a course in mathematics for students of physics 1

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Từ khoá: English for students of Physic, Science, Grammar in use, English – Vietnamese translation, Practice, Definitions, Relative clauses, Participle phrases, Adjectives.

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About the volume

This volume is the first volume, which focuses on general language in science (and physics as a science), of a two-book set for students of physics. The volume is composed of 5 units, each concerning with one general and simple topic about science and physics and being solved in within 10 -12 class - contact hours.

Each unit will be presented in the same frame as follows:

Each unit consists of five (5) main parts with its own aim(s) in improving students' language skills.

Part one: ***Reading passage***

This part mainly focuses on improving the students' reading skills. The comprehension tasks will range from skimming to scanning, from sensitizing to anticipating, from guessing to analyzing, etc. All is to support the aim.

The reading passage will also introduce new grammar pattern(s) to students.

Part two: ***Grammar in use***

This part gives a thorough explanation of the new grammar pattern(s) present in the reading passage.

Students will get more chance to practice those patterns in the practice part – the subpart in this part, and which will help to improve their writing skills.

Part three: ***Problem – solving***

In this part, students are acquainted with simple description of side, shape, and measurements of objects. Furthermore, they have a chance to practice building simple sentences and transforming the structure of a sentence to another one in a way that the sentence retains its meaning. These are the very simple level of writing skill practice. It is the base for students to develop their writing skills later on.

Part four: ***Translation***

This part is subdivided into two smaller tasks, one dealing with English – Vietnamese translation and the other for Vietnamese-English translation.

The aim of this part is to reinforce students' intake of new grammatical as well as vocabulary items.

Students study the ways/rules of transferring information from…to or to…from with their two concerned languages.

The part leaves a subpart for presenting vocabulary items relating to the reading and translating topics, hence helping the students enrich their vocabulary.

Part five: ***Free – reading passage***

This part is designed for the students to have more chance to read an authentic writing dealing with the same topic presented throughout the unit. Normally, the task dealing with this is simply requiring students to do translation on the passage, hence helping them with improving their vocabulary.

Unit One

SCIENCE

READING PASSAGE

Science and fields of science

Science (Latin *scientia*, from *scire*, “to know”), is the term which is used, in its broadest meaning to denote systematized knowledge in any field, but applied usually to the organization of objectively verifiable sense experience. The pursuit of knowledge in this context is known as pure science, to distinguish it from applied science, which is the search for practical uses of scientific knowledge, and from technology, through which applications are realized.

Knowledge of nature originally was largely an undifferentiated observation and interrelation of experiences. The Pythagorean scholars distinguished only four sciences: arithmetic, geometry, music, and astronomy. By the time of Aristotle, however, other fields could also be recognized: mechanics, optics, physics, meteorology, zoology, and botany. Chemistry remained outside the mainstream of science until the time of Robert Boyle in the 17th century, and geology achieved the status of a science only in the 18th century. By that time the study of heat, magnetism, and electricity had become part of physics. During the 19th century scientists finally recognized that pure mathematics differs from the other sciences in that it is a logic of relations and does not depend for its structure on the laws of nature. Its applicability in the elaboration of scientific theories, however, has resulted in its continued classification among the sciences.

The pure natural sciences are generally divided into two classes: the physical sciences and the biological, or life, sciences. The principal branches among the former are physics, astronomy, chemistry, and geology; the chief biological sciences are botany and zoology. The physical sciences can be subdivided to identify such fields as mechanics, cosmology, physical chemistry, and meteorology; physiology, embryology, anatomy, genetics, and ecology are subdivisions of the biological sciences.

The applied sciences include such fields as aeronautics, electronics, engineering, and metallurgy, which are applied physical sciences, and agronomy and medicine, which are applied biological sciences. In this case also, overlapping branches must be recognized. The cooperation, for example, between astrophysics (a branch of medical research based on principles of physics) and bioengineering resulted in the development of the heart-lung machine used in open-heart surgery and in the design of artificial organs such as heart chambers and valves, kidneys, blood vessels, and inner-ear bones. Advances such as these are generally the result of research by teams of specialists representing different sciences, both pure and applied. This interrelationship between theory and practice is as important to the growth of science today as it was at the time of Galileo.

(*From* **http://encarta.com**)

COMPREHENSION QUESTION

Exercise 1: *Answer the following questions by referring to the reading passage.*

1. What does the term ‘science’ denote in its broadest meaning?

   ……………………………………………………………………………………………
   …………………………………………………………………………………….......

2. What is applied science known as?

   ……………………………………………………………………………………………
   …………………………………………………………………………………….......

3. In what way does pure math differ from other sciences?

   ……………………………………………………………………………………………
   …………………………………………………………………………………….......

4. What sciences are pure natural sciences generally classified into?

   ……………………………………………………………………………………………
   …………………………………………………………………………………….......

5. Are sciences independent of one another?

   ……………………………………………………………………………………………
   …………………………………………………………………………………….......

Exercise 2: *Complete each of the following statements with words/ phrases from the reading passage*

1. The pursuit of …………… in this context is known as pure science.
2. The Pythagorean scholars …………… only four sciences.
3. Chemistry remained ……………the mainstream of science.
4. …………… that time the study of heat, magnetism, and electricity had become part of physics.

5. During the 19th century scientists finally recognized that…………… mathematics differs from the other sciences.
6. The pure natural …………… are generally divided into two classes.
7. The ……………branches among the former are physics, astronomy, chemistry.
8. The……………sciences can be subdivided to identify such fields as mechanics, cosmology.
9. Genetics, and ecology are subdivisions …………… the biological sciences.
10. All classifications of the pure sciences, ……………, are arbitrary.

Exercise 3: *Decide whether each of the following statements is true (T), false (F) or with no information to clarify (N).*

1. …………The term S**cience** is generally used to denote systematized knowledge in any field.
2. …………Pure science is different from applied one.
3. …………The Pythagorean scholars were not as good as the later ones.
4. ………… It was not until the 17th century that chemistry was realized as a science.
5. …………In the 18th century, physics dealt with the study of heat, magnetism, and electricity.
6. …………Mathematics is different from other sciences because it is the most difficult one.
7. …………Mathematics plays an important role in the development of scientific theories.
8. …………Both physical and biological sciences can be further divided into other sciences.
9. …………All classifications of the pure sciences are unchanged.
10. ………… Many sciences are closely related to one another.

GRAMMAR IN USE

Review of relative clauses

A) A relative clause is also known as an adjective clause. It is a subordinate clause with the function of modifying a noun/ noun phrase or a pronoun.

Example:

1. Science (pure science) is a term <u>which is used to denote systemized knowledge in any field.</u>

2. Applied science is the term that is used to refer to the search for practical uses of scientific knowledge.
3. Neil Armstrong was the first person who walked on the Moon.
4. Here, we should distinguish pure science from technology through which applications are realized.
5. Newton whom many of us, scientists have respected used not to be a good student at all.
6. Newton, whose discovery of the theory of gravity was very strange, has been the pioneer in Mechanics Physics.
7. The book of which the cover has been torn is a very famous one written by David Halliday.

From the above examples, we can see that the noun phrases *a term, the term, the first person; technology* and *Newton* are respectively modified by relative clauses

1. **which** is used to denote systemized knowledge in any field.
2. **that** is used to refer to the search for practical uses of scientific knowledge.
3. **who** walked on the Moon.
4. through **which** applications are realized.
5. **whom** many of us, scientists have respected.
6. **whose** discovery of the theory of gravity was very strange.
7. **of which** the cover has been torn.

B) You can easily realize that these clauses begin with **which/ that/ which/ who/ whom/ whose.** These are called **relative pronouns.** They function as pronouns, and at the same time, show the relationship between the modified noun/pronoun and other elements in the sentence. For example the first relative clause, listed above, shows the relationship between the subject and its complement (*science* and *term*).

By the functions and implications of these pronouns in each the above sentences, we can classify them into groups as in the following table.

Types / Functions	**For persons**	**For both**	**For non-persons**
Subject	Who	That	Which
Object	Whom/who	That/ử*	Which

Possessive	Whose	Whose	Whose/of which

* a relative pronoun replacing an objective noun can be omitted

C) Having a look at the example one, the relative clause is very necessary for the meaningful existence of the sentence because if we read the sentence - S***cience is a term***, it would be very difficult for us to understand what it means exactly: We know the word *science* and we know the word *term* but what is more about this term in relation with science is actually what we need to know. That's why a relative clause in this case works best. Such a relative clause is called a **restrictive relative clause.** This type of relative clause is sometimes known as **defining relative clause.**

Quite differently, from the fifth relative clause from the list we can see that the relative clause does not affect much to the meaning of the whole sentence, with or without this clause, the sentence still makes sense to us. In this case, the presence of a relative clause is only to give some extra information about Newton; such a relative clause is called a **non-restrictive clause** or sometimes **non-defining relative clause**.

Other differences between these two types of relative clauses are as follow:

- Non- defining clause is more common in written style
- Non- defining relative clause must be put between two commas, except when it is at the end of the sentence (the full stop replaces the second comma).
- Pronoun **that** can not be used in a non-defining relative clause

D) In example four, you can easily realize the preposition *through* be put in front of the pronoun **which**.

- Here, we should distinguish pure science from technology <u>through which applications are realized.</u>

It is easy to see that the sentence can be understood in a simpler way by splitting it into two simple sentences – Here, we should distinguish pure science from technology. Applications can be realized through technology. Now, it is obvious that the preposition *through* does not at all accompany the pronoun *which* randomly, actually, it accompanies the noun *technology* that the relative pronoun *which* replaces. Here, there is no change in position between the noun (now its *replacing item*) and its accompanying preposition.

In another case – Newton from whom we have been learning used not to be a good student anyway – the preposition *from* is once more considered to be accompanying the noun *Newton* and it is also put before the pronoun **whom** (replacing *Newton*).

From both cases, it is deduced that, we can put a preposition in front of objective pronouns, and this makes the sentence more formal. However, it is noted that,

- If a preposition is put in front of a pronoun, the pronoun can not be omitted.
- Prepositions can not be put in front of pronouns **that** and **who.**

- If the preposition is a part of a phrasal verb, it can not separate from its main verb. E.g. *The progress of science is the topic which/that/ứ we are* *<u>looking into</u>*.
- Such words as *some, many*, and *most* can go before **of whom** and **of which** in a non-defining relative clause. E.g. *The success of this theory is attributed to American scientists,* *<u>many of whom</u>* *did lose their lives for it.*

PRACTICE

Combine each of the following pairs of sentences into one sentence with a proper relative pronoun.

1. A group will carry out this investigation. This group will be organized.

   ……………………………………………………………………………......................

2. A machine is in the next room. The machine will make calculations.

   ……………………………………………………………………………......................

3. Barnard operates on the human heart. He is a heart surgeon.

   ……………………………………………………………………………......................

4. Computers are now helpful in a wide range of applications. Their functions are various.

   ……………………………………………………………………………......................

5. His articles will be published soon. His article is on the subject of scientific experimental methods.

   ……………………………………………………………………………......................

6. Many people’s lives rely on kidney machines. They can still run their lives for a long time.

   ……………………………………………………………………………......................

7. Marie Curie had a happy family life. Her devotion to science is very important.

   ……………………………………………………………………………......................

8. Most of our food consists of animal and plant cells. These cells contain a high proportion of water.

   ……………………………………………………………………………......................

9. Scientists are now facing a lot of matters. One of the matters is that of environmental pollution.

   ……………………………………………………………………………......................

10. The doctor has saved a lot of lives. His patients are normally heart attacked.

    ……………………………………………………………………………......................

11. The edition of the world science magazine this month is very interesting. Its cover is the picture of a virtual nuclear reactor.

    ………………………………………………………………………………………..................

    ………………………………………………………………………………………..................

12. The method is rather simple. It should be followed.

    ………………………………………………………………………………………..................

13. The students missed the start of the experiment. They were late for class.

    ………………………………………………………………………………………..................

14. The temperature of the ambient air is very important to this experiment. It should be always kept at 15 ^{0}C.

    ………………………………………………………………………………………..................

15. There is one more important question today. We must discuss the question thoroughly.

    ………………………………………………………………………………………..................

16. We eat some farm birds. They are known as poultry.

    ………………………………………………………………………………………..................

17. We have helped thousands of patients. Many of them have difficulty in language production.

    ………………………………………………………………………………………..................

18. We must obtain data for the report. The data must be of great importance.

    ………………………………………………………………………………………..................

19. We will use the material here. The material is of high quality.

    ………………………………………………………………………………………..................

20. Yeast and mould are fungi. Fungi grow on food.

    ………………………………………………………………………………………..................

PROBLEM SOLVING

I) Writing definitions

In science writing, the very first task you should do is to write definitions. Sometimes you are required to define a person, in other cases, you are asked to define an instrument, a noun, a technical term etc.

To write a definition, you often use a relative clause to clarify the noun/pronoun defined.

Example:

1. A barometer is an instrument *which is used to measure atmospheric pressure.*
2. Science is the term *which is used to denote systemized knowledge in any field.*
3. A scientist is a person *who studies science*.

Writing task

Combining each of the clauses in section A with a suitable one in section B to make a definition on each branch of science.

Section A

1. Archaeology	9. Information Science
2. Architecture(computerscience)	10. Linguistics
3. Biology	11. Mathematics
4. Chemistry	12. Meteorology
5. Earth Science	13. Physics
6. Economics	14. Political Science
7. Geography	15. Psychology
8. History	

is a branch of science **which/that**

Section B

a. studies the relationships among quantities, magnitudes, and properties and of logical operations by which unknown quantities, magnitudes, and properties may be deduced.

b. deals with the fundamental constituents of the universe, the forces they exert on one another, and the results produced by these forces.

c. studies of the composition, structure, properties, and interactions of matter.

d. functions as a means of encompassing the growing number of disciplines involved with the study of living forms.

e. deals with the distribution and arrangement of all elements of the earth's surface.

f. is the scientific study of language.

g. , in its broadest sense, is the totality of all past events, although a more realistic definition would limit it to the known past·

h. deals with the generation, collection, organization, storage, retrieval, and dissemination of recorded knowledge.

i. is concerned with the production, distribution, exchange, and consumption of goods and services.

j. is concerned with the planet Earth or one or more of its parts.

k. refers to the study of the structure of all or part of a computer system.

l. is the scientific study of behavior and the mind.

m. is the scientific study of past human culture and behavior, from the origins of humans to the present.

n. is the systematic study of and reflection upon politics.

o. studies the earth's atmosphere and especially the weather.

II) Reading basic formulae

1. *Complete the following table (look at the example) with verbs and nouns to describe mathematical processes.*

Sign	**Noun**	**Verb**
+	Addition	Add
-		
×		
÷		

2. *Speak out loud the following formulae*

a + b = c   a – b = c   a × b = c   a ÷ b = c

Then, read out the following equations:

1. $x = \frac{a-b}{c}$

2. $x + y = \frac{A}{a-b}$

3. $I = a + (n-1)d$

4. $V = IR$

5. $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$

6. $v = u + at$

7. $Ft = mv - mu$

8. $\frac{1}{R} = -\frac{M}{EI}$

9. $\frac{dQ}{dz} = -q$

10. $E = T + P - c + e$

3. *Complete the following statements:*

1. These signs **( )** are called ………….……………….…………….……………....
2. These signs **[ ]** are called ………….……………….…………….……………....
3. These signs **{ }** are called ………….……………….…………….…………...
4. This sign / is read ………….……………….…………….…………….…………..
5. This sign = is read ..…………………. ..…………………. ..…………………...
6. This sign + is read …………………....…………………...…………………......
7. This sign **-** is read …………………....…………………...…………………......
8. **ABC** are ………… letters; **def** are …………… letters. ..…………………......
9. **x** in $R_{\mathbf{x}}$ is read ……………………..…………………...…………………......
10. **x** in R^{x} is read ……………………..…………………...…………………......
11. $\mathbf{x}^2$ is read ……………………......…………………...…………………......
12. $\mathbf{x}^{\mathbf{3}}$ is read ……………………......…………………...…………………......
13. $\mathbf{x}^n$ is read ……………………......…………………...…………………......
14. $\mathbf{x}^{n-1}$ is read ……………………......…………………...…………………......
15. $\mathbf{x}^{-n}$ is read ……………………......…………………...…………………......
16. $\sqrt{x}$ is read ……………………...…………………...…………………......
17. $\sqrt[3]{x}$ is read ……………………...…………………...…………………......
18. $\sqrt[n]{x}$ is read ……………………...…………………...…………………......
19. $\frac{1}{2}$ is read ……………………......…………………...…………………......
20. $\frac{1}{3}$ is read ……………………......…………………...…………………......
21. $\frac{2}{3}$ is read ……………………......…………………...…………………......
22. $\frac{1}{4}$ is read……………………......…………………...…………………......
23. $\frac{3}{4}$ is read ……………………......…………………...…………………......
24. $\frac{1}{8}$ is read……………………......…………………...…………………......
25. $\frac{3}{17}$ is read……………………......…………………...…………………......

4. *Practice reading the following equations*

1. $x^{-p} = \frac{1}{x^p}$
2. $x^{p/q} = \sqrt[q]{x^p}$
3. $x^2 - a^2 = (x+a)(x-a)$
4. $y = ae^{kx}$
5. $x = \frac{nx_1 + mx_2}{m+n}$
6. $y - y_1 = \left(\frac{y_2 - y_1}{x_2 - x_1}\right)(x - x_1)$
7. $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$
8. $d = \sqrt{\left[(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2\right]}$
9. $b^2 = a^2(1 - e^2)$
10. $x^2 + y^2 + 2gx + 2fy + c = 0$

TRANSLATIONS

Task one: *English – Vietnamese translation*

1. A meteorologist is a person who studies the atmosphere. Meteorology is divided into a number of specialized sciences. Physical meteorology deals with the physical aspects of the atmosphere, such as the formation of clouds, rain, thunderstorms, and lightning.
2. Scientific knowledge in Egypt and Mesopotamia was chiefly of a practical nature, with little rational organization. Among the first Greek scholars to seek the fundamental causes of natural phenomena was the philosopher Tales, in the 6th century BC, who introduced the concept that the earth was a flat disk which floated on the universal element, water.
3. The scientific discoveries of Newton and the philosophical system of the French mathematician and philosopher Reno Descartes provided the background for the materialistic science of the 18th century, in which life processes were explained on a physicochemical basis.
4. In 1927 the German physicist Werner Heisenberg formulated the so-called uncertainty principle, which held that limits existed on the extent to which, on the subatomic scale, coordinates of an individual event can be determined.
5. Throughout history, scientific knowledge has been transmitted chiefly through written documents, some of which are more than 4000 years old. From ancient Greece, however, no substantial scientific work survives from the period before the geometrician Euclid's *Elements* (circa 300 BC).

(*From* different sources)

Task two: *Vietnamese – English translation*

1. Chớnh trị học là một mụn khoa học nghiờn cứu về cỏc vấn đề chớnh trị, nghiờn cứu về cỏc chớnh sỏch đối nội và quan hệ quốc tế.
2. Triết học là khoa học nghiờn cứu những quy luật chung nhất của thế giới và sự nhận thức thế giới. Triết học đó hỡnh thành từ rất sớm trong xó hội loài người. Ở nhiều nước, Triết học gắn bú chặt chẽ với tụn giỏo.
3. Khoa học và cụng nghệ gắn bú mật thiết với nhau. Cụng nghệ về thực chất chớnh là sự hiện thực hoỏ của cỏc ý tưởng khoa học.
4. Sự phỏt triển mạnh mẽ của cụng nghệ thụng tin, một nghành khoa học rất mới mẻ của con người, đó và đang làm thay đổi chớnh cuộc sống của con người về mọi mặt.
5. Cú lẽ con người trong tương lai sẽ cú hỡnh thể nhỏ hơn con người bõy giờ nhưng lại cú bộ nóo to hơn và đụi mắt lớn hơn bởi vỡ họ sử dụng hầu hết thời gian làm việc, giải trớ và cú lẽ cả ăn uống bờn mỏy vi tớnh.

(*From* different sources)

VOCABULARY ITEMS

Aeronautics (n): Hàng khụng học

Agronomy (n): Nụng học

Anatomy (n): Khoa giải phẫu

applicability (n): tớnh ứng dụng

applications (n): cỏc ứng dụng

Applied sciences (n): cỏc ngành khoa học ứng dụng

artificial organ(s) (n): (cỏc) cơ quan, bộ phận nhõn tạo

Astronomy (n): Thiờn văn học

Botany: Thực vật học

classification (n): sự phõn loại, xếp loại, hạng mục

Cosmology (n): Vũ trụ học

Ecology (n): Sinh thỏi học

elaboration (n): Sự chế tạo, sự phỏt sinh

Electronics (n): Điện tử học

Embryology (n): Khoa phụi học

Engineering (n): Khoa cụng trỡnh

formation (n): sự hỡnh thành

Genetics (n): Di truyền học

Geology (n): Địa chất học

interrelation(s) (n): (cỏc) mối quan hệ qua lại

law(s) of nature (n): (cỏc) quy luật của tự nhiờn

life prosses(es) (n): (cỏc) quỏ trỡnh sống

mainstream (n): dũng chớnh thống, xu hướng/ thế chủ đạo

materialistic science (n): khoa học vật chất

metallurgy (n): ngành luyện kim

observation (n): Sự quan sỏt

philosopher (n): triết gia

Physiology (n): Sinh lý học

practical nature (n): bản chất thực tế

Scientific theories (n): Cỏc học thuyết

specialized sciences (n): cỏc khoa học chuyờn ngành

to formulate : lập cụng thức, khỏi quỏt hoỏ bằng cụng thức

to transmit : truyền lại, truyền đi, lan toả đi

Zoology (n): Động vật học

FREE-READING PASSAGE

It is advisable that you read the following passage for some more about science. You can pick up some new vocabulary items. Try to do some practice on translation.

Scientific communication

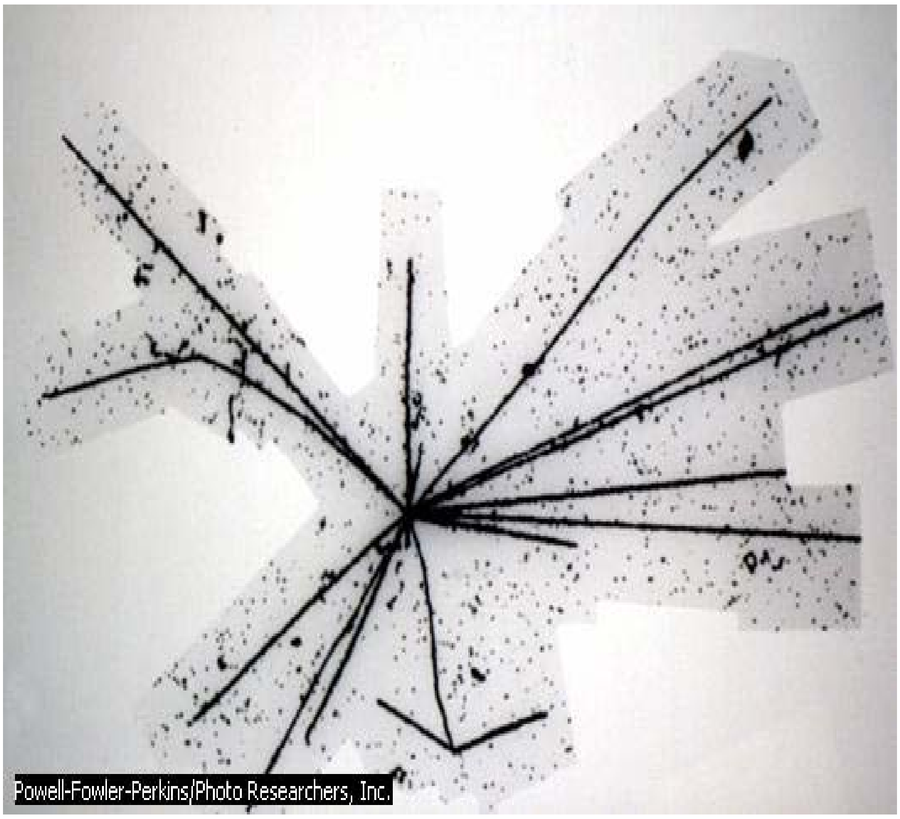
Throughout history, scientific knowledge has been transmitted chiefly through written documents, some of which are more than 4000 years old. From ancient Greece, however, no substantial scientific work survives from the period before the geometrician Euclid's *Elements* (circa 300 BC). Of the treatises written by leading scientists after that time, only about half are extant. Some of these are in Greek, and others were preserved through translation by Arab scholars in the Middle Ages. Medieval schools and universities were largely responsible for preserving these works and for fostering scientific activity.

Since the Renaissance, however, this work has been shared by scientific societies; the oldest such society, which still survives, is the Academia del Lincei (to which Galileo belonged), established in 1603 to promote the study of mathematical, physical, and natural sciences. Later in the century, governmental support of science led to the founding of the Royal Society of London (1662) and the Academia des Sciences de Paris (1666). These two organizations initiated publication of scientific journals, the former under the title *Philosophical Transactions* and the latter as *Mộmoires*.

During the 18th century academies of science were established by other leading nations. In the U.S. in 1743, Benjamin Franklin organized the American Philosophical Society for “promoting useful knowledge.” In 1780 the American Academy of Arts and Sciences was organized by John Adams, who became the second U.S. president in 1797. In 1831 the British Association for the Advancement of Science met for the first time, followed in 1848 by the American Association for the Advancement of Science, and in 1872 by the Association Franỗaise pour l'Avancement des Sciences. These national organizations issue the journals *Nature*, *Science*, and *Compte-Rendus*, respectively. The number of scientific journals grew so rapidly during the early 20th century that *A World List of Scientific Periodicals Published in the Years 1900-1933* contained some 36,000 entries in 18 languages. A large number of these are issued by specialized societies devoted to individual sciences, and most of them are fewer than 100 years old.

Since late in the 19th century, communication among scientists has been facilitated by the establishment of international organizations, such as the International Bureau of Weights and Measures (1873) and the International Council of Research (1919). The latter is a scientific federation subdivided into international unions for each of the various sciences. The unions hold international congresses every few years, the transactions of which are usually published. In addition to national and international scientific organizations, numerous major industrial firms have research departments; some of them regularly publish accounts of the work done or else file reports with government patent offices, which in turn print abstracts in bulletins that are published periodically.

(*From* http://encarta.com)



Cosmic rays are extremely energetic subatomic particles that travel through outer space at nearly the speed of light. Scientists learn about deep space by studying galactic cosmic rays, which originate many light-years away (a light-year represents the distance light travels in one year). This photograph, taken in the late 1940s with a special photographic emulsion called the Kodak NT4, records a collision of a cosmic-ray particle with a particle in the film. A cosmic-ray particle produced the track that starts at the top left corner of the photograph; this particle collided with a nucleus in the center of the photograph to create a spray of subatomic particles.

(**Powell-Fowler-Perkins/Photo Researchers, Inc**.)

Unit Two

PHYSICS

READING PASSAGE

Physics and scopes of Physics

Physics is the major science dealing with the fundamental constituents of the universe, the forces they exert on one another, and the results produced by these forces. Sometimes in modern physics a more sophisticated approach is taken that incorporates elements of the three areas listed above; it relates to the laws of symmetry and conservation, such as those pertaining to energy, momentum, charge, and parity.

Physics is closely related to the other natural sciences and, in a sense, encompasses them. Chemistry, for example, deals with the interaction of atoms to form molecules; much of modern geology is largely a study of the physics of the earth and is known as geophysics; and astronomy deals with the physics of the stars and outer space. Even living systems are made up of fundamental particles and, as studied in biophysics and biochemistry, they follow the same types of laws as the simpler particles traditionally studied by a physicist.

The emphasis on the interaction between particles in modern physics, known as the microscopic approach, must often be supplemented by a macroscopic approach that deals with larger elements or systems of particles. This macroscopic approach is indispensable to the application of physics to much of modern technology. Thermodynamics, for example, a branch of physics developed during the 19th century, deals with the elucidation and measurement of properties of a system as a whole and remains useful in other fields of physics; it also forms the basis of much of chemical and mechanical engineering. Such properties as the temperature, pressure, and volume of a gas have no meaning for an individual atom or molecule; these thermodynamic concepts can only be applied directly to a very large system of such particles. A bridge exists, however, between the microscopic and macroscopic approach; another branch of physics, known as statistical mechanics, indicates how pressure and temperature can be related to the motion of atoms and molecules on a statistical basis.

Physics emerged as a separate science only in the early 19th century; until that time a physicist was often also a mathematician, philosopher, chemist, biologist, engineer, or even primarily a political leader or artist. Today the field has grown to such an extent that with few exceptions modern physicists have to limit their attention to one or two branches of the science. Once the fundamental aspects of a new field are discovered and understood, they become the domain of engineers and other applied scientists. The 19th-century discoveries in electricity and magnetism, for example, are now the province of electrical and communication engineers; the properties of matter discovered at the beginning of the 20th century have been applied in electronics; and the discoveries of nuclear physics, most of them not yet 40 years old, have passed into the hands of nuclear engineers for applications to peaceful or military uses.

(*From* **http://encarta.com**)

COMPREHENSION QUESTION

Exercise 1: *Answer the following questions by referring to the reading passage.*

1. What does physics study in general?

   ……………………………………………………………………………………………
   ………………………………………………………………………………………

2. What is an approach in modern physics related to?

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   ………………………………………………………………………………………

3. Are there any relations between physics and other sciences? Give some illustrations.

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4. What does statistical physics show?

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   ……………………………………………………………………………

5. When was physics seen as a separate science?

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   ……………………………………………………………………………

Exercise 2: *Complete each of the following statements with words/ phrases from the reading passage*

1. Physics …………….. the fundamental constituents of the universe
2. … a more sophisticated approach ……………..elements of the three areas...
3. It relates to the laws of …………….. and conservation
4. Physics is closely related to the other natural ……………..
5. Chemistry deals with the …………….. of atoms to form molecules
6. Even living systems are made up of …………….. particles
7. The emphasis on the interaction between particles in modern physics, known as the …………….. approach
8. This macroscopic approach is …………….. to the application of physics
9. these thermodynamic concepts can only be applied ……………..to a very large system of such particles
10. A bridge exists, ……………..,between the microscopic and macroscopic approach

Exercise 3*:* *Decide whether each of the following statements is true (T), false (F) or with no information to clarify (N).*

1. ……………..Modern physics also deals with the fundamental constituents of the universe.
2. ……………..There are relations between physics and other natural sciences.
3. ……………..The microscopic approach is more important than the macroscopic one.
4. ……………..The macroscopic is unnecessary to the application of physics to much of modern technology.

5. ……………..Thermodynamics deals with the measurement of properties of a system as an individual.
6. ……………..*Statistical* mechanics shows the way in which pressure and temperature are related to each other.
7. ……………..Before the 19^{th} century, people had had no ideas of what physics was like.
8. ……………..Many people studied physics because it was interesting.
9. ……………..Today, physics has become the most important science.
10. ……………..Nuclear physics was originally for peaceful purposes.

GRAMMAR IN USE

I) Participle phrases replacing relative clauses

1. Participles of verbs

In English, each verb has two participles: $\begin{cases} participleI(PI) = verb\_ing \\ ParticipleII(PII) = verb\_ed \end{cases}$

In which the former is considered the active participle and the second is known as passive particle.

A participle phrase is the one with the centre element being a participle.

Example:

1. **working** with me
2. **studying** Physics last year
3. **written** by a famous scientist
4. **clarified** by the International Bureau of Weights and Measures
5. *having been* carefully **conducted** in the laboratory
6. *being* **considered** by the Government

II) Participles replacing relative clauses

From the above mentioned, it is deduced that each type of participle, therefore, will replace a corresponding relative clause with the same grammatical implication (whether passive or active), basing on the form of the verb phrase in the relative clause.

Consider the following examples (from **Unit one**)

1. Science (pure science) is a term <u>which is used to denote systemized knowledge in any field.</u>

2. Applied science is the term that is used to refer to the search for practical uses of scientific knowledge.
3. Neil Armstrong was the first person who walked on the Moon.
4. Here, we should distinguish pure science from technology through which applications are realized.
5. Newton whom many of us, scientists have respected used not to be a good student at all.
6. Newton, whose discovery of the theory of gravity was very strange, has been the pioneer in Mechanics Physics.

It is clearly seen that half of the above examples of relative clauses are active (3, 5, 6) and the other half are passive (1, 2, 4).

However, not all relative clauses but the ones with relative pronoun in subject position can be replaced with participle phrases. This is applicable to both types of relative clauses. Hence, among the above relative clauses, only the first three can be replaced.

We have:

1. Science (pure science) is a term used to denote systemized knowledge in any field.
2. Applied science is the term used to refer to the search for practical uses of scientific knowledge.
3. Neil Armstrong was the first person walking on the Moon.*

These sentences will be interpreted basing on the context in which it appears:

As in the first two participle phrases, they are used to make definitions so the verbs in the corresponding relative clauses must be in present tense while, in the last one, the tense of verb in the corresponding relative clause must be the simple past tense (it is the action of the past).

Note

- The third case of relative clause can be replaced with a to- infinitive (refer to **Unit eleven-Volumn 2**).
- Relative clauses with intransitive verbs can not be replaced with –ed phrase.

PRACTICE

Replace the relative clause in each of the following sentences with its corresponding participle phrase if possible.

1. Another scale which employs absolute zero as its lowest point is the Rankine scale, in which each degree of temperature is equivalent to one degree on the Fahrenheit scale.

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2. Democritus formulated a concept that has guided physics at various times ever since- the search for the basic building blocks of the universe and the forces that determine their behavior.

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3. Einstein's genius, which is characterized equally by logical clarity and creative imagination, succeeded in remolding and widening the imposing edifice whose foundations had been laid by Newton's great work.

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4. Field (physics) is the area that surrounds an object, in which a gravitational or electromagnetic force is exerted on other objects.

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5. Galileo's astronomical discoveries and his work in mechanics foreshadowed the work of the 17th-century English mathematician and physicist Sir Isaac Newton, one of the greatest scientists who ever lived.

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6. German astronomer Johannes Kepler, who was born in 1571, is a key figure in the history of physics.

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7. In the next millennium, physicists may achieve a single overarching theory that explains how the four fundamental forces in the universe can be unified.

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8. Mankind will always be indebted to Einstein for the removal of the obstacles to our outlook which were involved in the primitive notions of absolute space and time.

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9. Newton stated his ideas in several published works, two of which, *Philosophiae Naturalis Principia Mathematica* (Mathematical Principles of Natural Philosophy, 1687) and *Opticks* (1704), are considered among the greatest scientific works ever produced.

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10. Newton, Sir Isaac (1642-1727), who is considered one of the most important scientists of all time, is an English physicist, mathematician, and natural philosopher.

………………………………………………………………………………………
………………………………………………………………………………………
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11. No other half-century in history has witnessed so revolutionary a transformation in man's view of the nature of the physical universe as the one through which we have just passed.

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12. Over the last 1,000 years the science of physics has enabled us to probe and understand the world of the very large-the stars and the galaxies that contain them-and, more recently, the world of the very small-the fundamental particles that make up matter and the forces that govern their interactions.

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13. Physicists believe the universe began about 12 billion years ago in a cosmic explosion which is known as the big bang, when a magnificent dowry of energy appeared and converted to particles of matter.

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14. Physicists have also identified the four fundamental forces that govern the interactions between elementary particles.

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15. The Babylonians, Egyptians, and early Mesoamericans observed the motions of the planets and succeeded in predicting eclipses, but they failed to find an underlying system that governs planetary motion.

……………………………………………………………………………………………
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16. The English Scholastic philosopher and scientist Roger Bacon was one of the few philosophers who advocated the experimental method as the true foundation of scientific knowledge and who also did some work in astronomy, chemistry, optics, and machine design.

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……………………………………………………………………………………………
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17. The same spirit that characterized Einstein's unique scientific achievements also marked his attitude in all human relations.

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……………………………………………………………………………………

18. The sensation of warmth or coldness of a substance on contact is determined by the property which is known as temperature.

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……………………………………………………………………………………

19. We are missing lots of details about this original hot, tiny universe, in which space was expanding and rushing outward and particles were clustering and eventually binding.

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20. With the death of Albert Einstein, a life in the service of science and humanity which was as rich and fruitful as any in the whole history of our culture has come to an end.

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PROBLEM SOLVING

I) Reading complex formulae

1) Refer to appendix 6 for Greek letters and their pronunciation

2) What do the following symbols mean in English?

1. $\equiv$	2. $\neq$	3. $\cong$	4. $\rightarrow$	5. $<$	6. $>$
7. $\leq$	8. $\geq$	9. $\propto$	10. ∞	11. $\pm$	12. $\therefore$

3) Read out the following expressions

1. $f = \dfrac{1}{2\Pi\sqrt{LC}}$

2. $E = \delta T^4$

3. $W_s = \dfrac{2\pi f}{P}$

4. $y = \dfrac{W_0}{4\pi R}F$

5. $\mu_0 = 4\pi \times 10^{-7}\,Hm^{-1}$

6. $C = \dfrac{L}{R^2 + \varpi^2 L^2}$

7. $v_2 = \sqrt{\left(\dfrac{2e}{m}V_2\right)}$

8. $u = \dfrac{\frac{1}{2}\sigma_v^2}{K}$

9. $\sigma = \dfrac{Myc}{I} + \dfrac{P}{A}$

10. $y = \dfrac{4Q}{3\pi R^2}\left(R^2 - y^2\right)$

II) Adjectives order

1) It is obvious that words appear in sentences/ statements/ utterances in a linear order. However, each language has its own way of ordering the words for communicative purposes, it is, then, very important to understand this.

In English, the very difference in word order from that in Vietnamese is the order of adjectives: In English, adjectives go before nouns to modify nouns regardless of some exceptions while it is opposite in Vietnamese. For example:

English: a *successful* experiment → **Vietnamese**: một thí nghiệm *thành công*

And we have more than one type of adjectives and sometimes a group of adjectives at the same time modify one noun; that is why we have to clarify which type of adjective should go first, and which last.

English adjectives have the following normal rule of positioning:

size – general description – age – shape – colour – material – origin – purpose – participle----**Noun**

Example: a small nice old square brown wooden French writing desk *(một cái bàn viết cũ bằng gỗ nhỏ xinh xắn của Pháp)*

Note

- In practice, there are no more than five adjectives modifying one noun at the same time.

Practice task

Rearrange each of the following set of words to make a meaningful sentence. Pay attention to the order of adjectives where there is more than one adjective in the sentence.

1. pollution/ is/ problem/ noise/ a/ environmental/ serious.

   ……………………………………………………………………………………
   …………………………………………………………………………………

2. culture/ the/ some/ of/ environmental/a/ creation myths/ reflect/ circumstances/ particular.

   ……………………………………………………………………………………
   …………………………………………………………………………………

3. of/ explain/ creation mythologies/ actual/ processes/ the/ variety/ formation/ the/ by/ a/ of/ world.

   ……………………………………………………………………………………
   …………………………………………………………………………………

4. the/ compact/ proposes/ dense/ extremely/ that/ hot/ the/ once/ big bang theory/ was/ an/ and/ planet/ universe.

   ……………………………………………………………………………………
   …………………………………………………………………………………

5. solutions/ have/ served/ for/ much/ framework/ theory/ the/ these /as/ of/ current/ on/ theoretical/ the/ work/ big bang/ the.

   ……………………………………………………………………………………
   …………………………………………………………………………………

6. about/ consider/ stability/ doubts/ hypotheses/ a/ catastrophic/ such/ of/ rings/ some/ led/ to/ scientists/ the/ various.

   ……………………………………………………………………………………
   …………………………………………………………………………………

7. begins/ star/ life/ as/ a/ cool/ relatively/ a/ large/, /in/ nebula/ of/ mass/ gas/ a. some.

   ……………………………………………………………………………………
   …………………………………………………………………………………

8. a/ as/ experienced/ is/ sensation/ color/ by/ neurophysiological/ and/ humans/ of/ animals/,/ process/ perception/ a/ complex.

   ………………………………………………………………………………………………
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TRANSLATION

Task **one:** ***English – Vietnamese translation***

1. **Noise**, in physics, is an acoustic, electric, or electronic signal consisting of a random mixture of wavelengths. In information theory, the term designates a signal that contains no information. In acoustics, "white" noise consists of all audible frequencies, just as white light consists of all visible frequencies. Noise is also a subjective term, referring to any unwanted sound.
2. **Space**, in general usage, is that which is characterized by the property of extension or the ability to stretch out or extend in any direction; in astronomy, the region beyond the earth's atmosphere or beyond the solar system: outer space. The so-called actual space in which material objects exist and are perceived was regarded for many thousands of years as having three dimensions: left and right, up and down, and forward and backward.
3. Modern investigations in mathematics, physics, and astronomy have indicated that space and time are actually extensions of the same continuum, which scientists refer to as space-time or the space-time continuum.
4. A television program is created by focusing a television camera on a scene. The camera changes light from the scene into an electric signal, called the video signal, which varies depending on the strength, or brightness, of light received from each part of the scene. In color television, the camera produces an electric signal that varies depending on the strength of each color of light.
5. Refrigeration is the process of lowering the temperature and maintaining it in a given space for the purpose of chilling foods, preserving certain substances, or providing an atmosphere conducive to bodily comfort. Storing perishable foods, furs, pharmaceuticals, or other items under refrigeration is commonly known as cold storage. Such refrigeration checks both bacterial growth and adverse chemical reactions that occur in the normal atmosphere.

(*From* different sources)

Task **two:** ***Vietnamese – English translation***

Chúng ta làm quen với vật lý học chính bằng các đại lượng đo lường của vật lý mà chúng ta gặp hàng ngày mà trong số đó phải kể đến những đại lượng như độ dài, thời gian, khối lượng, nhiệt độ và áp suất, áp lực… Hàng ngày bạn vẫn thường nghe từ xung quanh mình những câu như: thời gian là vô tận vậy mà đời người lại không dài; khối lượng công việc quá lớn như vậy thì tôi không thể làm nổi; áp lực công việc như vậy là quá cao …. Trong những phát ngôn trên, rõ ràng có sự xuất hiện của các đại lượng vật lý, nhưng ở đây, ý nghĩa khoa học chính xác của chúng không còn tồn tại nữa, nó đã trở nên mơ hồ. Chính xác hơn là ý nghĩa khoa học của chúng hoàn toàn khác với nghĩa mà nó được sử dụng hàng ngày. Chính điều này gây trở ngại cho người sử dụng chúng, thông thường chúng làm cho người ta hiểu sai hơn là hiểu đúng.

(*From* **Fundamentals of Physics** – Translation version by Ngo Quoc Quynh as chief director)

VOCABULARY ITEMS

acoustic (n): thuộc về âm thanh

adverse (adj): đối địch, thù địch, chống đối/ bất lợi, có hại/ ngược

ambiguous (adj): khó hiểu, mơ hồ, nhập nhằng

approach (n): phương pháp tiếp cận/ cách tiếp cận/đường hướng tiếp cận

audible (adj): có thể nghe thấy/ có thể nghe rõ

biochemistry (n): ngành sinh hoá

biophysics (n): khoa lý sinh

conducive (adj): có ích, có lợi/ đưa đén, dẫn đến

constituents (n): thành phần cấu tạo

continuum (n): thể liên tục/ thảm thực vật liền (pl.): continua

dimension (n): chiều, kích thước, khổ, cỡ

(v): định kích thước, đo kích thước

elucidation (n): sự làm sáng tỏ/ sự giải thích

to elucidate: làm sáng tỏ/giải thích

extension (n): sự mở rộng/ sự kéo dài ra/sự ra hạn

fundamental (adj): cơ bản

Geology (n): địa chất học

indispensable (adj): không thể thiếu/ không thể bỏ qua

interaction (n): sự tương tác

to interact (ưith): tương tác với

laws of symmetry and conservation (n): định luật đối xứng và bảo toàn

perishable (adj): dễ thối, hỏng (rau, quả…)/ có thể bị tàn lụi, diệt vong

physical quantity (n): đại lượng vật lý

pressure (n): áp suất/ áp lực

properties (n): thuộc tính/ đặc điểm

refrigeration(n): sự làm lạnh, ướp lạnh

statistical mechanics (n): cơ học thống kê

storage (n): sự cất giữ, sự tích trữ, sự dự trữ, lưu kho

subjective (adj): chủ quan

thermodynamics (n): nhiệt động lực

to characterize (v): biểu thị đặc điểm/ mô tả đặc điểm

to designate(v): chỉ rõ, định rõ/ chọn lựa, chỉ định, bổ nhiệm

to encompass (v): vây quanh/ bao quanh/ chứa đựng/ hoàn thiện/ hoàn thành

to exert on: tác dụng/ động lên

FREE – READING PASSAGE

It is advisable that you read the following passage about one of the world ever greatest scientists who has contributed much to our beautiful life. Try to do practice on translation.

Albert Einstein (1879-1955)

(*By* **Niels Bohr and I. I. Rabi**)

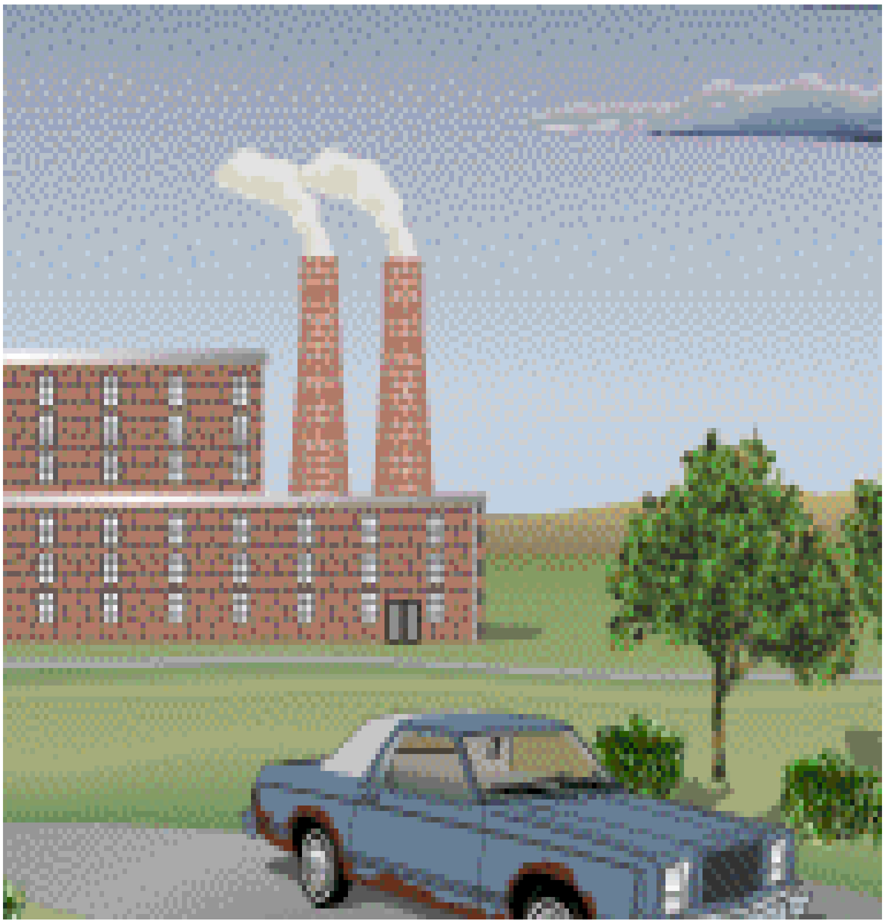
With the death of Albert Einstein, a life in the service of science and humanity which was as rich and fruitful as any in the whole history of our culture has come to an end. Mankind will always be indebted to Einstein for the removal of the obstacles to our outlook which were involved in the primitive notions of absolute space and time. He gave us a world picture with a unity and harmony surpassing the boldest dreams of the past.

Einstein's genius, characterized equally by logical clarity and creative imagination, succeeded in remolding and widening the imposing edifice whose foundations had been laid by Newton's great work. Within the frame of the relativity theory, demanding a formulation of the laws of nature independent of the observer and emphasizing the singular role of the speed of light, gravitational effects lost their isolated position and appeared as an integral part of a general kinematics description, capable of verification by refined astronomical observations. Moreover, Einstein's recognition of the equivalence of mass and energy should prove an invaluable guide in the exploration of atomic phenomena.

Indeed, the breadth of Einstein's views and the openness of his mind found most remarkable expression in the fact that, in the very same years when he gave a widened outlook to classical physics, he thoroughly grasped the fact that Planck's discovery of the universal quantum of action revealed an inherent limitation in such an approach. With unfailing intuition Einstein was led to the introduction of the idea of the photon as the carrier of momentum and energy in individual radiative processes. He thereby provided the starting point for the establishment of consistent quantum theoretical methods which have made it possible to account for an immense amount of experimental evidence concerning the properties of matter and even demanded reconsideration of our most elementary concepts.

The same spirit that characterized Einstein's unique scientific achievements also marked his attitude in all human relations. Notwithstanding the increasing reverence which people everywhere felt for his attainments and character, he behaved with unchanging natural modesty and expressed himself with a subtle and charming humor. He was always prepared to help people in difficulties of any kind, and to him, who himself had experienced the evils of racial prejudice; the promotion of understanding among nations was a foremost endeavor. His earnest admonitions on the responsibility involved in our rapidly growing mastery of the forces of nature will surely help to meet the challenge to civilization in the proper spirit.

To the whole of mankind Albert Einstein's death is a great loss, and to those of us who had the good fortune to enjoy his warm friendship it is a grief that we shall never more be able to see his gentle smile and listen to him. But the memories he has left behind will remain an ever-living source of fortitude and encouragement.



Chemical reactions occur continuously in the atmosphere, in factories, in vehicles, in the environment, and in our bodies. In a chemical reaction, one or more kinds of matter is changed into a new kind-or several new kinds-of matter. A few common chemical reactions are shown here. Life as we know it could not exist without these processes: plants could not photosynthesize, cars could not move, pudding could not thicken, muscles could not burn energy, glue could not stick, and fire could not burn.

Unit Three

MATTER AND MEASUREMENT

READING PASSAGE

Matter and Measurement

Matter, in science, is the general term applied to anything that has the property of occupying space and the attributes of gravity and inertia. In classical physics, matter and energy were considered two separate concepts that lay at the root of all physical phenomena. Modern physicists, however, have shown that it is possible to transform matter into energy and energy into matter and have thus broken down the classical distinction between the two concepts. When dealing with a large number of phenomena, however, such as motion, the behavior of liquids and gases, and heat, scientists find it simpler and more convenient to continue treating matter and energy as separate entities.

Certain elementary particles of matter combine to form atoms; in turn, atoms combine to form molecules. The properties of individual molecules and their distribution and arrangement give to matter in all its forms various qualities such as mass, hardness, viscosity, fluidity, color, taste, electrical resistivity, and heat conductivity, among others. In philosophy, matter has been generally regarded as the raw material of the physical world, although certain philosophers of the school of idealism, such as the Irish philosopher George Berkeley, denied that matter exists independent of the mind.

Matter exists in three states: solid, liquid and gas. A solid, for example a stone, has a definite shape and a definite volume; a liquid, for example oil, has definite volume but no definite shape; a gas, for example hydrogen (H), has neither definite shape nor volume. Water can exist in all three states; below 0^{o} C as a solid (ice); between 0^{o}C and 100^{o}C as a liquid (water); and above 100^{o}C as a gas (vapor). All matter consists of elements such as zinc (Zn) or oxygen (O), or of compounds such as nitric acid (HNO_3) or sulphur dioxide (SO_2).

When we measure quantities of matter, we may use the fundamental units of time (e.g. the second), mass (e.g. the kilogram) and length (e.g. the meter). Or we may use the units such as area (e.g. m^2) or volume (e.g. cm^3) or density (e.g. g/cm^3). These are known as derived units. The area of a rectangle is found by multiplying the length by the width. The volume of a cylinder is equal to ð x radius^2 x height (V = ðr^2h). The density of a substance is equal to the mass divided by the volume (d= m/v). We use the terms specific density or relative density to indicate density relative to the density of water. The table of densities below shows that mercury (Hg) has a density of 13.6g/cm^3. This means that a cubic centimeter of mercury has 13.6 times the mass of a cubic centimeter of water.

Substance	Density (g/cm^3)

Gold	19.3
mercury	13.6
Aluminum	2.7
Water	1.0
Ice	0.92
Hydrogen*	0.00009
Air*	0.0013

* at standard temperature and pressure

(*Adapted from* different sources)

COMPREHENSION QUESTION

Exercise 1: *Answer the following questions by referring to the reading passage.*

1. How is matter generally defined?

   …………………………………………………………………………………………
   ………………………………………………………………………………

   ……………………………………………………………………………………

2. Were the concepts on matter and energy in classical physics no longer valid? Why?

   ……………………………………………………………………………………

   …………………………………………………………………………………………
   ………………………………………………………………………………

3. What decides the qualities of matter?

   …………………………………………………………………………………………
   ………………………………………………………………………………

   ……………………………………………………………………………………

4. What do many philosophers consider matter as?

   ……………………………………………………………………………………

   ……………………………………………………………………………………

   ……………………………………………………………………………………

5. How many states can matter exist in? What are they?

   …………………………………………………………………………………………
   ………………………………………………………………………………

……………………………………………………………………………………

Exercise 2: *Complete each of the following statements with words/ phrases from the reading passage*

1. Matter is a general term applied to anything that has the ………….. of occupying space
2. Matter and energy were considered two separate …………..
3. Modern …………..have shown that it is possible to transform matter into energy
4. Scientists find it simpler and more ………….. to continue treating matter and energy as separate entities.
5. Certain ………….. particles of matter combine to form atoms
6. The properties of ………….. molecules and their distribution and arrangement give to matter various qualities.
7. In philosophy, matter has been ………….. regarded as the raw material of the physical world.
8. The Irish philosopher George Berkeley…………..that matter exists independent of the mind.
9. We use the terms specific density or relative density to ………….. density relative to the density of water.
10. This ………….. that a cubic centimeter of mercury has 13.6 times the mass of a cubic centimeter of water.

Exercise 3: *Decide whether each of the following statements is true (T), false (F) or with no information to clarify (N).*

1. …………..Matter is seen as anything that occupies space and has gravity and inertia.
2. …………..In classical physics, matter and energy were studied separately.
3. …………..Modern physicists have shown that matter can be changed into energy and vice versa.
4. …………..Atoms are made up by certain elementary particles of matter.
5. …………..Such qualities of matter as mass, hardness, viscosity…are controlled by the properties of individual molecules and their distribution and arrangement.
6. …………..In general, philosophers consider matter as the raw materials of the physical world.
7. …………..Matter exists in three states: solid, liquid, and gas at the same time.
8. …………..The fundamental units of measurement come from the derived ones.

9. ……………Specific density is the one which has been put in comparison with that of water.

10……………The volume of a substance can be found by dividing the mass by is density.

GRAMMAR IN USE

I) Relative clauses with relative adverbs

1) In unit one, you did review relative clauses with relative pronouns, in this unit you will have one more chance to review relative clauses with relative adverbs.

Example

a) The laboratory where experiments are conducted must be kept clean all the time.

b) The time when we should conduct the experiment has not been decided yet.

c) That Physics studies both universe and human being is the reason why I choose it to study for my life.

Each of the above sentences has a relative clause starting with a relative adverb:

a) **where** experiments are conducted

b) **when** we should conduct the experiment

c) **why** I choose it to study for my life.

2) From the examples, it is deduced that relative adverb

a) **where** is used to modify a nouns referring to a place;

b) **when** is used to modify the nouns referring to time; and

c) **why** is used to modify the noun *reason.*

3) However, there is difference among these relative adverbs in forming defining and non- defining relative clauses

3.1. *Non – defining relative clauses*

When and **where** are used in non- defining relative clauses

Example

a) You have to read the report next week, when the meeting is chair- manned by the president of our society.

b) The earth, where we are living, has always been a mystery objective for scientists.

c) Last year, when he got help from sponsors, was the most successful year for him since the start of his study in mechanics.

3.2. *Defining clause*

a) **When** and **where** are used in defining relative clauses, but each of these clauses modifies a special group of nouns.

- **When** follows the word *time* or other time notion as *day, week, month*, *year.*

Example:

1. The time **when** we make the observations must be long enough.
2. The day **when** I started the first lesson on Physics was very impressive.
3. 1642 is the year **when** Newton, Sir Isaac was born.

Note

Adverb **When** can be replaced with pronoun **which** and an appropriate preposition such as *in, at* or *on.*

The above examples can be rewritten in this way:

1. The time **during which** we make the observations must be long enough.
2. The day **on which** I started the first lesson on Physics was very impressive.
3. 1642 is the year **in which** Newton, Sir Isaac was born.

- **Where** follows the word *place* or other words referring to a place such as *room* or *street* and the two words *situation* and *stage*

Example:

1. The place **where** we do experiment is called a laboratory.
2. The room **where** lectures are given is called the lecture hall.

Note

Adverb **where** can be replaced with pronoun **which** and an appropriate preposition.

The above examples can be rewritten in this way:

1. The place **in which** we do experiment is called a laboratory.
2. The room **in which** lectures are given is called the lecture hall.

b) Adverb **why** follows the noun *reason*

Example

1. The reason **why** you did not succeed was because you had not well prepared for it.
2. Their conservations are the reason **why** they failed.

II) Participle adjectives

Each English verb has two participles (Refer to **Unit two**) which can function as adjectives, present participle being active adjective, and past participle being passive adjective. This means, the present participle can modify noun with the function that it can tell the feature of the noun itself while the past participle tells something about the noun that comes from outside the noun.

Example:

1. *training* program -> the program of training
2. *sounding* device -> the device for sounding
3. *filtering* paper -> the paper for filtering
4. *given* time -> the time which is given
5. *measured* block -> the block which has been measured
6. derived units -> the units which have been derived

PRACTICE

Exercise 1: *Combine each of the following pairs of sentences into one sentence using an appropriate relative adverb and the word given.*

1. Our universe and human beings are studied in an area. The area is science.

   Science……………………………………………………………………………

2. It was the year 1704. In this year, Newton had his second famous works named *Opticks* published.

   1704 was the year………………………………………………………………..

3. You do experiments in a room. We call that room a libratory.

   The room …………………………………………………………………………

4. It was the year 1792. France set up a new system of measurements in this year.

   The year 1792 ……………………………………………………………………

5. It is the International Bureau of Weights and Measurements near Paris. The standard meter is kept there.

   The International Bureau …………………………………………………………

   …………………………………………………………………………………....

6. Seven basic units were first defined in 1971. In this year, the 14th International Conference on Weights and Measures was held.

   The year 1971……………………………………………………………..…

……………………………………………………………………………………..…

7. It was the year 1959. In this year, a yard was officially defined as being 0.9144 meter.

   The year 1959 was the year ……………………………………………………

8. It was in the year 1960. A new standard meter was found out, basing on light wavelength.

   1960 was the year…………………………………………………………………

9. 1983 was an important year. In this year, standard meter was officially defined as the distance that light wave can travel in a given time.

   1983 was ………………………………………………………………………

   ……………………………………………………………………………….…

10. The English and metric systems of measurements are both in used in one country. That country is the U.S.

    The U.S. is …………………………………………………………………......

11. People prefer to use the metric system. It is because this system is simpler and more convenient to use.

    The reason……………………………………………………………….....…

    ……………………………………………………………………………….…

12. Both English and metric systems of measurements can be used at the same time. There are many situations for this application.

    There are ………………………………………………………………………

    ……………………………………………………………………………….…

13. He failed to give correct answer to the question. It is because he did not know how to convert the unit of length in English system of measurements.

    The reason ……………………………………………………………….....…

    ……………………………………………………………………………….…

14. Physics is an important field. Most of the universal and human issues are discussed in this filed.

    Physics is…………………………………………………………………….…

    ……………………………………………………………………………….…

15. Each week students have to go to the workshop. They do a lot of practice there.

    Weekly, ……………………………………………………………………….….

Exercise 2: *Give the appropriate form of the verb (either in present or past participle) to complete each of the following sentences*.

1. The (choose) ……………. seven units in 1971 are defined as basics units.
2. The (measure)……………… jar is used when we want to measure the volume of irregular objects.
3. The (travel) ………………. path of any object can be measured.
4. The conversion of English system of measurements confuses me. I am thoroughly (confuse)…………………
5. No one may attend the lecture except the (invite) …………….. guests.
6. The (exist)………………… matter that makes scientists wonder is how to maintain natural resources.
7. Physics is a very (stimulate) ……………….. subject because once you get your hands down to it, you start to think hard of our universe and ourselves.
8. The (freeze) ……………….water has lower density than liquid water.
9. Outstanding students always have (inquire)……………….. minds.
10. The (contaminate) ………………….. air has great influence on the success of the observations.

PROBLEM SOLVING

I) Asking and describing dimensions of objects

1. Fulfill the table below with appropriate words:

Noun	**Adjective**
Length	
	Wide
	Deep
Thickness	
	High

2. Make questions and give answer with the words from the above table about the dimensions of any object around you

Example: How high is the board?

What is the thickness of your book?

3. To ask and describe the dimensions of objects, you can use either nouns or their corresponding adjectives as in (2), along with suitable interrogative pronouns What or How

Then, we have the following patterns:

a)

Asking:

HOW	high wide long thick deep	is/ are	noun(s)?

Describing:

Noun(s) is/ are	………………..	high. wide. long. thick. deep.

b)

Asking:

WHAT is the	height width length depth thickness	of	noun(s)?

Describing:

THE	height width length depth thickness	of noun(s)	is/ are ………..

c)

Asking:

WHAT are the measurements of noun(s)?

Describing:

Noun(s)	is/ are	………..	in	height width length depth thickness

Or:

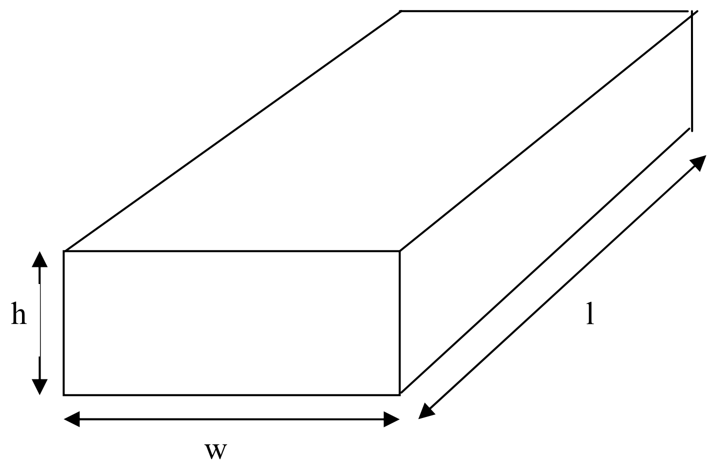
Noun(s)	has/ have a/the	height width length depth thickness	of	………

Note: With this way of describing, the question may be formed from the verb *to measure* to ask for the measurements of objects.

How does/ do + noun/nouns + measure?

4. Now, describe the dimension of the following object.

a/ w = 1m	h = 0.5m	l = 1,5m
b/ w = 0.7cm	h = 0.35cm	l = 1cm
c/ w= 0.07m	h = 0.03m	l = 0,14m



A is a block

a/………………………………………………………………………………….......

b/…………………………………………………………………………………...

c/…………………………………………………………………………………...

II) Describing shapes of objects

1. *Complete the table with suitable words*

Noun	**Adjective**
cuboid	
	conical

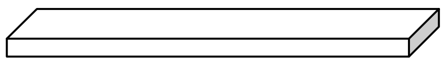
sphere	
cylinder	
	hemi-spherical
pyramid	
triangle	
	rectangular
square	

2. *Now describe the following objects. (Ask Q for this)*

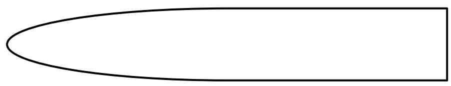
3. *Complete the following descriptions which are useful for describing the shapes of objects.*

a/ This is a …………………..……..……. line

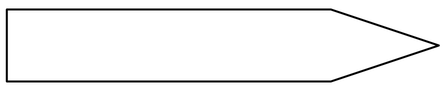
b/ This plate is …………………. …….....



c/ this rod is ……………….…….at one end.



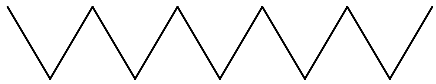
d/ This rod is ………………..….. at one end.

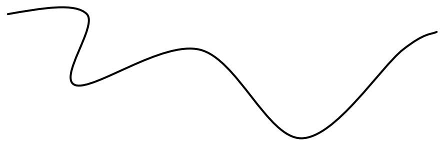


e/ This line is ……………..………..……..……..

f/This line is …………………………..………..

g/ This line is ………………………..……..… ----------------------------

h/ This line is ………………………..……..… 

i/ This line is ………………..……..……… 

TRANSLATION

Task one: *English – Vietnamese translation*

1. Scientists have found some experimental evidence for dark matter. Astronomers at Bell Labs in the United States found evidence for dark matter in an image taken by the Hubble Space Telescope (HST) in 1997. Light from a cluster of galaxies in the image was bent by another cluster of galaxies in the foreground of the picture. By making computer models of the cluster in the foreground and matching them to the way it bent the light of the background cluster in the image, the scientists were able to estimate the mass of the foreground cluster. The model that fit best showed that the cluster's mass was about 250 times as great as the mass of just the visible part of the cluster.
2. A physical change is a change in matter that involves no chemical reaction. When a substance undergoes a physical change, the composition of its molecules remains unchanged, and the substance does not lose its chemical identity. Melting, evaporating, and freezing are three types of physical change. For example, water (H_2O) is a liquid that freezes to form the solid ice, which may again be melted into water. Because molecules of water and ice are composed of the same chemical elements in the same proportions, the change from water to ice is a physical change. Physical changes include any alteration in the shape and size of a substance. For example cutting, grinding, crushing, annealing, dissolving, or emulsifying produce physical changes. Still another physical change is sublimation, the change from a solid to a gas.
3. When a substance undergoes a chemical change, the composition of its molecules changes. The properties of the original substance are lost, and new substances with new properties are produced. An example of a chemical change is the production of rust

(iron oxide) when oxygen in the air reacts with iron. Chemical changes may also result in physical changes. For example, when wood (a solid) is burned, it is combined with oxygen gas to produce gaseous carbon dioxide (CO_2), liquid water, and solid carbon. Some of the various chemical changes that matter may undergo are classified below. For a more detailed discussion of chemical reactions.

4. In the United States and Britain, the everyday units of linear measurement have been the inch, foot, yard, and mile. Until recently in Britain, the English units of length were defined in terms of the imperial standard yard, which was the distance between two lines on a bronze bar made in 1845 to replace an earlier yard bar that had been destroyed by fire in 1839. Because the imperial standard yard bar has been shrinking at the rate of 1.5 millionths of an inch per year, the United States adopted a copy of the international prototype meter as the national standard of length in 1889. Until 1960, all U.S. measurements of length were derived from a standard meter (meter prototype number 27). In 1960 the meter was redefined in terms of wavelengths of light from a krypton-86 source. In 1983 it was again redefined as the length of the path traveled by light in a vacuum in 1/299,792,458 of a second.

5. English units of weight (ounces, pounds, and tons) are now also derived from the metric standard of mass, which is the international prototype kilogram. This is a solid cylinder of platinum-iridium alloy maintained at constant temperature at Sevres near Paris. A copy, as exact as possible, of this standard is maintained by an agency of the U.S. Department of Commerce. Most countries have converted or are in the process of converting their local systems of weights and measures to the metric system. Some old terms, however, may continue in use.

(*From* different sources)

Task two: *Vietnamese – English translation*

1. Vật lý học dựa trên việc đo lường các đại lượng vật lý và các biến đổi trong các đại lượng vật lý xảy ra trong vũ trụ. Một số đại lượng vật lý được chọn làm các đại lượng cơ bản (như độ dài, thời gian, và khối lượng) và được định nghĩa thông qua một chuẩn và được gán cho một số đo đơn vị (như mét, giây, kilôgam). Các đại lượng vật lý khác (như tốc độ) được định nghĩa thông qua các đại lượng cơ bản và các chuẩn của chúng.

2. Để mô tả một đại lượng vật lý trước tiên chúng ta định nghĩa một đơn vị; đó là một số đo đại lượng được lấy chính xác bằng 1,0. Sau đó chúng ta định nghĩa một chuẩn, đó là một vật mốc để so sánh tất cả các mẫu khác của đại lượng đó. Thí dụ đơn vị của độ dài là mét, và như các bạn sẽ thấy, chuẩn cho mét là độ dài mà ánh sáng đi được trong chân không trong một phần nào đó của giây.

3. Năm 1971, Hội nghị Cân Đo Quốc tế lần thứ 14 lấy bảy đại lượng làm các đại lượng cơ bản, do đó hình thành cơ sở của Hệ Đơn vị Quốc tế, viết tắt là SI từ tên tiếng Pháp và thường được gọi là hệ mét. Nhiều đơn vị dẫn xuất SI được định nghiã theo các đơn vị cơ bản này. Thí dụ đơn vị cho công suất, gọi là oat (viết tắt là W) được định nghĩa theo các đơn vị cơ bản của khối lượng, độ dài, thời gian: 1 oat =1W= 1 kg.m^2/s^3.

(*From* **Fundamentals of Physics – Volume 1,** Translation version by Ngo Quoc Quynh, Dao Kim Ngoc)

VOCABULARY ITEMS

alteration (n): sự thay đổi, biến đổi

attributes (n): thuộc tính, đặc tính, tính chất

chemical identity (n): bản chất hoá học

chemical reaction (n): phản ứng hoá học

cluster (n): đám, bó, cụm; đàn, bầy

concepts (n): khái niệm

definite (n): xác định

distinction (n): sự phân biệt; điều phân biệt, điều khác nhau

distribution (n): sự phân bổ, sự phân phối, sự phân phát

experimental evidence (n): bằng chứng thực nghiệm

foreground (n): cảnh gần, cận cảnh

fundamental unit (n): đơn vị cơ bản (đo lường)

gravity (n): sự hút, sự hấp dẫn, trọng lực

imperial standard (n): chuẩn đo lường Anh

inertia (n): tính ì; quán tính

linear measurement (n): đo chiều dài

physical change (n): thay đổi vật lý

property (n): thuộc tính, đặc tính, tính chất

proportion (n): tỷ lệ, phần

prototype kilogram (n): cân nguyên mẫu

relative density (n): tỷ trọng tương đối

resistivity (n): suất điện trở

specific density (n): trọng lượng riêng

sublimation (n): sự thăng hoa; sự làm thăng hoa

to result in (v): dẫn đến

to undergo (v): trải qua

FREE - READING PASSAGE

It is advisable that you read the following passage to learn more about how important it is to study to measure things. It is about a very famous Institute in the US – the NIST

National Institute of Standards and Technology

(NIST) is the agency of the United States Department of Commerce. The NIST was formerly known as the National Bureau of Standards (NBS); the name change occurred in January 1989.

The NBS was established by Congress in 1901 as the central measurement laboratory of the federal government. The institute is the focal point in the United States for assuring maximum application of the physical and engineering sciences to the development of technology in industry and commerce. It comprises the National Measurement Laboratory, the National Engineering Laboratory, the Institute for Materials Science and Engineering, and the Institute for Computer Sciences and Technology. The NIST promotes the use of precision technology by conducting research and providing centralized services in four broad program areas: basic measurements and standards, materials measurements and standards, technological measurements and standards, and transfer of technical information.

The NIST provides facilities necessary for a complete and consistent system of basic physical and chemical measurements and standards in the United States, and it furnishes essential services leading to accurate and uniform measurements throughout the scientific community, industry, and commerce. In 1972, for example, agency scientists developed a helium-neon gas-laser technique that for the first time gave the precise measurement of the speed of light as 299,792.45 km/sec (186,282.396 mi/sec).

The NIST also cooperates with public and private organizations to develop technological standards and test methodologies by conducting research on the properties of materials that are needed by industry, commerce, educational institutions, and government. This research leads to improved methods of standardizing measurements and collecting data. One of the agency's activities is to relate the physical and chemical properties of materials to their behavior and their interaction with their environments; major contributions have been made in fire and motor-vehicle safety. In the 1970s the agency became involved in conserving energy in the home, office, and industry; measuring environmental pollution; and investigating the hazards of many consumer products.

Another major activity of the NIST is developing technical services to promote the use of available technology that will facilitate innovation and precision in industry and governmental institutions.

Finally, at federal, state, and local government levels, the NIST provides advisory and research services to all agencies by developing, producing, and distributing standard reference materials. It promotes optimum dissemination and accessibility of scientific information generated within the NIST and other agencies of the federal government. In this, the institute is assisted by its National Standard Reference Data System and by a system of information-analysis centers dealing with the broader aspects of the national measurement system. Because of its unique data-gathering functions, the NIST is the principal agent for the development of federal standards for automatic data processing techniques, for computer equipment, and for computer languages. After the name change in 1989, the agency announced that it would soon establish regional manufacturing technology centers to speed the spread of new technology.

(*From* **http://encarta.com**)

TABLE 1

QUANTITY	NAME OF BASE SI UNIT	SYMBOL
Length	meter (or metre)	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd

TABLE 2

QUANTITY	NAME OF SUPPLEMENTARY SI UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Si units

Unit Four

International System of Units

READING PASSAGE

International System of Units

International system of unit is the name adopted by the Eleventh General Conference on Weights and Measures, held in Paris in 1960, for a universal, unified, self-consistent system of measurement units based on the MKS (meter-kilogram-second) system. The international system is commonly referred to throughout the world as SI, after the initials of Systome International. The Metric Conversion Act of 1975 commits the United States to the increasing use of, and voluntary conversion to, the metric system of measurement, further defining *metric system* as the International System of Units as interpreted or modified for the United States by the secretary of commerce.

At the 1960 conference, standards were defined for six base units and for two supplementary units; a seventh base unit, the mole, was added in 1971. The names of these units are exactly the same in all languages.

In the metric system, the main unit of distance is the meter. Other units of distance are always obtained by multiplying the meter by 10 or a multiply of 10. Thanks to our system of writing numbers, this means that conversion of one unit to another within the metric system can be carried out by shifts of a decimal point.

There are several standard units of length in use today such as meter, inch, foot, mile and centimeter. The meter was originally defined in terms of the distance from the North Pole to the equator; this distance is closed to 10,000 kilometers or 107 meters. The standard meter of the world is the distance between two scratches on a platinum- alloy bar which is kept at the International Bureau of Weight and Measures in France. However, there is a unit of length in Nature which is much more accurate than the distance between two scratches on a piece of metal. This is wavelength of light from any sharp spectral line. The standard meter in France has been calibrated in terms of the number of wavelengths of light of a certain spectral line.

(*From* **http://encarta.com**)

COMPREHENSION QUESTION

Exercise 1: *Answer the following questions by referring to the reading passage.*

1. What was the aim of the 11th General Conference on Weight and Measurement, held in Paris in 1960?

   …………………………………………………………………………………………
   ……………………………………………………………………………………

2. How many units were defined at the conference?

   …………………………………………………………………………………………
   ……………………………………………………………………………………

3. Can you show the convenience of unit conversion within the metric system?

   …………………………………………………………………………………………
   ……………………………………………………………………………………

4. What was the meter originally taken?

   …………………………………………………………………………………………
   ……………………………………………………………………………………

5. How many standards to which the meter has been compared? What are they?

   …………………………………………………………………………………………
   ……………………………………………………………………………………

Exercise 2: *Complete each of the following statements with words/ phrases from the reading passage*

1. The international ……………. is commonly referred to throughout the world as SI.
2. The Metric Conversion Act of 1975 …………….the United States to the increasing use of the metric system of measurement.
3. At the 1960 conference, standards were defined for six base units and for two ……………. units.
4. In the metric system, the main unit of ……………. is the meter.
5. Other units of distance are always obtained by ……………. the meter by 10.
6. There are several standard units of length ……………. use today.
7. The meter was ……………. defined in terms of the distance from the North Pole to the equator.
8. This is …………….of light from any sharp spectral line.
9. The standard meter in France has been ……………. in terms of the number of wavelengths of light of a certain …………….line.

Exercise 3: *Decide whether each of the following statements is true (T), false (F) or with no information to clarify (N).*

1. …………….There are more than one system of measurement in use.

2. ……………The US have changed completely to the SI since 1975.
3. ……………It was not until 1975 that the SI was internationally realized.
4. ……………Standards for seven fundamental units were defined at the 1960 conference.
5. ……………The symbols of units are written differently in different languages.
6. ……………In the metric system, the meter can be used to obtain other units.
7. ……………Our system of writing numbers makes conversion of one unit to another within the metric system complicated.
8. ……………Meter, inch, foot, mile and centimeter are all units of the metric system.
9. ……………There have been three standards for the meter.
10. ……………The standard meter of the world is tested every year.

GRAMMAR IN USE

Adverbial clauses of time, place and reason

1. Adverbial clauses of time

An adverbial clause of time is a subordinate clause (dependent clause) in a complex sentence which starts with a conjunction of time. An adverbial clause of time sets a time reference for the action mentioned by the main verb phrase in the main clause.

Example:

a. *When we understood the law that governs all of those phenomena*, we arrived at the conclusion.
b. *While you are conducting experiment in the laboratory*, be careful with all types of acids because you may get burned.
c. You should be well- prepared before *any observation is made on a phenomenon.*

Some common conjunctions of time: when; while; before; after; since; (un)till; now that; as soon as; whenever; any time; by the time;

Note that, as for *before* and *after*, they can not only function as conjunctions of time but also as prepositions of time:

a. He jumped to the conclusion *before any of his classmates.*
b. He reached the conclusion *after his teacher's explanation.*

2. Adverbial clauses of reason

An adverbial clause of reason is a subordinate clause in a complex sentence that starts with one of following conjunctions: *because, since, as*

Example:

a. Because he was too hurried to reach the conclusion, he omitted a lot of valuable evidence.

b. He was successful since he learned of patience.

c. As he is still a student, he is unable to provide himself with such an expensive piece of equipment.

3. Adverbial clause of place

An adverbial clause of place is a subordinate clause in a complex sentence which starts with one of the following conjunctions: *wherever; anywhere; everywhere;* and *where.*

Example:

a. Wherever there are human beings, there are ways of measuring things.

b. Everywhere he goes, he takes along his own measuring tape.

Practice

Exercise 1: *Fill in each gap with one suitable conjunction of time, place or reason to form adverbial clause of time, place and reason for each of the following sentences. In some cases, there can be more than one choice.*

1. ………..work is done on a body, there is a transfer of energy to the body, and so work can be said to be energy in transit.
2. ………… an electric current flows through a wire, two important effects can be observed
3. ………… satellites were used in geodesy, geodetic networks were typically no larger than an individual country or continent.
4. …………..an electric current flows through a wire, two important effects can be observed
5. …………its name was changed in 1989, the agency announced that it would soon establish regional manufacturing technology centers to speed the spread of new technology.
6. …………… a current begins to flow in a conductor, a field moves out from the conductor.
7. ……………. an electric current flows in a metallic conductor, the flow is in one direction only·

8. …………….. interferometer measures distances in terms of light waves, it permits the definition of the standard meter in terms of the wavelength of light.
9. ……………NIST has unique data-gathering functions, it is the principal agent for the development of federal standards for automatic data processing techniques, for computer equipment, and for computer languages.
10. ……………some atoms combine to form solids, one or more electrons are often liberated and can move with ease through the material
11. Egypt is …………… Clepsydra or water clock is believed to have originated.
12. The first scientific study of electrical and magnetic phenomena, however, did not appear until AD1600, ……………the researches of the English physician William Gilbert were published.
13. Work is also expended ………. a force accelerates a body, such as the acceleration of an airplane because of the thrust forces developed by its jet engines.
14. Physics is ………… you can find answer to almost every phenomenon in nature.
15. The strength of a magnetic field depends on how concentrated the flux is; …………there is a lot of flux flowing, the field is strong.

Exercise 2: *Fill in the blank with each of the following given words. Each word is used once.*

Resonance

physical many	what	suspension	natural	concrete
bridge	stress	use	how	mechanical
amplitude	example	disaster	phenomenon	rate

Resonance is an important (1)......................phenomenon that can appear in a great (2)..........................different situations. A tragic example is the Tacoma Narrows bridge disaster. This (3).........................bridge in Washington State, collapsed in a mild gale on 1 July 1940. The wind set up oscillating around the (4)... which vibrated more and more violently until it broke up under the (5).........................The bridge had been in (6)........................for just four months; engineers learnt a lot about (7)..........................oscillations can build up when a (8)........................... structure is subject to repeated forces.

You will have observed a much more familiar (9)......................of resonance when pushing a small child on a swing; the swing + child has a natural frequency of oscillation; a small push each swing results in the (10)........................increasing until the child swinging high in the air.

PROBLEM SOLVING

Task one: Sentence building

From the prompts given, build up meaningful sentences; you can add any necessary material.

1. there/ be/ two/ system/ measurement/ use/ today.

   ……………………………………………………………………………………….

2. certain/ physical/ quantity/ be/ choose/ base quantities/ each/ be/ define/ in terms of/ standard.

   ……………………………………………………………………………………….

3. Physics/ be/ base/ measurement.

   ……………………………………………………………………………………….

4. describe/ physical/ quantity/ we/ first/ define/ unit.

   ……………………………………………………………………………………….

5. there/ be/ so/ many/ that/ physical/ quantity/ it/ be/ problem/ organize/ them.

   ……………………………………………………………………………………….

6. many/ SI/ derive/ unit/ be/ define/ terms/ seven/ base units.

   ……………………………………………………………………………………….

7. SI/ standard/ mass/ be/ platinum-iridium/ cylinder/ keep/ International Bureau of Weights and Measures/ near/ Paris/ assign/, / international agreement/ mass/, / one kilogram.

   ……………………………………………………………………………………….

   ……………………………………………………………………………………….

8. conversion/ units/ one/ system/ another/ may/ be/ perform/ use/ chain-link conversions.

   ……………………………………………………………………………………….

9. unit/ time/ be/ formerly/ define/ in terms of/ rotation/ Earth.

   ……………………………………………………………………………………….

10. atomic/ scale/ atomic/ mass/ unit/ define/ in terms of/ atom/ carbon-12/ be/ usually/ use.

    ……………………………………………………………………………………….

Task two: Sentences transformation

Rewrite each of the following sentences in the way that its meaning retains.

1. If we divide the mass of a substance by its density, we obtain its volume.

   To……………………………………………………………………………….....

2. Time, mass, and length are the most important fundamental units.

   The ………………………………………………………………………………..

3. The basic concepts of the thermodynamics are easily understood in terms of experiments.

   With………………………………………………………………………….....

4. An atom is the smallest particle that can not be split up in a chemical action.

   The ………………………………………………………………………………..

5. In a liquid, the depth and the pressure are in direct proportion.

   In a liquid,……………………………………………………………………....

6. The emission of alpha and beta particles causes a change in the atom.

   A change…………………………………………………………………………..

7. Each radioactive element has a fixed rate of decay called half-life.

   The half-life…………………………………………………………………......

8. Fast moving α particles could split the nucleus of an atom.

   The nucleus……………………………………………………………………..

9. Lightweight nuclei can be combined into heavier nuclei.

   Heavier nuclei…………………………………………………………………..

10. Cadmium absorbs neutrons, so cadmium robs are inserted or removed to control reaction.

    As ……………………………………………………………………………....

TRANSLATION

Task one: *English-Vietnamese translation*

1. Everyone has to measure lengths, reckon time, weigh various bodies. Therefore, everyone knows just what a centimeter, a second, and a gram are. But these measures are especially important for a physicist-they are necessary for making judgments about most physical phenomena. People try to measure distance, intervals of time and mass, which are called the basics concepts of physics, as accurately as possible.

2. Modern science and technology required a more precise standard than the distance between two fine scratches on a metal bar. In 1960, a new standard for the meter,

based on the wavelength of light, was adopted. Specially, the meter was redefined to be 1.650.763.73 wavelengths of a particular orange-red light emitted by atoms of krypton-86 in a gas discharge tube. This awkward number of wavelengths was chosen so that the new standard would be as consistent as possible with the old meter-bar standard.

3. Clocks and Watches are the devices used to measure or indicate the passage of time. A clock, which is larger than a watch, is usually intended to be kept in one place; a watch is designed to be carried or worn. Both types of timepieces require a source of power and a means of transmitting and controlling it, as well as indicators to register the lapse of time units.
4. CGS System, centimeter-gram-second system (usually written "cgs system"), is also a metric system based on the centimeter (c) for length, the gram (g) for mass, and the second (s) for time. It is derived from the meter-kilogram-second (or mks) system but uses certain special designations such as the dyne (for force) and the erg (for energy). It has generally been employed where small quantities are encountered, as in physics and chemistry.

(*From* different sources)

Task two: *Vietnamese-English translation*

1. Các khoảng cách dùng trong thiên văn lớn hơn rất nhiều so với các khoảng cách dùng trên Trái Đất, nên người ta dùng các đơn vị độ dài rất lớn để hình dung dễ dàng được các khoảng cách tương đối giữa các thiên thể. Một đơn vị thiên văn (AU) là khoảng cách trung bình giữa Trái Đất và Mặt Trời, bằng khoảng 92,9 x 106 dặm. Một parsec (pc) là khoảng cách mà từ đó 1 AU được nhìn dưới góc bằng đúng một giây góc. Một năm ánh sáng (ly) là khoảng cách mà ánh đi được trong một năm trong chân không với tốc độ 186000 dặm/s.. Tuy năm ánh sáng hay xuất hiện trên sách, báo phổ thông, các nhà thiên văn lại ưa dùng parsec.
2. Một khi chúng ta đã xác lập được một chuẩn, thì chúng ta phải đưa ra cách đo lường bằng chuẩn ấy với mọi đối tượng bất kỳ. Nhiều phép đo của chúng ta phải làm gián tiếp. Chẳng hạn mặc dù bạn có chuẩn để đo độ dài, nhưng bạn có chắc rằng bạn có thể dùng chuẩn ấy, một cách trực tiếp, để đo được bán kính của một nguyên tử hay khoảng cách từ trái đất tới một ngôi sao hay không.

(*From* **Fundamentals of Physics -** Translation version by Ngo Quoc Quynh as chief director)

VOCABULARY ITEMS

to adopt: chấp nhận, thông qua

agency (n): cơ quan, sở, hãng, hãng thông tấn

to calibrate: 1. định cỡ, xác định đường kính (nòng súng, ống...)

2. kiểm tra cỡ trước khi chia độ (ống đo nhiệt...)

concentrated (adj): cô đặc, độ đậm đặc

conductor (n): chất dẫn (điện, nhiệt)

consistent (adj): kiên định, trước sau như một, nhất quán

conversion (n): sự đổi, sự chuyển biến

decimal point (n): dấu đặt sau số đơn vị khi ghi phân số thập phân

to derive: phân xuất, dẫn xuất

effects (n): hiệu lực, hiệu quả, tác dụng

electric current (n): dòng điện

flux (n): dòng, luồng, thông lượng

geodesy (n): khoa đo đạc

initials (n): chữ cái đầu

interferometer (n): dụng cụ đo giao thoa

interval (n): khoảng (thời gian, không gian), khoảng(toán)

jet engines (n): động cơ phản lực

lapse (n): khoảng, quãng, lát, hồi

to liberate:giải phóng

to make judgment: đánh giá, phán xét

multiply (n): cơ số

orange-red (adj): màu đỏ da cam

precise (adj): chính xác

principal (adj): chính yếu, cơ bản

to reckon: đề cập, gợi ý

to register: 1. được chỉ ra, được ghi lại (về những con số); chỉ, ghi (con số bằng máy ghi, công tơ...) tự động

2. đăng ký; ghi vào sổ, vào sổ

scratch (n): vết xước

self-consistent (adj): trước sau như một với bản thân mình

shift (n): sự thay đổi (về vị trí, bản chất, hình dáng..)

spectral line (n): vạch phổ

standard (n): chuẩn

supplementary (adj): phụ, thứ cấp

transfer of energy (n): truyền nhiệt

unique (adj): độc nhất

FREE – READING PASSAGE

It is advisable that you read the following passage about some basic units in SI system of measurements. You can pick up some new vocabulary items. Try to do some practice on translation.

Length

The meter and the kilogram had their origin in the metric system. By international agreement, the standard meter had been defined as the distance between two fine lines on a bar of platinum-iridium alloy. The 1960 conference redefined the meter as 1,650,763.73 wavelengths of the reddish-orange light emitted by the isotope krypton-86. The meter was again redefined in 1983 as the length of the path traveled by light in vacuum during a time interval of 1/299,792,458 of a second.

Mass

When the metric system was created, the kilogram was defined as the mass of 1 cubic decimeter of pure water at the temperature of its maximum density (4.0° C/39.2° F). A solid cylinder of platinum was carefully made to match this quantity of water under the specified conditions. Later it was discovered that a quantity of water as pure or as stable as required could not be provided. Therefore the primary standard of mass became the platinum cylinder, which was replaced in 1889 by a platinum-iridium cylinder of similar mass. Today this cylinder still serves as the international kilogram, and the kilogram in SI is defined as a quantity of mass of the international prototype of the kilogram.

Time

For centuries, time has been universally measured in terms of the rotation of the earth. The second, the basic unit of time, was defined as 1/86,400 of a mean solar day or one complete rotation of the earth on its axis. Scientists discovered, however, that the rotation of the earth was not constant enough to serve as the basis of the time standard. As a result, the second was redefined in 1967 in terms of the resonant frequency of the cesium atom-that is, the frequency at which this atom absorbs energy, or 9,192,631,770 hertz (cycles per second).

Temperature

The temperature scale adopted by the 1960 conference was based on a fixed temperature point, the triple point of water, at which the solid, liquid, and gas are in equilibrium. The temperature of 273.16 K was assigned to this point. The freezing point of water was designated as 273.15 K, equaling exactly 0° on the Celsius temperature scale. The Celsius scale, which is identical to the centigrade scale, is named for the 18th-century Swedish astronomer Anders Celsius, who first proposed the use of a scale in which the interval between the freezing and boiling points of water is divided into 100 degrees. By international agreement, the term *Celsius* has officially replaced *centigrade.*

Other units

In SI, the ampere was defined as the constant current that, flowing in two parallel conductors one meter apart in a vacuum, will produce a force between the conductors of 2 if 10^{-7} newtons per meter of length.

In 1971 the mole was defined as the amount of substance of a system that contains as many elementary entities as there are atoms in 0.012 kilogram of carbon-12.

The international unit of light intensity, the candela, was originally defined as 1/60 of the light radiated from a square centimeter of a blackbody, a perfect radiator that absorbs no light, held at the temperature of freezing platinum. It is now more precisely defined as the intensity of a light source, in a given direction, with a frequency of 540 x 10^{12} hertz and a radiant intensity of 1/683 watts per steradian in that direction.

The radian is the plane angle between two radii of a circle that cut off on the circumference an arc equal in length to the radius.

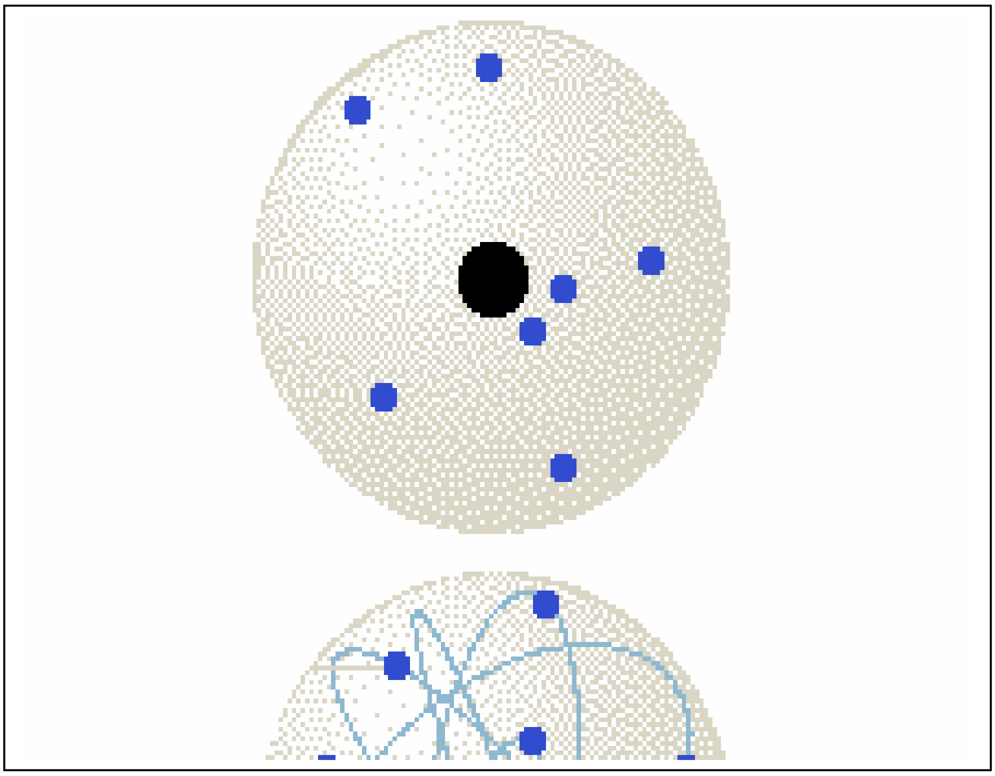
The steradian is defined as the solid angle that, having its vertex in the center of a sphere, cuts off an area of the surface of the sphere equal to that of a square with sides of length equal to the radius of the sphere.

The SI units for all other quantities are derived from the seven base units and the two supplementary units. Some derived units are used so often that they have been assigned special names-usually those of scientists.

One feature of SI is that it is a coherent system-that is, derived units are expressed as products and ratios of the base, supplementary, and other derived units without numerical factors. This results in some units being too large for ordinary use and others too small. To compensate, the prefixes developed for the metric system have been borrowed and expanded. These prefixes are used with all three types of units: base, supplementary, and derived. Examples are millimeter (mm), kilometer/hour (km/h), megawatt (MW), and picofarad (pF). Because double prefixes are not used, and because the base unit kilogram already contains a prefix, prefixes are not used with kilogram, although they are used with gram. The prefixes *hecto, deka, deci,* and *centi* are used only rarely, and then usually with *meter* to express areas and volumes. Because of established usage, the centimeter is retained for body measurements and clothing.

Certain units that are not part of SI are used so widely that it is impractical to abandon them.

In cases where their usage is already well established, certain other units are allowed for a limited time, subject to future review. They are the nautical mile, knot, angstrom, standard atmosphere, hectare, and bar.



Experimental data has been the impetus behind the creation and dismissal of physical models of the atom. Rutherford's model, in which electrons move around a tightly packed, positively charged nucleus, successfully explained the results of scattering experiments, but was unable to explain discrete atomic emission—that is, why atoms emit only certain wavelengths of light. Bohr began with Rutherford's model, but then postulated further that electrons can only move in certain quantized orbits; this model was able to explain certain qualities of discrete emission for hydrogen, but failed completely for other elements. Schrödinger's model, in which electrons are described not by the paths they take but by the regions where they are most likely to be found, can explain certain qualities of emission spectra for all elements; however, further refinements of the model, made throughout the 20th century, have been needed to explain all observable spectral phenomenon.

(Microsoft Corporation)

Unit Five

ELEMENTARY PARTICLES

READING PASSAGE

Elementary Particles

In physics, particles that cannot be broken down into any other particles are called elementary particles. The term *elementary particles* also is used more loosely to include some subatomic particles that are composed of other particles. Particles that cannot be broken further are sometimes called fundamental particles to avoid confusion. These fundamental particles provide the basic units that make up all matter and energy in the universe.

Scientists and philosophers have sought to identify and study elementary particles since ancient times. Aristotle and other ancient Greek philosophers believed that all things were composed of four elementary materials: fire, water, air, and earth. People in other ancient cultures developed similar notions of basic substances. As early scientists began collecting and analyzing information about the world, they showed that these materials were not fundamental but were made of other substances.

In the 1800s British physicist John Dalton was so sure he had identified the most basic objects that he called them *atoms* (Greek for "indivisible"). By the early 1900s scientists were able to break apart these atoms into particles that they called the electron and the nucleus. Electrons surround the dense nucleus of an atom. In the 1930s, researchers showed that the nucleus consists of smaller particles, called the proton and the neutron. Today, scientists have evidence that the proton and neutron are themselves made up of even smaller particles, called quarks.

Scientists now believe that quarks and three other types of particles—leptons, force-carrying bosons, and the Higgs boson-are truly fundamental and cannot be split into anything smaller. In the 1960s American physicists Steven Weinberg and Sheldon Glashow and Pakistani physicist Abdus Salam developed a mathematical description of the nature and behavior of elementary particles. Their theory, known as the standard model of particle physics, has greatly advanced understanding of the fundamental particles and forces in the universe. Yet some questions about particles remain unanswered by the standard model, and physicists continue to work toward a theory that would explain even more about particles.

(*From* **http://encarta.com**)

COMPREHENSION QUESTION

Exercise 1: *Answer the following questions by referring to the reading passage.*

1. What are elementary particles?
   …………………………………………………………………………………………
   ………………………………………………………………………………
2. Have elementary particles been studied recently? How long?
   …………………………………………………………………………………………
   ………………………………………………………………………………
3. What did Greek philosophers believe?
   …………………………………………………………………………………………
   ………………………………………………………………………………
4. What was noticeable in 1800s?
   …………………………………………………………………………………………
   ………………………………………………………………………………
5. Do scientists now fully understand particles? What will they have to do?
   …………………………………………………………………………………………
   ………………………………………………………………………………

Exercise 2: *Complete each of the following statements with words/ phrases from the reading passage*

1. Elementary particles are particles that cannot be ……………. down into any other particles.
2. The term elementary particles also is used more ……………. to include some subatomic particles.
3. Particles that cannot be broken further are sometimes called fundamental particles to ……………. confusion.
4. These fundamental particles provide the basic units that make up all matter and energy in the …………….
5. Scientists and philosophers have sought to ……………. and study elementary particles since ancient times.
6. People in other ancient cultures developed similar ……………. of basic substances.
7. In the 1800s British physicist John Dalton was so ……………. he had identified the most basic objects.
8. Electrons ……………. the dense nucleus of an atom.
9. Quarks and three other types of particles-leptons, force-carrying bosons, and the Higgs boson-are ……………. fundamental
10. ……………. some questions about particles remain unanswered by the standard model

Exercise 3: *Decide whether each of the following statements is true (T), false (F) or with no information to clarify (N).*

1. ……………. Elementary particles are the smallest ones.
2. ……………. Elementary and fundamental particles are the same.
3. ……………. All matter and energy are made up basing on fundamental particles.
4. ……………. Elementary particles have been studied for a very long time.
5. ……………. According to Aristotle and other Greek philosophers, every thing consisted of fire, water, air, and earth.
6. ……………. People in other ancient cultures had different opinions about fundamental particles.
7. ……………. Early scientists showed that the materials were not fundamental after they had collected and analyzed information about the world.
8. ……………. In Greek, 'atom' means 'visible'.
9. ……………. Quarks may soon be broken down into smaller particles.
10. ……………. The 'standard model' theory contributed greatly to the understanding of the universe.

GRAMMAR IN USE

Compound adjectives forming from participles

In Unit three, participles were introduced as adjectives. In this unit, participles are considered as the stem in forming compound adjectives.

1/ Noun-participle -> compound adjective

Example:

Active (noun-PI)	**Explanation**
Stress-bearing structure	➢ The structure that bears stress
Water-keeping pot	➢ A pot for keeping water
Atmospheric pressure-measuring device	➢ A device for measuring atmospheric pressure
North-seeking pole	➢ The pole that seeks north direction
Volume-measuring jar	➢ The jar that is used for measuring volume

Passive (noun-PII)	**Explanation**
Petrol-run engine	➢ an engine which is run by petrol
Book-based research	➢ a research that is based on books
Research-based report	➢ a report which is made basing on research

Nuclear waste-affected area ➢ the area that is affected by nuclear waste
Physics law-governed phenomenon ➢ a phenomenon which is governed by physics law

2/ adverb-participles -> compound adjectives

Example:

Active (adverb-PI)	**Explanation**
Exactly-measuring device	➢ the device that measures exactly
Slowly-changing phenomenon	➢ the phenomenon that changes slowly
Efficiently-operating apparatus	➢ the apparatus that operates efficiently
Widely-spreading effect	➢ the effect that spreads widely
Seriously-working scientist	➢ the scientist who works seriously

Passive (adverb-PII)	**Explanation**
Carefully-conducted experiment	➢ the experiment that is conducted carefully
Regularly-made observation	➢ the observation that is made regularly
Abruptly-activated behavior	➢ the behavior that is activated abruptly
Well-equipped laboratory	➢ the laboratory which is equipped well
Negatively charged particle	the particle that is negatively charged

PRACTICE

Exercise 1: *Form compound adjectives from participles, basing on the following explanations*

Explanation

1. the objects that oscillate freely ➢ freely-oscillating objects
2. the device that sounds echo
3. the devices which are used to conduct experiments
4. the analyzer which describes in detail
5. the students who work industriously
6. the device which is used to develop film
7. the graph that slopes upwards
8. the pole that points to the south
9. the system that transfers energy
10. the matter which is discussed heatedly
11. the waves that interfere destructively
12. a report that is well presented
13. the particles that move fast

14. the capacitor that is made of silver
15. a current that decreases gradually
16. a ball that is thrown horizontally
17. a body that falls freely
18. the anode which is negatively charged
19. a magnetic field which is created by electromagnetic coils
20. the device which is used for removing water

Exercise 2: *Fill in each of the gaps to complete the passage. Each word is used once.*

distinct light	because	attract	photons	experiments
protons	the	electromotive	work	same
nevertheless	particles	forces	quantum	mathematically
actually	absorbed	experiences		

For centuries, electricity and magnetism seemed (1)…………..forces. In the 1800s, however (2)…………… showed many connections between these two(3)………….. In 1864 British physicist James Clerk Maxwell drew together the(4) …………of many physicists to show that electricity and magnetism are(5) ……………different aspects of the (6)……………electromagnetic force. This force causes (7)……………with similar electric charges to repel one another and particles with opposite charges to (8)…………….one another. Maxwell also showed that (9)…………is a traveling form of electromagnetic energy. The founders of (10)……………..mechanics took Maxwell's work one step further. In 1925 German-British physicist Max Born, and German physicists Ernst Pascual Jordan and Werner Heisenberg showed (11)………………..that packets of light energy, later called (12)……………., are emitted and (13)…………….when charged particles attract or repel each other through the electromagnetic force.

PROBLEM SOLVING

Task one: *Sentences building*

From the prompts given, build up meaningful sentences; you can add any necessary material.

1. Experiment/ confirm/ existence/ many/ particles.

   ……………………………………………………………………………….…

2. Elementary particles/ not have/ electric charge/be/ electrically/ neutral/be not/ affect/ electromagnetic/ force.

   ……………………………………………………………………………….…

   ……………………………………………………………………………….…

3. strong/ nuclear force/ hold/ together/ nuclei/ inside/ atoms/ compose /matter.

…………………………………………………………………………………….…

…………………………………………………………………………………….…

4. Three/ quark/ together/ form/ baryon.

   …………………………………………………………………………………….…

5. Particles/ make/ quarks/ be/ call/ hadrons.

   …………………………………………………………………………………….…

6. fundamental/ particles/ make up/ protons/ neutrons/ be/ call/ quarks.

   …………………………………………………………………………………….…

7. quarks/ can/ not be/ isolate/ even/ most advanced/ laboratory/ equipment/ processes.

   …………………………………………………………………………………….…

   …………………………………………………………………………………….…

8. By the 1960s/ hundreds/ different/ elementary/ particle/ be/ see.

   …………………………………………………………………………………….…

9. Scientists/ divide/ leptons/ quarks/ two/ generation.

   …………………………………………………………………………………….…

10. Perl/ share/ 1995 Nobel Prize/ physics/ American/ physicist/ Frederick Reines/ part/ discover/ tau lepton.

    …………………………………………………………………………………….…

    …………………………………………………………………………………….…

Task two: *Sentences transformation*

Rewrite each of the following sentences in the way that its meaning retains.

1. Dividing the mass of a substance by its density, we find the substance's volume.

   To………………………………………………………………………………

2. Time, mass, and length are of seven fundamental units.

   Of………………………………………………………………………………

3. The basic concepts of the thermodynamics are easily understood in terms of experiments.

   Without…………………………………………………………………………

4. Atoms of different substances are different.

   Different………………………………………………………………………..

5. In a liquid, the depth and the pressure are in direct ratio.

   In a liquid,……………………………………………………………………...

6. In physics, particles that cannot be broken down into any other particles are called elementary particles.

   Elementary particles……………………………………………………………

…………………………………………………………………………………

7. Aristotle and other ancient Greek philosophers believed that all things were composed of four elementary materials: fire, water, air, and earth.

   All things…………………………………………………………………………

   ……………………………………………………………………………....…

8. Electrons surround the dense nucleus of an atom.

   The dense nuleus…………………………………………………………………

9. Scientists and philosophers have sought to identify and study elementary particles since ancient times.

   Elementary particles………………………………………………………………

   …………………………………………………………………………………

10. One of the key predictions of the standard model was the existence of particles carrying the weak force.

    The existence …………………………………………………………………….

    …………………………………………………………………………………

TRANSLATION

Task one: *English-Vietnamese translation*

1. Physicists discovered a third generation of quarks in 1977. American physicist Leon Lederman and his collaborators discovered mesons that contained a fifth quark: the bottom quark. Scientists assumed the bottom quark should have a partner, called the top quark, and so the hunt for this particle was on. This hunt finally ended in 1995, when evidence of the top quark was detected at the Fermi National Accelerator Laboratory in Batavia, Illinois. While the existence of the top quark was no surprise, the mass of it was. The top quark is over 40 times heavier than the bottom quark, and 174 times heavier than the proton, which contains three first generation quarks (two up quarks and one down quark).
2. Most of the predictions of the standard model have been verified, but physicists still seek evidence of physics beyond the standard model. They look for new particles both on Earth and throughout the cosmos. They work on theories that would explain why particles have the masses scientists have observed. In particular, they want to understand why the top quark is so much heavier than the other particles and why the second and third generation of particles exist at all. They look for connections between the four forces in the universe and continue their quest for a theory of everything.
3. Although the various particles differ widely in mass, charge, lifetime and in other ways, they all share two attributes that qualify them as being "elementary." First, as far as we know, any two particles of the same species are, except for their position and state of

motion, absolutely identical, whether they occupy the same atom or lie at opposite ends of the universe. Second, there is not now any successful theory that explains the elementary particles in terms of more elementary constituents, in the sense that the atomic nucleus is understood to be composed of protons and neutrons and the atom is understood to be composed of a nucleus and electrons. It is true that the elementary particles behave in some respects as if they were composed of still more elementary constituents, named quarks, but in spite of strenuous efforts it has been impossible to break particles into quarks.

4. We have discovered that the electron has a sibling and cousins that are apparently equally fundamental. The sibling is an electrically neutral particle, called the neutrino, which is much lighter than the electron. The cousins are two electrically charged particles, called the mu and the tau, which also have neutral siblings. The mu and the tau seem to be identical copies of the electron, except that they are respectively 200 and 3,500 times heavier. Their role in the scheme of things and the origin of their different masses remain mysteries—just the sort of mysteries that particle physicists, who study the constituents of matter and the forces that control their behavior, wish to resolve.
5. The number of protons in the nucleus of an atom determines what kind of *chemical element* it is. All substances in nature are made up of combinations of the 92 different chemical elements, substances that cannot be broken into simpler substances by chemical processes. The atom is the smallest part of a chemical element that still retains the properties of the element. The number of protons in each atom can range from one in the hydrogen atom to 92 in the uranium atom, the heaviest naturally occurring element. (In the laboratory, scientists have created elements with as many as 114 protons in each nucleus.) The atomic number of an element is equal to the number of protons in each atom's nucleus. The number of electrons in an uncharged atom must be equal to the number of protons, and the arrangement of these electrons determines the chemical properties of the atom.

(*From* different sources)

Task two: *Vietnamese-English translation*

1. Các nhà nguyên tử luận cho rằng vật chất cấu tạo từ những nguyên tử đang vận động trong chân không vô tận. Những nguyên tử đó đều thuộc cùng một vật chất, nhưng có hình dạng, kích thước và sự sắp xếp khác nhau.
2. Những hạt mới như proton, nơtron, electron dường như đủ để tạo thành toàn bộ mọi chất bền vững, nhưng số lượng hạt lại tăng rất nhanh. Năm 1932, Carl Anderson tìm thấy phản electron mà ba năm trước Derek đã tiên đoán bằng cách nghiên cứu các bó tia vũ trụ.
3. Murray Geli-Mann là một nhà lí thuyết và giả thuyết mà ông đưa ra hồi đầu các năm 60 có vẻ hoàn toàn kì cục; các hạt tạo thành hạt nhân, proton và nơtron, được tạo thành từ ba hạt quác (danh từ không có ý nghĩa chính xác, lấy từ một cuốn tiểu thuyết của James

Joyce) là những hạt không thể tách riêng được, mang điện tích phân số +2/3 cho quác u (up) và -1/3 cho quác d (down). Sau này người ta còn tìm thấy những tính chất của quác: duyên (c) và đẹp (b, còn được hiểu là đáy "bottom")

4. Trong quá trình nhiên cứu cấu tạo của vật chất, người ta đã phát hiện ra những thành phần vật chất ngày càng nhỏ hơn: phân tử, nguyên tử, hạt nhân và electron, nuclon…Người ta quy ước gọi các hạt nhỏ hơn hạt nhân nguyên tử là các hạt sơ cấp ví dụ electron, nuclon… là các hạt sơ cấp. Hạt sơ cấp không phải là các hạt nhỏ nhất tạo nên vật chất mà chỉ là giới hạn hiện nay của sự phát hiện các hạt nhỏ bằng thiết bị thí nghiệm. Đã có những cơ sở lí thuyết để khẳng định rằng nuclon, chẳng hạn, có cấu tạo phức tạp.

(*From* different sources)

VOCABULARY ITEMS

analyzer (n): dụng cụ phân tích, máy phân tích
to be in direct proportion (exp.): tỉ lệ thuận với
to assume: giả thiết
to behave: phản ứng
behavior (n): phản ứng
capacitor (n): tụ điện
collaborator (n): đồng sự
to conduct: thực hiện
constituent (n): thành phần cấu tạo, cấu tử
destructively (adv): đạp đổ, phá hoại
to develop: phóng, in tráng (ảnh)
distinct (adj): khác biệt
elementary particles (np.): hạt sơ cấp
energy (n): năng lượng
fundamental particles (np.): hạt cơ bản
identical (adj): giống hoàn toàn
to identify: xác định đặc tính
industriously (adv): có hiệu quả
to interfere: giao thoa
to isolate: cách ly, cách biệt
nature (n): bản chất
neutral (adj): trung hoà, trung tính
notion (n): khái niệm

particle (n): hạt
quantum (n):lượng tử
respectively (adv): lần lượt
sibling (n): anh chị em ruột
to slope : nghiêng, dốc
to split: tách, chẻ
standard model (np.): mẫu chuẩn
subatomic particles (np): hạt dưới nguyên tử
substance (n): chất
thermodynamics (n): nhiệt động lực học
transfer (n): truyền

FREE-READING PASSAGE

It is advisable that you read the following passage about one of the basic constituents of matter. You can pick up some new vocabulary items. Try to do some practice on translation.

Structure and characteristics of proton

The proton is 1,836 times as heavy as the electron. For an atom of hydrogen, which contains one electron and one proton, the proton provides 99.95 percent of the mass. The neutron weighs a little more than the proton. Elements heavier than hydrogen usually contain about the same number of protons and neutrons in their nuclei, so the atomic mass, or the mass of one atom, is usually about twice the atomic number.

Protons are affected by all four of the fundamental forces that govern all interactions between particles and energy in the universe. The *electromagnetic force* arises from matter carrying an electrical charge. It causes positively charged protons to attract negatively charged electrons and holds them in orbit around the nucleus of the atom. This force also makes the closely packed protons within the atomic nucleus repel each other with a force that is 100 million times stronger than the electrical attraction that binds the electrons. This repulsion is overcome, however, by the *strong nuclear force*, which binds the protons and neutrons together into a compact nucleus. The other two fundamental forces, *gravitation* and the *weak nuclear force*, also affect the proton. Gravitation is a force that attracts anything with mass (such as the proton) to every other thing in the universe that has mass. It is weak when the masses are small, but can become very large when the masses are great. The weak nuclear force is a feeble force that occurs between certain types of elementary particles, including the proton, and governs how some elementary particles break up into other particles.

The proton was long thought to be a pointlike, indivisible particle, like the electron. In the 1950s, however, scientists used beams of electrons to probe the proton and found that it has a definite shape and size. These experiments showed that, rather than being an indivisible point, the proton has an outer diameter of about 10-13 cm, with a cloudlike shell surrounding a dense center.

Beginning in 1947, physicists discovered more and more elementary particles in addition to the proton, neutron, and electron. These particles appeared to be related to protons and neutrons and to each other. Two different elementary particles had one property, such as an electric charge, that was identical, while another two particles were related by having the exact opposite property. These relationships suggested that protons and other elementary particles might be made up of smaller building blocks, which scientists called quarks. In 1967 physicists used high-powered electron beams to probe deep inside the proton and discovered evidence that quarks exist. Three quarks join together to form a proton. The strong nuclear force is actually a force that attracts quarks to each other to make a proton or neutron. The quarks of a neutron or proton will also attract the quarks of another neutron or proton, thus holding a nucleus together.

Protons originally formed about a thousandth of a second after the Big Bang, the explosion that scientists believe occurred at the beginning of the universe (*see* Big Bang Theory). In that short time, the temperature of the early universe dropped sufficiently for energetic quarks to join together. It is possible that protons may break up again, but this type of event, called proton decay, would be extremely rare. Experiments have shown that the average lifetime of the proton is at least 10^{35} years (the number 10^{35} means a 1 followed by 35 zeros). This may appear to be an odd answer, since the age of the universe is only about 15 x 10^{9} years. Some protons live for a much shorter time than the average value, however, and scientists are constructing large experiments with thousands of tons of material, hoping to see a proton decay.

(*From* **http://encarta.com**)

APPENDIX

1. SCOPE OF FIELDS IN PHYSICS

Acoustics: The science of the production, transmission, and effects of sound. **Âm học**

Atomic Physics: A branch of physics concerned with the structures of the atom, the characteristics of the electrons and other elementary particles of which the atom is composed, the arrangement of the atom’s energy states, and the processes involved in the radiation of light and x-rays. **Vật lý nguyên tử**

Fluid Mechanics: The science concerned with fluids, either at rest or in motion, and dealing with pressures, velocities, and accelerations in the fluid, including fluid deformation and compression or expansion. **Cơ học chất lỏng**

Mechanics: The branch of physics which seeks to formulate general rules for predicting the behavior of a physical system under the influence of any type of interaction with its environment. **Cơ học**

Nuclear Physics: The study of the characteristics, behavior, and internal structure of the atomic nucleus. **Vật lý hạt nhân**

Optics: The study of phenomena associated with the generation, transmission, and detection of electromagnetic radiation in the spectral range extending from the long-wave edge of the x-ray region to the short-wave edge of the radio region, and the science of light. **Quang học**

Particle physics: The branch of physics concerned with understanding the properties, behavior, and structure of elementary particles, especially through study of collisions or decays involving energies of hundreds of MeV or more. **Vật lý hạt**

Physics: The science concerned with those aspects of nature which can be understood in terms of elementary principles and laws. **Vật lý** (lý thuyết)

Plasma Physics: The study of highly ionized gases. **Vật lý Plasma**

Quantum Mechanics: The modern theory of matter, of electromagnetic radiation, and of the interaction between matter and radiation; it differs from classical physics, which it generalizes and supersedes, mainly in the realm of atomic and subatomic phenomena. **Cơ lượng tử**

Relativity: The study of physics theory which recognizes the universal character of the propagation speed of light and the consequent dependence of space, time, and other mechanical measurements on the motion of the observer performing the measurements, the two main divisions are special theory and general theory. **Tương đối**

Solid-state Physics: The branch of physics centering on the physical properties of solid materials, it is usually concerned with the properties of crystalline material only, but it is sometimes extended to include the properties of glasses or polymers. **Vật lý chất rắn**

Spectroscopy: The branch of physics concerned with the production measurement, and interpretation of electromagnetic spectra arising from either emission ro absorption of radiant energy by various substances.

Statistical Mechanics: That branch of physics which endeavors to explain and predict the macroscopic properties and behavior of a system on the basis of the known characteristics and interactions of the microscopic constituents of the system, usually when the number of such constituents is very large. **Cơ học thống kê**

Thermodynamics: The branch of physics which seeks to derive, from a few basis postulates, relations between properties of substances, especially those which are affected by changes in temperature, and a description of the conversion of energy from one form to another. **Nhiệt động lực học**

2. Type of radioactivity

Type	Symbol	*Particles emitted*	*Change in atomic number, ΔZ*	*Change in atomic mass number, ΔA*
Alpha	α	Helium nucleus	-2	-4

Beta negatron	β^-	Negative electron and antineutrino	+1	0
Beta positron	β^+	Positive electron and neutrino	-1	0
Electron capture	EC	Neutrino	-1	0
Isomeric transition	IT	Gamma rays or conversion electrons or both (and positive-negative electron pair)	0	0
Proton	ρ	Proton	-1	-1
Spontaneous fission	SF	Heavy fragments and neutrons	Various	Various
Isomeric spontaneous fission	ISF	Heavy fragments and neutrons	Various	Various
Beta-delayed spontaneous fission	$(EC+\beta^+)$-SF	Positive electron, neutrino, heavy fragments, and neutrons	Various	Various
	β^-SF	Negative electron, antineutrino, heavy fragments, and neutrons	Various	Various
Beta-delayed neutron	β^{-n}	Negative electron, and antineutrino, neutron	+1	-1
Beta-delayed two-neutron (three-neutron)	$\beta^{-2n(3n)}$	Negative electron, antineutrino, and two (three) neutrons	+1	-2 (-3)
Beta-delayed proton	$\beta^{+\rho}$ or $(\beta^+EC)\rho$	Positive electron, neutrino, and proton	-2	-1
Beta-delayed two-proton	$\beta^{+2\rho}$	Positive electron, neutrino, and two protons	-3	-2
Beta-delayed triton	$\beta^-{}^3_1H$	Negative electron, antineutrino and triton	0	-3
Beta-delayed alpha	$\beta^+\alpha$	Positive electron, neutrino and alpha	-3	-4
	$\beta^-\alpha$	Negative electron, antineutrino, and alpha	-1	-4
Beta-delayed alpha-neutron	$\beta^-\alpha$,n	Negative electron, antineutrino, alpha, and neutron	-1	-5

Double beta decay	$\beta^-\beta^-$	Two negative electrons and two antineutrinos	+2	0
	$\beta^+\beta^+$	Two positive electrons and two neutrinos	-2	0
Double electron capture	EC EC	Two neutrinos	-2	0
Two-proton	2ρ	Two protons	-2	-2
Neutron	N	Neutron	0	-1
Two-neutron	2n	Two neutrons	0	-2
Heavy clusters	${}^{14}_{6}C$	${}^{14}_{6}C$ nucleus	-6	-14
	${}^{20}_{8}O$	${}^{20}_{8}O$ nucleus	-8	-20
	${}^{24}_{10}Ne$	${}^{24}_{10}Ne$ nucleus	-10	-24

3. Electromagnetic spectrum

Frequency Hz	*Wavelength, m*	*Nomenclature*	*Typical source*
10^{23}	3×10^{-15}	Cosmic photons	Astronomical
10^{22}	3×10^{-14}	γ-rays	Radioactive nuclei
10^{21}	3×10^{-13}	γ-rays, X-rays	
10^{20}	3×10^{-12}	X-rays	Atomic inner shell, positron-electron annihilation
10^{19}	3×10^{-11}	Soft X-rays	Electron impact on a solid
10^{18}	3×10^{-10}	Ultraviolet, X-rays	Atoms in sparks
10^{17}	3×10^{-9}	Ultraviolet	Atoms in sparks and arcs
10^{16}	3×10^{-8}	Ultraviolet	Atoms in sparks and arcs
10^{15}	3×10^{-7}	Visible spectrum	Atoms, hot bodies, molecules
10^{14}	3×10^{-6}	Infrared	Hot bodies, molecules
10^{13}	3×10^{-5}	Infrared	Hot bodies, molecules
10^{12}	3×10^{-4}	Far-infrared	Hot bodies, molecules
10^{11}	3×10^{-3}	Microwaves	Electronic devices
10^{10}	3×10^{-2}	Microwaves, radar	Electronic devices
10^{9}	3×10^{-1}	Radar	Electronic devices, interstellar hydrogen

10^{8}	3	Television, FM radio	Electronic devices
10^{7}	30	Short-wave radio	Electronic devices
10^{6}	300	AM radio	Electronic devices
10^{5}	3000	Long-wave radio	Electronic devices
10^{4}	3×10^{4}	Induction heating	Electronic devices
10^{3}	3×10^{5}		Electronic devices
100	3×10^{6}	Power	Rotating machinery
10	3×10^{7}	Power	Rotating machinery
1	3×10^{8}		Commutated direct current
0	Infinity	Direct current	Batteries

4. SI prefixes

Factor	Prefix	Symbol	Factor	Prefix	Symbol
10^{24}	yotta	Y	10^{-1}	deci	d
10^{21}	zeta	Z	10^{-2}	centi	c
10^{18}	exa	E	10^{-3}	milli	m
10^{15}	peta	P	10^{-6}	micro	õ
10^{12}	tera	T	10^{-9}	nano	n
10^{9}	giga	G	10^{-12}	pico	p
10^{6}	mega	M	10^{-15}	femto	f
10^{3}	kilo	k	10^{-18}	atto	a
10^{2}	hector	h	10^{-21}	zepto	z
10^{1}	deka	da	10^{-24}	yocto	y

5. Some physical properties

AIR (dry, at 20^0 C and 1 atm)

Density	1.21 kg/m^3
Specific heat at constant pressure	1010J/kg.K
Ratio of specific heats	1.40
Speed of sound	343m/s
Electrical breakdown strength	3 $x10^6$
Effective molar mass	0.0289kg/mol

WATER

Density	$1000kg/m^3$
Speed of sound	1460 m/s
Specific heat at constant pressure	4190J/kg.K
Heat of fusion(0^0C)	333kJ/kg
Heat of evaporation (100^0C)	2269kJ/kg
Index of refraction (λ = 589nm)	1.33
Molar mass	0.0180kg/mol

EARTH

Mass	5.9810^{24}kg
Mean radius	6.37 x 19^6 m
Free-fall acceleration at the Earth's surface	$9.8m/s^2$
Standard atmosphere	1.01 $x10^6$ Pa
Period of satellite at 100-km altitude	86.3min
Radius of the geosynchronous orbit	42,200km
Escape Speed	11.2km/s
Magnetic dipole moment	8.0 $x10^{22}A.m^2$
Mean electric field at surface	150V/m

DISTANCE TO:

Moon	x 10^8m
Sun	1.50 x 10^{11}m
Nearest star	4.04 x 10^{16}m
Galactic center	2.2 x 10^{20}m
Andromeda galaxy	2.1 x 10^{22} m
Edge of the observable universe	~ 10^{26}m

6. Greek letters

Alpha	α	Nu	ν
Beta	β	Xi	ξ
Gamma	ɣ	Omicron	o
Delta	△	Pi	π
Epsilon	ε	Rho	ρ
Zeta	Z	Sigma	σ
Eta	ɳ	Tau	τ
Theta	θ	Upsilon	υ
Iota	ι	Phi	φ
Kappa	κ	Chi	x
Lambda	λ	Psi	ψ
Mu	μ	Omega	ω

Reference:

A.S.Hornby, **Oxford Advanced Learner's Dictionary of Current English**.

References

Books in English

1. Anita Pineas; 1991, *Writing in English*, book 1, Macmilan Publishers.
2. Benjamin Cowell; 2001, *Light and Matter series*, Fullerton California.
3. David Blackie; 1981, *English for Basic Physics,* Student's book, Thomas Nelson & SMS Limited, England.
4. David Halliday, Robert Resnick, Jeark Walker; 1997, *Fundamentals of Physics*, Extended John Wiley & SMS. Inc.
5. David Jolly; 1984, *Writing tasks, Student's Book*, Cambridge University Press.
6. David Sang; 1997, *Basic Physics 1 and 2*, Cambridge University Press.
7. Hồ Hải Thụy-Editor in Chief; 1997, *English-Vietnamese dictionary*, HoChiMinh City's Publishing House.
8. J.P.B.Allen, H.G.Widdowson; 1997, *English in Physical Science*, Student's edition, Oxpford University Press.
9. J.P.B.Allen, H.G.Widdowson; 1997, *English in teacher's edition*, Student's edition, Oxford University Press.
10. Jay Bolemon; 1989, *Physics - An Introduction*, Prentice Hall, Englewood. Cliffs, New Jersey 07632.
11. John Eastwood; 1994, *Oxford Guide to English Grammar*, Oxford University Press.
12. John Sinclair-Editor in Chief; 1992, *BBC English Dictionary*; Harper Collins Publishers.
13. John Sinclair-Editor in Chief; 1993, *Collins Cobuild English Language dictionary*; Harper Collins Publishers.
14. L.D.Landau, A.I.Kitaigorodsky; 1980, *Physical bodies*, Book 1, Mir Publishers Moscow.
15. R.R.Jordan; 1990, *Academic writing Course*, Nelson study skills in English.
16. Randolph Quirk, Sidney Greenburg; 1976, *A University Grammar of English*, Sidney Greenburg.
17. Sybil.P.Parker-Editor in Chief; 1997, *Dictionary of Physics*; McGraw-Hill.
18. UniHaber-Schaim, Gerald L.Abegg, John H.Dodge, H.Graden Kirksey, James A.Walter; 1997, *Introductory Physical Science*, Prentic-Hall, Inc., Englewood Cliffs, New Jersey 07632.

Books in Vietnamese

19. *Bách khoa Tri thức phổ thông*, Nhà xuất bản Văn hoá - Thông tin, Hà Nội, 2000.

20. Ban biên soạn; 1993, *Từ điển Kỹ Thuật Tổng Hợp Anh-Việt*; Nhà xuất bản Khoa học Kỹ thuật.
21. Ban từ điển Nhà xuất bản Khoa học Kỹ thuật; 1997, *Từ điển Vật Lý Tối Thiểu*, Nhà xuất bản Khoa học Kỹ thuật.
22. Bùi Phụng; 1996, *Từ điển Việt-Anh*, Nhà xuất bản Thế Giới.
23. Dương Trọng Bái, Tô Giang, Nguyễn Đức Thâm, Bùi Gia Thịnh; 1999, *Vật lý 10*, Nhà xuất bản Giáo dục.
24. Đào Văn Phúc, Dương Trọng Bái, Nguyễn Thượng Chung, Vũ Quang; 2000, *Vật lý 12*, Nhà xuất bản Giáo dục.
25. Nguyễn Xuân Khai; 1997, *Từ điển Vật lý Anh-Việt*, Nhà xuất bản Đồng Nai.
26. Phan Tử Phùng; 1993, *Tiếng Anh Khoa học*, Nhà xuất bản Khoa học Kỹ thuật.
27. Vũ Thanh Khiết, Phạm Quý Tư, Nguyễn Phúc Thuần, Nguyễn Đức Thâm; 2000, *Vật lý 11*, Nhà xuất bản Giáo dục.
28. Vũ Thanh Khiết, Vũ Quang, Phan Tuấn Anh, Tô Giang; 2000, *Ôn lý thuyết thi đại học - Vật lý 1, 2*, Nhà xuất bản Đại học Quốc gia Hà Nội.

CD Rom

29. Encarta Encyclopedia Deluxe 2001, Microsoft.
30. Britannica Encyclopedia 2001 Deluxe Edition.

Websites

31. http://encarta.com
32. http://bookmarkphysics.iop.org
33. http://www.aip.org
34. http://www.colorado.edu
35. http://www.scri.fsu.edu
36. http://fyi.cnn.com
37. http://www.pery-lake.k12.oh.us
38. http://www.pnl.gov
39. http://physicsweb.org
40. http://www.kek.jp
41. http://www.slac.standford.edu
42. http://www.lightmatter.com
43. http://vnexpress.net