

Lesson 1

The Atom

Part I: Pre-Reading

A. Pronunciation Practice

fa.mil.iar (fə-mīl' yər)

liq.uid (līk' wīd)

sol.id (səl' īd)

gas (gās)

mol.e.cule (mōlī-kyōōl)

par.ti.cle (pār' tī-kəl)

com.pound (kōm-pōund')

re.duce (rī-dōōs')

ti.ny (tī nē)

com.po.nent (kəm-pō nənt)

phys.i.cist (fīz' ī-sīst)

at.mos.phere (āt' mə-sfīr)

cre.ate (krē-āt')

lab.o.ra.to.ry (lāb' rə-tōrē)

prop.er.ty (prōp' ər-tē)

hy.dro.gen (hī' drə-jən)

ox.y.gen (ōk' sī-jən)

ap.pear (ə-pīr')

dif.fer (dīf' ər)

sub.a.tom.ic (süb ə-tōm' ik)

ba.sic (bā' sīk)

e.lec.tric.i.ty (ī-lēk-trīs' ə-tē)

pro.ton (prō' tōn)

e.lec.tron (ī-lēk' trōn)

neu.tron (nōō' trōn)

lo.cate (lōkāt)

nu.cle.us (nōō' klē-əs)

or.bit (ōr' bīt)

es.ti.mate (ēs' tə-māt)

tril.lionth (trīl' yānth)

di.am.e.ter (dī-ām' ī-tər)

ex.treme (īk-strēm')

dis.lodge (dīs-lōj')

per.ma.nent (pūr' mən-ənt)

par.tic.i.pate (pār-tīs' ə-pāt)

straight (strāt)

de.ter.mine (dī-tūr' mīn)

i.den.ti.fy (ī-dēn' tə-fī)

neu.tral.ize (nōō' trə-līz)

out.num.ber (out-nūm' bər)

dec.ade (dēk' ād)

ab.sorb (əb-sōrb')

en.tire.ly (ēn-tīr' lē)

nu.cle.on.ics (nōōklē-ōn' īks)

se.cret (sē' krīt)

re.lease (rē-lēs')

en.gage (ēn-gāj')

bet.ter.ment (bēt' ər-mənt)

B. Word Study: Definitions

solid: form of matter like iron; substance not in the form of a liquid or gas

compound:
subatomic:

something made up of two or more combined parts
related to any of the particles smaller than an atom;
related to inter-atomic particles; related to particles
inside an atom

nucleus:

central part of an atom consisting of protons and
neutrons

orbit:

path of a body traveling around another

diameter:

length of a straight line drawn from side to side
through the center of a circular, spherical, or cylin-
drical form

dislodge:

force something out of its place

neutralize:

take away the effect or quality with an opposite effect
or quality

nucleonics:

branch of physical science dealing with nucleons or the
phenomena of the atomic nucleus; applying nuclear
science to industry, biology, physics, chemistry, etc.

C. Word Study: Definitions and Exemplifications

reduce:

make less; make smaller in size, number, degree

By taking precautions in the factory, we can *reduce* the
possibility of accidents.

grain:

tiny, hard bit

A *grain* of salt can be reduced to a molecule of salt.

component:

necessary or essential part

Two atoms of hydrogen and one atom of oxygen are
the *components* of a molecule of water.

physicist:

expert on physics

Albert Einstein is a well-known mathematician; he is
also known as a *physicist*.

building block:

basic part

Every substance is composed of one or more elements.

In other words, elements are the *building blocks* of all
substances.

basically:

fundamentally

Basically, the law in current electronic theory is Ohm's
law.

locate:

situate

Where is the new car factory to be *located*?

estimate:

calculate the number of something

	The engineers <i>estimated</i> that it would take three months to finish the contract.
extremely:	in the utmost degree; to the utmost point It was <i>extremely</i> difficult for the students to solve the problem.
permanent:	not expected to change; keep for a long time When a magnetized material keeps its magnetic field for a long time, it is called a <i>permanent</i> magnet.
revolve:	go around in a circle; cause to go around The earth <i>revolves</i> around the sun.
straight:	not bent or curved This line is bent a little in the middle. Make it <i>straight</i> .
outnumber:	be greater in number than An atom becomes positive when the protons <i>outnumber</i> the electron.
decade:	period of ten years Medical sciences have made great advances over the last two <i>decades</i> .
release:	allow to go; set free; free What is <i>released</i> when acids are put in aqueous solutions?
be engaged:	be busy with Our professor is <i>engaged</i> in scientific projects.
betterment:	making or becoming better; improvement For the <i>betterment</i> of work conditions; the government has recently passed several laws.

D. Grammatical Points

There are several structures to express result. One of them is as follows:

so+adjective (or adverb)+that

In addition to indicate result, emphasis is shown when this structure is used.

1. Model: a. Electrons are very tiny.

That is why no man has ever seen one.

b. Electrons are so tiny that no man has ever seen one.

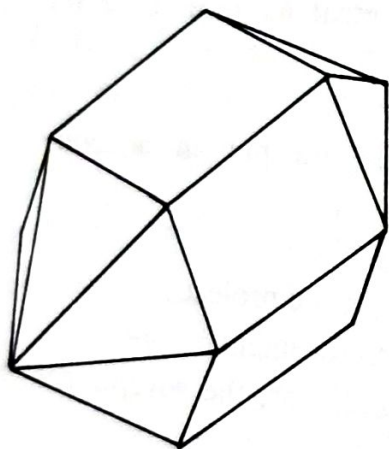
A perfect participle can be used where one action is immediately followed by another with the same subject. The perfect participle emphasizes that the first action is complete before the second one starts or when there is an interval of time between the two actions.

2. Model: a. The scientists have mastered this power.
They are now busily engaged in finding ways to use it.
- b. Having mastered this power, the scientists are now busily engaged in finding ways to use it.

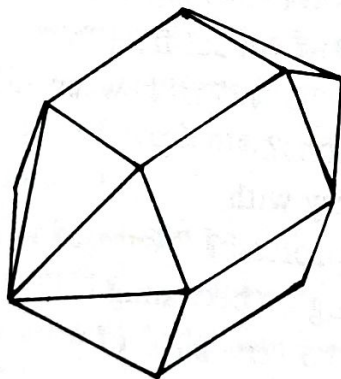
Part II: Reading for Comprehension

The Atom

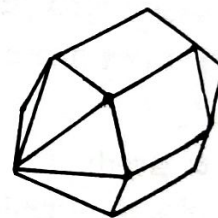
Most of us are familiar with the fact that any matter whether a liquid, or a solid, or a gas, is made up of molecules. A molecule is the smallest particle that a compound can be reduced to before it breaks down into its elements. For example, if we took a grain of table salt and kept breaking it in half until it got as small as it possibly could and yet still be salt, we would have a molecule of salt. If we then broke it in half again, the salt would change into its elements.



a grain of salt



can be reduced to



sodium chlorine



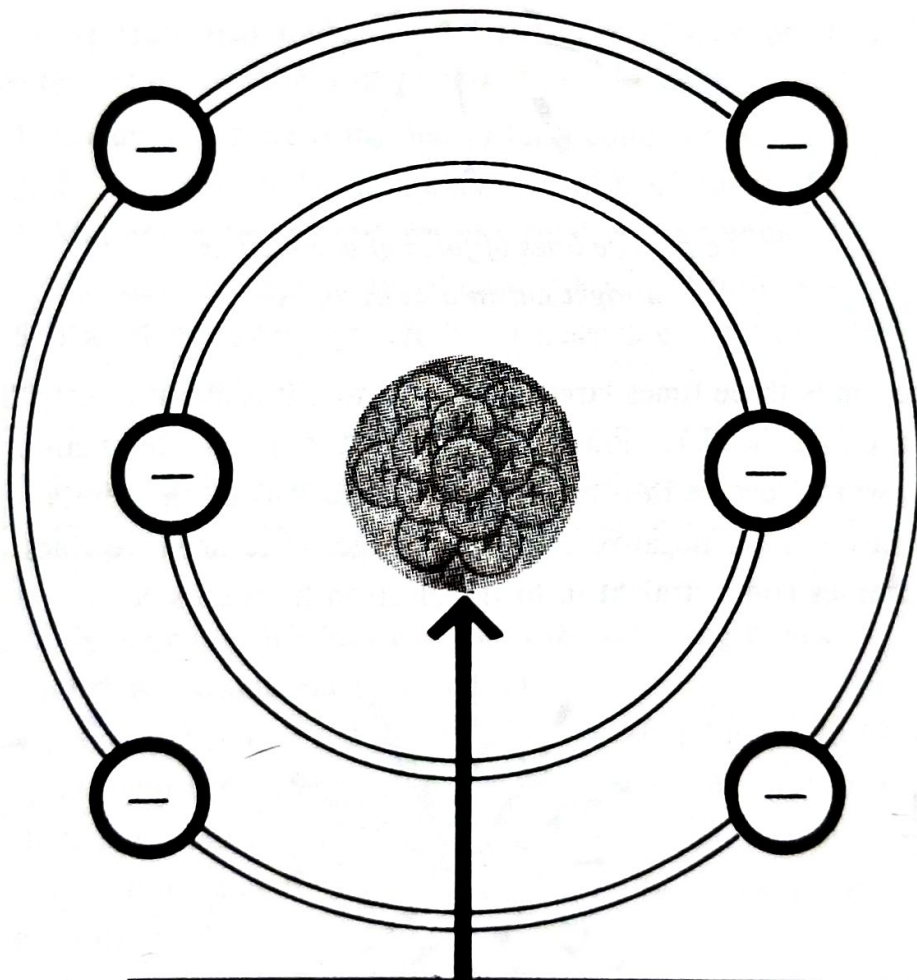
a molecule of salt

Molecules, however, are themselves made up of still tinier components known as atoms. Atoms, according to physicists, are the building blocks of our physical world. So far 92 different natural atomic elements—those found in the earth and atmosphere of the world—are known to exist. Several others have been created in the laboratory; it is expected that many more still to be produced.

An atom is the smallest particle that an element can be reduced to and still keep its own atomic properties. If a drop of water is reduced to its smallest size, a molecule of water is produced. But if that molecule of water is reduced still further, atoms of hydrogen and oxygen appear. If the atom of an element is broken down any further, that element does not exist any longer.

Basically, an atom contains three types of subatomic particles: protons, electrons, and neutrons. The protons and the neutrons are located in the center, or nucleus; the electrons, however, travel about the nucleus in orbits.

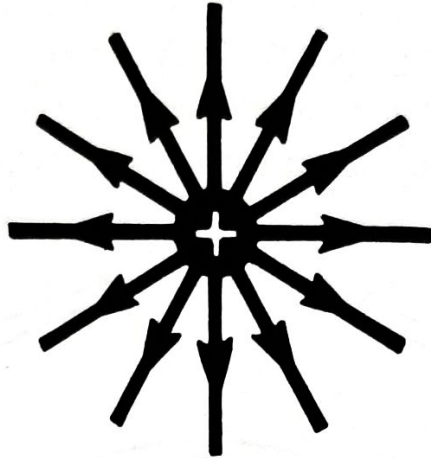
The nucleus is the central part of the atom. It contains the protons and neutrons of an atom. Since the nucleus contains neutrons, which are electrically neutral and protons, which have positive electrical charges, the nucleus of any atom is always positive. (The number of protons in the nucleus determines how one atom of an element differs from another.) For example, the nucleus of a hydrogen atom contains one proton, oxygen has eight, copper has 29, silver has 47, and gold has 79. As a matter of fact, this is how the different elements are identified by atomic numbers; the atomic number is the number of protons that each atom has in its nucleus.



The nucleus contains six protons (+) and six neutrons. Six electrons (-) orbit about the nucleus.

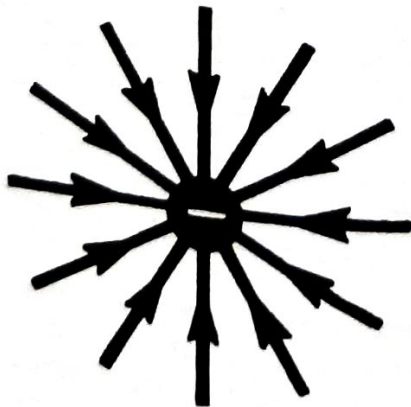
the carbon atom

The proton is very small. It is estimated to be 0.07 trillionth of an inch in diameter. The proton is one-third the diameter of an electron, but it has almost 1840 times the mass of an electron; the proton is almost 1840 times heavier than the electron. It is extremely difficult to dislodge a proton from the nucleus of an atom. Therefore, protons are considered permanent parts of the nucleus. A proton has a positive electrical charge. The lines of force of this charge go straight out in all directions from the proton.



the positive lines of force of a proton go straight out in all directions

An electron is three times larger than a proton; it is about 0.22 trillionth of an inch in diameter. It is, however, about 1840 times lighter than a proton. Electrons, which revolve in orbits around the nucleus of an atom, are easy to move. Electrons have negative electrical charges. The negative lines of force of these charges come straight in to the electron from all sides.



the negative lines of force of an electron come straight in from all directions

Protons and electrons in a well-behaved atom tend to neutralize one another. That is, there are the same number of electrons and protons in an atom. Atoms are, therefore, normally neutral in nature, but if by some means they are made to lose one of their electrons, they are said to be positive in nature because the protons outnumber the electrons. Atoms become negative, of course, when they gain electrons: in this case, electrons outnumber the protons.

Over the past decades, scientists have become so interested in the nucleus of the atom that they have created an entirely new branch of physics called nucleonics, through which they discovered the secret of releasing atomic energy. Having mastered this power, scientists are now busily engaged in finding ways to use it for the betterment of mankind.

A. Read each statement and decide whether it is true or false. Write 'T' before true statements and 'F' before false statements.

-~~F~~ 1. Elements can be combined to form compounds.
-~~F~~ 2. The atomic number is the number of neutrons in the nucleus.
-~~T~~ 3. Matter can be in the form of a solid, gas, or liquid.
-~~F~~ 4. The electron is 1840 times heavier than the proton.
-~~T~~ 5. The three basic subatomic particles are electrons, protons, and neutrons.
-~~F~~ 6. Elements are the basic materials that make up matter.
-~~F~~ 7. Neutrons have positive and negative electrical charges.
-~~F~~ 8. Elements are identified by the number of their atoms.

B. Circle a, b, c, or d which best completes the following items.

- 1. The atom is the smallest particle that
 - a. a compound can be reduced to after breaking down into its elements
 - b. an element can be reduced to before breaking down into its protons
 - ✓c. an element can be reduced to and still retain its own characteristics
 - d. a compound can be reduced to and still keep the properties of the protons
- 2. The atom of one element is different from the atom of another element because
 - a. of the number of protons, electrons, and neutrons
 - b. of the fact that subatomic particles of one of them revolve around the nucleus in orbits

- c. the nucleus of the former atom is always electrically positive
✓d. the number of protons in the nucleus determines how the atom should differ from another atom
3. The central part of the atom is
a. the neutron
b. the electron
c. the proton
✓d. the nucleus
4. The proton is three times smaller than
a. the nucleus
b. the electron
c. the neutron
d. the molecule
5. It is **not** true that
a. the neutron is electrically neutral and is in the nucleus
b. the electron has a negative charge and is larger than the proton
c. the proton has a positive charge and is in the nucleus of the atom
✓d. the nucleus is electrically positive in nature and contains the sub-atomic particles
6. It is **not** true that
a. gases are made up of molecules
b. molecules are made up of atoms
c. atoms contain protons, electrons, and neutrons
✓d. electrons travel about atoms in orbits

C. Answer the following questions orally.

1. How is the atomic number of an element identified?
2. What are the characteristics of an electron?
3. What are the characteristics of a proton?
4. What are the characteristics of a nucleus?
5. What is a compound?
6. Which has a greater diameter: a proton or an electron? By how much?
7. What is the atomic number of copper?
8. Why does one element differ from another?

Part III: Homework

Section One: Vocabulary Exercises

- A. Fill in the blanks with the words from the following table to complete the sentences. Base your choices on the items of the table only. Make neces-

sary changes if required.

Verb	Noun	Adjective	Adverb
orbit	orbit مدار	orbital مداری	_____
differ تفاوت داشتن	difference تفاوت	different متفاوت	differently
identify تعیین کردن	identification	identified	_____
base	base پایه	basic اساسی	basically

- BC is the base of the triangle ABC.
- The students were required to identify the atomic number of ten elements.
- Some artificial satellites can orbit the earth in less than an hour.
- Crude oils from various oil fields almost always differ in composition.
- The thermostat is based on the fact that dissimilar metals have different coefficients of expansion.
- If enough energy is added to an electron, that electron will move out of its orbit to the next higher one.
- Since two charges are needed to complete a circuit, it is the difference of potential between these two charges that provides the electric force.
- The electron produces its own magnetic field because of its intrinsic spin.
- There are basic differences between a blower and a fan.
- Human beings behave differently particularly when emergencies arise.
- The number of persons killed in the road accident took the police only a few minutes. * identification
- Different lasers emit radiation with a different degree of coherence.

B. Fill in the blanks with the appropriate words from the list below. There are more options than required.

diameters قطر ها	orbit مدار	particles ذرات	elements عناصر
compound مرکب	nucleus هسته	reduced کاهش یافته	component تشکیل دهنده
neutralize خنثی	differ تفاوت داشتن	dislodged خارج کردن	estimated تخمین زدن
properties ویژگی	absorb جذب کردن	isolated جدا کردن	

- It took the mechanic a long time to put the dislodged parts of the engine together.
- Why don't protons repel each other with sufficient force to split the nucleus?
- The different hydrocarbons present in petroleum have different boiling temperatures; therefore, they can be isolated according to their boiling temperatures.
- Bases acids.

↓
neutralize

5. The chemical ^{properties} of iron are different from those of steel.
6. The atoms of all ^{elements} can have up to seven shells.
7. Dark surfaces ^{absorb} heat more than bright surfaces.
8. Because of the great speed of the electron, (centrifugal force) tends to pull the electron out of ^{orbit} ^{تغیر}
9. The surveyor ^{estimated} the quantity and cost of the materials. ^{تخمین زد}
10. The danger of overheating of the machine parts can be ^{reduced} by lubrication. ^{کمزور}

C. Match the words in Column I with their appropriate equivalents in Column II. Insert the letters a, b, c, ... in the parentheses provided. There are more options in Column II than required.

Column I	Column II
1. particle ^{ذره}	(f) a. moderate in a nuclear reactor
2. engage ^{اشغال داسین}	(h) b. allow to go; set free
3. identify ^{مقین کران}	(e) c. electrons with positive electrical charges
4. participate ^{شرکت کران}	(l) d. give what is needed
5. positron	(c) e. recognize; know; able to name
6. element	(k) f. single piece of solid material; very small bit
7. release ^{آزاد کران}	(b) g. split an atomic nucleus into two
8. determine ^{محاسبہ کران}	(j) h. busy oneself with
	i. move forward
	j. find out precisely; calculate
	k. simple substance which cannot be resolved into simpler substances by normal chemical means
	l. have a share; take part

Section Two: Grammatical Exercises

A. Do the following exercises according to the explanations given in the Pre-Reading Part. Write your sentences in the spaces provided.

1. a. The planes flew very low.

That is why none of the radars could detect them.

b.

2. a. This problem is very complex.

That is why it can only be solved by a computer.

b.

- 3. a. The bacteria are very small.
That is why they pass through very fine filters.
b.
- 4. a. The temperatures in the turbine are very high.
That is why special nickel alloys must be used.
b.
- 5. a. This particular physics experiment is very complicated.
That is why some students will not be able to carry it out.
b.
- 6. a. This parcel is very heavy.
That is why she cannot lift it up.
b.
- 7. a. The country has many natural resources.
That is why it can support itself easily.
b.
- 8. a. The increase in population is very rapid in India.
That is why there is a food shortage.
b.

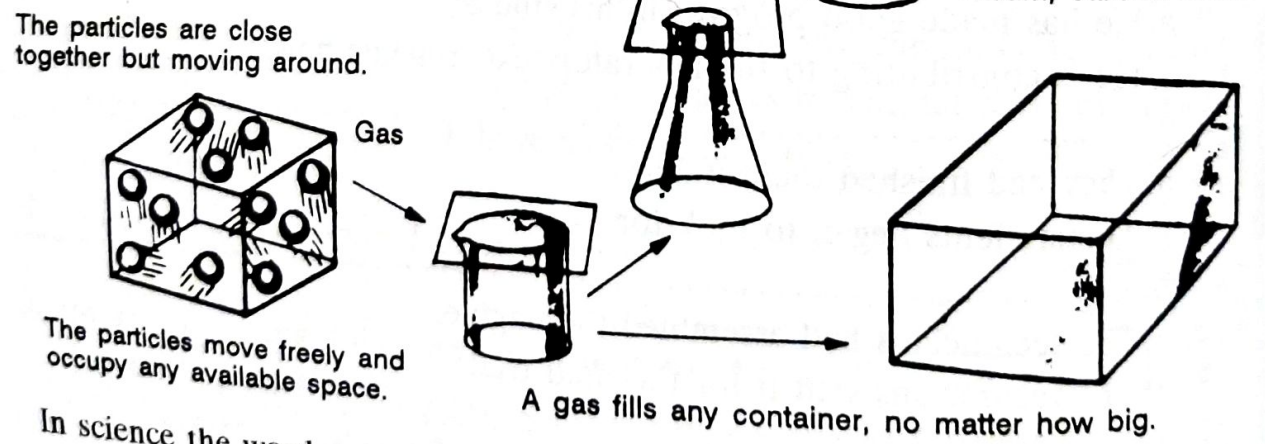
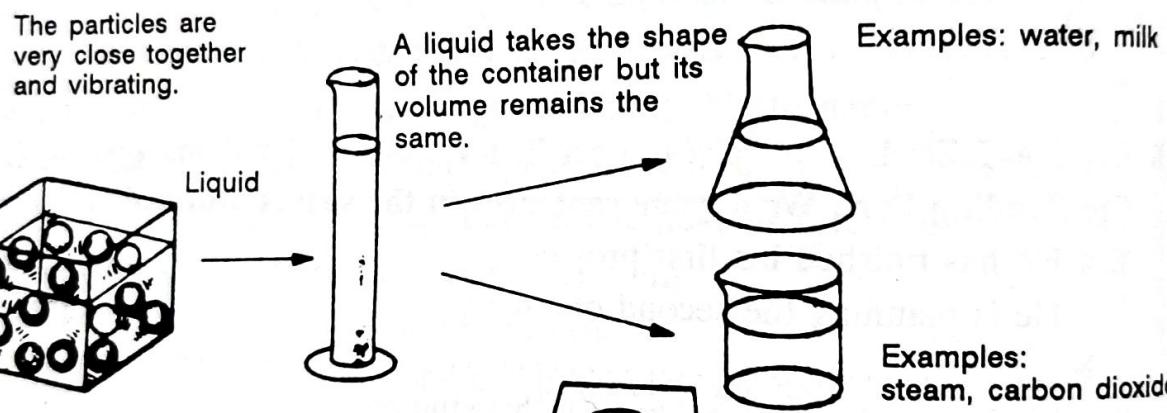
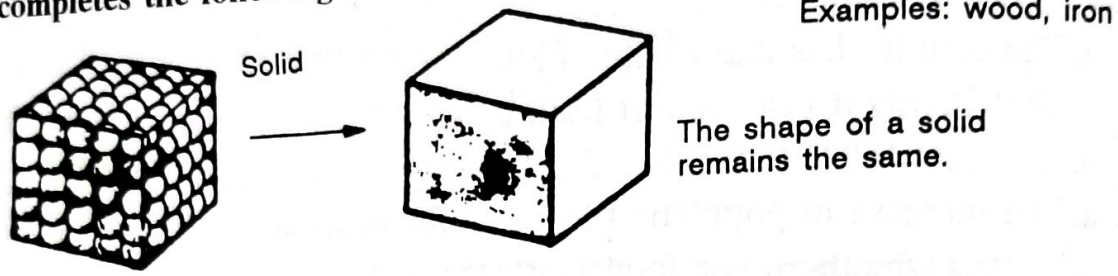
B. Do the following exercises according to the explanations given in the Pre-Reading Part. Write your sentences in the spaces provided.

- 1. a. He has finished his first project.
He is planning the second one now.
b.
- 2. a. He has made good progress in his studies.
He is contributing to the laboratory experiments now.
b.
- 3. a. They had finished their studies.
The students began to look for jobs.
b.
- 4. a. The technicians had assembled the engine.
The technicians sent it for the final trial.
b.
- 5. a. The students had studied for two hours.
They took a break for ten minutes.
b.
- 6. a. The engineers had designed the suspension bridge.
They continued to improve its details.
b.

7. a. The researcher had written all the data.
He felt much relieved.
b.
8. a. The student had failed the course twice.
He did not want to try it again.
b.

Section Three: Reading Comprehension Exercises

Read the following text carefully and then select a, b, c, or d which best completes the following items.



In science the word matter refers to all things which have weight and occupy space. The earth and its substances are good examples of matter. Sometimes a piece of matter may be so tiny or so far away that our senses alone cannot be used to detect it. Special instruments like the microscope and telescope have to be used for this purpose. Matter is made up of tiny particles called electrons. The arrangement and the movement of these electrons are respon-

sible for the property, state, and behavior of substances.

There are certain characteristics or properties which distinguish substances from one another. These properties are either physical or chemical. Physical properties such as color, size, shape, melting point, and boiling point are used to identify substances. Chemical properties enable the substances to take part in chemical changes in which new substances are produced. An example of this is when carbon is burned in air and carbon dioxide (CO₂) is formed.

Matter can also exist in three states: solid, liquid, and gas. In the solid state, the molecules are strongly attracted to one another so that they have a definite volume and shape. In the liquid state, the molecules are not strongly attracted to one another and can move about. Matter in this state has a definite volume but no definite shape. In the gaseous state, a substance possesses neither a shape nor a fixed volume. There is a weak attraction between molecules; hence, they can move about freely.

Water, like all other examples of matter, can be converted to the other states depending on the amount of temperature and pressure. For example, water as a liquid can be converted to ice at zero degrees Centigrade. It can also be converted to steam or water vapor at 100 degrees Centigrade.

1. The molecules of a solid substance

- a. are firmly ^{strongly + nicely} attached to one another
- b. are loosely attracted to one another
- c. move about freely
- d. have no fixed volume

2. The behavior of a substance is dependent upon

- a. the property of that substance
- b. the state of the substance
- c. the arrangement and movement of its electrons
- d. the responsibility of its electrons to move around

3. In line 2, 'its' refers to

- a. space
- b. earth
- c. matter
- d. weight

4. In line 3, 'far away' is used to point to

- a. space
- b. substance
- c. earth
- d. matter

5. In line 4, 'it' refers to

- a. space
- b. weight
- c. matter
- d. earth

6. In line 17, 'this' refers to
- a. other states
 - b. the solid state
 - c. the gaseous state
 - ✓d. the liquid state
7. In line 23, 'It' refers to
- a. ice
 - ✓b. water
 - c. liquid
 - d. matter
8. Substances differ from one another because their are different.
- ✓a. properties
 - b. behaviors
 - c. arrangements
 - d. movements
9. The best title for this passage may be
- a. 'Substances'
 - b. 'Matter'
 - ✓c. 'States of Matter'
 - d. 'Behavior of Substance'

Section Four: Translation Practice and Terminology Equivalents

A. Translate the following passage into Persian.

The idea that everything is made up of very small particles, or atoms, was known to the Greeks over two thousand years ago, but it was only about one hundred and fifty years ago that John Dalton put forward the important ideas which made the atomic theory really useful and greatly hastened the development of modern chemistry. What Dalton said was that although many thousands of different chemical substances are known, these are made up of only a few different kinds of atom combined together in definite simple ways. We now know that there are altogether only about one hundred different types of atom, and about a third of these make up most of the substances encountered in everyday life. Atoms cannot be destroyed or changed in any way by chemical reactions; all that can happen is that the arrangement of the atoms is changed so as to produce another chemical substance with different properties.

B. Determine the Persian equivalents of the following technical terms and write them in the spaces provided.

- | | | | |
|--------------------------|------------|-------------------------|--------------------|
| absorb | جذب کردن | centrifugal force | نیروی گریز از مرکز |
| aqueous | آب یا بید | coefficient | ضریب |
| atomic number | عدد اتمی | component | جزء |
| base | اسید | compound | ترکیب |
| behavior of matter | رفتار ماده | detect | پیدا کردن |
| boiling point | نقطه جوش | diameter | قطر |

element عنصر
 expansion انبساط
 filter صافی
 gaseous گازی
 grain ذره
 instrument ابزار، وسیله، اعداد و سنج
 isolate جدا کردن
 lines of force خطوط نیرو
 lubrication روغنکاری، لغز
 melting point نقطه ذوب
 microscope میکروسکوپ
 neutralize خنثی کردن
 nuclear هسته‌ای
 nucleonics علوم هسته‌شناسی
 orbit مدار
 overheating گرم شدن بیش از حد

particle ذره
 positron پوزیترون
 pressure فشار
 property ویژگی
 reaction واکنش
 reactor رآکتور
 repel دفع کردن
 space فضا
 state of matter حالت ماده
 subatomic زیر اتمی
 surveyor ابریزاب و زمین‌بردار
 telescope تلسکوپ
 temperature دما
 volume حجم
 weight وزن
 well-behaved atom اتم کامیل

What Is Energy?

Part I: Pre-Reading

A. Pronunciation Practice

1. spe.cial (spěsh' əl)
 2. ma.te.ri.al (mə-tîr' ē-əl)
 3. cur.rent (kûr' ənt)
 4. mus.cle (mûs' əl)
 5. mus.cu.lar (mûs' kyə-lər)
 6. wind.mill (wînd' mîl)
 7. me.chan.i.cal (mî-kăn' ĭ-kəl)
 8. gas.o.line (găs' ə-lēn)
 9. har.ness (här' nîs)
 10. wa.ter (wô' tər)
 11. var.i.ous (vâr' ē-əs)
 12. fu.el (fyoo' əl)
 huge (hyooj)

- a.mount (ə-mount')
- dis.cov.er (dĭ-skŭv' ər)
- source (sôrs)
- ki.net.ic (kĭ-nět' ĭk)
- po.ten.tial (pə-těn' shəl)
- grav.i.ty (grăv' ĭ-tē)
- twist (twĭst)
- wound (waund)
- wind (wînd)
- sur.round (sə-round')
- down.ward (doun' wərd)
- pull (pŭol)

B. Word Study: Definitions

- matter: substance of which a physical thing is made
1. current: flow of electricity
2. mechanical: of machines; connected with machines; produced by machines
3. windmill: mill operated by the wind
4. water wheel: wheel made to rotate by the flow of water
5. gasoline: petrol; motor spirit
6. kinetic: of motion; caused by motion
7. pull: force
8. gravity: force of attraction between any two objects, especially that force which attracts objects towards the center of the earth
9. potential: that can or may come into existence or action

C. Word Study: Definitions and Exemplifications

- take up: occupy time or space; fill time or space
Gases take up the whole space of their containers.
- bring about: cause to happen
Heat often brings about chemical changes in matter.
- lock up: hold
A great amount of energy is locked up in the atom.
- bend: cause something to be out of a straight line or surface
When rays of light pass through a piece of glass, they bend.
- twist: turn especially by the use of force
We can twist a strong wire and make a spring.

D. Grammatical Points

An adjective clause is usually introduced by a relative pronoun: that, which, who, whom, etc. It always follows the noun modified, but it may be reduced to a prepositional adjective either single or compound.

1. Model: a. Water which is running has kinetic energy.

b. Running water has kinetic energy.

2. Model: a. This energy is stored in the stone which is lifted.

b. This energy is stored in the lifted stone.

However, if an adjective clause is in the passive form, the relative pronoun and the verb 'be' may be deleted, and the remaining adjective phrase kept after the noun.

3. Model: a. Rubber which is produced by a chemical process in factories is known as synthetic rubber.

b. Rubber produced by a chemical process in factories is known as synthetic rubber.

The majority of statements in technical writing are in the passive form because the technical writer wants to be objective and impersonal. The form of the passive is as follows:

(Pro)noun+a form of be+past participle+the agent

In technical writing, however, it is not usual to add the name of the agent to a sentence if the agent is a person. But very often the agent is not a person, and it may be necessary to add it.

4. Model: a. Such things as heat, light, sound, and electric current bring about many changes in matter.

b. Many changes in matter are brought about by such things as heat, light, sound, and electric current.

What Is Energy?

In science, we have a special word for ^{کلیه چیزوں کو} all materials. We call all materials matter. Matter is anything that takes up space and has weight. Plants, animals, air, water, soil, rock—all living and non-living things—are made from matter. Matter itself is made up of very small particles called molecules, and molecules are made up of tiny particles called atoms. ^{ذرات}

Many changes in matter are brought about by such things as heat, light, sound, and electric current. Yet these things are not matter because they do not take up space and do not have weight. So there is something besides matter in our world which makes matter move or change. We have a special word for it; we call it energy. Heat, light, sound, and electric current are just some of its different forms. The energy of the muscles that move the parts of your body is called muscular energy. Mechanical devices such as windmills, water wheels, and steam or gasoline engines harness various forms of energy and change them into another form, called mechanical energy. Mechanical energy can be used to run our machines.

Another form of energy is stored in the molecules of some materials. We call this form chemical energy. Coal, gasoline, and other fuels have chemical energy stored in them. When any fuel is burned, the stored energy is released. Huge amounts of still another form of energy are locked up in atoms. This kind of energy is called atomic energy. As new and better ways of releasing atomic energy are discovered, atoms will become one of our most important sources of energy.

Though energy exists in various forms, scientists have found that there are really just two kinds of energy. Running water, a falling weight, or any moving object has energy. You know that this is true because of what happens when they strike something. This kind of energy is called kinetic energy. It is the kind of energy that matter has because of its motion. However, materials and objects often have energy even if they are not moving. ^{حالت} If you lift a stone, energy has to be used to overcome the downward pull of gravity. This energy is stored in the lifted stone. When you release the stone it falls back to the ground. And the energy stored in the stone is set free. So the other kind of energy is the energy stored in matter. We call this kind potential energy. Springs that have been pulled, pressed, bent, twisted, or wound up contain energy stored as potential energy.

Energy does not take up space and does not have weight, but we can often feel or see what it does. Whenever matter moves or changes, it is energy that causes this to happen. Also, when matter changes, the form or kind of energy, or both will change. For example, when light energy from the sun strikes the earth, much of it is changed into heat energy. But some of it is changed into chemical energy and stored in the food made by green plants. When this food is used in our bodies, the chemical energy is changed into muscular energy and heat.

قاسم

A. Read each statement and decide whether it is true or false. Write 'T' before true statements and 'F' before false statements. Base your answers on the information in this passage only, even if you disagree with what the author has said.

- T... 1. Water above a dam has potential energy which is released when the water rushes down the spillway.
- F... 2. We cannot see or feel what energy does.
- F... 3. Heat, light, sound, and electric current are the materials that bring about many changes in matter.
- F... 4. A stretched rubber band has kinetic energy.
- T... 5. The metabolism of food in our bodies results in muscular energy and heat.

B. Circle a, b, c, or d which best completes the following items.

- 1. Paragraph 3 mainly discusses
 - a. how chemical energy is released
 - b. the importance of atomic energy
 - c. chemical energy and atomic energy
 - d. atomic energy stored in matter
- 2. To run a machine, a gasoline engine harnesses energy.
 - a. mechanical energy and changes it into chemical
 - b. chemical energy and changes it into mechanical
 - c. heat energy and changes it into chemical
 - d. mechanical energy and changes it into heat
- 3. The food that we obtain from green plants is the result of the change of energy.
 - a. light energy into heat
 - b. chemical energy into muscular
 - c. light energy into chemical
 - d. chemical energy into heat

The existing factors in chemistry
Plays energy

- Press the button

4. It is **not** true that matter
 a. is anything that occupies space and has weight
 b. is of fundamental importance in the composition of the universe
 c. and energy are the two fundamental factors in the composition of the universe
 d. is the only factor that brings about various changes in the forms of energy
5. It is **not** true that energy
 a. can cause matter to move
 b. can take up space
 c. has different forms
 d. has two main kinds

C. Answer the following questions orally.

- How do you define the two main kinds of energy?
- What is energy? Can you name at least five different forms of energy mentioned in the passage?
- Why does a stone fall to the ground when you lift and release it?
- What is an example of the change of chemical energy into heat energy?
- What is the scientific word for all materials?

Part III: Homework

Section One: Vocabulary Exercises

A. Fill in the blanks with the words from the following table to complete the sentences. Base your choices on the items of the table only. Make necessary changes if required.

Verb	Noun	Adjective	Adverb
exist ^{وجود داشتن}	existence ^{هستی}	existing ^{موجود}	_____
specialize ^{متخصص شدن}	specialist ^{متخصص}	special ^{مخصوص}	_____
mechanize ^{ماشینی کردن}	mechanics ^{مکانیک}	mechanical ^{مکانیکی}	mechanically ^{بصورت مکانیکی}
press ^{مستردارن}	pressure ^{ساز}	_____	_____

- They have invented an instrument for measuring the **pressure** of liquids or gases.
- Some of the **existing** elements can not be found in the pure state in nature.
- If you **press** that button, a bell will ring.

4. We have a good ^{specialist} working with us in our field of study.
5. Farming is ^{mechanize} in order to increase the amount of grains produced.
6. When a man troubled or worried about a problem, he is sometimes unable to concentrate; therefore, he does his work mechanically.
7. Our depends upon the energy we receive from the sun. ^{specialist}
8. Some of the students at the anthropology department will in economic anthropology. ^{mechanical}
9. Her work is entirely; it does not involve imagination or innovation.
10. Most scientists think that water does not exit on the surface of the moon.
11. The science that deals with energy and forces and their effect on bodies ismechanis.
12. Each department in a university has regulations of its own; in other words, each department has regulations. ^{Special}

under Pressure
- The Pressure of water.

B. Fill in the blanks with the appropriate words from the list below. There are more options than required.

- | | | | | | | | |
|-------------|----------------|--------|-------|----------|--------|------------|-------------|
| transformed | تغییر شده دارن | rotary | چرخشی | capacity | ظرفیت | attraction | کشش |
| reaction | واکنش | force | نیروی | thermal | حرارتی | weightless | بوزن |
| potential | پتانسیل | mass | جرم | motion | جنبش | measured | اندازه گیری |

- The downward force exerted by an object is the same as its weight.
- It is known that energy can be ^{transformed} from one system to another.
- In water turbines, the kinetic energy of running or falling water is converted into mechanical rotary motion.
- A nuclear reactor serves to convert nuclear energy into ^{thermomoment} thermal energy.
- The force of attraction exerted by the mass of the earth is called gravity.
- When a force acts upon a rigid body, it is balanced by an equal reaction force acting in the opposite direction.
- Energy is commonly defined as the capacity of a system to do work.
- When a body escapes from gravity, it becomes weightless.

C. Match the words in Column I with their appropriate equivalents in Column II. Insert the letters a, b, c, ... in the parentheses provided. There are more options in Column II than required.

- | Column I | Column II |
|------------------------|--|
| 1. <u>transmit</u> () | a. something invented or adapted for a special purpose |
| 2. <u>rotate</u> () | |

تعريف (3) ()
 3. define ()
 اصول = 4. principle ()
 4. principle ()
 5. device ()
 5. device ()
 6. huge ()
 6. huge ()

- b. make or become larger
- c. very great
- d. pass on or hand on
- e. explain the meaning of
- f. special quality that belongs to something
- g. basic truth; general law of cause and effect
- h. cause to move round a central point
- i. succeed in doing or getting

Section Two: Grammatical Exercises

A. Do the following exercises according to the explanations given in the Pre-Reading Part. Write your sentences in the spaces provided.

1. a. The machine broke with a sound which was frightening.
 b.
2. a. Last night we saw an unidentified object which was flying.
 b.
3. a. High buildings must be strong enough to resist the forces which are damaging.
 b.
4. a. Induction motors operate through the medium of a magnetic field which is moving.
 b.
5. a. Sound waves from an object which is vibrating move in every direction.
 b.
6. a. The needs which were growing for rubber were satisfied after synthetic rubber was produced.
 b.
7. a. The industrial areas which were developing were too far from the rubber plantations.
 b.

B. Do the following exercises according to the explanations given in the Pre-Reading Part. Write your sentences in the spaces provided.

1. a. The plastic which is heated is injected into a mold and so takes its shape.
 b.

2. a. In this area only water which is pumped is available.
b.
3. a. The original book is in English; the one I have is a copy which is translated.
b.
4. a. Those cards which are punched are fed into the machine.
b.
5. a. The clay that is compressed is strong enough to withstand great pressure.
b.
6. a. The latex which has been dried is despatched to other countries.
b.
7. a. The plantations which were established had to be in countries with a hot, humid climate.
b.

C. Do the following exercises according to the explanations given in the Pre-Reading Part. Write your sentences in the spaces provided.

1. a. The exhaust steam is passed over tubes which are filled with cold water.
b.
2. a. The efficiency of an engine is the ratio of the work which is done to the heat which is received.
b.
3. a. The power which is demanded from modern turbines is continually increasing.
b.
4. a. The research which is being carried out on this subject is extensive.
b.
5. a. The torque which is exerted on the crankshaft should be even.
b.
6. a. Generators which are not required for service are stopped.
b.
7. a. Industry could not depend on supplies which were stopped by war or shipping troubles.
b.

D. Do the following exercises according to the explanations given in the Pre-Reading Part. Write your sentences in the spaces provided.

1. a. Coal miners produce millions of tons of coal every week.
b.
2. a. Scientists know that matter is made up of very small particles.
b.
3. a. A skilled operator can carry out many operations on a lathe.
b.
4. a. Mechanical devices harness various forms of energy.
b.
5. a. Scientists call the form of energy stored in the molecules of some materials chemical energy.
b.
6. a. That country does not produce any heavy industrial machinery.
b.
7. a. The operator selected the appropriate gear for the job.
b.

Section Three: Reading Comprehension Exercises

Read the following text carefully and then select a, b, c, or d which best completes the following items.

Power is any amount of energy that can be used to do work. One of the great natural sources of power is water. Water power can be changed into electrical power in the following way.

First, water is stored in a reservoir behind a dam. The water is then channeled in a certain way so that its power turns a fan-shaped wheel called a turbine. The turbine, in turn, runs a dynamo, which is a machine that turns coils of copper wire within a magnetic field. This action causes electric currents to flow in the copper wires. This is the process that makes electricity. Thus, water power helps make electrical power.

1. A dynamo is a machine that
 - a. turns a fan-shaped wheel
 - ✓ b. turns coils of copper wire
 - c. channels water
 - d. runs a turbine
2. Electric currents flow in the copper wires when
 - a. the dynamo turns the turbine
 - ✓ b. the coils of copper wire are turned

B. Determine the Persian equivalents of the following technical terms and write them in the spaces provided.

- anthropology انسان شناسی
- chemical energy انرژی شیمیایی
- compress فشرودن
- crankshaft میل بند
- device وسیله و دستگاه
- dynamo دینامو
- earthquake زلزله
- economic اقتصادی
- efficiency بازده
- generator ژنراتور
- gravity جاذبه زمین
- induction القاء
- kinetic energy انرژی جنبشی
- latex لاتکس
- magnetic field میدان مغناطیسی
- mass جرم

- matter ماده
- mechanize مکانیزه کردن
- nuclear energy انرژی هسته‌ای
- potential energy انرژی پتانسیل
- pressure فشار
- principle اصل
- ratio نسبت
- rest-mass energy انرژی جرم سکون
- rotary چرخشی
- rotate چرخیدن
- sound waves امواج صوتی
- thermal حرارتی
- torque گشتاور
- transmit انتقال یا پخش کردن
- turbine توربین
- vibrate لرزیدن

Lesson 3

Nuclear Energy

Part I: Pre-Reading

A. Pronunciation Practice

nu.cle.ar (nōō' klē-ər)

re.al.ize (rē 'ə-līz)

fur.nace (fūr'nīs) → موقد

gen.er.a.tor (jēn' ə-rātər)

ma.chin.er.y (mə-shē'nə-rē)

cal.cu.late (kāl' kyə-lāt)

buck.et (bŭk' ĩt)

Eu.ro.pe (yōōr' ə-p)

the.o.ry (thē 'ə-rē)

math.e.mat.i.cal (măthə-măt'ĭ-kəl)

cal.cu.la.tion (kāl' kyə-lā 'shən)

prac.ti.cal (prăk' tĭ-kəl)

ap.pli.ca.tion (ăp' lĭ-kā 'shən)

de.clare (dĭ-klār')

e.nor.mous (ĭ-nôr' məs)

sup.port (sə-pôrt')

e.qua.tion (ĭ-kwā 'zhən)

mul.ti.ply (mŭl' tə-plĭ)

square (skwâr)

ounce (ouns)

Ein.stein (ĭn' -stĭn)

B. Word Study: Definitions

nuclear: coming from or having to do with the nucleus of an atom

nuclear energy: energy that can be released from the nucleus of an atom

furnace: ^{موقد} an enclosed structure in which heat is produced

generator: machine by which mechanical energy is changed into electrical energy

machinery: ^{مشین، ماشین، قطار} machines or parts of machines

bucket: ^{سطل} container used for carrying water; pail

mass: quantity of matter in a body

equation: statement in mathematics indicating the equality between two expressions

multiply: ^{بضرب کردن} add a number to itself a certain number of times

square: ^{مربع} multiply a number by itself

C. Word Study: Definitions and Exemplifications

wasteful: causing waste; using more than needed

People should try not to be *wasteful* of their natural resources.

compound:

made up of two or more parts
Bronze is a *compound* of copper and tin.

convert:

change something into something different
Certain elements can be *converted* into energy by splitting up their atoms.

generate:

produce
A hydroelectric power station *generates* electricity by converting power in one form into power in another form.

calculate:

find out by working with numbers
Scientists *calculated* the sun to be about 93,000,000 miles away from the earth.

application:

the act of putting something to use
The *application* of scientific knowledge made it possible for man to walk on the moon.

declare:

announce; proclaim; make something known
The meeting was *declared* cancelled.

enormous:

much greater than the usual size or amount; very large
The flood caused an *enormous* amount of damage.

work out:

devise; plan
A committee has been appointed to *work out* a new policy for the college.

D. Grammatical Point

Notice the following model of conditional sentences.

- Model: a. If one pound of any element were completely converted into energy, it would release the same amount of heat as the burning of 1,500,000 tons of coal.
- b. One pound of any element, if completely converted into energy, would release the same amount of heat as the burning of 1,500,000 tons of coal.

Part II: Reading for Comprehension

Nuclear Energy

The burning of coal is very wasteful of energy. This can be realized when we

amount it
application ← apply = use
equal

(remember that one pound of coal burned in the furnace of a power station will raise enough steam to drive a generator that will produce enough current to light a one-bar electric fire for three hours.) On the other hand, if all the energy in the atoms of a pound of coal could be released, there should be enough energy to drive all the machinery in all the factories in Britain for a month.

In simple words, all this means that one pound of any element or compound of elements, if completely converted into energy by breaking up the atoms, would release the same amount of heat as the burning of 1,500,000 tons of coal. (Scientists have calculated that if a bucket of sand from the beach could be completely converted into energy, and if the energy so obtained was used to drive electric generators, enough current would be produced to supply the whole of Europe for five years.) In other words, a bucket of sand contains enough energy to generate a thousand million pounds worth of electricity.)

Albert Einstein was the first man to realize the vast amount of energy locked in the atom. Einstein was also the first to show in theory how the energy of the atom might be released. Indeed without Einstein's theory, which was the result of many complicated mathematical calculations, there would never have been any practical application of nuclear power.

In 1905, which was many years before other scientists really understood a great deal about atomic energy, Einstein declared that if a given mass of matter was 'destroyed', an enormous amount of energy would be obtained. To support this theory, Einstein worked out what is probably the most important equation in the history of mathematics. However, (it was by no means a complicated equation.) Here it is: $E=MC^2$. Turned into simple language, Einstein's equation means that energy (E) is equal to mass (M) multiplied by the speed of light (C) squared (C^2). This means that if all the energy in, for example, one gram of an element could be released, it would present an enormous value of power.

A. Read each statement and decide whether it is true or false. Write 'T' before true statements and 'F' before false statements.

..F... 1. The author recommends us to use coal as a source of energy.

..T... 2. The nuclear energy of a bucket of sand, if released and used to drive electric generators, would produce the electricity needs of Europe for five years.

..F... 3. Einstein was the first to release the energy of the atom.

..T... 4. One pound of coal, if burned in the furnace of a power station, will

7. All the examples and explanations given in the passage mainly support the idea that
- all the energy in the atoms of a pound of coal could be released
 - without Einstein's theory, there would never have been any practical application of nuclear power
 - by breaking up the atoms of any element a lot of energy is obtained
 - nuclear energy is more economical than the energy obtained from the coal

C. Answer the following questions orally.

- How do we realize that burning of coal is very wasteful of energy?
- What does Einstein's equation in simple language mean?
- What did Einstein declare in 1905?
- If a pound of coal is burned, how much energy will be released?
- How do you describe nuclear energy in your simple words?

Part III: Homework

Section One: Vocabulary Exercises

*A. Fill in the blanks with the words from the following table to complete the sentences. Base your choices on the items of the table only. Make necessary changes if required.

Verb	Noun	Adjective	Adverb
calculate <small>حساب کردن</small>	calculation <small>محاسبه</small>	calculating <small>حسابگر</small>	_____
energize <small>انرژی دارن</small>	energy <small>انرژی</small>	energetic <small>فعال</small>	energetically <small>فعالانه</small>
convert <small>تبدیل کردن</small>	conversion <small>تبدیل</small>	convertible <small>تبدیل پذیر</small>	_____
complete <small>کامل کردن</small>	completion <small>کامل</small>	complete <small>کامل</small>	completely <small>کاملاً</small>

- The article was revised before being published.
- The generators at the dam mechanical energy into electrical energy.
- I have never seen such an old man. He is very dynamic and full of energy.
- The success of the experiment was the result of careful
- The engineers will the design of the new bridge soon.

Convertible

6. Wood is into paper.

× 7. Electricity machines to operate.

× 8. machines are widely used today.

comple

9. Upon of his university studies, he will do his military service.

✓ 11. Vaporization is the of water into vapor.

12. The engineers the cost of the project and let the contractors know about it.

* 13. There has been a change in the government policy toward this important issue.

14. Steam engines change heat into mechanical energy.

* B. Fill in the blanks with the appropriate words from the list below. There are more options than required.

در بعضی چیزها قرار دارد

- | | | | | | |
|------------|------------|--------------|---------|----------|---------------|
| Huge | enormous | بزرگ | carbon | turbines | exposing |
| | magnetic | مغناطیسی | oxide | convert | nuclear |
| | exchangers | مبادله کننده | reactor | generate | propulsion |
| industries | | صنایع | split | fission | تجزیه هسته ای |

nuclear

1. The operating life of a reactor cannot be estimated with certainty.

* 2. Plutonium is the element produced by exposing uranium 238 to neutrons.

3. Some thermal power stations burn coal to water into steam for driving turbines.

* 4. Certain countries a vast amount of electricity from their nuclear power stations.

5. A is a machine in which uranium or plutonium atoms are split in a controlled way.

6. Turbo-generators are electric generators turned by turbines.

7. Graphite is a form of used as a moderator in some nuclear reactors.

8. An industrial complex is a group of established with close interconnections.

9. An advanced gas-cooled reactor uses uranium as its fuel.

10. The present literature on nuclear properties is and is now expanding at a rapid rate.

تیز

enormous

C. Match the words in Column I with their appropriate equivalents in

Column II. Insert the letters a, b, c, ... in the parentheses provided. There are more options in Column II than required.

Column I

1. nuclear power (f)
2. grid (h)
3. load factor (g)
4. overall utilization (i)
5. radio-active bombardment (b)
6. echo (c)
7. fast reactor (e)
8. discharge (l)

Column II

- a. electricity generated by nuclear power
- b. subjection to a stream of high-speed particles resulting from atomic fission
- c. repetition of a sound caused by the reflection of sound waves
- d. oxygen carried by the rocket to burn the fuel
- e. reactor in which neutrons do not slow down; it can produce more fuel than it uses up
- f. power obtained from heat produced by nuclear reactions such as fission
- g. atomic power stations
- h. electricity supply network
- i. general exploitation
- j. maximum possible yearly use of power made by an electricity-generating plant
- k. material acting as a cooler
- l. take out the contents of liquid, gas, electric current, etc.

کتابخانه ملی ایران
کتابخانه مرکزی
کتابخانه تخصصی

در معرض (در دسترس)

در معرض (انرژی)

میان ابرها کشیده

سخت‌ترین

استفاده

مقدار ممکن توان

محتویات

Section Two: Grammatical Exercises

A. Do the following exercises according to the explanations given in the Pre-Reading Part. Write your sentences in the spaces provided.

1. a. If these waste chemicals were allowed to enter the river, they would poison it.
b.
2. a. If the spare parts of this car were made in Iran, they would not cost so much.
b.
3. a. If the director were supported by the employees, he would feel sure about his future.
b.
4. a. If the part were examined, it would probably be found to be faulty.
b.
5. a. If the voltage were doubled, it would produce the required current.
b.

Section Three: Reading Comprehension Exercises

Read the following text carefully and then select a, b, c, or d which best completes the following items.

Scientists who helped develop the atom bomb are searching for ways to make atomic energy a blessing to the world. When atoms are splitting, hundreds of other atom-splitting substances called radioisotopes are produced. Doctors find some of these useful in studying what goes on in the body. After a small amount has been swallowed in a pill, doctors can tell by means of a delicate instrument just where the substance goes in the body. Also, doctors expect that some of the substances will cure diseases. Perhaps your life will be saved by one of the radioisotopes.

Also, scientists are trying to 'turn the wheels' in factories, run trains, and drive ships with atomic engines. If they succeed, men will no longer need to strive so hard to dig coal or pump oil from the earth for these purposes, for the energy in all the coal and oil in the world is as nothing compared with the energy in atoms.

1. The text says, your life may be saved by

- a. scientists
- b. doctors
- c. radioisotopes
- d. pills

2. Physicians expect radioisotopes to help them in

- a. giving pills
- b. curing diseases
- c. making people grow
- d. making patients stronger

3. The scientists are trying to develop engines.

- a. steam
- b. gasoline
- c. electric
- d. atomic

4. If the new engine succeeds, the activities concerning may be largely changed.

- a. mining
- b. building
- c. sailing
- d. farming

5. Whether or not great power becomes a blessing depends upon its

- a. size
- b. use
- c. energy
- d. strength

6. According to the text, may especially profit by the use of some of the atom-splitting substances.

- a. chemistry
- b. nursing
- c. teaching
- d. medicine

energize انرژی دارن
exchanger مبدل
fast reactor واکنش تند و سریع
fission شکافت
furnace کوره
gas-cooled device وسیله خنک کننده با گاز
generator مولد
graphite core هسته گرافیتی
grid شبکه
industrial complex مجتمع صنعتی
load factor عامل بار
moderator تعدیل کننده
nuclear هسته ای
nuclear electricity برق هسته ای
nuclear reactor رآکتور هسته ای
power station نیروگاه
pressure vessel ظرف فشار
propulsion پیشروی
radioisotopes رادیوایزوتوپ
split شکافت
turbine توربین
turbo generator مولد توربینی
utilization بهره برداری
vertical channel کانال عمودی

energize انرژی دارن
exchanger مبدل
fast reactor واکنش تند و سریع
fission شکافت
furnace کوره
gas-cooled device وسیله خنک کننده با گاز
generator مولد
graphite core هسته گرافیتی
grid شبکه
industrial complex مجتمع صنعتی
load factor عامل بار
moderator تعدیل کننده
nuclear هسته ای
nuclear electricity برق هسته ای
nuclear reactor رآکتور هسته ای
power station نیروگاه
pressure vessel ظرف فشار
propulsion پیشروی
radioisotopes رادیوایزوتوپ
split شکافت
turbine توربین
turbo generator مولد توربینی
utilization بهره برداری
vertical channel کانال عمودی

Lesson 4

What Is Electricity?

Part I: Pre-Reading

A. Pronunciation Practice

an.cient (ān' shənt)	ef.fect (ī-fĕkt')
meant (mĕnt)	gen.er.ate (jĕn' ə-rāt)
re.la.tion.ship (rī-lā 'shən-shĭp)	dy.na.mo (dī 'nə-mō)
light.ning (līt' nĭng)	volt.age (vōl' tĭj)
ap.pre.ci.ate (ə-prĕ 'shĕ-āt)	re.sis.tance (rī-zĭs' təns)
rheu.ma.tism (rĕō' mə-tĭzəm)	con.se.quent.ly (kŏn' sĭ-kwĕntlĕ)
fos.sil (fŏs' əl)	com.pare (kəm-pār')
res.in (rĕz' ĭn)	con.sid.er (kən-sĭd' ər)
de.rive (dĭ-rĭv')	vol.ume (vōl' yōōm)
mag.ne.sia (măg-nĕ 'zhə)	cer.tain (sŭrt' n)
at.trac.tion (ə-trăk' shən)	am.pere (ăm' pĭr)
re.pul.sion (rĭ-pŭl' shən)	po.ten.ti.al (pə-tĕn' shĕ-əl)
mag.net.ic (măg-nĕt' ĭk)	ohm (ōm)
in.vis.i.ble (ĭn-vĭz' ə-bəl)	e.lec.tric (ĭ-lĕk' trĭk)
hy.dro.e.lec.tric' i.ty (hĭdrō-ĭ-lĕk- trĭsĭ-tĕ)	

B. Word Study: Definitions

- 1 magnet: مغناطيس piece of iron or steel able to attract iron
- 2 magnetic: مغناطيسي relating to a magnet or to magnetism
- 3 magnetism: علم المغناطيسية science of magnetic phenomena and properties
- 4 lightning: برق flash of bright light produced by natural electricity in the sky
- 5 resin: مادة لاصقة sticky substance that flows out from most plants when cut
- 6 property: خاصية special quality that belongs to something
- 7 charge: شحنة كهربائية quantity of unbalanced electricity in a body
- 8 charge: شحن fill; give an electric charge to

- 9 electrify: ^{بشارت کردن} charge something with electricity
- 10 attract: ^{جذب کردن} pull towards
- 11 repel: ^{دفع کردن} drive back or away
- 12 dynamo: ^{دینام} electromagnetic machine which converts mechanical energy into a.c. or d.c. electrical supply
- 13 volume: ^{حجم} space occupied by a substance
- 14 resistance: ^{مقاومت} power of standing against the force of something

C. Word Study: Definitions and Exemplifications

- 15 appreciate: ^{قدردانی} understand
They did not *appreciate* how lightning was caused.
- 16 eel: ^{مارماهی} snake-like fish
An *eel* can often give a powerful electric shock.
- 17 subject: ^{تذریه کار} cause a thing or a person to experience something
The fuse wire burnt out because it was *subjected* to a high voltage. ^{تذریه کار}
- 18 rheumatism: ^{بیماری درناک} painful disease with inflation of the muscles and joints
The physician diagnosed the disease as *rheumatism*.
- 19 derive: ^{استخراج کردن} get from a source
Thousands of English words are *derived* from Latin.
- 20 rub: ^{مالشیدن} move one thing backwards and forwards on the surface of another
The little boy was *rubbing* his hands together to make them warm.
- 21 mineral: ^{معده} substance got from the earth by mining
Coal and oil are examples of *minerals*.
- 22 invisible: ^{نا دیده} that cannot be seen
Millions of stars are *invisible* to the human eye.
- 23 effect: result; outcome
The *effect* of heat upon metals is quite noticeable.
- 24 consequently: therefore
The fossil resin called 'elektron' got electrified when rubbed; *consequently*, the force it acquired came to be known as electricity.

D. Grammatical Points

Some verbs can take wh-clauses as their objects.

1. Model: a. They saw lightning.

The lightning was caused by natural electricity in the sky.
(appreciate)

b. They saw lightning, but did not appreciate how it was caused.

With reference to the grammatical point explained in Lesson 2, notice the following Model sentences.

2. Model: a. They also knew that a mineral which had a dark color had the properties of attraction and repulsion.

b. They also knew that a dark-colored mineral had the properties of attraction and repulsion.

Part II: Reading for Comprehension

What Is Electricity?

To the ^٥ancients, electricity meant many things. (They had no idea that there was any relationship between electricity and ^٣magnetism.) They saw lightning, ^٤but did not appreciate how it was caused. They knew that a certain fish called an 'electric eel' could give a powerful electric shock; indeed, ^٢Roman emperors were subjected to this as a cure for rheumatism. (The Greeks knew that the fossil ^٥resin called elektron, from which our word 'electricity' was derived, became ^٥electrified when rubbed.) They also knew that a ^٥dark-colored mineral found at ^٢Magnesia had the ^٥properties of attraction and ^٥repulsion which we now call magnetic.) ^٤

However, all this was some time ago, and we now believe that we have an answer to the question "What is electricity?" Electricity is an invisible force that can produce heat, light, motion, and many other physical effects. The force is an ^٣attraction or repulsion between electric ^٣charges. (Electricity is generated at large power stations by big machines known as generators.) They are, in fact, large ^٢dynamos driven by powerful engines which derive their power from water or steam. (The electricity which derives its power from water is known as hydroelectricity.) ^٤

Electricity can also be explained in terms of current, voltage, and resistance. ^٤The flow of electricity, the electric current, along a wire may be compared to the flow of water along a pipe. If you consider water flowing along a pipe, the ^٥volume of water passing a certain point in a given time is similar to the electric current. Electric current is measured in amperes. The pressure of the water in the pipe may be compared to the electric potential. Potential is

measured in volts. The resistance of the walls of the pipe to the water current may be compared to the resistance of the wire to the electric current, i.e. a narrow pipe offers more resistance than a wide pipe, and, similarly, a thin wire offers more resistance than a thick wire of the same metal. Resistance is measured in ohms.

A. Read each statement and decide whether it is true or false. Write 'T' before true statements and 'F' before false statements.

-T..... 1. Electricity is the force generated by big machines.
.....F..... 2. The word 'elektron' is derived from the word 'electricity'.
.....T..... 3. Hydroelectricity is the production of electricity by water power.
.....T..... 4. The attraction and repulsion characteristics of a mineral called magnetic properties.
.....F..... 5. The ancients had no ideas at all about electricity.

B. Circle a, b, c, or d which best completes the following items.

1. Generators transform
a. chemical energy into mechanical energy
b. electrical energy into mechanical energy
c. chemical energy into electrical energy
✓ d. mechanical energy into electrical energy
2. It is not true that
a. Roman emperors very often experienced the electric shock given by an eel to cure rheumatism
b. electric potential is the same as the pressure of water in a pipe
c. a thin wire offers more resistance than a thick wire of the same metal
✓ d. Roman emperors were unaware of electricity and its effect on rheumatism.
3. In line 10, 'this' refers to
a. a dark-colored mineral found at Magnesia
b. the electron being electrified when rubbed
✓ c. the fact that ancient people did not know much about electricity
d. properties of attraction and repulsion
4. In paragraph 3, the writer does not compare
a. flow of water and flow of electricity
b. resistance of the walls of a pipe to water and resistance of a wire to electric current
✓ c. volume of pipes and volume of wires

- d. pressure of water and electric potential
5. The contrast in paragraphs 1 and 2 is between
- the relationship between lightning and magnetism on the one hand and electricity on the other
 - the past and present knowledge of electricity
 - electricity produced by nature and electricity generated by machines
 - static electricity and hydroelectric current

C. Answer the following questions orally.

- What is electricity?
- What do we call the force which is the result of attraction or repulsion between electric charges?
- What important quantities are involved in the description of electricity?
- How does water power lead to electricity?
- What is the relationship between electricity and magnetism?
- How is hydroelectricity defined?
- How do you explain electric current, electric potential, and electric resistance?

Part III: Homework

Section One: Vocabulary Exercises

A. Fill in the blanks with the words from the following table to complete the sentences. Base your choices on the items of the table only. Make necessary changes if required.

Verb	Noun	Adjective	Adverb
electrify	electricity	electric	electrically
magnetize	magnet	magnetic	magnetically
produce	production	productive	productively
measure	measurement	measurable	measurably

- In some countries, agricultural *Production* has been mechanized.
- The standard unit of mass is the kilogram; however we *measure* very small masses in grams. *electric*
- electric* currents cannot flow easily in all substances.
- Iran *Produces* a large quantity of oil every day.

5. Copper allows ^{electricity} to flow easily through it.
6. Of all the metals, iron, cobalt, and nickel have the greatest ^{magnetic} properties.
7. A ^{magnet} produces a magnetic field in the space around it.
8. In physics, the researchers came within ^{measurable} distance of success.
9. If we ^{magnetize} an iron bar, the quality of attracting pieces of iron will be found at two regions at the ends of the bar.
10. Accurate ^{measurement} is essential for making good quality machines and parts.
11. The ^{productive} lands of Iran are mostly located in the Northern part of the country.
12. Scientists are experimenting on cars that run ^{electrically}.

B. Fill in the blanks with the appropriate words from the list below. There are more options than required.

- | | | | |
|--------|----------|------------|------------|
| field | current | properties | electrical |
| repel | element | electrons | resistance |
| magnet | positive | potential | attraction |

1. Unlike poles attract whereas like poles ^{repel} one another.
2. If there is a potential difference between the ends of a conductor, a ^{current} will flow along it.
3. The magnetic ^{field} increases with an increase in the current.
4. Resistors are devices whereby ^{resistance} is interposed in a circuit.
5. Generally speaking, mixtures of metals containing a magnetic substance have magnetic ^{properties}.
6. The magnetic force of ^{attraction} is concentrated near the ends of the magnet.
7. Generators are machines used for the large-scale production of ^{electrical} energy.
8. A substance which is attracted by a magnet can itself be made into a ^{magnet}.

C. Match the words in Column I with their appropriate equivalents in Column II. Insert the letters a, b, c, ... in the parentheses provided. There are more options in Column II than required.

- | | |
|---------------------|---|
| Column I | Column II |
| 1. electromagnetism | a. work got out of a machine divided by the work put in |
| 2. efficiency | b. cause to exist or occur; produce |
| 3. magnetization | c. multiplying by two |
| 4. loop | |

- | | | |
|--------------|-----|--|
| 5. electrify | (f) | d. science of the properties and relations |
| 6. generate | (b) | between magnetism and electric currents |
| 7. kinetic | (h) | e. process of turning a piece of magnetic material into a magnet |
| | | f. charge something with electricity |
| | | g. made into liquid by heat |
| | | h. due to motion; moving |
| | | i. of magnets |
| | | j. simple closed connection; part of a circuit |

Section Two: Grammatical Exercises

A. Do the following exercises according to the explanations given in the Pre-Reading Part. Write your sentences in the spaces provided.

1. a. He bought the watch.
The watch was made **in Switzerland**. (know)
b.
2. a. She heard the noise.
The noise was made **by a tractor**. (realize)
b.
3. a. We felt very cold.
The cold came in from **the open window upstairs**. (find out)
b.
4. a. The workers welcomed the raise in salary.
The raise was decided upon **because the workers had worked hard**.
(know)
b.
5. a. Early men discovered fire.
Fire was produced by **lightning**. (appreciate)
b.
6. a. The poor woman received some money every month.
Her neighbors sent it. (discover)
b.

B. Do the following exercises according to the explanations given in the Pre-Reading Part. Write your sentences in the spaces provided.

1. a. One of the largest hospitals of the city was built by a man who had a good heart.
b.

lightning
thunder

Collaboration
make a mistake.

2. a. The policeman easily caught the thief who had red hair.
b.
3. a. The soldier was shot by an enemy with a hard heart.
b.
4. a. On my way to college, I usually see an old man with long hair.
b.
5. a. I borrowed the money from a woman who had a bad temper.
b.
6. a. Mr Hosseini visited a doctor who had a good temper.
b.

Section Three: Reading Comprehension Exercises

Read the following text carefully and then select a, b, c, or d which best completes the following items.

One hundred times a second lightning strikes somewhere on the earth. It is a great killer which causes a lot of damage. Hundreds of deaths are caused by lightning each year, and most of the forest fires are set off by lightning. Therefore, scientists are very interested in controlling lightning.

In ancient times, people thought that lightning was fire thrown from heaven to earth by the angry gods. Modern scientists, however, know that thunder clouds, like all clouds, are filled with ions—atoms with either too many or too few electrons. The scientists cannot understand why the ions separate in the clouds, but the positive ions move to the top of the cloud, and the negative ions move to the bottom. The negative ions in the bottom of the cloud repel, or push against, the negative ions in the earth below. But they attract the positive ions in the ground. The amount of electrical force between the cloud and the earth becomes great. A lot of ionized particles then suddenly break away toward the ground to combine the cloud's negative ions and the earth's positive ones.

Scientists are trying to control this lightning. They drop a lot of tiny pieces of aluminum-covered glass into the cloud. These tiny pieces of glass act like magnets and build fields of magnetic force within the cloud. This lets the electrons in the cloud move from top to bottom. The electric force is lessened and lightning is prevented.

1. After the ions separate in the clouds,
✓ a. the negative ions move down

مستند

- b. the negative ions in the earth push against the top of the cloud
 - c. the positive ions move down
 - d. the positive ions in the cloud repel the negative ions in the earth
2. In line 11, 'they' refers to
- a. the negative ions in the ground
 - b. the positive ions in the cloud
 - c. the negative ions in the cloud
 - d. the positive ions in the ground
3. It is not true that lightning
- a. is responsible for many deaths
 - b. starts many forest fires
 - c. strikes everywhere on earth simultaneously
 - d. causes a lot of damage
4. In line 18, 'This' refers to
- a. tiny pieces of glass
 - b. lightning caused by thunderstorms
 - c. the dropping of aluminum-covered glass
 - d. the formation of magnetic fields within the cloud
5. It is not true that
- a. in the past people thought that gods caused lightning
 - b. all clouds have ions in them
 - c. scientists can explain why ions separate in the clouds
 - d. people of the past believed that lightning was fire thrown from heaven to earth

15:37

سری
3

15:58

16:22

Section Four: Translation Practice and Terminology Equivalents

A. Translate the following passage into Persian.

When a plastic ruler has been rubbed against wool, it will attract small pieces of paper. To explain why this takes place, we must refer to our knowledge of the electrical balance of the atom. As we know, electrons orbit the nucleus, just as planets orbit the sun. But there is a difference: the latter maintain their orbits by gravitational attraction, whereas the former maintain their orbits by electrical attraction since unlike charges attract each other, thus making the whole atom electrically neutral. But if electrons are removed from, or added to, an atom, it will then carry an electric charge, and such charged atoms are known as ions. The simplest method of achieving this is by friction. Electrons are dislodged from the atoms of the plastic ruler, leaving them with too few, and thus carrying a positive charge. Electrons are added to the atoms of the

wool, thus giving them a negative charge. In this way an electric charge has been obtained. An electric charge thus produced is known as static electricity.

B. Determine the Persian equivalents of the following technical terms and write them in the spaces provided,

- agriculture کشاورزی
- alloy آلیاژ
- attract جذب کردن
- conduct هدایت کردن
- conductor رسانا
- electrify برق دار کردن
- friction اصطکاک
- generate تولید کردن
- ion یون
- ionize یونیزه کردن
- lightning آذرخش
- loop حلقه
- magnet آهنربا

- magnetism مغناطیسیت
- magnetize آهنربا کردن
- multiply ضرب کردن
- nucleus هسته
- orbit مدار
- potential difference اختلاف پتانسیل
- property خاصیت
- repel دفع کردن
- resistance مقاومت
- resistor مقاومتگر
- static electricity الکتریسیته ساکن
- thunder رعد
- volume حجم

The Electronic computer

Part I: Pre-Reading

A. Pronunciation Practice

ul.ti.mate (ül' tə-mít)	tun.nel (tŭn' əl)
ter.ri.fic (tə-ríf' ík)	flash (flásh)
sat.el.lite (săt' l-ít)	com.pli.cat.ed (kóm' plí-kătíd)
height (hīt)	op.ti.mize (öp' tə -míz)
a.ston.ish (ə-stŏn' ísh)	de.sign (dí-zín')
ra.di.a.tion (rādē-ā' shən)	spec.i.fi.ca.tion (spēs ə-fí-kā' shən)
de.tect (dí-těkt')	com.pose (kəm-pōz')
me.te.or.ite (mē' tē-ə-rīt)	pre.dict (prí-díkt')
or.gan.ize (ôr' gə-níz)	ad.van.tage (äd-ván' tǐj)
com.pu.ta.tion (kŏmpyŏŏ-tā' shən)	a.vi.a.tion (āvē-ā' shən)
sub.tract (səb-trăkt')	pi.lot (pī lət)
dig.it (díj' ít)	med.i.cine (méd' í-sín)
av.er.age (áv' ər-íj)	an.a.lyze (ăn' ə-líz)
in.struc.tion (ín-strŭk' shən)	di.ag.nose (dí' əg-nŏs)
de.vise (dí-víz')	dis.ease (dí-zēz')
tech.ni.cian (těk-nísh' ən)	med.i.ca.tion (méd ə-kā' shən)
gath.er (găth' ər)	tis.sue (tísh' ŏŏ)
pour (pôr)	or.gan (ôr' gən)
ef.fi.cient (í-físh' ənt)	pre.scribe (prí-skrīb')

B. Word Study: Definitions

↳ satellite:	planet moving round another; artificial object put in orbit round the earth
≈ radiation:	sending out energy in rays
§ meteorite: سین الماسی	fallen meteor
↳ digit: رقم	any number from 0 to 9
↳ instructions:	coded commands; directions orders; or explanations

aviation:
medication:
transplant:

طيران
دوا
کاشت

art and science of flying in aircraft
medicine
transfer tissue or an organ from one body to another

C. Word Study: Definitions and Exemplifications

10 compute: حساب کردن calculate

The engineer *computed* the horse power of the engine.

9 terrific: فوق العاده causing fear; terrible

He always drives at a *terrific* speed.

10 roar: سر و صدا loud continuous sound

The jet plane took off with a *terrific roar*.

11 transmit: فرستادن send out

Light waves do not need a medium for their transmission; they can be *transmitted* through empty space.

12 detect: کشف کردن discover the existence of something

Error handling is part of a computer program that *detects* and corrects the errors of the program.

13 subtract: کم کردن take a number away from another number

Two *subtracted* from eight is six.

14 multiply: ضرب کردن add a number a given number of times

Three *multiplied* by four is twelve.

15 lightning speed: بسیار سریع very fast

A computer gathers and processes information with *lightning speed*.

16 accuracy: دقت correctness

High standards of *accuracy* are necessary for a student if he wishes to do his work well.

17 devise: ابداع think out; plan

There are manufacturing plants *devised* to operate by robots.

18 gather: جمع کردن collect; bring together; obtain gradually

The journalists *gather* information from various sources.

19 store: ذخیره keep for future use

Some people *store* vegetables for winter use.

20 pour out: بریزن give out; produce; send out

A computer can *pour out* the stored data whenever needed.

- 21 flash out: ارسال سریع
send out instantly
A computer can *flash out* the information stored in memory in an instant.
- 22 complicated:
difficult to analyze, understand, or explain
The mechanism of the brain is very *complicated*, but unlike a computer, it is not mechanical.
- 23 stand for:
represent; be a symbol for
In mathematics, the letter X *stands for* the first unknown quantity.
- 24 optimize: بچشم رسانیدن
make as perfect as possible
The aim of every factory is to *optimize* its production.
- 25 pick out: جدا کردن
choose
Efficient file systems ensure that the required files be easily *picked out* whenever needed.
- 26 specifications: مشخصات
details for a design
The systems analyst gives *specifications* for the data processing problems to the programmer.
- 27 compose: درین کردن
put musical notes together
The musician *composed* an opera.
- 28 analyze: آنالیز
examine something in order to learn what it is made up of
An engineer *analyzes* an ore to find out whether it contains impurities.
- 29 tissue: بافت
mass of cells
Some plants can acquire and store water in their *tissues*.
- 30 organ: عضو
any part of body with a vital function
The *organ* which chiefly distinguishes human beings from other animals is brain.
- 31 advantage: سودمند
something useful or helpful; something likely to bring success in competition with another or others
Minicomputers have the *advantage* of being cheaper as well as portable.
- 32 diagnose: تشخیص دادن
identify or discover a disease through examination or analysis
Sometimes it is more difficult to *diagnose* a disease than to treat it.
- 33 prescribe: تجویز کردن
advise the use of
The doctor *prescribed* some medicine for him.

D. Grammatical Points

Appositives are words or phrases that are used to explain or to describe other nouns. Appositives and the nouns explained are identical in reference.

1. Model: a. The electronic computer has been in use only since 1946.
It is the marvel of the machine age.

b. The electronic computer, the marvel of the machine age, has been in use only since 1946.

'as-----as' is a common conjunction used in both equal and unequal comparisons of two units.

2. Model: (equal comparison)

a. Minicomputers are efficient.

Microcomputers are efficient, too.

b. Minicomputers are as efficient as microcomputers.

: (unequal comparison)

a. A team of engineers worked for a year to produce only three designs, none of which was efficient.

The computer's design was efficient.

b. A team of engineers worked for a year to produce only three designs none of which was as efficient as the computer's.

Part II: Reading for Comprehension

The Electronic Computer

With a terrific roar from its rocket engine, the satellite is sent up into the sky. Minutes later, at a height of 300 miles, this tiny electronic moon begins to go round the earth. Its radio begins to transmit an astonishing amount of information about the satellite's path, the amount of radiation it detects, and the presence of meteorites. Information of all kinds races back to the earth. No human being could possibly copy down, remember, or organize all these facts, but an electronic computer can.

The electronic computer has been in use only since 1946. It can do simple computations—add, subtract, multiply, and divide—with lightning speed and perfect accuracy. It can multiply two 10-digit numbers in 1/1,000 second, a problem that would take an average person five minutes to do with pencil and paper. Some computers can work 500,000 times faster than any person can.

Once it is given a 'program', that is, a carefully worked-out set of instructions devised by a technician trained in computer language, a computer

- Computers can gather the information.

- not only can she play tennis, but also she can dance well.

can gather a wide range of information for many purposes.

Not only can the computer gather facts, it can also store them as fast as they are gathered and can pour them out whenever they are needed. The computer is really a high-powered 'memory' machine that 'has all the answers' or almost all. For example, the computer can tell us the most efficient speed for driving a car through a certain tunnel, or the kind of weather we will have tomorrow. The computer will flash out the answers in less than a second.

²⁰ Besides gathering and storing information, the computer can also solve complicated problems that once took months for people to do. For example, within sixteen hours an electronic brain named CHEOPS (which stands for Chemical Engineering Optimization System) solved a difficult design problem. First, it was given all the information necessary for designing a chemical plant. After running through 16,000 possible designs, it ²⁵ picked out the plan for the plant that would produce the greatest amount of the chemicals at the lowest cost. Then it gave out a printed set of exact ²⁶ specifications. Before CHEOPS solved this problem, a team of engineers having the same information had worked for a year to produce only three designs, none of which was as efficient as the computer's.

At times computers seem ²¹ almost human. They can 'read' handprinted letters, play chess, ²² compose music, write plays, and even design other computers. Is it any wonder that they are sometimes called 'thinking machines?' ²³ *حقیقی جسم صیابی تعجب ندارد*

Although computers cannot predict the future, their ²⁴ advantages are becoming more obvious every day. ²⁵ *سفر صیابی*

a. Computers are being used in space travel. Rockets, satellites, and ²⁶ *هوا فضا* spaceships are guided by computers.

b. Computers are being used in ²⁷ aviation. They are used in the training of airline pilots. Computers also direct the flight of planes from one city to another, control their air speeds and the heights at which they fly, and even land them.

c. Computers are being used in medicine. They are used in ²⁸ analyzing blood samples, in ²⁹ diagnosing diseases, and in ³⁰ prescribing medication. They also keep records of the tissue types of patients waiting for organ ³¹ transplants.

A. Read each statement and decide whether it is true or false. Write 'T' before true statements and 'F' before false statements.

..... 1. A program is a number of coded commands, directions, and explanations devised by a computer.

- 2. An electronic computer cannot perform all the activities done by human beings.
- 3. We have been using the electronic computer since when we learned to do simple computations, like adding and dividing.
- 4. Only a computer is capable of keeping track of the huge amount of information sent to the earth by the rocket's radio in a short period of time.
- 5. The computer has the ability to store the information and flash it out when needed.
- 6. At an altitude of 300 miles, the rocket's radio with a terrific roar transmits a great amount of information to the earth.

B. Circle a, b, c, or d which best completes the following items.

1. A computer will not be able to gather information, compose music, and do all sorts of other activities unless it
- a. is informed by a trained technician c. acts like a human being
b. has a high powered memory d. is programed
2. The main difference between paragraphs 3 and 5 is that
- a. the third paragraph talks about business and industry, but the fifth one talks about CHEOPS
- b. each of the paragraphs discusses the importance of the computer in chemical plants in different ways
- ✓ c. the third paragraph discusses the gathering of information, but the fifth one talks about solving complicated problems through computers
- d. the third paragraph discusses the physical ability of the computer, but the fifth one talks about the inefficiency of the mental power of human beings
3. In paragraph 6, it is implied that
عبر مستقيم ، تلويحاً
- ✓ a. computers must be called thinking machines
- ✓ b. the computer can perform some complicated mental activities
- c. human beings are not as intelligent as computers
- d. a person's mental power is similar to the computer's in all respects
4. The writer of the passage mainly believes that
- a. we have been able to make use of the electronic computer for about forty years
- b. the electronic computer can remember and organize facts much more quickly and efficiently than human beings can

- c. human beings can live together more comfortably when they make use of the computers which work very fast
- d. no machine, however quick and efficient, can take the place of a person
5. It is **not** true that computers
- a. are used to guide airplanes, rockets, and spaceships
- b. help diagnose diseases
- c. can predict the future accurately
- d. are used in airports to land airplanes

C. Answer the following questions orally.

- How do computers help physicians?
- What kind of information was CHEOPS fed with?
- What uses do computers have in aviation?
- What kind of information does the satellite's radio send to the earth?
- Besides gathering information and finding answers to difficult questions, what else can a computer do?

Part III: Homework

Section One: Vocabulary Exercises

A. Fill in the blanks with the words from the following table to complete the sentences. Base your choices on the items of the table only. Make necessary changes if required.

Verb	Noun	Adjective	Adverb
instruct	instruction	instructive	instructively
_____	accuracy	accurate	accurately
add	addition	additional	additionally
perfect	perfection	perfect	perfectly

صورتاً آموزنده
صورتاً صحیح
تعداد
کاملاً

- In addition to their speed, computers are accurate and can do repetitive operations over and over again without becoming tired or bored.
- Several terminals can be added to a basic computer system if the need arises.

3. A trip around the world is an ^{instructive} experience.
4. After a long discussion, he was ^{so} satisfied. ^{Perfectly}
5. ^{accuracy} is one of the advantages of using computers in research or in statistical analysis. ^{consist of}
6. We were to document our programs very carefully.
7. Scientists are still trying to ^{at} the computer. * ~~attempts~~ ^{Perfect}
8. He studies four hours every day in ^{addition} to his daily work.
9. There is often no ^{additional} charge for the programs when buying a computer system.
10. The ~~perfection~~ of the design will take some more time.
11. Practice makes ~~perfect~~ ^{Perfect}
12. He gave us strict ^{instruction} to handle the instrument with care.

*B. Fill in the blanks with the appropriate words from the list below. There are more options than required.

				technicians	adding
process	operations	efficiency	peripheral	information	output
programs	arithmetic	electronics			
machines	forecast				

1. A computer is an electronic device... used for processing data.
- *2. Data are pieces of information that have been properly prepared so that the machine can work with them.
3. Computers can plot the course of rockets, prepare bank statements, predict election results, forecast weather conditions and perform many other tasks.
4. Many people believe that a computer is a very large ~~adding~~ machine.
5. The internal ~~operator~~ of a computer are called processing.
6. Output ~~consists~~ of the results of processing data.
7. Computers have circuits for performing ^{arithmetic} operations such as addition, subtraction, division, multiplication and exponentiation.
8. In school terms, the subject matter is considered as input, the studying as processing, and the knowledge as ~~output~~ ^{output}.
9. Many daily tasks can be viewed as ~~process~~ ^{process}; that is, they can be worked out in a step-by-step process.
10. Machines that are used in connection with the computer are called ^{peripheral} devices.

C. Match the words in Column I with their appropriate equivalents in Column II. Insert the letters a, b, c, ... in the parentheses provided. There are more options in Column II than required.

Column I

Column II

سخت افزار
 نرم افزار
 داده
 حافظه
 کنسول
 ماشین
 تشکیل
 شامل

1. computer system
2. hardware
3. software
4. data
5. memory
6. console
7. plant
8. consist of

- (b) a. electronic and mechanical equipment in a computer system
- (a) b. outline prepared for some purpose
- (j) c. part of the computer that receives and stores information
- (g) d. what has control over the system
- (e) e. apparatus and machinery used in an industrial process
- (f) f. be made up of
- g. properly prepared pieces of information
- h. interface, or communication device, between the operator and the computer
- i. what is put out by the computer
- j. programs associated with a computer system
- k. take up with the fingers
- l. computer together with all the devices and programs that are necessary for its operation

Section Two: Grammatical Exercises

A. Do the following exercises according to the explanations given in the Pre-Reading Part. Write your sentences in the spaces provided.

1. a. Mathematics no longer interests him.

It was once his favorite subject.

b.

2. a. Lybia is a leading producer of oil.

It is a country in North Africa.

b.

3. a. Professor Nelson arrived in Iran yesterday.

He is an expert in computer technology.

b.

4. a. The volcano erupted again with great violence.

It has been dormant for over a hundred years.

b.

5. a. Mr. Campbell was on television last night.
He is the producer of International Business Machines.
b.
6. a. Television brings the world into our homes in sight and sound.
It is one of the wonders of electronics era.
b.

B. Do the following exercises according to the explanations given in the Pre-Reading Part. Write your sentences in the spaces provided.

1. a. Copper is flexible.
Aluminum is flexible, too.
b.
2. a. A bicycle is not complex in structure.
A hovercraft is complex in structure.
b.
3. a. A jet plane is not very efficient at low speeds.
A propeller-driven plane is efficient at low speeds.
b.
4. a. Impact printers are expensive.
Non-impact printers are expensive, too.
b.
5. a. The civil engineer recently employed is not qualified enough.
Other engineers in the office are very qualified.
b.
6. a. Data preparation is important.
Data Processing is important, too.
b.

Section Three: Reading Comprehension Exercises

Read the following text carefully and then select a, b, c, or d which best completes the following items.

A computer is a machine with an intricate network of electronic circuits that operate switches or magnetize tiny metal cores. The switches, like the cores, are capable of being in one of two possible states, that is, on or off, magnetized or demagnetized.

The basic idea of a computer is that we can make the machine do what we want by inputting signals, that turn certain switches on and turn others off, or that magnetize or do not magnetize the cores.

The basic job of computers is the processing of information. For this reason, computers can be defined as devices which accept information in the form of instructions, called a program, perform mathematical operations on the information, and then supply results of these operations. The program, which tells the computers what to do, and the data, which provide the information needed to solve the problem, are kept inside the computer, in a place called memory.

Computers are thought to have many remarkable powers. However, most computers, whether large or small, have three basic capabilities. First, computers have circuits for performing arithmetic operations, such as: addition, subtraction, division, multiplication.

Second, computers have a means of communicating with the user. After all, if we couldn't feed information in and get results back, these machines would not be of much use.

Third, computers have circuits which can make decisions. The kinds of decisions which computer circuits can make are not of the type: "Who would win a war between two countries?" or "Who is the richest person in the world?" The computer can only decide whether one number is less than or greater than another, or if two numbers are equal.

A computer can solve a series of problems and make hundreds, even thousands, of decisions without becoming tired or bored. It can find the solution to a problem in a fraction of the time.

A computer can replace people in dull, routine tasks, but it has no originality; it works according to the instructions given to it. There are times when a computer seems to operate like a mechanical 'brain', but its achievements are limited by the minds of human beings. A computer cannot do anything unless a person tells it what to do and gives it the appropriate information; but because electric pulses can move at the speed of light, a computer can carry out vast numbers of arithmetic operations almost instantaneously. A person can do everything a computer can do, but in many cases that person would be dead long before the job was finished.

1. The main idea of the passage is that
 - a. computers have changed the way in which many kinds of jobs are done
 - b. instructions and data must be given to the computer to act on
 - c. computers are machines capable of processing and outputting data
 - d. without computers, many tasks would take much longer to do
2. A computer program is
 - a. the processed information
 - b. the result of the mathematical operations

- c. the information in the form of instructions
 - d. the data kept in the computer's memory
3. A computer is basically made to work by
- a. having its electronic circuits under control
 - b. having its cores switched on and off
 - c. having its switches turned on and off
 - d. giving it the necessary information
4. The information required for the performance of various operations is
- a. acquired from certain mathematical processes
 - b. received from the magnetic cores
 - c. provided by the on and off switches
 - d. found in the memory of the computer
5. The computer's achievements depend upon
- a. the kinds of problems applied to it
 - b. the number of instructions given to it
 - c. the mind of human beings
 - d. the originality of its brain
6. Computers are able to solve problems and make decisions, but they cannot
- a. process information
 - b. be accurate
 - c. think
 - d. store data
7. Computers cannot be useful machines
- a. although they have remarkable powers
 - b. unless they communicate with the user
 - c. if they possess a means of communication
 - d. in spite of their basic capabilities
8. Computers are not able to
- a. perform arithmetic operations
 - b. make decisions
 - c. communicate in some way with the user
 - d. generate data
9. Paragraph 6 mainly talks about
- a. the richest person in the world
 - b. a war between two countries
 - c. arithmetic calculations
 - d. the kinds of decisions computer circuits can make

Section Four: Translation Practice and Terminology Equivalents

A. Translate the following passage into Persian.

Major inventions are usually the result of technology catching up with the ideas of theorists. Charles Babbage (1792-1871) showed that it was possible to make a machine perform arithmetical calculations according to a predetermined series of instructions. But this discovery was of little value until thermionic valves and, later, bistable electronic circuits had been invented. At the same time, with the growth of industry and commerce in the nineteenth century, it became necessary to find a way of storing vast quantities of data in a form in which they could be easily retrieved and processed. Hermann Hollerith (1860-1929) used data stored in the form of holes punched in cards, an invention of the French weaver Joseph Maric Jacquard (1752-1834).

Theorists evolved the idea of the stored program; in the 1940's these three lines of research came together and the earliest true computers, such as ENIAC and EDSAC, were built. Since then things have developed so fast that we now talk about 'third-' and 'fourth-generation' computers. Technology has caught up with theory and every year there are new discoveries and inventions.

B. Determine the Persian equivalents of the following technical terms and write them in the spaces provided.

adding machine	حسابگر جمع کننده	intricate	بسیار پیچیده
apparatus	وسایل و دستگاه	memory	.....
bank statement	گزارش حساب بانکی	operator	.....
bistable	دو حاله	outline	مقدمه
circuit	مدار	output	خروج
compute	حساب کردن	pour out	پسریختن
computer system	.....	process	پردازش
console	.....	program	.....
core	هسته	pulse	تپان
device	.....	punch	سوراخ کردن
devise	اصطلاح	retrieve	بازگشت
digit	رقم	software	نرم افزار
exponentiation	تواندهی	specifications	مشخصات
flash out	پسریختن	statistical	آمار
hardware	سخت افزار	statistics	جمع آمار
instructions	دستور العمل ها	terminal	پایانه
interface	تلفظ	thermionic valve	لامپ ترمیونیک

Oil

Part I: Pre-Reading

A. Pronunciation Practice

pol.i.ti.cian (pŏlĭ-tĭsh ən)
 air.plane (âr plān)
 lu.bri.cate (lŏŏ brĭ-kāt)
 re.fine (rĭ-fĭn´)
 com.bus.tion (kəm-bŭs´chən)
 car.riage (kār´ij)
 war.fare (wŏr fār)
 su.pe.ri.or (sŏŏ-pĭr´ē-ər)
 il.lu.mi.na.tion (ĭ-lŏŏmə-nā-shən)
 slip.per.y (slĭp´ə-rē)
 fric.tion (frĭk shən)
 prop.er (prŏp´ər)
 suf.fi.cient (sə-fĭsh ənt)
 air.craft (âr´krāft)
 con.fi.dent (kŏn´fĭ-dənt)
 for.ma.tion (fŏr-mā´shən)

o.rig.i.nate (ə-rĭj´ə-nāt)
 dis.tant (dĭs´tənt)
 mi.nute (mĭ-nyŏŏt´)
 de.pos.it (dĭ-pŏz´ĭt)
 mud (mŭd)
 proc.ess (prŏs´əs)
 im.pris.on (ĭm-prĭz´ən)
 con.firm (kən-fŭrm´)
 glance (glāns)
 crude (krŏŏd)
 re.fin.er.y (rĭ-fĭ´nə-rē)
 treat (trēt)
 va.por (vā´pər)
 com.mon (kŏm´ən)
 va.por.ize (vā´pə-rĭz)
 con.dense (kən-dĕns´)

B. Word Study: Definitions

warship: ship for use in war
 lubricate: put oil or grease into machine parts to make them work easily
 internal combustion engine: engine in which combustion of a fuel takes place within the cylinder, and products of combustion form the working medium during the power stroke
 carriage: vehicle, especially one with four wheels, pushed by a horse for carrying people

illuminate:	give light to
illumination:	action of illuminating or state of being illuminated
slippery:	causing one to slide or fall; smooth, wet, polished surface so that it is difficult to hold on or to stand on
friction:	resistance to relative motion between two bodies in contact
treat:	put (a substance) through a process (in manufacture, etc.)
vapor:	substance in the gaseous state as distinguished from the liquid or solid state; steam
vaporize:	convert into vapor; become vapor
condense:	cause a liquid to increase in density or strength; become thicker; make more compact

C. Word Study: Definitions and Exemplifications

politician:	person taking part in politics or much interested in politics The mayor is a skilled <i>politician</i> .
warfare:	making war; condition of being at war; fighting <i>Warfare</i> raged along the border for days.
sufficient:	enough Do we have <i>sufficient</i> fuel for the trip?
aircraft:	any machine(s) made to fly in the air Airplanes, helicopters, gliders, and airships are all <i>aircraft</i> .
confident:	having trust or faith; certain; sure He feels <i>confident</i> of passing the examination.
formation:	process of forming or shaping; that which is formed The <i>formation</i> of ice from water requires a temperature of less than thirty-two degrees Fahrenheit.
originate:	bring into being; come into being; start; begin The fire <i>originated</i> in an old deserted building.
distant:	far away in space or time Pluto is the most <i>distant</i> planet from the sun.
minute:	very small; tiny A <i>minute</i> piece of dust blew into his eye.
huge:	very big; very great; enormous Elephants are <i>huge</i> animals.
deposit:	something that has settled and is left as a layer There is often a <i>deposit</i> of mud and sand at the mouth of a river.

- mud: soft, wet, sticky earth or dirt
Rain turns dust into *mud*.
- imprison: put into prison; keep as in prison; lock up
To become oil, some creatures are *imprisoned* between layers of rock.
- confirm: show to be true or correct
The report of an earthquake in Gorgan has now been *confirmed*.
- glance: quick look
He took a *glance* at the newspaper headlines.
- crude: in a natural or raw state; not refined or manufactured
Crude rubber is rubber as it is drained from the bark of rubber trees.
- commonest: most usual
The *commonest* form of oil treatment is heating.
- grade: step, stage, or degree (in rank, quality, value, etc.)
The various *grades* of lubricating oils are classified according to their application in industry.

D. Grammatical Points

With reference to the Grammatical Point explained in Lesson 2, notice the following Model sentences.

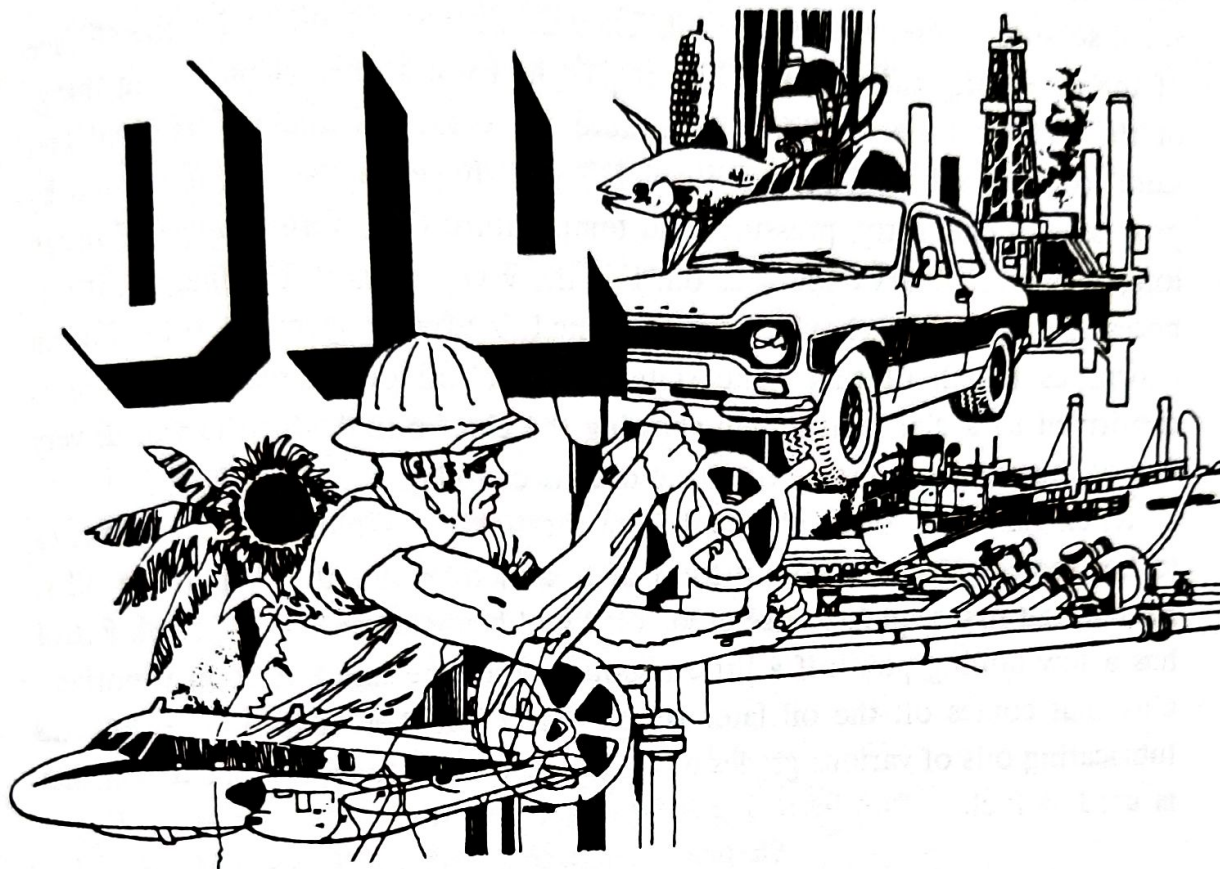
- 1. Model: a. They produce oil of different grades.
- b. Oil of different grades is produced.

One of the commonest ways of showing that one event is dependent in some way on another event taking place is through the use of the conditional sentences. In other words, conditional sentences indicate that something will happen if something else happens first. A conditional sentence consists of two parts: The *if* clause and the *result* clause. If the verb in the *if* clause has the present tense verb form, the *result* may be either present or future. However, in technical writing, the present verb form is preferred. The *if* clause or the *result* clause may appear initially.

- 2. Model: a. The cylinder temperature rises if the quantity of steam flowing through the cylinders (be increased)
- b. The cylinder temperature rises if the quantity of steam flowing through the cylinders is increased.

Part II: Reading for Comprehension

Oil



There are three main groups of oils: animal, vegetable, and mineral. To the ordinary man, one kind of oil may be as important as another. But when the politician or the engineer refers to oil, he almost always means mineral oil, the oil that drives tanks, airplanes, warships, motor-cars, and diesel locomotives; the oil that is used to lubricate all kinds of machinery. This is the oil that has changed the life of the ordinary man. When it is refined into petrol, it is used to drive the internal combustion engine. To it we owe the existence of the motor-car, which has replaced the private carriage drawn by the horse. To it we owe the possibility of flying. It has changed the methods of warfare on land and sea. This kind of oil comes out of the earth. Because it burns well, it is used as fuel; in some ways it is superior to coal in this respect. Many big ships now burn oil instead of coal. Because it burns brightly, it is used for illumination; countless homes are still illuminated with oil-burning lamps. Because it is very slippery, it is used for lubrication. Two metal surfaces rubbing together cause friction and heat; but if they are separated by a thin film of oil, the friction and heat are reduced. No machine would work for long if it were not properly lubricated. The oil used for this purpose must

be of the correct thickness; if it is too thin, it will not give sufficient lubrication, and if it is too thick, it will not reach all parts that must be lubricated.

What was the origin of the oil which now drives our motor-cars and aircraft? Scientists are confident about the formation of coal, but they do not seem so sure when asked about oil. They think that the oil under the surface of the earth originated in the distant past and was formed from living things in the sea. Countless billions of minute sea creatures and plants lived and sank to the sea bed. They were covered with huge deposits of mud; and by processes of chemistry, pressure, and temperature they were changed through long ages into what we know as oil. For these creatures to become oil, it was necessary that they should be imprisoned between layers of rock for an enormous length of time. The statement that oil originated in the sea is confirmed by a glance at a map showing the chief oilfields of the world: very few of them are far distant from the oceans of today.

When the crude oil is obtained from the field, it is taken to the refineries to be treated. The commonest form of treatment is heating. When the oil is heated, the first vapors to rise are cooled and become the finest petrol. Petrol has a low boiling point; if a little is poured into the hand, it soon vaporizes. Gas that comes off the oil later is condensed into kerosene. Last of all the lubricating oils of various grades are produced. What remains is heavy oil that is used as fuel.

A. Read each statement and decide whether it is true or false. Write 'T' before true statements and 'F' before false statements.

- F... 1. Scientists are quite sure about the formation of oil.
- T... 2. Most of the oilfields of the world are near the seas and oceans of today.
- T... 3. Heating is a very important factor in refining oil.
- F... 4. Lubricating oils are used to produce friction in machines.
- T... 5. Petrol easily vaporizes.
- F... 6. Kerosene is the condensed gas obtained from oil.

B. Circle a, b, c, or d which best completes the following items.

- 1. Oil-burning lamps
 - a. are used in more and more homes nowadays
 - b. are not used very much now
 - c. burn more brightly than any other kind of lamp
 - d. are used by a large number of people, although not so many as previously

2. The purpose of lubrication is
- a. to produce heat
 - ✓ b. to reduce friction
 - c. to reach all parts of a machine
 - ✓ d. to produce oil of the right thickness
3. Scientists think that
- ✓ a. coal was formed from layers under the surface of the earth
 - b. coal was formed from large deposits of mud on the sea bed
 - c. oil was formed from sea creatures caught between layers of rock
 - d. oil was formed from sea water by processes of chemistry, pressure, and temperature
4. When crude oil is heated, petrol rises from it first because
- ✓ a. it has a low boiling point
 - b. we want to collect it first
 - c. it can be cooled easily
 - d. it is the most important product of crude oil
5. Paragraph 3 mainly discusses
- a. different boiling points of oil
 - b. how petrol is produced
 - c. the properties of petrol
 - ✓ d. the refining of oil

C. Answer the following questions orally.

1. What are some of the uses of mineral oil?
2. What is the refined oil called, and what is it used for?
3. What happens if a machine is not lubricated?
4. What happens if the oil used for lubrication is too thick?
5. What are some main factors responsible for the changing of living creatures into oil?
6. How does the writer support the idea that oil originated in the sea?

Part III: Homework

Section One: Vocabulary Exercises

A. Fill in the blanks with the words from the following table to complete the sentences. Base your choices on the items of the table only. Make necessary changes if required.

Verb	Noun	Adjective	Adverb
thicken	thickness	thick	thickly
suffice	sufficiency	sufficient	sufficiently
think	thought	thoughtful	thoughtfully
illuminate	illumination	illuminated	_____

1. Looking at me, the little boy asked my name.
2. The snow fell and soon covered the ground.
3. To the room, they used oil-burning lamps.
4. Do you in English when you speak English?
5. Since the rooms were poorly, he preferred to study in the library.
6. He often acts without
7. The mixture gradually as the temperature changed.
8. One meal a day will not a growing boy.
9. The oil used for lubrication must be of the correct
10. These newly-born babies are not in good physical condition; they are not fed.
11. The walls were so that they were not destroyed by the bomb.
12. Oil is also used for since it burns brightly.
13. He considers the consequences of his behavior or words. In other words, he is a person.
14. heat must be applied to melt the metal.

B. Fill in the blanks with the appropriate words from the list below. There are more options than required.

heat	friction	vaporizes	combustion
treat	refinery	imprisons	lubrication
process	thickens	machinery	illumination
replace	slippery	condenses	

1. Drilling for oil is a difficult
2. Mineral oil is very; therefore, it acts as a good lubricant.
3. To make some metals bright, one should them with special chemicals.
4. The lack of grease in machines causes
5. A great many people in the world depend upon oil lamps for
6. Oils of different grades are used for
7. Steam into water when it touches a cold surface.
8. The tungsten wire inside an electric bulb sometimes
9. The crude oil is taken to the to be treated.
10. Can anything a mother's love and care?

C. Match the words in Column I with their appropriate equivalents in Column II. Insert the letters a, b, c, ... in the parentheses provided. There

are more options in Column II than required.

Column I

Column II

- | | | |
|---------------|-----|--|
| 1. kerosene | () | a. thick, semi-solid oily substance |
| 2. grease | () | b. material for producing heat or energy |
| 3. torch | () | c. record made to help the memory |
| 4. combustion | () | d. oil obtained from petroleum used as fuel |
| 5. pour | () | e. process of burning |
| 6. fuel | () | f. go in different ways |
| | | g. ability to move |
| | | h. cause a liquid to flow in a continuous stream |
| | | i. piece of wood treated with oil for using as a flaming light |

Section Two: Grammatical Exercises

A. Do the following exercise according to the explanations given in the Pre-Reading Part.

The crude oil which (obtain) from the oil well (take) to the refinery. There it (treat) with heat. The first vapors rising from it (collect and cool) to form petrol. The gas that (obtain) next (condense) into kerosene. Then oils of different grades (produce), which (use) for lubrication. Last of all, a thick oil (leave behind), which (burn) as fuel.

B. Do the following exercises according to the explanations given in the Pre-Reading Part. Write your sentences in the spaces provided.

1. a. If the steam (not be superheated), higher pressures are necessary.
b.
2. a. The fuel (ignite) spontaneously if it reaches the critical temperature.
b.
3. a. If the combustion chamber (not be designed) properly, the mixture may ignite spontaneously.
b.
4. a. There will be appreciable heat loss if the gases (be allowed) to escape unburnt.
b.
5. a. If the combustion gases (not be diluted), the temperature at the turbine will be too high.
b.

6. a. If the water is not pure, it (need) further treatment.
 b.
7. a. Oil floats if you (pour) it on water.
 b.
8. a. The bearings become overheated if the supply of lubricant (fail).
 b.

Section Three: Reading Comprehension Exercises

Read the following text carefully and then select a, b, c, or d which best completes the following items.

Petroleum is one of the greatest servants of mankind. It provides light, heat, and power for automobiles, tractors, planes, and ships. Without it, nearly all our machines would stop because of friction and lack of fuel. From petroleum come kerosene, fuel, lubricating oils, greases, wax, asphalt, and many other products.

What is petroleum? The word comes from Latin and means 'rock oil'. How was it formed? Scientists believe that petroleum was formed from plants and animals that lived ages ago in and around warm seas that covered much of the earth. As the plants and animals died, they piled up on the sea bottom. In time, millions of tons of sand and mud covered them. Under pressure, the mud and sand changed to rock. The plants and animals turned to a dark liquid trapped in the pores of rocks. Upheavals of the earth's crust caused parts of the old sea floor to become dry land. Some of the liquid oozed to the surface of the earth where men first noticed it.

Petroleum, or crude oil, has been used for thousands of years. Ancient people, including the Chinese and Egyptians, used it as a medicine. In India, it was being burned long before the beginning of the Christian Era. It was used in ancient days to make torches and, in its heavier forms of pitch and asphalt, to bind bricks, to make waterproof baskets, and to seal the seams of wooden ships. The American Indians used petroleum for many purposes, and when the white men went to America, they imitated the practice of the Indians and used this 'mineral oil' for medicinal purposes.

Crude petroleum, as it comes from the well, is of little use. It must be refined. The basic refining process, distillation, is based on the fact that petroleum is a mixture of many solids liquids, and gases. By means of heat, distillation separates the different things nature put into crude oil. This is possible because each part of the mixture boils, or changes to a gas, at a different temperature. As a result, different petroleum products are obtained.

1. In line 1, 'Petroleum is one of the greatest servants of mankind' means
 - a. petroleum is the greatest servant of mankind
 - b. petroleum is the only servant of mankind
 - c. there are other servants of mankind in addition to petroleum
 - d. petroleum is as great as other servants of mankind
2. In line 2, 'it' refers to
 - a. petroleum
 - b. power
 - c. heat
 - d. mankind
3. In line 10, 'them' refers to
 - a. plants and animals
 - b. petroleum and a dark liquid
 - c. sand and mud
 - d. fuel and lubricating oils
4. In line 14, 'it' refers to
 - a. the old sea floor
 - b. petroleum
 - c. the earth's crust
 - d. earth
5. In line 21, 'they' refers to
 - a. the white men
 - b. the American Indians
 - c. the Chinese
 - d. the Egyptians
6. According to the passage, it is true that
 - a. American Indians used petroleum for medical purposes
 - b. In China, petroleum was used for illumination
 - c. the use of petroleum by American Indians became very specialized
 - d. Indians used petroleum for the treatment of different illnesses
7. According to the passage, it is **not** true that
 - a. petroleum is used for a variety of purposes
 - b. distillation is a refining process
 - c. the earth was once covered by warm seas
 - d. crude petroleum is of little value
8. Petroleum has been used
 - a. for very specific purposes
 - b. for a very long time
 - c. to make pitch
 - d. to reduce friction

Section Four: Translation Practice and Terminology Equivalents

A. Translate the following passage into Persian.

We cannot, of course, see the oil which is trapped deep down in the ground. Men must study the rocks carefully. When they think that the rocks in a certain place may contain oil, a metal tower called a derrick is built. A machine in the tower gradually cuts a narrow hole down into the ground. As

the hole is made, a steel pipe is pushed down to stop the sides from falling in, and to keep out water. At last, if the men have judged correctly, the hole reaches the oil. Usually the oil rushes up the pipe with great force, driven by the pressure of the gas in the top of the layer of rock, and it streams high into the air. If this oil should catch alight, there would be a terrible fire. A kind of lid is fixed to the top of the pipe, and the oil is allowed to flow out gently through taps. After a 'well' has been used for a long time, it may be necessary to use a pump to get the oil out.

B. Determine the Persian equivalents of the following technical terms and write them in the spaces provided.

- | | |
|--------------------------------------|-------------------------|
| bearings | machinery |
| bind | melt |
| bricks | mixture |
| combustion chamber | oilfield |
| condense | overheat |
| critical temperature | oil thickness |
| crude oil | petrol |
| crust | pore |
| deposit | product |
| dilute | pure water |
| distillation | refine |
| electric bulb | refinery |
| film of oil | seal |
| float | seam |
| friction | slippery |
| fuel | spontaneously |
| heat | steel pipe |
| heat loss | superheat |
| ignite | treat |
| illumination | treatment |
| internal combustion engine | turbine |
| kerosene | vapor |
| layer | vaporize |
| lid | waterproof |
| lubricant | wax |
| lubricate | well |
| lubrication | |