels are created like •minds distinct from bodies or •minds united to bodies. I don't go in for *conjectures* or for deciding about questions on which I have no certain reasons. I agree with you that we should not think of God except as being *what all good people would wish there to be if he didn't exist*.

Your argument using the acceleration of motion to prove that the same substance can take up different amounts of space at different times is ingenious; but it falls far short of the mark, because motion is not a substance but a mode, and a mode of such a kind that we can *deeply* conceive how it can be lessened or increased in the same place. In forming opinions about any being we should use the notions that are appropriate to it, and not go by comparisons between it and other beings. Thus what is appropriate to •shape isn't appropriate to •motion; and neither of these is •appropriate to an extended thing. [That last clause is puzzling. Descartes's *propriæ* has a narrower meaning of 'appropriate to x'—roughly the sense of 'appropriate to x *and to nothing else*', but that merely trades in one puzzle for another.] Remember that *nothing has no properties*, and that what is commonly called 'empty space' is not •nothing, but •a real body deprived of all its accidents (i.e. everything that can be present or absent without the body going out of existence). Anyone who has fully realised this, and who has observed how each part of this space or body differs from all others and is impenetrable, will easily see that no other thing can have the same divisibility, tangibility and impenetrability.

I said that God is extended in virtue of his power, because that power does or can manifest itself in extended being. It is certain that God's essence must be present everywhere for his power to be able to manifest itself everywhere; but I deny that it is there in the way extended being is there, i.e. in the way in which I just described an extended thing.

[A paragraph about aspects of motion and rest. Then:]

The transfer that I call 'motion' is no less something existent than shape is: it is a mode in a body." The power causing motion may be the power of God himself preserving the same amount of transfer in matter as he put in it in the first moment of creation; or it may be the power of a created substance, like our mind, or of any other such thing to which he gave the power to move a body. In a created substance this power is a mode, but it is not a mode in God. Since this is not easy for everyone to understand, I didn't want to discuss it in my writings. I was afraid of seeming inclined to favour the view of those [such as More] who consider God as a world-soul united to matter.

I agree that 'if matter is left to itself and receives no impulse from anywhere' it will remain entirely still. But it receives an impulse from God, who preserves the same amount of motion or transfer in it—·i.e. in the material world·—as he placed in it at the beginning. And this transfer is no more violent [see Glossary] for matter than rest is: the term

'violent' refers only to our will, which is said to suffer violence when something happens that goes against it. In nature, however, nothing is violent: it is equally natural for bodies •to collide with each other, and perhaps to disintegrate, as it is for them •to be still. What causes you difficulty in this matter, I think, is that you conceive of a motionless body as containing a force by which it resists motion, regarding this force as something positive—a certain action distinct from the body's being at rest—whereas in fact the force is nothing but a modal entity.

You observe correctly that 'motion, being a mode of body, can't pass from one body to another'; and I didn't say that it can. . . . And when I said that the same amount of motion always remains in matter, I meant this about the force which impels its parts, which is applied at different times to different parts of matter in accordance with the rules set out in *Principles* 2:45 and following. [Assuming that Descartes's *leges* = 'laws' was a slip for *regulae* = 'rules', as in *Principles* 2:45 and following.] So there's no need for you to worry about the transmigration of rest from one object to another, since not even motion, considered as a mode that is the contrary to rest, transmigrates in that fashion.

You add that body seems to you to be 'alive with a stupid and drunken life'. This, I take it, is just a fine phrase; but I must tell you once for all, with the candour that you permit me, that nothing takes us further from the discovery of truth than setting up as true something that we have no positive reason for but are merely attracted to. That's what happens when we have invented or imagined something and afterwards take pleasure in our fictions, as you do in your corporeal angels, your shadow of the divine essence, and the rest. No-one should entertain any such thoughts, because that blocks the road to truth.

⊕ [30.viii.49: Descartes writes to Picot with detailed instructions about how the money in his estate is to be distributed if he should die on the journey to Stockholm.]

⊕ [30.viii.49: Descartes writes to Hogelande about which of his papers should be burned and which saved if he dies on the journey to Stockholm. He wants the letters Voetius wrote to Mersenne to be kept for possible legal use; but (he ends up saying) Hogelande can decide for himself which of the other ones to burn.]

⊕ [18.xii.49: Descartes writes to Brégy on various minor matters, including the dreadfulness of the Stockholm weather starting shortly after Brégy left.]

to Brégy, 15.i.1650:

Since I had the pleasure of last writing, I have seen the Queen only four or five times, always in the morning in her library, in the company of Freinshemius. So I have had no opportunity to speak about any matter that concerns you. A fortnight ago she went to Uppsala. I didn't go with her, nor have I seen her since she returned on Thursday evening. I know also that our ambassador saw her only once before her visit to Uppsala, apart from his first audience at which I was present. [This was Chanut, promoted.] I haven't made any other visits, nor have I heard about any. This makes me think that during the winter men's thoughts are frozen here, like the water. . . . I swear to you that my desire to return to my ·Dutch· solitude grows stronger with each passing day, and indeed I don't know whether I can wait here until you return. I do still fervently wish to serve the Queen, and she does show me as much good-will as I can reasonably hope for. But I am not in my element here. I desire only peace and quiet, which are benefits that the most powerful kings on earth can't give to those who are unable to acquire them for themselves. I pray God that you are granted the good things

you desire. Be assured that I am, Sir, your most humble and obedient servant, DESCARTES.

* * * * *

Not long after that letter was written Chanut fell ill with pneumonia; Descartes helped to nurse him through it, but contracted the disease himself and died of it on the 11th of February 1650.

The following notes on people—mostly Descartes's contemporaries—aim only to give the bare minimum needed to understand why each person figures in the Correspondence in the way he does: nationality, clerical or lay, Catholic or Protestant, position or profession, and so on. For more about those who participated in the Correspondence see CSMK, which is the basis for most of what follows.

Arnauld, Antoine: French theologian and philosopher.

Balzac, Jean-Louis Guez de: French writer and patron of the arts.

Bannius (Johannes Albertus Ban): Catholic Archbishop of Harlem, musician and musical theorist.

Beaugrand, Jean de: French artist and mathematician.

Beeckman, Isaac: Dutch physician and scholar. Eventually academic head of the University of Utrecht.

Brasset, Henri: French diplomat, for some years the French diplomatic representative in The Hague.

Brégy, Vicomte de Flécelles: French diplomat. Arrived in Stockholm shortly after Descartes.

Buitendijk: Official of the University or Dordrecht.

Carcavi, Pierre de: French government official.

Cavendish, William: Marquess of Newcastle,

Chandoux, Sieur de: French physicist and chemist.

Chanut, Hector-Pierre: French diplomat who served his government at the Swedish court.

Charlet, Etienne: Jesuit priest and theologian. Taught at the College of la Flèche; Descartes was one of his pupils; later head of the Jesuits in Rome.

Christina, Queen of Sweden (1626-89): Lively and influential; also flighty and unpredictable; turned Catholic and abdicated at the age of 28.

Ciermans, Jean: Dutch Jesuit, professor of mathematics at Louvain.

Clerselier, Claude: French government official; edited/published several of Descartes's works (including his correspondence) after Descartes's death. Brother-in-law of Chanut.

Colvius, Andreas: Dutch Protestant minister and amateur scientist.

Debeaune, Florimond: French mathematician and student of astronomy.

Delaunay, the Abbé: Not identified for sure.

Dinet, Jacques: French Jesuit priest, taught Descartes in College; rose to a commanding position in the Society of Jesus in Paris.

Emilius, Anthony: Professor of history at the university of Utrecht.

Ferrier, Jean: French instrument maker.

Freinshemius (Johannes Freinsheim): German classical scholar, Queen Christina's librarian at the time of Descartes's visit to Stockholm.

Fromondus (Libert Froidmont): Belgian Protestant theologian.

Gibieuf, Guillaume: French Catholic priest and theologian; teacher at the Sorbonne.

Gillot. Jean: French. A pupil and then protégé of Descartes.

Golius (Jacob Gool): Dutch mathematician, professor of Mathematics at Leiden.

Grandamy, Jacques: French Jesuit priest, physicist, astronomer, and teacher of philosophy

Hardy, Claude: French mathematician: reported to have known 35 oriental languages.

Hogelande, Cornelis van: Dutch physician.

Huygens, Constantijn: Dutch diplomat and amateur scientist; poet, composer, and musicologist; secretary to the Prince of Orange, sometimes having to accompany him into war zones.

le Conte, Antoine: Adviser to the French king, and friend of Chanut.

Lull, Raymond: 13th-14th century philosopher who wrote a manual purporting to proviode a method for solving all problems.

Mersenne, Marin: Catholic priest, theologian, and physicist; a 'monk' because he belonged to the monastic order of Minims.

Mesland, Denis: Jesuit priest. For more, see first paragraph of Descartes's letter to him on page 181.

Meysonnier, Lazare: French physician.

More, Henry: English philosopher and poet.

Morin, Jean-Baptiste: French mathematician, physician, and astrologer.

Mydorge, Claude: French court official and amateur mathematician and scientist.

Naudé, Gabriel: French scholar, librarian, and physician.

Noël, Etienne: Jesuit priest and physicist,

Pascal, Blaise: French mathematician, physicist, polymath.

Pascal, Étienne: French mathematician, father of Blaise.

Petit, Pierre: French military engineer and amateur physicist.

Plempius (Vopiscus-Fortunatus Plemp): Dutch physician and philosopher.

Pollot, Alphonse: French soldier and courtier, on the staff of the Prince of Orange.

Raei, Johannes de: Dutch philosopher; pupil of Regius.

Regius (Henri le Roy): Dutch physician and professor of medicine.

Reneri (Henri Regnier): French philosopher.

Sainte-Croix: This name seems to refer to André Jumeau, Prior of the monastery of Sainte-Croix and a mathematician.

Scheiner, Christophe: German Jesuit and astronomer.

Schichardus (Wilhelm Schickardt): German professor philosophy.

Schooten, Franciscus van: Dutch mathematician.

Schurman, Anne-Marie de: German-Dutch painter, engraver, scholar and poet; proficient in 14 languages.

Silhon, Jean de: French government official and amateur theologian.

Stampoien, Johan: Dutch mathematician.

Thuillerie, Gaspard Coignet de la: French ambassador to Sweden.

van der Hoolck, Gisbert: Mayor of Utrecht.

Vanini, Cesare: Ex-priest who flamboyantly proclaimed atheism; condemned and brutally executed in Toulouse in 1619.

Vatier, Antoine: French Jesuit priest and theologian.

Vesalius, Andreas: Influential 16th-century anatomist.

Viète, François: French mathematician, whose work helped pave the way for Descartes's analytic geometry.

Ville-Bressieu, Etienne de: French physicist, chemist, and engineer to the King of France.

Villiers, Christophe: French physician.

Voetius (Gisbert Voët): Dutch theologian and professor at the University of Utrecht.

Vorstius (Adolph Vorster): Dutch physician, became professor of medicine at the University of Utrecht.

Wassenaer, Jacques: Dutch mathematician.

White, Thomas: English philosopher and controversialist.

Wilhelm, David le Leu de: Dutch banker, collector, aficionado of ideas; brother-in-law of Constantijn Huygens.