

Selected Correspondence of Descartes

René Descartes

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[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.

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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 Adam and Paul Tannery, 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 sun’s 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 Cottingham, Robert Stoothoff, Dugald Murdoch, and Anthony Kenny.

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 volenté: Descartes repeatedly associates rationally loving x with joining oneself *de volenté* with x. This doesn’t mean joining oneself voluntarily, by volition [*volenté*]; it is a technical term, which he explains on page 191 where he equates ‘x joins itself to y *de volenté*’ with ‘x considers itself and y as forming two parts of a single whole’. A bit less abruptly, you join yourself *de volenté* 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 is 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 this 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 uses 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').

vidid: 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 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 its 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 Vatieer, 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 epistolary 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 geometers 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 at 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 un-

derstand 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 an 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 year's 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 transcendently 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 be 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 Blaise 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 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 Meyssonier, 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 Meyssonier, 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 Meyssonier'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 Waessenaer'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 prove 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.]