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КАФЕДРА АНГЛИЙСКОГО ЯЗЫКА

ПРАКТИЧЕСКОЕ ПОСОБИЕ

для студентов
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TABLE OF CONTENTS

PRESENT PARTICIPLE (Active and Passive)

1. Liquids occupy a definite volume and show a large resistance to forces tending to change it.

2. Let us consider the motion of an automobile moving along a straight and even road.

3. We say "assume as being at rest" because no object is really quite motionless.

4. A straight line regarded as having a definite magnitude and direction, but no definite location in space, is called a vector.

5. A body at rest is in equilibrium, also a body moving with constant velocity in a straight line, also a body turning with constant speed of rotation about an axis through its center of mass.

6. The planets revolve around the sun in orbits nearly circular, moving all of them in the same direction.

7. The lens acts upon light passing through it as a burning glass acts upon sunlight, concentrating it into one bright spot.

8. The friction force between two surfaces depends on their nature, being smaller for hard smooth surfaces than for rough ones.

9. We can imagine the liquid as consisting of separate particles moving about freely. Then the particles in the top layer, immediately under the piston, will move to the spaces between the particles in the next layer, displacing the particles in all directions. These displaced particles in their turn will move to the next layer of particles, doing the same, etc.

10. A general theory of partial differential equations scarcely exists, and interests mainly centers around particular equations such as the Cauchy-Riemann equations, the equations arising in hydrodynamics elasticity, static and dynamic electricity, heat flow, and wave motion.

11. A ball will remain motionless unless it is set in motion by some force. However, being once set in motion, it will travel with a uniform speed and in a straight line for an indefinite period of time.

12. The conclusions of science, being based on observation and reasoning, can be no more accurate than the observation made or the reasoning used.

13. The acceleration of a body when falling is constant.

14. When calculating the weight of a body, we have to multiply its specific gravity by its volume.

15. A wheel rolling in a straight line along a level surface is in equilibrium if moving with a constant speed.

16. Rays of light when passing close to large masses are bent towards the attracting mass.

17. In many cases of flow, a gas, while traveling at a velocity of several hundred feet per second, may at the same time exchange energy with the surroundings.

18. While working with these laws of electromagnetism, Maxwell made a deduction showing that the laws were inconsistent with another law of mathematical physics known as the equation of continuity.

19. Giving, as they did, so much information about the behavior of planets, the experiments making use of radio methods can be hardly overestimated.

PERFECT PARTICIPLE (Active and Passive)

1. Having greatly improved on his first telescope, Galileo made a series of discoveries.

2. Having discussed the algebra of complex numbers, we may now consider the differential calculus of complex variables.

3. Having received elaborate and precise instructions as to the problem, the computer proceeds to grind out figures at a prodigious rate.

4. We regard the Curies as having discovered the phenomenon of radioactivity.

5. Lodygin was practically without money, having spent all he had on his numerous experiments.

6. Stokes may be regarded as having founded the modern theory of hydrodynamics.

7. Having established relations of interdependence among physical facts, modern physics tries to interpret these relations.

8. Having defined the operations of addition and multiplication, together with the inverse operation of subtraction and division, we must next consider whether these operations obey the commutative, associative and distributive laws of algebra.

9. Having been measured with unreliable instruments, the data were incorrect.

10. Having briefly mentioned the development of the new branches of mathematics, we must pass on to the one who is perhaps the greatest of all scientists - to Isaac Newton.

11. Having been invented simultaneously, though independently, by Newton and Leibnitz, the calculus gave rise to bitter enmity between the partisans of both scientists.

PAST PARTICIPLE

1. The work done in overcoming the resistance is A=FS.

2. Each of the units employed might be arbitrarily chosen without reference to any other.

3. We can measure the amount of work done during a given conversion of energy.

4. We define stress as resistance to change of form and measure it in terms of the force exerted per unit of area.

5. The methods given in the preceding pages are sufficient for the numerical solution of all ordinary differential equations having numerical coefficient and sufficient initial conditions.

6. Two algebraic expressions are identical when they have equal numerical values for all the numerical equivalents of the letters contained in them.

7. Applied mathematics is not merely a piece of pure mathematics in which the symbols used are largely devoid of meaning.

8. Created by the human mind to count the objects in various assemblages, numbers have no reference to the individual characteristics of the objects counted.

9. For the most part, though not entirely, the equations considered are of the second order in two independent variables.

10. A weight lying on the ground does not work and can do no work, since the position does not change. The same weight lifted to a certain height and allowed to fall can produce work.

11. Easily drawn and producing accurate results, methods of graphical representation find wide application in these days, not only to pure academic studies, but also to the practical problems confronting engineers and architects.

12. Kinetic energy is that possessed by a body by reason of its motion - for example, the energy of a steam crane used in moving heavy articles.

13. If we may describe the mathematics known before 1600 as elementary mathematics, then we may state that elementary mathematics is infinitesimal compared to what has been created since.

14. Largely concerned in the practical application of mathematics, the Hindoo books are illustrated with problems arising in daily life.

15. No number exists which has negative value when multiplied by itself.

16. If no friction of any kind is present to resist the motion of the vibrating body, its vibration when once started, will continue indefinitely without further stimulus.

17. We shall now have occasion to use the "word system", which in its mathematical sense, has a meaning somewhat more definite than when used colloquially.

18. Bodies which do not suffer strain when acted on by forces are rigid bodies.

19. Unless otherwise stated the values used are taken in the decimal system.

20. The first Law of motion, arrived at through experience, appeared in Newton's "Philosophiae Naturalis Principia Mathematica" in 1687.

21. When suitably taught, mechanics illustrates well the spirit of applied mathematics.

22. Every body continues in its state of rest, or of moving with constant velocity in a straight line, unless acted upon by some external force.

23. The reader will find many examples, followed by notes explaining why particular examples have been selected.

24. A body when immersed in a liquid is pressed upwards by a force equal to the weight of the liquid displaced. Hence a body weighs less when in a liquid than when weighed in air.

25. According to the legend, Archimedes discovered his principle when given the problem of determining whether a crown of king Hero was or was not pure gold.

26. Although taught to children in the early grades, algebra developed historically long after geometry and to my mind is of considerably greater intellectual difficulty.

27. The discussion of the problem in question begins in the article to follow though alluded to before that article.

28. To explore with any degree of completeness the theories referred to above would demand a course of study far wider than that covered in this book.

ABSOLUTE CONSTRUCTION

1. The square of any number being positive, the square root of a negative number seems imaginary.

2. The speed of light being extremely great, we cannot measure it by ordinary means.

3. Other conditions being equal, the acceleration will be the same.

4. We say that n tends to infinity, or $n \to \infty$, this last symbol being usually employed as an abbreviation for "infinity".

5. A prism is a body having two opposite faces equal and parallel, the other faces being flat planes connecting the edges of the two parallel faces.

6. As we assign a price to each article of trade, so we may assign a number to each piece of matter, equality of these numbers implying mechanical equivalence.

7. All machines that have ever been built by a man have some energy "loss", that energy being converted into useless heat due to friction.

8. In astronomy even vast bodies as the Earth and the Sun can be treated as material particles, their actual dimensions being negligible compared with their mutual distances.

9. There being no fluid between the earth and the sun, the heat which reaches the earth from the sun cannot be brought to the earth by convection.

10. The total weight of all meteorite bodies reaching the earth's surface in a day is estimated at 10 to 20 tons, their velocities outside our atmosphere being between 10 and 70 kilometers per second.

11. The earth is not exactly spherical but is flattened at the poles, the polar diameter being nearly 27 miles, or about one three hundredth part less than the equatorial.

12. A rope, divided by knots into parts proportional to 3:4:5, was taken and laid out in the form of a triangle. The angle between the two short sides of this triangle being the right angle, the required direction is given immediately.

13. Classical mechanics was the center of physical thought from the time of Galileo to the time of Planck, the avowed purpose of most physicists being to give a mechanical interpretation to all physical phenomena.

14. Frequently no unit is mentioned, but when it is desired to emphasize that circular measure is used, we say the angle is one of 0 radians, the radian being defined as the angle subtended by an arc equal to the radius.

15. Everyday observations show that hot objects radiate much more heat than cold ones, the quantity of energy radiated increasing very rapidly with increased temperature.

16. Traces of the ancient way of counting, using the fingers and toes, are imbedded in our own language, the word "digit" meaning not only the numbers 1, 2, 3... but a finger or a toe as well.

17. Experiments show us that there is very little attraction between the molecules of any gas. This attractive force being so small, a given body of gas has neither definite shape nor definite size but takes both the size and shape of any container into which it is placed.

18. As it is now generally understood, the term arithmetization is used to denote the movement which has resulted in placing analysis on a basic free from all notions derived from the idea of measurable quantity, the fractional negative and irrational numbers being so defined that they depend ultimately upon the conception of integral number.

19. The originals having been lost or destroyed in the sack of Alexandria, the Arabic translation of the works of Euclid, Archimedes, Apollonius and other great scientists are in some cases the only copies we possess of these writings.

20. The system under consideration is regarded as composed of particles. The forces acting on the particles are in part internal and in part external, the internal forces satisfying the law of action and reaction.

21. Gambling being one of the accomplishments of a gentleman in that day, Descartes gambled with enthusiasm and some success. Whatever he undertook he did with his whole soul.

22. Many men had preceded Newton in the science of Mechanics, perhaps the most outstanding being Galileo who in his studies of accelerated motion had laid much of the ground work for Newton's formulation of his three laws.

GERUND

A

1. Solving problems is a fundamental human activity.

2. "Setting up equations is like translation from one language into another," said Newton in his Arithmetica Universalis.

3. Using ABC for known quantities and XYZ for the unknowns is accepted in mathematics.

4. Devising a plan, conceiving the idea of an appropriate action is the main achievement in the solution of a problem.

5. Formulating a problem in the specific terms which a computer can use is frequently quite a chore.

6. Mastery is but a step away from prediction, for knowing the unfailing course of nature makes possible the employment of nature in engineering devices.

7. Einstein's most cherished desire was becoming a scientist, which at a time seemed unlikely.

8. No one has succeeded in proving the theorem which Fermat left in the margin of a book.

9. So far only the quantum theory has succeeded in giving satisfactory explanations of such a deviation.

10. Newton showed that Kepler was correct in believing that planets described elliptic orbits about the sun.

11. His work resulted in giving a new interpretation to many phenomena.

12. The reader must get used to using words, with which he is familiar in other connections, as the technical terms of mathematics with different meaning.

13. By Maxwell's time, the physicists of the XIX century had succeeded in formulating mathematically the quantitative aspects of various electrical and magnetic phenomena that had been studied over the proceeding centuries.

14. Numerical differentiation in the process of calculating the derivatives of a function by means of a set of given values of that function.

15. The operation of multiplying two integers a, b together is one which is always a possible operation in accordance with the definition of the operation of multiplication.

16. For making your experiment you only need two pieces of paper of the same type, of the same size.

17. The capacity for doing work, which a moving body possesses, is called the kinetic energy of the given body.

18. It is important to have a choice of methods for obtaining latent roots and latent vectors without undul labor, and the object of the present paper is to augment the existing store of such methods.

19. After measuring the segment AB we shall prefix a+sign to the resulting number.

20. After colliding with the far more massive atom the electron may be found moving at the same speed as before.

21. Before proceeding to the discussion of certain properties of general integrals, we shall mention some other classes of integrals and briefly outline some of their relations with one another.

22. In describing a displacement we do not need to make any reference to the time in which the point moves from one position to the other.

23. The work done in rising the weight or compressing a spring is the same whether done in a second or in an hour.

24. Dynamics treats of the effect of forces in causing or modifying the motion of masses and in producing strains in elastic bodies.

25. In writing on paper or blackboard we usually distinguish vectors from scalars by drawing a short line above each letter, used to represent a vector.

26. In dealing with the new numbers however we must devote some attention from time to time to the actual operations on vectors before interpreting these in terms of the quantities represented.

27. Friction is diminished by polishing the surfaces, which diminishes the friction.

28. The actual comparison of masses is accomplished with great accuracy by weighing.

29. When two displacements are to be added, the addition may be performed by drawing a triangle.

30. The law of motion is sometimes expressed by saying that the body has inertia.

31. By giving three real numbers in a definite order we may by any one of various schemes determine the amount, direction and sense of the motion of the air at the point.

32. Liquids are assumed incompressible, although it is possible to carry a liquid such as water through a process in which its density changes, merely by subjecting the water to extreme pressure.

33. The problem is solved by representing the function by an interpolation formula and then differentiating this formula as many times as desired.

GERUND, VERBAL NOUN

B

1. The earth's going around the sun does not make the stars noticeably change in direction, which shows how enormously far away they are.

2. Einstein's being awarded the Nobel prize in physics was known and acclaimed by all true scientists.

3. Mastery is but a step away from prediction, for knowing the unfailing course of nature makes possible the employment of nature in engineering devices.

4. One of the great accomplishments of computer science is its enabling computers to control things.

5. The atomic nucleus is far from being a simple particle; in spite of its being so small its structure is very complex.

6. Solids in greatly differing degrees resist being changed in shape (that is resist deformation).

7. Friction is the cause of a large proportion of energy being lost in heat.

8. Instead of occupying a fairly limited region in space an event (in a mathematical model) occurs at a mathematical point; and instead of being of fairly short duration it occurs instantaneously.

9. The friction force, instead of being independent of the speed, is directly proportional to it, provided the speed is not too high.

10. It will be useful to get some practice in the use of some rather cumbersome procedures, if for no other reason than that of becoming aware of what can be done with a little knowledge of the differential calculus.

11. Today there is scarcely a subject with any pretensions to being called a science which does not sooner or later reduce its objects mathematical investigation.

12. In spite of not having any university education, Faraday made his great discoveries.

13. Why does a stone hit the ground sooner than a feather in spite of them having been dropped at the same time and from the same height?

14. Cases and liquids are perfectly elastic. In spite of them having been compressed, they return to their original volume as soon as the applied force has stopped acting.

15. It is not clear that an aggregate defined as a class of objects is necessarily capable of being ordered at all.

16. A triple is itself a vector quantity and may indeed be regarded as a sort of ideal simple vector quantity capable of being employed to characterize other vector quantities.

17. The theorem may be stated in a somewhat different form, in which it is capable of being proved in a simple manner.

18. Besides being able to perform the basic arithmetic operations, the computers may be made to answer questions either yes or no.

19. Examples of sliding vectors have already occurred without being mentioned as such.

20. In addition to being used as an important mathematical tool the computers find wide application in science and engineering and even in arts.

21. The ancient Greek philosopher Thales of Miletus is credited with the discovery that amber on being rubbed can attract light things.

22. One can easily repeat Galileo's experiment by dropping a large stone and a small one at the same time from the same height and by observing their hitting the ground at the same time.

23. The worst may happen if a student embarks upon computations or constructions without having understood a problem.

24. It was then found that Uranus had been seen and recorded as a fixed star no less than twenty times between 1690 and 1781, four astronomers having been concerned, who had thus each had a chance of being its discoverer.

25. As for my remarks about the Mellory brothers' laboratory being as it were cut off from the outside world, I believe that your objections here are due to a misunderstanding, caused evidently by my not having made myself perfectly clear.

VERBAL NOUN

1. Employing the positive real numbers, we must always have an understanding as to the size of the unit employed.

2. These forces do not prevent molecular motion within the liquid itself, but prevent the escaping of molecules from the surface of the liquid.

3. Everybody is familiar with the fact that when a chair is pushed it will move on for a time and pass a distance before it stops at last. Why does it stop? Due to the scraping of the chair against the floor, there is a certain amount of resistance which must be overcome.

4. The student should make certain that he has a clear understanding of the fundamental process of differentiation and its use in deriving the various formulas for differentiation.

INFINITIVE

1. To do work is the capacity of energy.

2. To test the above statement is not difficult at all.

3. To change force of effort is one of the important uses of machines, the latter being also used to change speed.

4. To give a true picture of the surrounding matter is the task of natural science.

5. To raise the number "a" to a power having an integral positive exponent "n" is to find the product of "n" equal factors aaa…a.

6. To set up equations means to express in mathematical symbols a condition that is stated in words.

7. Our purpose is to obtain information on the common divisors of f_0 and f_1.

8. The only way to get more dependable results is to have coefficients of greater accuracy.

9. Our general object in statics is to find the positions of equilibrium of a system.

10. One of the first problem in any analytic geometric investigation of a configuration is to discover a covariant coordinate system.

11. The very first thing we must do for our problem is to understand it.

12. The object of this book is to introduce a reader to the general properties of an analytic function of a single complex variable.

13. The scheme now coming into general use is to use the ordinary italics for scalars as usual and to represent vectors by the black-faced clarendon letters.

14. Newton was the first to realize the elliptical path of comets and was the discoverer of the three basic laws of motion which are the foundation of practical mechanics.

15. Different kinds of matter differ greatly in ability to preserve their shapes.

16. When falling the more massive bodies have more inertia to be overcome.

17. Mechanics is traditionally the first branch of applied mathematics to be studied as such, and there are good reasons in support of this tradition.

18. Newton's Laws of motion to be discussed in the article to follow are based upon his own and Galileo's experiments. His laws of motion are to be modified when speed approaches the speed of light.

19. According to the law of Conservation and Transformation of Energy, the useful work to be done by a machine is less than the total work performed by it.

20. Actually the method of analytic continuation is rarely used for an extended interval because the labor required almost always exceeds that of other methods to be explained later.

21. When we employ numbers which may be both positive and negative, we find it necessary to specify not only the unit to be employed in the measurement, but also the initial value or starting point, from which we measure, and the sense in which the measurement has been made.

22. An abacus is a simple and a very ancient object which can be used to calculate with.

23. In order to avoid confusing the main issue we have put down only the essential results, having the details to the student.

24. To raise a product to a power it is sufficient to raise each of its factors separately to that power.

25. To solve an equation one must find the values of the unknowns that satisfy the equation, i.e. reduce it to an identity.

26. The logarithm of a given number to a given base is the exponent of the power to which this base must be raised in order to obtain the given number.

27. Inertia is one of the reasons why extra power is required to set the car going. We need this power to overcome the resistance of the car to any change in its condition.

28. Bacon filled a massive lead ball with water, sealed it up and then struck it with a hammer so as to diminish the internal volume and in this way compress the water contained therein.

29. The history of science abounds with theories, accepted with eagerness only to be rejected later.

30. There are at least two cases on record of meteor falls that were violent enough to have wrecked a whole city; but in each case the fall was in a desolate region.

31. Atoms are much too small to be seen, so that experiments to find out their structure and behavior have to be conducted with large number of atoms.

32. To have produced anything of the slightest permanent interest, whether it be a copy of verses or a geometrical theorem, is to have done something.

INFINITIVE (for-phrase)

1. It took some fifty years or so for the world to digest all Newton's work.

2. It is not difficult for us, with our training in geometry, to think of a scrap of matter with no size at all.

3. It is possible for the astronomers to find the distance to the moon or to the star by merely finding the direction to them from two places.

4. It is scarcely necessary for anyone to learn the length of time that it takes the planets to go once around the sun and the velocities at which they travel along their orbits. Though they are interesting figures to have for reference.

5. It takes considerable time for the earth to become fully heated after getting so cold in winter, and to cool off after the summer's heat.

6. For a molecule of air to escape from the earth it must attain a speed of seven miles a second.

7. It can be shown that the necessary and sufficient condition for a Jordan arc to be rectifiable is that the sums should be bounded for all possible modes of subdivision of the range of values of the parameter.

8. For any natural physical state to change, some alteration of the conditions acting upon this state must occur.

9. Descartes and Fermat so thoroughly explored and developed analytic geometry, that the new revolutionary technique was completed and ready, as the seventeenth century ended, for Newton and Leibnitz to produce from it the mathematical advance that has made possible our modern age of engineering and science.

OBJECTIVE WITH THE INFINITIVE

1. We know gravity to pull on every particle of a body.

2. We know the velocity of a particle to be continuously changing if this particle has nonuniform motion.

3. We can expect acceleration to be different for different weights, but this is not the case.

4. Let us suppose a force to be applied indefinitely at any point of the body in the line of action.

5. We consider the equation containing one or more ordinary derivatives or differentials to be an ordinary differential equation.

6. As in liquids, the atmospheric pressure at any given point is equal in all directions, but we know it to decrease as altitude increases.

7. Experiments have proved the pressure of a gas at fixed temperature to depend on its acceleration.

8. We have thought the above law to hold only for gases which are under normal conditions.

9. We observe the volume of a given mass of a gas to decrease as the temperature decreases.

10. On assuming the body with the mass m to be acted upon by force f, let us calculate the acceleration.

11. Recent research has shown the nucleus to be an exceedingly complex structure.

12. The measurement is made by permitting a beam of sunlight to be completely absorbed by a body of known hot capacity.

13. The reader should not expect “real numbers” to be more real, or any less imaginary, than “imaginary numbers”.

14. Whether information in storage requires electrical energy to remain in storage is also important.

15. Suppose the earth to be in rotation about some axis through is center of gravity and to be acted on by the attractions of the sun and the moon.

16. If we imagine the motion to have been started instantaneously at time t, the result we have arrived at may be stated in the formula to follow.

17. It is clear that the speed of a machine is an essential factor in the consideration of the overloading of wings, and hence it is natural to expect the overloading to be a maximum when the speed is greatest.

18. The Greeks considered abstract intellectual activity to be essentially an end in itself, requiring no further justification.

19. Newton’s “Principia”, universally estimated by competent judges to be the greatest contribution to science ever made by one man, was composed in 1684-1686.

20. There is no difficulty in supposing the craters on the moon to have been produced by forces similar to those which have given rise mountains on the Earth.

21. When a particle is moving as part of a rigid body, it is acted on by the external impressed forces and also by the molecular reactions of the other particles. If we consider this particle to be separated from the rest of the body, and all these forces removed, there is some one force which, under the same initial conditions, would make it move in the same way as before.

22. Mathematical investigation of the disturbances in the orbit of Uranus resulted in conclusions which permitted a telescope to be pointed at a definite spot in the heavens and at a definite hour, to put to the test the theoretical calculations. Neptune duly made its appearance as theory had predicted.

23. Leibnitz first used the term “differential equation” to denote the relationship between the differentials dx and dy of two variables x and y. We now maintain differential equations to include any algebraical equality which involves either differentials or differential coefficient.

24. After the programmer has constructed a program, that is after he has decided what he wants the machine to do and in which chronological order it should be done, he has to inform the machine of his intentions. This is accomplished by means of a code which permits the desired machine operations to be specified in all necessary details.

25. Elimination enables the accidental features associated with any natural phenomenon to be discarded and essential or general characteristics to be retained.

26. It was the problem of a vibrating string that first caused mathematicians to doubt whether they had apprehended what a function may be in mathematical analysis.

27. The presence of a body in a stream causes energy to be redistributed between the two forms, so that where pressure is high, velocity is low, and vice versa.

NOMINATIVE with the INFINITIVE

1. When the state or condition of a body is such that it can do work, the body is said to possess energy.

2. A variable approaching the ∞ is often said to become infinite, while the variable approaching zero is known as infinitesimal.

3. The location of the center of gravity of a uniform body is known to depend on its shape and size.

4. Inertia is known to be one of the fundamental characteristics of matter.

5. Mathematics must now be said to begin with the calculus.

6. Most vibrations with which we are familiar are observed to cease gradually.

7. When the limits between the integration to be performed are stated, the integral is said to be definite; when the limits are omitted, the integral is said to be indefinite.

8. Newton's theory of light was later shown to be unsound, but it occupied a central place in science for many years.

9. When the sum of an infinite series approaches closer and closer to some definite finite value, as the number of terms is increased without limit, the series is known to be a convergent series.

10. A book lying on a table is expected to keep its position without any difficulty, as one knows it to be in a state of equilibrium.

11. Quantum mechanics must yield the same results as classical mechanics when applied to problems where the classical theory is known from experience to give the correct description of events.

12. For nearly two thousand years all heavy objects were believed to fall faster than the light ones; it is easy to understand this mistaken idea, for if a stone and a feather are both dropped, the stone will hit the ground sooner than the feather.

13. Higher mathematics, in general, deals with magnitudes which change in a continuous manner. In order to render such a process susceptible to mathematical treatment, the magnitude is supposed to change during a series of very short intervals of time.

14. When we start a new subject, we are not expected to know what the technical words mean. They are introduced with some formality, being given definitions.

15. The function is analytic at all points of the region if its derivative can be shown directly from the definition or through the differentiation formulas, to exist throughout some open two-dimensional region.

16. The atom is believed to be made up of a central nucleus of positive electricity around which a number of negatively charged particles, called electrons, travel in circular or elliptical orbits.

17. Hippocrates is supposed to have discovered many of the important properties of the circle.

18. Alexander of Macedonia is reported to have asked his tutor for shorter proofs in his geometrical theorems.

19. An Indian prince is reported to have offered to the inventor of chess any reward he might desire.

20. If asteroids were made in the way that they are supposed to have been, it is probable that there are many thousands of them too small to have been discovered.

21. From the people of India our present system of numerals is supposed to have been derived. Its origin is obscure but these numerals appear to have been in fairly common use in India in the X century.

22. The earth seems to be fixed, as we cannot feel it moving.

23. The three famous “construction problems” of antiquity proved to be unsolvable.

24. To know that certain mathematical problems have unique solution might seem to have no significance in mathematical physics.

25. The method to be presented below does not seem to offer any advantage over the one discussed above.

26. In many cases where the solution of a differential equation is needed it proves to be impossible to obtain a solution in elementary form.

27. Zero doesn’t seem at first sight to be such a remarkable addition to human thought and development.

28. Computers have proven to be capable of matching or outperforming men in many information processing activities, in terms of speed, cost, or capacity to integrate a multitude of factors.

29. Such an approach to the problem, although it has been pursued with a remarkable measure of success, has proved to be both cumbersome and essentially inadequate.

30. If the computed function happens to be affected with an error, the argument determined from this function is necessarily incorrect in some degree.

31. We know gravity to act on every particle of a body so that its weight is actually distributed throughout the body. But a solid body appears to have one point at which it can be supported by a single upward force.

32. The ancients seem to have thought that air and water could be transformed into each other.

33. It is difficult to ascribe this theorem of Pythagoras as it appears to have been known long before his time.

34. When Newton went to Cambridge he seems to have possessed a good all-round education of the normal type for the time, having received all the book-learning available.

35. There appears to be one universal natural law: differences of energy levels ever tend to disappear.

36. There appears to be no alternative but to solve such an equation by one or other of the accepted methods.

37. There does not appear to be an argument between the results obtained in these laboratories.

38. The postulates of the theory under discussion are of fundamental importance, and are likely to form the nucleus of future theories.

39. Errors are most likely to occur in computing and recording the doubled products – by forgetting to multiply by 2, by recording the results with the wrong sign, etc.

40. Our conception of the problem is likely to be rather incomplete when we start the work; our outlook is different when we have made some progress; it is again different when we have almost obtained the solution.

41. While the discrepancy in the meaning of the word “billion” – whether it is 10^9 or 10^{12} – is not likely to cause any serious misunderstandings in everyday life, some universal agreement on usage and nomenclature would nevertheless be desirable.

42. Bodies said to be rigid do not suffer strain when acted on by forces.

43. Let us examine the proposition likely to give the results required.

44. The mere fact of a body appearing to be at rest cannot be taken as a demonstration that its parts may not be in a state of motion.

45. We define “a property” to be a two-valued function which divides figures into two classes; a figure is said to have or not to have the property according to whether the function’s value is 1 or 0.

46. Lie's results constitute a distinct addition to the theory. The whole of his investigation is not, it could hardly be expected to be novel; but in his exposition there lies a great interest in the application and combination of ideas which occur in other associations.

47. On November 10th, 1619 Descartes is said to find a magic key which would unlock the treasure house of nature. What was this marvelous key? Descartes himself does not seem to have told anyone explicitly, but it is usually believed to have been nothing less than the application of algebra to geometry, analytic geometry in short.

MODAL VERBS followed by INFINITIVE PERFECT

1. The universe must have been smaller ages ago.

2. It appears that the earth's axial rotation must have been faster in remote times, the moon nearer, and the month shorter.

3. The basic idea of matching the objects with fingers must have come long before history opened her first page.

4. As early as 5700 B.C. Babylonians had a well-established calendar and must have developed a type of practical arithmetic.

5. Pythagoras must have had considerable personal charm and conviction; his school became a center and attracted large numbers of students.

6. If the craters on the moon are old volcanoes, what a grand sight it must have been when they were in eruption, throwing out lava and fire.

7. The change in the position of a particle must not only have magnitude, i.e. there must be a certain distance measured along the path traversed by the particle between its first and last positions, but also the motion of the particle must have been in some direction; so that velocity is a vector.

8. The Pythagoreans may have been the first to give a satisfactory proof of the Pythagorean theorem.

9. Both the Babylonians and the Egyptians were indefatigable builders and skilled irrigation engineers, and their extensive labors in these fields may have stimulated empirical calculations.

10. Before meteorites strike into the earth's atmosphere and become hot enough to be seen, they are supposed to be travelling around and around the sun, as the planets do. They may have been doing this as long as the earth has.

11. The present inclination of the moon's orbit, and the obliquity of the earth's equator to the ecliptic, may also have resulted from tidal action, starting with initial inclination of about 12° for the system.

12. The eminence of the number "ten" is not due to special mathematical properties of this number and it is not due to whatever mystical significance it might have had in the past. It is due to the simple fact that human beings have ten fingers.

13. Theodorus cannot have known the fundamental theorem, and it is unlikely that he knew even Euclid's theorem 3, he must have argued much as we argued at the end of the preceding section.

14. The discovery of the theorem of Pythagoras can hardly have been made by Pythagoras himself; but it was certainly made in his school.

15. The teacher should try to understand what is going on in the student's mind and ask a question or indicate a step that could have occurred to the student himself.

CONDITIONAL CLAUSES

1. If a homogeneous body is symmetrical about some point, the center of gravity of the body coincides with the center of symmetry.

2. If two functions are continuous, their sum, product and quotient are continuous provided the denominator is not zero.

3. If an experiment is repeated under the same conditions, the same results will be obtained.

4. If the body is in stable equilibrium, then any change of position will raise its center of gravity, and the potential energy of the body increase.

5. If you have a child in school or college, you will appreciate how badly we need a modern Euclid to make a clarification of algebra, analytic geometry, and calculus.

6. If there were no force resisting its motion, the speed of a ball would remain unchanged.

7. If there were air on the moon, this would show during the eclipse as a hazy covering around the moon.

8. If molecules were not in motion, they could be packed in actual contact like dead sardines in a can.

9. If gravity had no effect on the earth's atmosphere, the latter would meander off into space.

10. If integration were defined as the process of finding a function with given derivative, there would be a different integral for every variable.

11. Jupiter is so big that if all the other planets were rolled into one, this new globe would still be smaller than him.

12. If forces equal to the effective forces but acting in exactly opposite directions were applied at each point of the system, these would be in equilibrium with the impressed forces.

13. If a gas at constant pressure could be cooled to a temperature of 273° below zero on the centigrade scale, its volume would presumably shrink 273/273 of its volume at 0° C. In other words, it would occupy no volume at all.

14. I can't go into the theory of relativity at this point – even if I were able, which I am not – but it is important for you to understand, that non-Euclidean space was discovered by a critical examination of the assumptions underlying Greek geometry.

15. When uniform, the speed of a point is measured by the distance passed over by it in a unit of time; when variable, by the distance which would be passed over by the point in a unit of time, if it continued to move during that unit of time with the speed which it has at the instant under consideration.

16. If World War I had not occurred, an average man would never have heard of chlorine.

17. The Greeks considered abstract intellectual activity to be essentially an end in itself requiring no further justification. No doubt Egyptian geometers would have considered most Greek geometry useless.

18. Without Descartes's technique, Newton would have had a terrible time putting together the wonderful structure – part algebraic and part geometric – which finally explained and analyzed how the planets revolved about the sun.

19. What Abel and Galois might have accomplished in a normal lifetime cannot even be conjectured that it would have been much and of highest quality seems probable.

20. The numerical solution of differential equations has never quite attained respectability among pure mathematicians. Otherwise surely the subject would have been much better standardized, the gaps in our present knowledge would have been filled, and arguments concerning which method is best would have been settled.

21. Telescopes were directed to search for the planet at the time and place determined mathematically by Adams and Leverier. The planet called Neptune was located. It was barely observable with the telescopes of those days and would hardly have been noticed if astronomers had not been looking for it at the predicted location.

22. Masses which have equal inertias have also equal weights, provided they are weighed in a vacuum at the same point on the earth.

23. Any force however small can give as great a velocity as may be desired to any mass however great, provided it acts for a long enough time.

24. The change of velocity is not constant unless the change is constant both in magnitude and direction.

25. Unless the gas is compressed into a very small volume, the average distance between its molecules is very great as compared with their dimensions.

26. When a body is suspended from a point round which it can move freely, it will not rest unless its center of gravity be in the vertical line passing through the point of suspension.

27. But for the adroit coaxing and goading of Halley, Newton's "Principia" would probably never have been written.

28. But for the power possessed by some church dignitaries, Medieval schools very easily might have disappeared completely.

INVERSION

A

1. Should the oscillator burst into free oscillations, the frequency would be very unstable.

2. Should the problem of this kind be so absurd the men of science would hardly have taken so deep an interest in its solution.

3. Should the contents of this volume prove of any assistance to others in enabling them to proceed with the study of more advanced treatises, the author will be amply rewarded for his task.

4. Should the reader feel that our discussion of axiomatics fails to convey clearly exactly what is meant, let us remind him that our method of thorough explanation of these basic matters is, by example, the subject matter of the later chapter.

5. Should the reader of this book question the relation between logic and usefulness, let us remind him that scientific progress during the Golden age of Greece resulted from the application of logic to the investigation of natural phenomena.

6. If there were no sunshine, the world would have no sources of power for running machinery. Were it not for instruments that have been invented to study the heavens, we should probably know very little more about the sun than ancient peoples knew.

7. Were it not for the urging and financial assistance of the astronomer E. Halley, the Mathematical Principles of Natural Philosophy, which embodied the fruit of Newton's work, would never have been published.

8. The increase of mass is so small that the whole phenomenon might be regarded as trivial, were it not for the attention that has been directed to the very large amounts of energy that could be made available if mass were converted into energy on any appreciable scale.

9. What would have happened to Galileo had he refused to forswear his scientific knowledge we can only conjecture.

10. Neither Abel, nor Galois would have chosen the road Gauss followed had it not been for the hints in the Gaussian theory of binomial equations.

11. The quantum theory, useful as it has proved itself does not yet possess the assured position of the atomic theory of matter.

12. Incomplete though these figures are, they give more information in several respects than has before been available.

13. Significant as was Fermat's work in other departments of mathematics, he is usually considered to have made his greatest and most personal contribution in arithmetic.

14. Strange as it may seem, the theory of numbers, being the purest kind of mathematics, can be called, from a certain aspect, an empirical or even an experimental science.

15. This is no place for an examination of the philosophical basis of the theory of Relativity – important as it is – nor can we delve deeply into the purely mathematical aspect of the theory, owing to the great difficulty and complexity of the subject.

16. This notion of the essential nature of a fraction, dependent as it is upon the notions of a unit, and of the divisibility of such unit into equal parts, is incompatible with the modern view that Mathematical analysis should be developed upon the basis of pure Arithmetic.

17. Surrounding this nucleus are electrons, the actual number depending upon the atom being considered.

18. Perhaps never was the making of an important invention shared by so many persons distributed so widely over the world.

19. In each case the elements of length, direction and sense are involved, but it no case is the vector associated with any particular point or line.

20. Little did people realize a few years ago that the force of running water would someday be furnishing electricity for lighting and heating homes, for running street-cars, and furnishing power for factories.

21. Not until 1930 did the first evidence of the actual existence of such uncharged particles, called neutrons come forth.

22. Only at a rather advanced stage of intellectual development does the abstract character of the idea of number become clear.

23. Gauss founded a new dynasty of mathematicians. No longer do we find lawyers, diplomats, or even many scientists pursuing mathematics as a side line in their spare time.

24. Not only does a computer control processes and movements outside itself, but it can also control itself.

25. Not only does water expand when it is being cooled between 4° and 0°, but when it changes to the solid there is marked expansion.

26. If we had four fingers instead of ten, not only would we call our numbers by different names, but we would also write them in a different way.

27. In Ptolemy's exhaustive treatise not only are the basic theorems of trigonometry set forth but accurate tables of trigonometric values are included.

28. Not only did the Arabs produced the most able men of war of their day, but, subjected to the diverse cultural influences swept up by their conquests, they produced a group of artists, scientists and mathematicians that is the marvel of history.

INVERSION (nor)

B

1. “Hot” and “cold” are not very definite terms, nor are our temperature sensations very definite.

2. The above principle itself is not a new physical principle, nor any addition to existing physical principles.

3. The results obtained were not so important as we had expected them to be, nor were they always accepted.

4. If it were not for friction, nails and screws would not hold, ropes could not be made, nor could we even walk across a floor.

5. In all changes occurring in nature energy is transformed from one form into another, but it does not disappear nor is it created anew.

6. The fireplaces were not economical, for much of the heat went up the chimney, neither were they comfortable, for one had to be quite near them to get warm.

7. The student will frequently find that the solution of a differential equation is a matter of routine. However, this is not guaranteed, nor is it guaranteed that a given equation will fall under any of his classifications.

8. Truth in physical science is not to be sought for in dogma, nor can a system of nature be built up from our inner consciousness, it must be sought for earnestly and honestly by patient observation and skilled experiment.

9. Neither Kronecker nor Dedekind have yet been honored by being called a philosopher in the accepted sense. Nor can either be mentioned as involved in useless activities.

SUBJUNCTIVE

1. If the pressure at any point be increased by any means, the pressure at every other point will be increased to an equal extent.

2. Thales of Miletus is credited with the discovery that amber on being rubbed can attract light bodies. If this be true, he can be acclaimed as the discoverer of electricity.

3. From the results of the experiments we learn that, if a body be let fall towards the earth in vacuo, it will move with an acceleration which is always the same at the same place on the earth, but which varies slightly for different places.

4. It is natural that the author should try to develop some general rules that will enable us to arrive at the result more easily.

5. It is very unlikely that there should exist a proof of the famous theorem based on any methods one can reasonably assume Fermat could have made.

6. It was but natural that Newton should spend much time and considerable amount of money on what we should call alchemy, but what in his days was orthodox chemistry.

7. Since Newton's second law involves the resultant of all the forces exerted on a body, it is extremely important that one should learn as early as possible how to recognize just what forces are exerted on a particular body.

8. It is sufficient, in order that the object may be regarded under the form of unity, that it be so far distinct from other objects, as to be recognized at the time when it is counted, as discrete and identifiable.

9. At each point of indeterminacy of the function, it is immaterial whether the function be capable of having all, or only some, values between the limits of indeterminacy; thus, there is no loss of generality, if the function be regarded as having two values only at each such point, viz. the two limits of indeterminacy at the point.

10. It is evident that the boundary of the set S is the sum of the boundary segments of the system G, and in order that a vertex of this system be a boundary vertex it is necessary and sufficient that it lie on the boundary of the set S.

11. In order that the method should lead to an effective solution, it is necessary that f(x) should be numerically less than a positive constant K (less than unity) for all values of x within a range which includes a, the root to be calculated.

12. The necessary and sufficient condition that a rigid body with a fixed point 0 be in equilibrium is that the moment of the applied forces with respect to ∞ be zero.

13. The necessary and sufficient condition that a particle constrained to a smooth surface or curve be in equilibrium under the action of an applied force f is that f be normal to the surface or curve at the particle.

14. If the boundary value is not prescribed at an isolated point of discontinuity for the boundary values, or at infinity, the condition that the harmonic function be uniformly bounded in some neighborhood of this point makes Dirichlet's problem determinate.

15. The development of the telegraph required that information be broken down into elementary signals.

16. Archimedes refused to obey the soldier's order that he accompany him to the Roman leader until he had worked out his problem.

17. Because the chapter is intended primarily for reference, it is suggested that the reader review the first two sections and then turn to chapter one, using the remainder of the chapter if need arises.

18. Einstein suggested that we go further and regard the energy emitted by an oscillator, as a quantum or corpuscle of radiant energy which, preserving a certain degree of individuality, could only be reabsorbed as a whole.

19. In 1634 Descartes being then thirty-eight, his imposing treatise “Le Monde” was undergoing its final revision. But he suppressed his book and decided that it should be published after his death.

20. In addition and subtraction the figures must be so placed that the decimal points come under each other. The operation can then be carried out just as if we were dealing with whole numbers.

21. In determining the orbit of a planet we may neglect the acceleration of the sun and treat it as if it were at rest.

22. If a rigid body be moving under the influence of a central force, the motion of the center of gravity is not generally the same as if the whole mass were collected at the center of gravity and it were then acted on by the same central force.

23. The principle asserts that, if the attraction of the central force on each element of the body be found, the motion of the center of gravity is the same as if these forces were applied at the center of gravity parallel to their original directions.

24. Sometimes, sitting in a railroad car looking out of the window at cars on another track, you have probably noticed that cars and even telegraph poles look as if they were beginning to move backward.

25. The most noticeable difference between the landscape of the moon and the landscape of the earth is that on the moon there are thousands of craters. Through the telescope these craters look as if they had been made by volcanoes.

SHOULD (SHALL)

1. We shall consider the energy changes which accompany nuclear reactions. The basic principles underlying all such considerations are the equivalence of mass and energy.

2. We shall find answers to the questions – what kind of waves are light waves in the theory of electricity and magnetism.

3. The teacher should help, but not too much and too little, so that the student shall have a reasonable share of the work.

4. He said: "We were confident from the very beginning of the experiment that we should be able to find the explanation to the phenomenon that puzzled so many research workers."

5. To solve this problem, we should apply Newton's Laws of motion.

6. It should be noted that a "curve" in its mathematical sense includes a straight line.

7. In using the first principle it should be noticed that the impressed forces are to be applied at the center of gravity.

8. If the air molecules were stationary, we should expect the smoke particles to be stationary too.

9. As previously pointed out, when an expression is integrated an arbitrary constant appears, and this constant should be determined before proceeding further, if possible.

10. Why should mass vary with velocity? Why should an electron possess mass?

11. According to classical theory, in empty space light should be propagated in a straight line.

12. Should the contents of this volume prove of any assistance to the students, the author will be amply rewarded.

13. If all the people of the world should count the atoms in a drop of water, they would not be able to finish their work even in ten thousand years.

14. Should the uniform change in volume continue during the cooling of a gas to very low temperatures, the gas sample, would have no volume at -273°.

15. The professor insisted that the students should pay attention to this phenomenon.

16. In order that this relation should be valid two conditions must be observed.

17. The professor suggested that he should repeat the experiment under different conditions.

18. The use of struts enters very largely into airplane construction hence, it is important that the theory underlying the formulae employed in their design should be clearly understood and appreciated.

19. That the body may be in equilibrium under two forces, it is necessary that the two forces P and Q should be equal and opposite.

WOULD (WILL)

1. Many new scientific discoveries will be made before a voyage to Mars.

2. The stars considered represent what our sun will be like when it has exhausted its hydrogen, some ten billion years or more from now.

3. If a body is subject to no external force whatever, the center of mass will move in a straight line with constant velocity and the angular momentum will be constant in both direction and magnitude.

4. Archimedes once exclaimed somewhat enthusiastically, "give me a fulcrum" – i.e. something firm to rest his lever against – "and I will move the world."

5. When we talk of problem-solving we will usually suppose that all the problems to be solved are initially well defined.

6. "If our discussion stimulates you to research in this domain, the object of these seminars which you have followed with so much attention has been achieved."

7. The principles, by which the motion of a single particle under the action of given forces can be determined, will be found discussed in any treatise on dynamics of a particle.

8. We were sure that the method now in use would give the results desired.

9. I was not sure whether the theory considered would account for the phenomena in question.

10. Bessel predicted that 50 years would be required for Sirius to go all the way around the circuit.

11. Maxwell noticed that the addition of a new term to Ampere's law would secure the consistency of the laws of electromagnetism and therefore decided to add it.

12. Recently it was announced that a search would be made for radio signal from other planets. Naturally this implies the existence of intelligent beings on other planets.

13. We tried to solidify this substance but it would not, for the pressure was too low.

14. The nearer you move to the equator, the hotter the climate would become.

15. The line of the quickest descent from a given point to a curve in the same vertical plane is the straight line down which a body would slide from the given point to the given curve in the shortest time.

16. Heated materials always expanding, it was necessary to find such a metal which would expand on heating to the same amount as glass and, therefore, would remain airtight when the lamp became hot.

17. The astronomers of the past would say, when the planet Mars was in a spot directly opposite to that occupied by the sun, that Mars is in opposition to the sun.

18. Leibnitz made the independent discovery and the great simplification of the calculus, as well as invented a calculating machine, which would divide, multiply, and extract roots, as well as add and subtract.