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same kind of matter, or of the same chemical element, must have the same mass. A series of numbers proportional to the masses of different kinds of atoms are called the *atomic weights*. For example, if we take the mass of an atom of hydrogen as unity, then that of an atom of oxygen will be about 8, of carbon about 6, &c. These numbers are only relative, since nothing is known of the absolute mass of any one atom. Cf. CHEMICAL SYNTHESIS. For the atom in philosophy, see MONAD.

**Molecules.** Most substances with which we are familiar are compounded of various elements: hence these smallest portions must be capable of subdivision into these elements, and therefore cannot be atoms. These smallest portions, portions which cannot be divided without changing the chemical properties of the compound, are called molecules. The distinction between an atom and a molecule is that the latter is subject to division, while the former is not.

**Elements** are the different kinds of matter which cannot be decomposed, and which therefore make up the substance of the material universe. From a purely logical point of view, the distinction between an element and a compound would seem to be relative to our knowledge at the moment. Possibly many of what we call elements are compounds which we have not succeeded in decomposing; and the idea that all matter may be of one kind, and all atoms be really molecules made up of different arrangements of one kind of primaeva atoms, has been widely entertained, and may be well founded. But it is a significant fact in this connection that no progress is being made in the way of decomposing the accepted elements. In no case has a substance accepted in our modern chemistry as an element been decomposed or transformed into another. The distinction between elements and compounds is therefore a real one in kind, whether, in the absolute sense, an atom is or is not a compound. (S.N.)

**Matter and Form:** Ger. *Materie* (Stoff) und *Form*; Fr. *la matière et la forme*; Ital. *materia e forma*. The word matter (Lat. *materia*, which was used to translate the Gr. *ύλη*) is often employed where the more appropriate Greek word would be *σῶμα*, *corpus*, body; or *ὑποκείμενον*, *subjectum*, or even *ὑπόστασις*, translated *person* in theology. *Form* (Lat. *forma*, used to translate the Gr. *μορφή* and *εἶδος*, though the latter is more exactly represented by *species*) is often employed where *σχῆμα*, figure, or *εἶδος*, shape, would be near equivalents. The Greek expressions *μορφή*,

*παράδειγμα*, *εἶδος*, *ἰδέα*, *τὸ τί ἐστι*, *τὸ τί ἦν εἶναι*, are pretty nearly synonymous.

The distinction of matter and form was first made, apparently, by Aristotle. It almost involves his metaphysical doctrine; and as long as his reign lasted, it was dominant. Afterwards it was in disfavour; but Kant applied the terms, as he did many others drawn from the same source, to an analogous but widely different distinction. In many special phrases the Aristotelian and Kantian senses almost coalesce, in others they are quite disconnected. It will, therefore, be convenient to consider: (1) the Aristotelian distinction; (2) the Kantian distinction; and (3) special applications.

**The Aristotelian distinction.** Not only was the distinction originated by Aristotle, but one of the two conceptions, that of *matter*, is largely due to him. Indeed, it is perhaps true that the Greek word for matter in the sense of material, *ύλη*, was never understood in that general sense before Aristotle came to Athens. For the first unquestionable cases of that meaning occur in certain dialogues of Plato, concerning which—though there are no dates that are not open to dispute—it seems to the present writer that it is as certain as any such fact in the history of Greek philosophy that the earliest of them was written about the time of Aristotle's arrival. It is true that, as Aristotle himself says, *matter* was the earliest philosophical conception. For the first Ionian philosophers directed their thoughts to the question what the world was made of. But the extreme vagueness of the notion with them is shown by their calling it *ἡ ἀρχή*, the beginning, by the nonsense of the question, and by many more special symptoms. If the philosophical conception of matter distinguished the metaphysics of Aristotle, that of Plato had been no less marked by its extraordinary development of the notion of form, to which the mixed morality and questioning spirit of Socrates had naturally led up; the morality, because the form is the complex of characters that a thing ought to have; the questioning, because it drew attention to the difference between those elements of truth which experience brutally forces upon us, and those of which reason persuades us, which latter make up the form. But Aristotle's distinction set form, as well as matter, in a new light.

It must not be forgotten that Aristotle was an Asclepiad, that is, that he belonged to a family which for generation after generation,

from prehistoric times, had had their attention turned to vital phenomena; and he is almost as remarkable for his capacity as a naturalist as he is for his incapacity in physics and mathematics. He must have had prominently before his mind the fact that all eggs are very much alike, and all seeds are very much alike, while the animals that grow out of the one, the plants that grow out of the other, are as different as possible. Accordingly, his *dunamis* is germinal being, not amounting to existence; while his *entelechy* is the perfect thing that ought to grow out of that germ. Matter, which he associates with stuff, timber, metal, is that undifferentiated element of a thing which it must possess to have even germinal being. Since matter is, in itself, indeterminate, it is also in itself unknowable; but it is both determinable by form and knowable, even sensible, through form. The notion that the form can antecede matter is, to Aristotle, perfectly ridiculous. It is the result of the development of matter. He looks upon the problem from the point of view of a naturalist. In particular, the soul is an outgrowth of the body.

The scholastics, who regarded Aristotle as all but infallible, yet to whom the ideas of a naturalist were utterly foreign, who were thoroughly theological in their notions, admitted that the soul was a form. But then, they had great difficulty with those opinions of their master which depended upon his conceiving of matter as more primitive than form. Their notions of form were rather allied to those of Plato. The mode of being that, in some sense, anteceded individual existence, they would have held to be one in which there was form without matter, if awe of Aristotle had not caused them to modify the proposition in one way or another. A question, for example, which exercised them greatly was, how the form was restricted to individual existence? For Aristotle there could not be any such question, because he did not conceive of a form taking on individuality, but of an undifferentiated matter taking on, or rather developing, form, and individuality, perhaps, with it (412 a, 7).

**The Kantian distinction.** Aristotle refuses to consider any proposition as *science* which is not universal. He does not go so far as to say that all knowledge involves synthesis, but he often approaches doing so. In particular, he holds that matter is something in itself beyond our knowledge, but the existence of which has to be assumed in order to

synthesize the opposites that are involved in all change. He expressly defines that as the function of the conception of matter. With Kant, the view that all knowledge involves synthesis—various acts of synthesis one over another—is vastly more developed; and he, too, employs the terms *matter* and *form* as called for by such synthesis. But it is curious that while with Aristotle it is matter that is the quasi-hypothesis imported into the facts that the mind may synthesize, with Kant, on the other hand, it is form which performs this function. The matter of cognition consists of those elements which are brutally and severally forced upon us by experience. By the form he means the rational or intelligible elements of cognition, which he wishes, as far as possible, to regard as independent contributions of the mind itself, which we have no right to suppose are duplicated by anything corresponding to them in the thing. For the Aristotelian, all pure matter is exactly alike, equally devoid of all predicates, while the forms make all the variety of the universe. For the Kantian, on the other hand, matter is the manifold, while the pure forms are the few different modes of unity. Nevertheless, the Kantians—indeed, Kant himself (see the *Critic of the Pure Reason*, 1st ed., 266)—argued that they were using the terms in their old and accepted sense. What enabled them to give some speciousness to their contention was the circumstance that during the full century and more of neglect of the Aristotelian doctrine that had intervened, certain secondary senses of the term *matter*, especially that of corporeal matter, and that of a species of corporeal matter, had become relatively prominent.

**Special senses.** Although there is only one *first* or *primary* matter, absolutely indeterminate, yet Aristotle often uses the term in a modified sense as that which is relatively indeterminate; so that the *last* or *second* matter is the same as the form. But these phrases are also used in quite other senses, which need not here be specially noticed. Matter being taken relatively, the same thing can have this or that as its matter in different respects; and so matter is distinguished into *materia ex qua*, *in qua*, and *circa quam*. *Materia ex qua* is the material; silver is the *materia ex qua* of a dime. *Materia in qua* is the subject in which the form inheres; *materia circa quam* is the object. Aquinas illustrates the distinction by virtue, which is a form, and, as such, has no *materia ex qua*; but it

has a subject in which it inheres and an object upon which it is exercised. Aquinas introduced the term *signate matter*. Matter of composition, or *proximate matter*, is that of which a thing consists; matter of generation, or *remote matter*, that from which it is developed, as a seed or egg.

The varieties of form are so numerous that they may best be taken in alphabetical order.

*Absolute form*: form abstracted from matter.

*Accidental form*: an accident, or that the presence of which constitutes an accident; as music is the accidental form of the musician.

*Advenient form*: a form subsequent to the final form.

*Apprehended form* = apprehended SPECIES (q. v.).

*Artificial form*: a form superinduced by art.

*Assistant form*: an agent aiding in the realization of a form, especially of that whose essential character is to move; as the angel who turns the heavens round once every twenty-four hours, or the captain of a ship.

*Astral form*. According to Gilbert (*De Magnete*), phenomena of electricity are produced by a material effluvium, while the action of a magnet takes place directly at a distance. Whatever it may be then which constitutes the magnetic field, not being matter, must be called form. Gilbert names it *forma prima radicalis et astralis*.

*Common form*: a form belonging to a species.

*Completive form*: used by Aquinas in the sense of the last of the series of forms which gradually bring a thing to fully developed existence. By Aristotle called *last form*.

*Composite form*: the form of a collective whole, so far as it is different from its parts.

*Corporeal form*: a form of a corporeal nature. This is used by Aquinas, *Summa Theol.*, pars I. qu. lxxv. art. 4. See *Material form*.

*Disponent form*: a form rendering matter apt to receive another, *principal*, form. Thus, dryness in wood disposes it to receive combustibility.

*Elementary form*: one of the four combinations of hot and cold with moist and dry which were supposed to characterize the four elements.

*Exemplar form*: an idea.

*Final form*: see *Completive form*.

*General form*: the form of a genus; as we should now say a *generic form*.

*Immaterial form*: a form which neither depends upon matter while it is being made nor after it is made; a term employed in the theological doctrine of creation.

*Incorruptible form*: a form not subject to corruption.

*Individual form*: in one of the theories of individuation, was a form which by existing in matter acquired the power of individuating another form.

*Informant form*: a form which is a part of the thing of which it is the form.

*Inherent form*: a form which can only exist in a state of inherence in matter.

*Intellective form*: the mind as form.

*Intelligible form*: see *Sensible form*.

*Intermediate form*: a form having a middle position between an elementary and a complete form.

*Material form*: a term of Scotus, who defines it as follows: 'Formam materialem dico esse omnem illam, quae ex natura sua necessario inclinatur naturaliter, ut sit actus materiae, sive sit substantialis, sive accidentalis' (*Op. Oxon.*, IV. i. 1); 'Ideo dici potest tertio modo.' But elsewhere (*ibid.*, I Post. qu. ii.) he distinguishes two senses of the term: 'Forma materialis potest intelligi dupliciter. Uno modo dicitur, quae educitur de potentia materiae, vel quia utitur organo corporeo in operando: et isto modo forma intellectiva non est forma materialis. Alio modo dicitur forma materialis, quia perfectio materiae, et isto modo anima intellectiva est forma materialis, ideo aliquam variationem potest accipere a materia, quam perficit, quia ex materia et forma fit vere unum.' Perhaps the most accessible book from which to gain a hint of the nature of the difficulty which gives rise to this distinction is Bridges' edition of what is called *The Opus Majus of Roger Bacon*, ii. 507-11, cap. ii.

*Mathematical form*: an object of mathematical contemplation, and the result of mathematical abstraction.

*Metaphysical form*: form in the philosophical sense.

*Native or natural form, forma in natura existens, forma naturae, form of a nature*, is a term going back to John of Salisbury (*Opera*, ed. Giles, v. 92), and closely connected, if not synonymous, with *material form*. Certain questions started by Aristotle in Book V of the *Metaphysics* (of which there is an admirable periphrastic translation by Grote, *Aristotle*, 2nd ed., 619 ff.) gave rise to discussions in which the doctrine was compared with Christian beliefs; and the *natural form* plays a considerable part in such discussions. Bacon adopted the term *forma naturae*. He did not grossly depart from the received

meaning of the term, but owing to his occupying himself with inquiries quite antipodal to those of the scholastics, the two parties did not understand one another. Bacon means the physical explanation of a phenomenon, its occult *modus operandi*. Among the followers of Bacon we, at first, hear a great deal about forms. Boyle wrote whole books about them. But the distinction of matter and form was not calculated to further such inquiries as theirs. It is adapted to expressing phenomena of life. It might be twisted to such a purpose as Gilbert put it to (see *Astral form*), but it was not suited to the mechanical philosophy of Boyle, and only led to wordy and fruitless discussions.

*Participate form*: a form considered as it is united with matter.

*Preparatory form*: a term used by Boyle where *disponent* form would be more technical. He says, 'The preparatory form is but (if I may so speak) a harbinger that disposes the matter to receive a more perfect form, which; if it be not to be succeeded by any other more noble, is entitled the specific form of that body; as in the embryo, the vegetative and the sensitive soul is but preparatory to the rational, which alone is said to be the specific form of man' (*Free Considerations about Subordinate Forms*).

*Physical form*: such forms as may form the object of physical inquiries. Of course, the term was very differently understood during scholastic times and in the 17th century. But the above definition covers both uses.

*Primary form*. There is no such well-recognized term of metaphysics; but a remark of William Gilbert leads us to suppose that medical men attached some meaning to it.

*Principal form* is that which *per se* constitutes a species. Called also *specific form*.

*Radical form*: see *Astral form*.

*Sensible form*. Though it chanced that Aristotle nowhere distinguishes *μορφή* into *αἰσθητή* and *νοητή*, yet his followers did. Sensible forms are those which the outward senses distinguish; intelligible are those which the intellect alone can distinguish.

*Significate form*: a Thomistic term, a form distinguished by a name.

*Simple form*: form without matter. 'Forma simplex, quae est purus actus, est solus deus,' says St. Thomas.

*Specific form*: see *Principal form*.

*Subsistent form*: a form capable of existing separate from matter, as Aquinas holds that the angels and departed spirits are.

*Substantial form*: a form which constitutes a *nature*, i.e. a species or genus. Thus, the accidental form of a musician is music; but his substantial form is the rational soul which makes him a man. When men's thoughts became turned from theology to the investigation of physics, those who were animated by the new spirit found themselves confronted with objections based upon allegations of substantial forms. That these substantial forms, so used, were merely a hindrance to the progress of science, was quite plain to them. But the objections were urged with a logical accuracy, born of centuries of study, with which the new men were utterly incapable of coping. Their proper course would have been quietly to pursue their own inquiries, and leave the theologians to square their results with philosophy as best they could. But circumstances did not permit this. The theologians had the popular intelligence and the arm of power on their side; and when an apparent opposition arose, they naturally exerted themselves to put it down. Thus, the innovators were led to protest against these senseless and harmful substantial forms; and they had to formulate their objections to them—a business for which they were entirely unfitted. But since the discoveries of the physicists were plainly adding to man's knowledge and power, while their antagonists were simply obstructive, the former soon carried the day in the general opinion of mankind. The history proves that there was something vicious about the theological application of *substantial forms*; but it in no degree goes to show that the physicists accurately defined the objection to that application. In reviewing the arguments at the present day, when the position of the mechanical philosophers is becoming almost as obsolete as that of the scholastic doctors, we first note that when the new men denied that the substantial forms were 'entities,' what they really had in mind was, that those forms had not such a mode of being as would confer upon them the power dynamical to react upon things. The Scotists, for it was they upon whom, as being in possession of the universities, the brunt of the battle fell, had in fact never called the substantial forms 'entities,' a word sounding like a Scotistic term, but in fact the mere caricature of such a term. But had they used the word, nothing more innocent than the only meaning it could bear for them could be imagined. To call a form an 'entity' could hardly mean more

than to call it an abstraction. If the distinction of matter and form could have any value at all, it was the substantial forms that were, properly speaking, forms. If the Scotists could really specify any natural class, say man—and physics was at that time in no condition to raise any just doubt upon that score—then they were perfectly justified in giving a name to the intelligible characteristic of that class, and that was all the substantial form made any pretension to being. But the Scotists were guilty of two faults. The first—great enough, certainly, but relatively inconsiderable—was often referred to, though not distinctly analysed and brought home to them. It was that they were utterly uncritical in accepting classes as natural, and seemed to think that ordinary language was a sufficient guarantee in the matter. Their other and principal fault, which may with justice be called a sin, since it involved a certain moral delinquency, was that they set up their idle logical distinctions as precluding all physical inquiry. The physicists and Scotists, being intent upon widely discrepant purposes, could not understand one another. There was a tolerably good excuse for the physicist, since the intention of the Scotist was of an abstract and technical kind, not easily understood. But there was no other excuse for the Scotist than that he was so drugged with his metaphysics that ordinary human needs had lost all appeal to him. All through the 18th century and a large part of the 19th, exclamations against the monstrosities of the scholastic dogma that substantial forms were entities continued to be part of the stock-in-trade of metaphysicians, and it accorded with the prevalent nominalism. But nowadays, when it is clearly seen that physical science gives its assent much more to scholastic realism (limited closely to its formal statement) than it does to nominalism, a view of the history more like that here put forward is beginning to prevail.

In the following terms, mostly Kantian, prepositional phrases express the qualifications.

*Form of corporeity*: a very common term of scholasticism, originating with Avicenna, and used by Aquinas (*Summa Theol.*, pars i. cap. lxi. art. 2), but more particularly by Scotus (in his great discussion *Opus Oxon.*, IV. dist. xi. 9. 3, beginning 'De secundo articulo dico') and by all his followers. The point is, that the rational soul, being purely spiritual, cannot confer corporeity upon the human body,

but a special form, the form of corporeity, is requisite. Suarez and others, generally Thomists, as well as Henry of Ghent, denied this on the ground that a species has but one form. Thus a great metaphysical dispute arose. It sprung from the study of the doctrine of transubstantiation. See Cavellus, *Suppl. ad quaest. Scoti in De Anima*, disp. 6, which is in the Lyons ed. of Scotus, tom. ii.

*Form of cognition*, in Kant's doctrine, is that element of knowledge which the matter of experience must assume in order to be apprehended by the mind. Kant seems to have been thinking of legal forms which must be complied with in order to give standing before a court. So an English sovereign, in order to be crowned, must, as a 'matter of form,' swear to an intensity of loathing for Romish dogmas which he probably regards with great coolness. Kant's definitions are chiefly the following:—

'In the phenomenon, that which corresponds to the impression of sense, I call the matter of it; while that which constitutes the fact that manifoldness of the phenomenon is intuited as ordered in certain relations, I call the form of the phenomenon' (*Krit. d. reinen Vernunft*, 1st ed., 20).

'All cognition requires a concept, be it as imperfect and dark as you will; and this, in respect to its form, is always a universal which serves as a rule' (ibid., 106).

'The transcendental unity of the synthesis of the imagination is the pure form of all possible cognition, through which, consequently, all objects of possible experience must a priori be represented' (ibid., 118).

'There are two factors in cognition; first, the concept by which any object is thought—that is, the category; and secondly, the intuition by which that object is given. For if the concept had had no corresponding intuition, it would be a thought, no doubt, as far as its form goes; but having no object, no cognition whatsoever [he means, whether true or false] of anything would be possible by it; since, so far as I should know, there would be nothing, and perhaps could be nothing, to which such a concept would be applicable' (2nd ed. of the *Deduction of the Categories*, § 22).

'It is not more surprising that the laws of phenomena in nature must agree with the understanding and its a priori form, i.e. with its power of combining any manifold, than that the phenomena themselves must agree with the a priori form of sensuous intuition.

For just as phenomena have no existence in themselves, but are merely relative to the mind, as having senses, so laws do not exist in the phenomena, but are merely relative to the mind in which the phenomena inhere, that mind exercising understanding' (and see the rest of this passage, ibid., § 26).

*Form of forms*. Francis Bacon says 'the soul may be called the form of forms,' which would be a pretty conceit, were it not plagiarized from the serious doctrine of Aristotle: *ὁ νοῦς εἶδος εἰδῶν* (432 a, 2).

The terms *matter* and *form* are used in certain peculiar ways in logic. Speaking *materialiter*, the matter of a proposition is said to be its subject and predicate, while the copula is its form. But speaking *formaliter*, the matter of a proposition is, as we familiarly say, the 'matter of fact' to which the proposition relates; or as defined by the scholastics, 'habitus extremorum adinvicem.' The second tractate of the *Summulae* of Petrus Hispanus begins with the words: 'Propositionum triplex est materia; scilicet, naturalis, contingens, et remota. Naturalis est illa in qua praedicatum essentia subiecti vel proprium eius; ut, homo est animal; vel, homo est risibilis. Contingens est illa in qua praedicatum potest adesse et abesse subiecto praeter subiecti corruptionem; ut, homo est albus, homo non est albus. Remota est illa in qua praedicatum non potest convenire cum subiecto; ut, homo est asinus.'

Of a syllogism, the proximate matter is the three propositions; the remote, the three terms. The form, which ought to be the *ergo*, by the same right by which the copula is recognized as the form of the proposition, is said to be 'apta trium propositionum dispositio ad conclusionem ex praemissis necessario colligendam.' But Kant, in the *Logik* by Jäsche, § 59, makes the premises the matter, and the conclusion the form. (C.S.P.)

*Maxim* (in ethics) [Lat. *maxima sententia*, opinion of greatest weight]: Ger. *Maxime*; Fr. *maxime*; Ital. *massima*. (1) Any important principle for the regulation of conduct.

(2) A technical term in Kant's ethics: a practical principle regarded by the agent as valid for his own will.

In this latter sense a maxim is distinguished from a practical law. The latter is regarded as objectively valid, or valid for the will of every rational being. Morality consists, according to Kant, in the objective law becoming also the subjective maxim of the will; and his moral imperative is accordingly ex-

pressed in the terms, 'Act so that the maxim of thy will can always at the same time hold good as a principle of universal legislation.' Cf. Kant, *Krit. d. prakt. Vernunft*, Pt. I. Bk. II. chap. i. §§ 1 and 7. (W.R.S.)

*Maxim* (in logic). A widely received general assertion or rule.

The earliest writers, so far as has been shown, to use *maxima* as a substantive were Albertus Magnus and Petrus Hispanus. The former (*Post. Anal.*, lib. I. cap. ii) makes *maximae* constitute the seventh of thirteen classes of propositions which may be accepted, though they are uncertain, so that they differ widely from *dignitates*, or axioms. He says, 'Maximae propositiones opinantur esse quae non recipiuntur nisi in quantum sunt manifestae. Et putat vulgus commune et alii simplices et non periti quod sint primae ex sui veritate communicantes omnem intellectum; sicut est ista propositio, Mendacium est turpe,' &c. Hamilton quotes, but gives an unverifiable reference to, a sentence in which Albertus makes *maxima* another name for a *dignitas*. Petrus Hispanus (*Summulae*, v) says, 'Maxima est propositio qua non est altera prior neque notior'; and he divides commonplaces into two kinds, called Maxim and Difference of Maxim. This phraseology was so generally followed that it is surprising that Frantl's attribution of it to Albert of Saxony (who simply copies the *Summulae* here, almost verbatim) should have found any acceptance. Blundeville and other early writers of logic in English take the word from the *Summulae*. It was also adopted into English law. The meaning now tends to return to that used by Albertus. Kant (*Krit. d. reinen Vernunft*, 1st ed., 656) defines a maxim of reason as a subjective principle derived not from the character of the object, but from the interest of reason in such perfection of cognition as may be possible; and in the *Critic of the Practical Reason* he endeavours to make out something analogous in that sphere. In the *Logik* by Jäsche (Einleitung III) he defines a maxim as an inward principle of choice between different ends. (C.S.P.)

*Maxim* (legal): Ger. *Rechtsregel*, *Grundsatz*; Fr. *maxime de droit*; Ital. *massima giuridica*. The sententious expression of an established rule of law in a short form, which has become authoritative by long use and general approval; a legal axiom. Such a maxim has the force of law, e.g. 'Causa proxima, non remota, spectatur.'

The use of maxims is common to all