

Leucippus and Democritus

Leucippus and Democritus are credited with the development of ancient Greek atomism. We know very little about Leucippus but slightly more about Democritus. He seems to have been born c. 460 BC and may have travelled widely. He wrote numerous works on diverse topics and Aristotle discussed his atomistic theories in some detail. He was significantly influential, most notably upon Epicurus.

[30] Leucippus was born at Elea, but some say at Abdera and others at Miletus. He was a pupil of Zeno. His views were these. The entirety of things is unlimited, and they all change into one another. The entirety includes the empty (*kenon*) as well as the full (*plêres*). The worlds (*kosmoi*) are formed when atoms fall into the void and are entangled with one another; and from their motion as they increase in bulk arises the substance of the stars. The sun revolves in a larger circle round the moon. The earth rides steadily, being whirled about the centre; its shape is like that of a drum. Leucippus was the first to set up atoms as first principles. Such is a general summary of his views; on particular points they are as follows.

[31] He declares the entirety to be unlimited, as already stated; but of the entirety part is full and part empty, and these he calls elements. Out of them arise the worlds unlimited in number and into them they are dissolved. This is how the worlds are formed. In a given section many atoms of all manner of shapes are carried from the unlimited into the vast empty space. These collect together and form a single vortex, in which they jostle against each other and, circling round in every possible way, separate off, by like atoms joining like. And, the atoms being so numerous that they can no longer revolve in equilibrium, the light ones pass into the empty space outside, as if they were being winnowed; the remainder keep together and, becoming entangled, go on their circuit together, and form a primary spherical system.

[32] This parts off like a shell, enclosing within it atoms of all kinds; and, as these are whirled round by virtue of the resistance of the centre, the enclosing shell becomes thinner, the adjacent atoms continually combining when they touch the vortex. In this way the earth is formed by portions brought to the centre coalescing. And again, even the outer shell grows larger by the influx of atoms from outside, and, as it is carried round in the vortex, adds to itself whatever atoms it touches. And of these some portions are locked together and form a mass, at first damp and miry, but, when they have dried and revolve with the universal vortex, they afterwards take fire and form the substance of the stars.

[33] ... Eclipses of the sun are rare; eclipses of the moon constantly occur, and this because their orbits are unequal. As the world is born, so, too, it grows, decays and perishes, in virtue of some necessity, the nature of which he does <not> specify.

Diogenes Laertius 9.30–3, trans. R. D. Hicks adapted

Apollodorus in his *Chronology* tells us that Epicurus was a pupil of Nausiphanes and Praxiphanes; but in his letter to Eurylochus, Epicurus himself denies it and says that he was self-taught. Both Epicurus and Hermarchus deny the very existence of Leucippus the philosopher, though by some and by Apollodorus the Epicurean he is said to have been the teacher of Democritus. Demetrius the Magnesian affirms that Epicurus also attended the lectures of Xenocrates.

Diogenes Laertius 10.13, trans. R. D. Hicks

[34] Democritus was the son of Hegesistratus, though some say of Athenocritus, and others again of Damasippus. He was a native of Abdera or, according to some, of Miletus. He was a pupil of certain Magians and Chaldaeans. For when King Xerxes was entertained by the father of Democritus he left men in charge, as, in fact, is stated by Herodotus; and from these men, while still a boy, he learned theology and astronomy. Afterwards he met Leucippus and, according to some, Anaxagoras, being forty years younger than the latter. But Favorinus in his *Miscellaneous History* tells us that Democritus, speaking of Anaxagoras, declared that his views on the sun and the moon were not original but of great antiquity, and that he had simply stolen them. [35] Democritus also pulled to pieces the views of Anaxagoras on cosmogony and on mind, having a spite against him, because Anaxagoras did not take to him. If this be so, how could he have been his pupil, as some suggest? According to Demetrius in his book on *Men of the Same Name* and Antisthenes in his *Successions of Philosophers*, he travelled into Egypt to learn geometry from the priests, and he also went into Persia to visit the Chaldaeans as well as to the Red Sea. Some say that he associated with the Gymnosophists in India and went to Ethiopia...

[38] His character can also be seen from his writings. "He would seem," says Thrasyllus, "to have been an admirer of the Pythagoreans. Moreover, he mentions Pythagoras himself, praising him in a work of his own entitled Pythagoras. He seems to have taken all his ideas from him and, if chronology did not stand in the way, he might have been thought his pupil." Glaucus of Rhegium certainly says that he was taught by one of the Pythagoreans, and Glaucus was his contemporary. Apollodorus of Cyzicus, again, will have it that he lived with Philolaus. ...

[40] Aristoxenus in his *Historical Notes* affirms that Plato wished to burn all the writings of Democritus that he could collect, but that Amyclas and Clinias the Pythagoreans prevented him, saying that there was no advantage in doing so, for already the books were widely circulated. And there is clear evidence for this in the fact that Plato, who mentions almost all the early philosophers, never once alludes to Democritus, not even where it would be necessary to controvert him, obviously because he knew that he would have to match himself against the prince of philosophers, for whom, to be sure, Timon has this manner of praise:

Such is the wise Democritus, the guardian of discourse, keen-witted disputant, among the best I ever read...

[44] His opinions are these. The first principles of the universe are atoms and empty space; everything else is merely thought to exist. The worlds are unlimited; they come into being and perish. Nothing can come into being from that which is not nor pass away into that which is not. Further, the atoms are unlimited in size and number, and they are borne along in the whole universe in a vortex, and thereby generate all composite things—fire, water, air, earth; for even these are conglomerations of given atoms. And it is because of their solidity that these atoms are impassive and unalterable. The sun and the moon have been composed of such smooth and spherical masses [i.e. atoms], and so also the soul, which is identical with reason. We see by virtue of the impact of images upon our eyes.

[45] All things happen by virtue of necessity, the vortex being the cause of the creation of all things, and this he calls necessity. The end (*telos*) of action is tranquillity (*euthumia*), which is not identical with pleasure (*hedonē*), as some by a false interpretation have understood, but a state in which the soul continues calm and strong, undisturbed by any fear or superstition or any other affect (*pathos*). This he calls well-being (*euestō*) and many other names. The qualities (*poiotētas*) of things exist merely by convention (*nomos*); in nature there is nothing but atoms and void space. These, then, are his opinions.

Diogenes Laertius 10.13, trans. R. D. Hicks adapted

However, Leucippus and his companion Democritus say that the elements (*stoicheia*) are the full (*to plēres*) and the empty (*to kenon*), calling one 'what-is' (*to on*) and the other 'what-is-not' (*to mē on*); of these, what-is is full and solid (*stereon*) while what-is-not is empty and insubstantial (*manos*). (That is why they say that what-is is no more than what-is-not, because the empty is no less than the body). As matter, these are the causes of what there is. And just as those who make the underlying substance one generate the other things by means of its attributes, positing the insubstantial and the dense (*puknos*) as principles of these attributes, in the same way these people to say that the differentiae are the causes of the other things. And these differentiae, they say, are three — shape, order, and position. For they say that what-is differs only in 'rhythm' (*rusmos*), 'contact' (*diathigē*), and 'turning' (*tropē*) alone. And of these rhythm is shape (*schēma*), contact is arrangement (*taxis*), and turning is position (*thesis*). For A differs from N in shape, AN from NA in arrangement, and Z from N in position. However, concerning change/motion (*kinēsis*) — whence it originates and how it belongs to the things there are — these people, like the others, have lazily neglected.

Aristotle *Metaphysics* 985b4–20 = DK 67 A6

For they [Leucippus and Democritus] say that the atoms move by mutually impacting upon and striking against each other, but they do not discuss the origin (*archē*) of natural motion. For the motion in accordance with mutual impact is forced (*biaios*) and not natural, and forced motion is posterior to that which is in accordance with nature. Neither do they discuss the origin of weight in the atoms. For they say that the partless items which they postulate as parts of atoms have no weight, but how could weight come to be from a compound of weightless things?

Alexander of Aphrodisias *In Metaph.* 36.21–7 = DK 67 A6

Leucippus and Democritus mark out all things very systematically in a single theory, taking the natural starting point as their own. For some of the early philosophers held that what-is is necessarily one and immovable. For the void (*to kenon*) is not, and motion is impossible without a separate void, nor can there be many things without something to keep them apart... But Leucippus thought he had arguments that assert what is generally granted to perception, not abolishing the coming-to-be, perishing, motion, or plurality of things. Agreeing on these matters with the phenomena and agreeing with those who support the one that there could be no motion without void, he asserts that void is what-is-not and that nothing of what-is is not, since what-principally (*kuriōs*)-is is completely full (*pamplēres*). But this kind of thing is not one thing but things that are unlimited in number and invisible because of the minuteness of their size. These move in the void (for there is void), and they produce coming-to-be by combining and perishing by coming apart, and they act and are acted upon wherever they happen to come into contact (for in this way they are not one), and they generate <compounds> by becoming combined and entangled. A plurality could not come to be from what is in reality one, nor one from what is really many, but this is impossible.

Aristotle *De Generatione et Corruptione* 324b35–325a36 = DK 67 A6, trans. McKirahan and Curd adapted

In describing the atoms as touching one another Democritus did not use the term 'touch' (*haphē*) in its principal sense; he applied the term to the atoms' being close to one another, not widely separated, for they are totally separated by the void.

Philoponus *De Generatione et Corruptione* 158.26ff = DL 67 A7, trans. C. Taylor adapted

It is not merely on our theory that being limited (*to peparanthai*) is distinct from being touched (*haptesthai*). The same result follows from the hypotheses of Democritus; for as the atoms are carried about in the void they are limited, but they are not touched by anything.

Philoponus *In Phys.* 494.19–25, trans. C. Taylor adapted

Leucippus of Elea or Miletus (both are reported) associated in philosophy with Parmenides, but did not follow the same path as Parmenides and Xenophanes about what there is, but, it seems, the opposite. For they made the entirety consist of one changeless, ungenerated, and bounded thing and did not admit that one could even think of what is not, while he posited the atoms, an infinite number of elements in continual motion, and held that they have an infinite number of shapes, since there is no more reason for them to be one shape than another, and that coming to be and change are unceasing among the things that there are. Further, what-is subsists (*huparchein*) no more than what-is-not, and both are equally causes of the things that come to be. For positing the essence (*ousia*) of the atoms as solid (*nastos*) and full (*plēres*) he said that it is what-is and travelled in the void, which he called ‘what-is-not’ and said it is no less than what is (*ouk elatton tou ontos einai*).

Similarly his associate Democritus of Abdera posited as principles the full (*to plēres*) and the void (*to kenon*), calling the one ‘what-is’ and the other ‘what-is-not’. They posit the atoms as matter of the things that there are, and generate everything else by their differences. There are three of these, ‘rhythm’ (*rusmos*), ‘turning’ (*tropē*), and ‘contact’ (*diathigē*). That is to say, shape (*schēma*), position (*thesis*), and arrangement (*taxis*). For it is natural for like to be affected by like (*pephukenai gar to homoin hupo tou homoiou kineisthai*) and for things of the same kind to move towards one another and for each of the shapes to be reorganized into a different complex and so make another state. So they claimed that, the principles being infinite, they would readily account for all substances and properties, and what is the cause of anything and how. That is why they say that only those who make their elements infinite can make everything turn out according to their theory. They say that the number of shapes belonging to the atoms is infinite because there is no more reason for them to be one shape than another; for that is the explanation they give of the infinity.

Simplicius *In Phys.* 28.4–15, 15–26 = DK 67 A8, 68 A38, trans. Taylor adapted

Having established the shapes (*schēmata*), Democritus and Leucippus base their account of alteration (*alloiōsis*) and coming-to-be on them: coming-to-be and perishing by means of separation (*diakrisei*) and combination (*sugkrisei*), alteration by means of arrangement (*taxis*) and position (*thesis*). Since they held that the truth is in the appearing (*en tō phainesthai*), and what appears (*ta phainomena*) are opposite and unlimited things, they made the shapes unlimited, so that on account of changes of the composite, the same thing seems opposite to one person and another, and it shifts position when a small additional amount is mixed in, and it appears completely different when a single thing shifts position. For tragedy and comedy come to be out of the same letters.

Aristotle *De Generatione et Corruptione* 315b6–25 = DK 67 A9, trans. McKirahan and Curd adapted

Leucippus, an associate of Zeno, did not adhere to the same doctrine, but says things are infinitely many and always in motion, and that coming to be and change are continuous. He says that the elements are the full and the void. He says that worlds come into being in this way; when many bodies are collected out of the surroundings and flow together into a great void, in their collisions those of the same and similar shapes get entangled, and from these entanglements stars come into being and grow and decay through necessity. But what the necessity might be he does not explain.

Democritus was known to Leucippus. Democritus of Abdera, son of Damasippus, associated with many naked sages in India and priests and astrologers in Egypt and magi in Babylon. Like Leucippus he says that the elements are plenum and void, calling the plenum what is and the void what is not. He said that the things that there are are always in motion in the void, and that there are infinitely many worlds differing in size, some with neither sun nor moon, some with sun and moon larger than ours and some with more. The distances between the worlds are unequal, and there are more in some parts of the universe and fewer in others; some are growing, some are at their peak, and some decaying, in some parts they are coming into being and in others ceasing to be. They are destroyed by collision with one another. There are worlds without animals or plants or any moisture. In our world the earth came into being before the stars, and the moon is the lowest, then the sun, then the fixed stars. Nor are the planets at equal heights either. A world is at its peak until it can no longer assimilate material from outside. He used to laugh at everything, holding all human affairs to be laughable.

Hippolytus *Refutation* 1.12.1–13.4 = DK 67A10, 68 A40, trans. Taylor adapted

Those who abandoned division to infinity (*ep apeiron*) on the grounds that we cannot divide to infinity and as a result cannot guarantee that the division cannot end, declared that bodies are composed of indivisible things and are divided into indivisibles. Except that Leucippus and Democritus hold that the cause of the primary bodies' indivisibility is not only their inability to be affected but also their minute size and lack of parts.

Simplicius *In Phys.* 925.10–15 = DK 67 A13, trans. McKirahan and Curd

The followers of Leucippus and Democritus called the smallest and primary bodies atoms; and [they say that] by virtue of differences in their shapes and position and order, some bodies come to be hot and fiery — those composed of rather sharp and minute primary bodies situated in a similar position, while others come to be cold and watery— those composed of the opposite kinds of bodies. And some come to be bright and shining, while others come to be dim and dark.

Simplicius *In Phys.* 36.1–7 = DK 67 A14, trans. McKirahan and Curd adapted

These atoms, which are separate from one another in the infinite void and differ in shape and size and position and arrangement, move in the void, and when they overtake one another they collide, and some rebound in whatever direction they may happen to, but others become entangled by virtue of the way their shapes, sizes, positions, and arrangements correspond, and they stay together, and this is how compounds are produced.

Simplicius *In Cael.* 242.21–26 = DK 67 A14, trans. McKirahan and Curd

But what people mean by ‘void’ (*kenon*) is an extended space in which there is no perceptible body. They, however, thinking that all there is (*to on apan*) is bodies, say that void is that in which there is nothing at all, because what is full of air is void. But it is not this that needs to be shown, that air is something, but that there is no extension (*diastēma*) — either separable or actively existing — that is distinct from bodies, and that divides the totality of body so that it is not continuous (as Democritus, Leucippus, and many other of the physicists say), or is perhaps even outside the totality of body, which is continuous.

These thinkers, then, do not meet the problem head on, but rather those who say that a void does exist. And they say, for one thing, that there would be no movement with respect to place (that is, spatial movement and increase). For [they say that] there would not seem to be movement, if there were no void, since what is full (*plēres*) cannot receive something. For if it were to receive something, and there were two things in the same place, it would be possible for any number of bodies whatsoever to be together, since one cannot say what difference in number would cause what is stated not to hold. But if this is possible, then the smallest thing will be receptive of the greatest, since a great thing is many small ones. So if it is possible that many equal things should be in the same place, it is possible that many unequal things should be. (Melissus even shows on the basis of these considerations that the universe is immovable. For if it is to be moved, there must (he says) be a void, but a void is not among the beings.) One way, then, in which they show that a void is something is on the basis of these considerations.

Another is from the fact that some things are seen to contract and be compressed—for example, they even say that wine-jars will be receptive of the wine along with the wineskins, on the supposition that the condensed body contracts into the voids within itself. Further, increase too seems to all of them to occur by means of a void. For nourishment is a body, and it is impossible for two bodies to be together [in exactly the same place]. They also produce as evidence the [vessel] that surrounds ashes, which is receptive of as much water as the empty vessel.

The Pythagoreans too said that a void exists, and that it enters the heaven itself from the unlimited breath, as the heaven is also inhaling the void, which distinguished the natures of things, since it is what separates and distinguishes the successive things in the series. This happens first in the case of the numbers, since the void distinguishes their nature. The grounds, then, on which people say that there is, or that there is not, a void are pretty much these and this many.

Aristotle *Physics* 213a27–b28 ≈ DK 67 A19, trans. Reeve adapted

A brief quotation from Aristotle’s *On Democritus* will set out their view.

Democritus thinks that the nature of the eternal things consists of small substances (*ousiai*) infinite in number. As a place (*topos*) for these, he hypothesises something else, unlimited in magnitude, and he calls their place ‘the void’ (*to kenon*), ‘nothing’, (*ouden*), and ‘the unlimited’ (*to apeiron*). And each of the substances he calls ‘thing’ (*den*),¹ ‘solid’ (*nastos*), and ‘what-is’ (*to on*). He thinks that the substances are so small as to escape our senses. They have all kinds of forms and all kinds of shapes and differences of size. Now from these as elements he generates the visible and perceptible bodies. He says that they conflict with one another and travel about in the void because of their unlikeness and the other differences which have been mentioned, and as they travel about they collide and entangle with one another, and that entanglement makes them touch and be near one another, but does not really generate any single nature from them; for it would be quite absurd for two or more

¹ The word ‘*den*’ is an idiosyncratic neologism formed by removing the negative prefix ‘*ou*’ (rather than ‘*oud*’) from ‘*ouden*’; cf. Plutarch *Adversus Colotem* 1108f–1109a.

things ever to become one. He explains the fact that the substances remain together for some time by the dovetailing and interlocking of the bodies; for some of them are uneven, some hook-shaped, some concave, some convex, the rest with innumerable differences. He thinks that they hang on to one another and remain together until some stronger necessity, approaching from the surroundings, shakes the complex apart and disperses it. He says that coming to be and its opposite, separation, occur not only in the case of animals but also in plants and worlds and in general all sensible bodies. Now if coming to be is joining together of atoms, and passing away is separation, according to Democritus too coming to be would be alteration.

Simplicius *In Cael.* 295.1–22 = DK 68 A37, trans. C. Taylor adapted

Those who give the name 'atoms' to an infinite number of tiny, indestructible bodies, and postulate empty space unbounded in extent, say that these atoms travel at random in the void. In their disorderly rush they collide by chance, get entangled through their variety of shapes and latch on to one another, thus making the world and the things in it, or rather infinitely many worlds. Epicurus and Democritus were of this opinion; but they differed to this extent, that the former held that the atoms were all extremely small and hence imperceptible, while Democritus held that some atoms were extremely large. Both say that there are atoms, and that they are so called because of their indestructible solidity.

Eusebius *Praeparatio Evangelica* 14.23.2–3 = DK 68 A43, trans. C. Taylor

For Democritus said there were two [properties of atoms]: size (*megethos*) and shape (*schēma*). To these Epicurus added a third: weight (*baros*). For it is necessary, he said, for bodies to be moved by the impact (*plēgē*) of weight.

Aëtius 1.3.18 = DK 68 A47; cf. Cicero *De Fato* 20.46

Democritus said that the primary bodies (i.e. solids (*nasta*)) had no weight, but were moved by mutual impact in the unlimited. And it is possible for an atom to be as big as a world.

Aëtius 1.12.6 = DK 68 A47

If there are indivisible magnitudes, are they bodies, as Leucippus and Democritus say, or planes as in the *Timaeus*? This seems irrational, as we have said before, to divide as far as the plane; so it is more reasonable that there should be indivisible bodies, but that too contains a great deal of irrationality. All the same it is possible to have qualitative change and coming to be, as we have said, by varying the same thing in position and arrangement and difference of shape, as Democritus does (which is why he says there is no such thing as colour; things are coloured by the position [sc. of their atoms]), but those who divide things up into planes cannot... Democritus would appear to have been convinced by appropriate arguments, belonging to the nature of the subject-matter. What I mean will become clearer as we proceed. For there is a problem, if one posits a body and a magnitude divisible at every point, and posits this as possible. For what will there be which survives the division? For if it is divisible at every point, and this is possible, it could at one and the same time be divided, even if it has not been divided at one and the same time; and if that were to happen, there would be no impossibility. So if it is divisible at every point, both at the mid-point and generally, nothing impossible will have occurred if it is divided, for even if it were divided into ten thousand parts ten thousand times over, there is no impossibility, though perhaps no one would divide it like that. Now since the body is like that at every point, let it have been divided. What is now left? A magnitude? That is not possible; for it will be something undivided, but it was assumed that it was divisible at every point. But if no body or magnitude is left, but there is a division, either it will be composed of points, and put

together from things with no magnitude, or it will be nothing at all, so that even if it could come to be by being put together out of nothing, the whole would be nothing but an appearance. Similarly, if it is composed of points, it will not be a quantity. For when they were in contact and together as one magnitude, they did not make the whole any bigger; for when it is divided into two or more parts the whole is no larger or smaller than before; so that even if they are all put together, they will not make any magnitude. But now if a sort of sawdust results from the division of the body, and a body emerges from the magnitude in this way, the same argument applies; for how is that divisible? And if what results is not a body but some separate nature or property, and the magnitude consists of points or intersections with that property, it is absurd that a magnitude should consist of non-magnitudes. Further, where will the points be, and will they be motionless or in motion? And an intersection is always of two things, so that there is something besides the intersection and the division and the point. Now if anyone posits that any body of whatever kind is divisible at every point, this follows. Further, if, having divided it, I put the piece of wood or whatever back together, it is again one thing, the same size as before. Now clearly this is so if I cut the wood at any point; for it was potentially divided at every point. So what is there besides the division? If there is some property, how is it resolved into things of that kind and reconstituted from them? And how are those things separated? So if it is impossible that magnitudes should be composed of points and intersections, there must be indivisible bodies and magnitudes.

But on the other hand if we posit them, the consequences are no less impossible, as we have discussed elsewhere. Still we must try to resolve these difficulties, so we must set out the problem from the beginning once again. That every perceptible body should be both divisible at any point and indivisible is not at all absurd; the former attribute will belong to it potentially, the latter actually. That it should be at one and the same time potentially divisible at every point would appear to be impossible. For if it is possible, it could happen (not so as to be actually both indivisible and divided at one and the same time, but divided at every point); so there will be nothing left, and the body will disappear into something incorporeal, and would come into being again either out of points or altogether from nothing. And how is that possible? But surely it is clear that it is divided into separate, ever smaller magnitudes, removed and separated from one another. Now if it is divided piece by piece the breaking up could not go on to infinity, nor can it be divided at one and the same time at every point (for that is not possible), but only so far; so there must exist indivisible magnitudes which are invisible, especially if there is to be coming to be and passing away, occurring by joining together and separation respectively. This is the argument which seems to necessitate the existence of indivisible magnitudes ...

Aristotle *De Generatione et Corruptione* 315b28–317a17 = DK 68 A48b, trans. Taylor

‘For by convention colour, by convention sweet, by convention bitter, but in reality atoms and the void’ says Democritus, who maintains that all the perceptible qualities come into being relative to us who perceive them (*gignesthai ... pros ēmas tous aisthanomenous autōn*), by the combination of atoms, but by nature (*phusis*) nothing is white or black or yellow or red or bitter or sweet. By the expression ‘by convention’ he means ‘conventionally’ (*nomisti*) and ‘relative to us’ (*pros ēmas*), not according to the nature of things themselves (*ou kat’ autēn tōn pragmatōn ten phusin*), which he calls by contrast ‘reality’ (*heteē*), forming the term from ‘real’ (*to heteon*) which means ‘true’ (*alēthes*). The general thought of this theory is as follows. People think of things as being white and black and sweet and bitter and all the other qualities of that kind, but in truth ‘thing’ (*hen*) and ‘nothing’ (*mēden*) is all there is. That too is something he himself said, ‘thing’ being his name for the atoms and ‘nothing’ for the void. All the atoms are small bodies without qualities (*chōris poiōtētwn*), and the void is a space

(*chōra*) in which all these bodies move up and down for ever, or somehow get entangled with one another or collide or rebound, and in these contacts they separate and combine again, thus making all combinations including our bodies and their states and perceptions. They think that the primary bodies are incapable of being affected (some, such as the followers of Epicurus, taking them to be invulnerable because of their hardness, others, such as the followers of Leucippus, to be indivisible because of their smallness), and incapable of any change in those qualities which all men, taught by their senses, have believed in; thus they say that none of them becomes hot or cold, or dry or wet, much less turns black or white or suffers any qualitative change of any kind.

Galen *De Elementis secundum Hippocratem* 1.2, 417.9ff Kühn = DK 68 A49, trans. Taylor adapted

But even more in his second charge he [i.e., Colotes] fails to see that he is expelling Epicurus from life along with Democritus. For he says that Democritus' statements that colour and sweetness and the compound and the rest are by convention, but the void and the atoms in reality contradict the senses, and that someone who abides by this theory and applies it would not consider that he is a man or that he is alive. I have nothing to say in reply to this assertion, but I can say that these views are as inseparable from Epicurus' theories as they say shape and weight are from the atoms. For what does Democritus say? That an infinite number of atomic, undifferentiated substances, incapable of affecting or being affected, travel about, scattered in the void. And whenever they approach one another, come together or get entangled with one another, these collections appear as water, fire, a plant, or a man. Everything consists of the atoms, which he calls 'forms/ and there is nothing else. For there is no coming to be from what is not, and nothing could come to be from what is, since, because of their solidity, the atoms neither are affected nor change. Hence no colour comes into being from colourless things, nor any nature or soul from things which can neither affect nor be affected. So Democritus should be charged, not with drawing conclusions which agree with his principles, but with choosing principles from which those conclusions follow. For he ought not to have posited changeless primary substances, but having posited them he should have seen that all qualities disappear. But it is altogether shameless to see the absurdity and then deny it. So Epicurus is being altogether shameless when he says that he posits the same principles, but does not say that colour is by convention, and sweet and bitter and the other qualities. ... It was not necessary to postulate, or rather to filch from Democritus, the doctrine that atoms are the principles of everything, but once having postulated it and swanked over its initial plausibilities he should have swallowed the bitter dregs, or else shown how corpuscles with no qualities produce every kind of quality purely by their juxtaposition

Plutarch *Adversus Colotem* 1110e–1111c = DK 68 A57, trans. Taylor

The followers of Plato and Democritus supposed that only intelligible things are true/real (*alethē*). Democritus held this because nothing is perceivable by nature; the atoms which combine to form all things have a nature lacking every perceivable quality.

Sextus Empiricus *Adversus Mathematicos* 8.6 = DK 68 A59

The followers of Democritus and later of Epicurus hold that all the atoms, being all of the same nature, possess weight, and by virtue of some being heavier the lighter ones are squeezed out and travel upward as the heavier ones sink down, and thus they say that some things seem light while others seem heavy.

Simplicius *De Cael.* 569.5–9 = DK 68 A61, trans. McKirahan and Curd adapted

Democritus neglects that for the sake of which [i.e. the final cause], reducing all things which nature uses to necessity.

Aristotle *De Generatione Animalium* 789b2–4 = DK 68 A66

The words ‘the ancient theory that denies chance’ seem to refer to Democritus; for although he appears to have used luck/chance (*tuchē*) in his cosmogony, in his more detailed discussions he says that chance is the cause of nothing and reduces everything to other causes. For instance, the cause of finding the treasure is digging or planting the olive, or of the bald man’s fracturing his skull is the eagle’s having dropped the tortoise to break its shell.

Simplicius *In Phys.* 330.14–20 = DK 68 A68, trans. Taylor adapted

Democritus stated that thunder results from an uneven compound forcing the surrounding cloud to move downward. Lightning is the collision of clouds, as a result of which the atoms that generate fire are filtered through interstices containing much void (a process that involves friction) and collect in the same place. A thunderbolt occurs when there is a violent motion of fire-producing atoms that are very pure, fine, even, and ‘close-fitted’ (the word Democritus himself uses). A waterspout occurs when compounds of fire containing much void are held back in regions with a lot of void and are wrapped in special membranes, and form bodies because of this rich mixture and make a rush toward the depth.

Aëtius 3.3.11 = DK 68 A93, trans. McKirahan and Curd

On account of this some believed that the soul is fire. For it has extremely subtle parts (*leptomerēs*) and is the most incorporeal of the elements. Furthermore, it principally is moved and moves other things. Democritus discusses this most neatly, explaining why each of these things obtain. For, among the primary and indivisible bodies, soul (*psuchē*) and mind (*nous*) are the same thing and set things in motion through their smallness and shape (*schēma*). He says that, among the shapes, the spherical is that which is most mobile. Mind and fire is of this sort.

Aristotle *De Anima* 405a5–13 = DK 68 A101

If they [i.e., the early philosophers] said that mind moves everything, how is it that they said that motion was proper to the soul? Yes, they did, he [i.e., Aristotle] says, for they thought that soul and mind were identical, as for instance Democritus did. Now we nowhere find him explicitly saying that mind and soul are identical, but he establishes this by an argument. Democritus, he says, plainly intends this; for he said straight out that truth and appearance are identical, and that there is no difference between the truth and what appears to the senses, but what appears and seems so to each individual is true, as Protagoras said, whereas in fact they are different, sensation and imagination being concerned with appearance, and the mind with truth. Now if the mind is concerned with truth, and the soul is restricted to appearance, and what is true is the same as what appears, as Democritus thinks, then the mind is identical with the soul. For as the mind is to truth, so the soul is to appearance; hence, by transposition, as appearance is to truth, so the mind is to the soul. Now if truth and appearance are identical, then the mind and the soul are identical

Philoponus *In De Anim.* 71.19–34 = DK 68 A113, trans. Taylor

But it cannot be said either that every appearance is true or that every one is false or that some are true and some false, as we will establish; therefore appearance cannot be said to be the criterion. One cannot say that every appearance is true because of the ‘turning about,’ as Democritus and Plato taught, speaking against Protagoras. For if every appearance is true, then even *not* every appearance’s being true, since it takes the form of an appearance, will be true, and thus every appearance’s being true will become false. And even aside from such a turning about, saying that every appearance is true goes against what is apparent, and against plain experience, since a great many of them are false.

Sextus Empiricus *Adversus Mathematicos* 7.389–90 = DK 68 A114, trans. Bett

Democritus says no colour exists by nature. For the elements have no qualities, namely the compacts and the void. And their compounds are coloured by contact, contour, and rotation, of which the one is order, the second figure, and the third orientation. In addition to these are the appearances. The colours found in the appearances are of four kinds: white, black, red, and yellow.

Aëtius 1.15.8 = DK 69 A125, trans. D. Graham

For he says that white and black are rough/jagged (*trachus*) and smooth (*leion*) and he reduces (*anagein*) flavours into the shapes.

Aristotle *De Sensu* 442b11–12 = DK 69 A126

Democritus assigns a shape (*schēma*) to each [taste]; for instance he identifies sweet with round and sizable atoms. Sour consists of large, rough atoms with many angles, not rounded. Sharp tastes as the name implies are caused by what is sharp in bulk, angular, curved, fine and not rounded. Bitter taste is caused by what is rounded, fine, angular, and curved. Salty taste is caused by what is angular, sizable, crooked, and having equal sides. A spicy taste is caused by what is rounded and smooth with crookedness and small size. An oily taste is caused by what is fine, round, and small.

Theophrastus *De Causis Plantarum* 6.1.6 = DK 68 A129, trans. D. Graham adapted

From the fact that the honey appears bitter to some but sweet to others, Democritus said that it is itself neither sweet nor bitter.

Sextus Empiricus *Outlines of Pyrrhonism* 2.63 = DK 68 A134

[49] Concerning perception, Democritus does not make clear whether it occurs on account of those things which are contrary or those things which are alike. If he makes perception come about through alteration (*allioutai*), it would appear to be through differences (*diaphora*); for like is not altered by like (*ou... to homoion hupo tou homiou*). However, again, perception and in general alteration are instances of being acted on; and it is impossible, he says, for things which are not the same to be acted on, but even if different things act [sc. on one another] they do so not insofar as they are different, but insofar as the same attribute belongs to them, i.e., they are alike. So, concerning this issue, it is possible to take either view. An attempt at a detailed discussion of each sense follows.

[50] He makes sight occur by means of an image/reflection (*emphasis*). His account of this is original, for he says that the image is not immediately produced in the eyeball, but the air

between the sight and the thing seen is compacted by the seer and the thing seen and an impression is made on it, as everything is always giving off an effluence. This mass of air, which is solid and of a different colour, is then imaged in the eyes, which are moist; a dense body does not take the image, but a moist one lets it pass through. That is why moist eyes are better at seeing than hard ones, provided that the outer coating is as fine as possible, and the inside as porous as possible without any dense, strong flesh or thick, greasy liquid, and the veins in the region of the eyes are straight and free of moisture, so that they match the shape of the impressions; for everything most readily recognizes things of the same kind as itself. ...

[51–4, Theophrastus offers criticisms; 55–7 discusses his account of hearing; 58 briefly discusses thinking (*phronein*), saying it occurs through proper balance; 59 discusses heavy and light, hot and cold, and colours in other theories]

[60] Democritus and Plato discussed them [colours] most fully, for they distinguish them in detail; except that Plato does not deprive the perceptible objects of their own nature (*phusis*), whereas Democritus makes them all affections of the sense (*pathē tēs aisthēōs*). We shall not discuss which of these views is true, but let us try to set out how far each pursued the topic and what distinctions he made, having first given an outline of each view in its entirety. Democritus does speak alike about all of them, but differentiates some by their magnitudes (*megethos*), some by shape (*schēma*), and some by arrangement (*taxis*) and position (*thesis*). Plato ascribes almost all to affections and [i.e., states of] the sense. So each seems to contradict his assumption. The result is that each seems to contradict his assumption.

[61] Democritus makes them out to be affection of the sense but distinguishes them with respect to their own nature, while Plato makes them out to be things in their own right but ascribes them to states of the sense. Democritus distinguishes heavy (*barus*) and light (*kouphos*) according to magnitude; for if they were separated from one another individually, whatever their differences in shape, their weight would be in proportion to their magnitude. Of course in compounds the lighter is the one which contains the more void, the heavier the one which contains less; he says so in some places.

[62] However, elsewhere he says that the light is simply the subtle/fine (*to lepton*). His view on hard (*sklēros*) and soft (*malakos*) is very similar; he says that the hard is the dense (*to puknon*), and the soft is the loose-textured (*to manon*), and the various degrees are in proportion. The hard and soft, heavy and light differ in respect of position (*thesis*) and of inclusion of void. That is why iron is harder and lead heavier; for iron is irregularly constituted, with large empty spaces in many places, but some areas densely packed, and absolutely it has more void. But lead, though containing less void, is regularly arranged throughout; consequently it is heavier but softer than iron.

[63] That is his account of heavy and light and hard and soft. None of the other perceivable qualities has any nature of its own, but all are affections of the sense when it is altered so as to give rise to an appearance. For there is no nature belonging to hot or cold, but change in shape [sc. of the thing perceived] brings about alteration in us; a concentrated effect dominates each individual, whereas an effect which is spread out over time is not noticed. The evidence for this is that things do not naturally seem the same to all creatures, but what is sweet to us is bitter to other creatures, sharp-tasting to others, pungent to others, sour to others again, and the same for other cases. ... [64 discusses effect of age on perceivers]

[65] Sharp flavour consists of small, subtle atoms of an angular, zigzag shape. Because these are pungent they penetrate everywhere, and because they are rough and angular they compress and contract, thus creating empty spaces in the body and heating it; for the more void a thing contains, the hotter it becomes. Sweet consists of round atoms which are not too small, and therefore generally flow through and permeate the entire body, but not violently or quickly. But it purges other people, since as it permeates it moistens the other atoms and

makes them move about; and as they get moistened and moved from their respective positions they flow into the gut, which offers the easiest movement as it contains most void.

[66] Sour consists of large, many-angled atoms with the minimum of roundness; when these enter the body they stop up the veins and prevent them from flowing; that is why the gut ceases to function. Bitter consists of small, smooth, round atoms with spikes on the circumference as well; that is why it is sticky and viscous. Salty consists of large atoms which are not round, in some cases uneven <but in most cases not>; that is why it is not composed of zigzag atoms (by uneven he means atoms which overlap and get entangled with one another). They are large because the salt comes to the surface; for if they were small they would be mixed in with all the rest as they were knocked about by those surrounding them. They are not round because salty things are rough and round things smooth. They are not uneven because they are not interlocked; that is why it is powdery.

[67] Pungent is small, round, and angular, but not uneven. For what is pungent has many projections and makes things hot by its roughness and flows through them because it is small, round, and angular; for what is angular has that character. He gives a similar account of the properties of each flavour, referring them to the atomic shapes. None of them is found pure and unmixed with others, but in everything there are many, and the same thing contains smooth, rough, round, sharp, and the rest. The shape which occurs most frequently among the constituents is the one which determines how the thing is perceived and what properties it has, though that also depends on the disposition of whatever observer it comes into contact with; for there are considerable differences there too, since sometimes the same feature produces opposite effects, and sometimes opposite features produce the same effect.

Theophrastus *De Sensibus* 49–67 = DK 68 A135, trans. C. Taylor adapted

[68] [Theophrastus' criticisms of Democritus' theory:] It would appear to be absurd first of all not to give the same cause for everything alike, but to ascribe heaviness and lightness, softness and hardness to largeness, smallness, looseness of texture, and density, while distinguishing hot and cold and the rest by their shapes. And then it is absurd to postulate intrinsic natures of heavy and light, hard and soft (for largeness, softness, looseness, and density are not relative), and yet make hot, cold, etc. relative to perception, while reiterating that the shape which underlies heat is the sphere.

[69] But in general the greatest contradiction, which pervades the whole theory, is his both making them affections of perception and at the same time distinguishing them by their shapes, and saying that the same thing appears bitter to some, sweet to others, and different to yet others. For it is impossible for the shape to be an affect, or for the same thing to be spherical to some and differently shaped to others (yet perhaps that is how it has to be, if it is sweet to some and bitter to others), or for the shapes to change according to our dispositions. It is simply the case that shape is intrinsic, but sweet and sensible qualities in general are relative and dependent on other things, as he says. And it is absurd to require that the same appearance should be presented to everyone who perceives the same thing, and should be the test of their truth, when he has previously said that things appear differently to those who have different dispositions, and again that none has more truth than any other.

Theophrastus *De Sensibus* 68–9 = DK 68 A135, trans. C. Taylor adapted

Suppose that the soul (*animus*) perishes when the body does; won't there then be no pain or any sensation at all in the body? No one says this, although Epicurus alleges that Democritus does so, although Democriteans deny this.

Cicero *Tusculan Disputations* 1.38.82 = DK 68 A160

However, Democritus and certain others say that the elements have souls and are themselves causes of the generation of stones; on account of this he says that soul is in a stone just as in any other generative seed, which in bringing a stone into being move the heat within the matter itself in the way in which a hammer is moved by the smith in making an axe or a saw.

Albertus Magnus *De Lapidibus* 1.1.4 = DK 68 A164, trans. C. Taylor

Democritus posits that effluences (*aporroias*) are emitted and that like things are drawn to like, and also that everything travels into the void. On these assumptions he supposes that the magnet and the iron are composed of similar atoms, but smaller in the case of the magnet, which is also looser-textured than the iron with more void. Therefore its atoms are more mobile, and they move quickly towards the iron (moving towards their like), enter its pores, and as they penetrate it move its atoms through their small size. The atoms which are set in motion flow outwards towards the magnet because of its likeness and because it has more void, and the iron itself follows and moves towards the magnet on account of the heavy discharge of atoms. It is no longer the case that the stone travels towards the iron because the iron does not have so much void as the stone. Now one might accept that magnet and iron are composed of similar elements, but how could amber and chaff be? And if someone says that here too this is the cause, many things are attracted by amber. Now if all of these are composed of similar elements [sc. to those of amber], they would be composed of similar elements to one another, and would attract one another.

Ps-Alexander of Aphrodisias *Aporiai kai Luseis* [*Questions and Answers*] 2.23 = DK 68 A165, trans. C. Taylor adapted

[135] Democritus sometimes does away with what appears to the senses (*ta phainomena tais aisthēsi*) and says that none of these things in accordance with reality/truth (*kat' aletheian*), but only in accordance with opinion (*kata doxan*), while what is true in the things that obtain (*en tois ousin huparchein*) is that there are atoms and void. For he says:

By convention (*nomos*) sweet and by convention bitter, by convention hot, by convention cold, by convention colour, but in reality (*eteē*) atoms and void. [DK 68 B9]

(Perceptible things are thought and opined to be, but it is not these things that are in accordance with reality, but only atoms and void.)

[136] And in *Strengthenings/Confirmations*, despite having promised strong trust to the senses, he is nonetheless found condemning them. For he says:

In fact we understand nothing precise (*atrekēs*), but what changes according to the condition of the body (*kata sōmatos diathēkēn*) and of the things that enter it and of the things that offer resistance to it. [DK 69 B9]

And again he says:

It has been shown in many ways that in reality we do not understand what each thing is or is not like. [DK 69 B10]

[137] And in *On Ideas* he says:

A human being must know by this rule (*tō kanonī*) that he is removed from reality. [DK 69 B6]

And again:

This argument (*logos*) too shows that in verity we know nothing about anything, but opinion (*doxis*) is for everyone a reshaping. [DK 68 B7]

And yet again:

However it will be clear that to know in reality what each thing is like is hopeless. [DK 68 B8]

In these places, then, he more or less removes all apprehension (*katalēpsis*), even though it is only the senses that he singles out for attack.

[138] But in *Rules* he says that there are two forms of knowledge (*gnōsis*), one through the senses and the other through thought (*dianoia*). Of these he calls the one through thought 'legitimate' (*gnēsios*), testifying to its trustworthiness for the judgment of truth, while he names the one through the senses 'clandestine/bastard' (*skotios*), excluding it from accurately (*aplantes*) discerning what is true. He says in so many words:

There are two forms of cognition (*gnōmē*), one legitimate, the other bastard. And all these are of the bastard kind: sight, hearing, smell, taste, touch. The other one is legitimate and separated from this. [DK 68 B11]

Sextus Empiricus *Adversus Mathematicos* 7.135–9, trans. R. Bett adapted

The first charge Colotes makes against him [Democritus] is that by saying that each thing is no more of one kind than another (*ou mallon toion ē toion*) he has thrown life into confusion. But Democritus was so far from thinking that each thing is no more of one kind than another that he opposed the sophist Protagoras for saying just that and wrote many persuasive arguments against him. Colotes did not come across these, even in a dream, and was misled by Democritus' phraseology, when he said that 'thing' is no more than 'nothing' (*mē mallon to den ē to mēden*), calling 'thing' body and 'nothing' the void, since that too has a nature (*phusis*) and substance (*hupostasis*) of its own.

Plutarch *Adversus Colotem* 1108f = DK 68 B156, trans. Taylor adapted

And Democritus says that certain images (*eidōla*) come into humans' vicinity, and that some of these are producers of good, others of bad (hence he also prayed to get propitious images), and that these are large, indeed super-large, and difficult to destroy but not indestructible, and that they signify the future to humans, since they are observed and utter sounds. And so the ancients, receiving an appearance of these images, supposed that there was a god – since there is no other god besides these that has an indestructible nature.

Sextus Empiricus, *Against the Mathematicians* 9.19 = DK 69 B166, trans. R. Bett

Best for a person is to live his life being as cheerful and as little distressed as possible. This will occur if he does not make his pleasures in mortal things.

Stobaeus *Eclogae* 3.1.47 = DK 68 B189, trans. McKirahan and Curd

Cheerfulness (*euthumiē*) arises in people through moderation of enjoyment and due proportion in life (*metriotēti terpsios kai biou summetrēs*). Deficiencies and excesses tend to change suddenly and give rise to large movements in the soul. Souls that undergo motions involving large intervals are neither steady nor cheerful.

Stobaeus *Eclogae* 3.1.120 = DK 68 B191, trans. McKirahan and Curd

All those who make their pleasures from the belly, exceeding the right time (*ton kairon*) for food, drink, or sex, have short-lived pleasures — only for as long as they eat or drink— but many pains.

Stobaeus *Eclogae* 3.18.35 = DK 68 B235, trans. McKirahan and Curd

The philosophy of Democritus is also said to have something in common with [Pyrrhonian] scepticism, since it is thought to make use of the same materials as us. For from the fact that honey appears sweet to some and bitter to others, they say that Democritus deduces that it is neither sweet nor bitter, and for this reason makes the utterance ‘no more’ (*ou mallon*), which is sceptical. However, the sceptics and Democriteans use the expression ‘no more’ in different ways. The latter use it to mean that neither is the case, we use to mean that we do not know whether some apparent thing is both or neither. Accordingly, even in this respect we differ. However, the clearest distinction is made when Democritus says ‘in reality (*eteē*) there are atoms and void’. For by ‘in reality’ he means ‘in truth’ — and I think it is superfluous to remark that he differs from us in saying that atoms and void in truth subsist, even if he does begin from the anomaly in what is apparent.

Sextus Empiricus *Outlines of Pyrrhonism* 1.213–214, trans. Annas and Barnes adapted

‘Indivisible’ has various senses: what is capable of being divided but has not yet been divided, e.g., every continuous quantity; what is wholly incapable of being divided, in virtue of having no parts into which it could be divided, e.g., a point and a monad; what has parts and size, but is incapable of being divided because of its solidity and fullness, e.g., each of the atoms of Democritus.

Simplicius *In Phys.* 81.34–82.3, trans. Taylor

It is called an atom not because it is the smallest thing, but because it cannot be cut, since it cannot be affected and contains no void.

Eusebius *Praeparatio Evangelica* 14.14.5, trans. Taylor

This [i.e., that contradictories are true of the same thing] follows also in the case of those who say that what appears to be and what is are the same, e.g., Democritus, Protagoras, and their followers.

Alexander of Aphrodisias *In Metaph.* 271.38–272.2, trans. Taylor

The translations draw upon C. C. W. Taylor, *The Atomists: Leucippus and Democritus* (University of Toronto Press, 1999), D. Graham, *The Texts of Early Greek Philosophy* (Cambridge University Press, 2010), P. Curd and R. D. McKirahan, *A Presocratics Reader* (Hackett, 2011), C. D. C. Reeve, *Aristotle: Metaphysics* (Hackett, 2016), R. Bett, *Against the Logicians* (Cambridge University Press, 2005), and some others.