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a.n. MENTERI HUKUM DAN HAK ASASI MANUSIA
DIREKTUR JENDERAL KEKAYAAN INTELEKTUAL

Dr. Freddy Harris, S.H., LL.M., ACCS.
NIP. 196611181994031001

ENGLISH

For Students of
Engineering & Toefl Preparation

Sukirmiyadi

Penerbit
Unesa University Press

ENGLISH FOR STUDENTS OF
ENGINEERING & TOEFL PREPARATION

Sukirmiyadi

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PREFACE

This book is written especially for the teaching of English to non-English Department students at the tertiary level majoring in the fields of Engineering, Science and Technology. It aims at achieving the basic needs of the learner's preparation for Academic English purpose that focuses in Reading Comprehension and the mastery of specific terms related to the learner's major of study.

In line with the statement above, the passages or reading texts in this book are selected from those in various topics of Engineering, Science and technology and some other materials related to. Therefore, this book was designed to help the students develop the skills they need particularly to meet the reading demand during and after this course of formal studies in terms of material mastery of English for Academic Purposes. Moreover, this book is aimed at fulfilling the need of University students who are learning English in accordance with their own disciplines.

Besides, this book is also completed with some theories and exercises of Basic Grammatical Structure to prepare the learner's competence of English especially to face the test preparation of TOEFL Equivalence.

Finally, it is expected that this simple book will be useful and helpful to provide the students with valuable background knowledge in comprehending the scientific books which are mostly still written in English, and as the basic competence of Grammatical Structure as well.

Surabaya, January 17th, 2019

The Writer

DAFTAR ISI

UNIT 1 (One)
ENGINEERING Part One

Engineering is as old as history. It was impossible for mankind to emerge from a primitive hunting and gathering existence without the engineering skills needed to create tools, metal refining processes, buildings, roads, and irrigation and sanitation systems. As human society has grown more complex, the need for many different engineering skills has multiplied. In our era, engineering has significantly changed our daily existence.

Indeed the social changes that have been created by engineers are so great that our society has not yet completely come to grips with all that they mean. Engineers make practical application of the findings of pure sciences such as physics or chemistry. A three-part distinction is sometimes made between pure science, applied sciences, and engineering. The research of pure science is done primarily to our knowledge research findings. Applied science is concerned with discovering the research one step further by devising workable processes based on the discoveries of applied science.

An example of this three-part system is in the development of nuclear energy. Chemists and physicists studied the structure of the atom over a long period of time. They learned that atoms of Uranium-235 could be split into two nearly equal parts, releasing a great deal of energy in the process. Then, under the pressure of World War II, applied science took over the research to find a military use for this release of energy. Applied scientists discovered that it was possible to create a chain reaction, a controlled release of energy that continued by itself. Then, engineers, together with scientists began to work out the difficult and complex system that made the atomic bomb a team to find ways of putting atomic energy to work for peaceful purposes such as generating electric power.

For thousands of years, engineers based their work on empirical information, information that depended on observation and experience rather than on theoretical knowledge. Many ancient structures, such as the aqueducts of Rome, have survived because they were built with greater strength than would be considered necessary by modern standards, which are based on scientific research and complex mathematical calculations. With the emergence of the modern age, however, engineering has become so complex and sophisticated that it is impossible to solve the problems without the support of scientific research based on established theories.

1. What were some of the products of engineering skills that were necessary in order to mankind to emerge from a primitive existence?
2. How has engineering changed our daily existence?
3. What three-part distinction is often made concerning science? What is the function of each of these parts of science?
4. What example is given of this division of scientific effort three-parts? Can you think of any other examples?
5. On what kind of information did engineers base their work for thousands of years?
6. Why are many structures from ancient times still in existence?
7. What has happened to engineering since the beginning of the modern age?

**A common way of asking new words in English is by adding standard combinations of letters to existing words, either at the beginning (prefixes) or at the end (suffixes). By noting this carefully, you will find it easy to make large increases in your recognition of vocabulary.

1. The suffix – is

A person who studies and applies	Geology is a geologist Biology is a biologist Sociology is a …… …… is a chemist Anthropology is an …… …… is a psychologist Archeology is an …… …… is an ecologist Agronomy is an …….....

2. The suffix – (i) an

A person who studies A person who studies applies	Mathematics is a mathematician Statistics is a ……..…… …… is an obstetrician
Put a person who applies the study of	Economics is an …… …… is an engineer Architecture is an ……... ……..…… is a doctor

Exercise 2

**Using appropriate words chosen from the reading passage fill in the blanks in the following!

Mankind uses their ……..... skills to improve their life. Without these skills, it is impossible for them to …… from their primitive life. In daily practices, engineering skills are developed by making practical …… of …… sciences. The …… findings of pure sciences are first studied by …… scientist to find their possible application. Engineering then continues the research by (……) workable processes based on the …… of applied science.

UNIT 2 (Two)
ENGINEERING Part Two

Engineering is often defined as the practical application of theoretical sciences, such as physics or chemistry, for the benefit of mankind. Many of the early branches of engineering, however, were based not on science but on **empirical information**, that is, information that depend on observation and experience rather than theoretical knowledge. Many of the structures that have survived from ancient times such as the aqueducts of Rome, exist because they were built with greater strength than modern standard require. But at least the Roman engineers were sure their buildings would last for a long time. Probably the oldest text in engineering is the work of a Roman architect and engineer named Vitruvius Pollio, who wrote a book in the first century B.C. about the engineering practices of his day. Many of the problems encountered by Vitruvius Pollio were similar to those that modern engineers still must confront.

Since the beginning of the modern age in the sixteenth and seventeenth centuries, there has been an explosion of knowledge in every scientific field: physics and chemistry, astronomy and psychology, as well as recently developed disciplines like nuclear and solid state physics. One reason for this rapid increase in scientific knowledge was the development of the experimental method to verify theories. At least of equal importance has been the use of **quantification**, which is, putting the date from the results of experimentation into precise mathematical terms. It cannot be emphasized too strongly that mathematics is the basic tool of modern engineering.

As scientific knowledge increased, so did the practical applications. The eighteenth century witnessed the beginning of what is usually called the Industrial Revolution, in which machines began to do more and more of the work that previously had been done by human

beings or animals. In the nineteenth century and in our day, both scientific research and the practical applications of its result have progressed rapidly. They have given the civil engineer new and stronger materials, the mathematical formulas which he can use to calculate the **stresses** that will be encountered in a structure; and machines that make possible the construction of skyscrapers, dams, tunnels, and bridges that could never have been built before.

Another result of the explosion of knowledge was an increase in the number of scientific and engineering specialties. By the end of the nineteenth century, not only were civil, mechanical, and mining and metallurgical engineering recognized, but courses were also being offered in the newer specialties of **electrical engineering** and **chemical engineering**. Of course, many of these disciplines are subdivisions of earlier specialties electronic engineering from electrical engineering, for example, or petroleum engineering from chemical engineering.

Comprehension:

I. Answer the following questions based on the text!

1. What is the definition of engineering as frequently given by people?
2. On what kind of information were many of the early branches of engineering based?
3. How do the surviving ancient buildings compare with those built by modern standards?
4. What is probably the oldest textbook about engineering? Who wrote it?
5. What has happened to scientific knowledge since the beginning of the modern age in the sixteenth and seventeenth century?
6. What are two reasons for the rapid increase in scientific knowledge?
7. What began in the eighteenth century? Has this movement continued up to the present?
8. What scientific research and the practical applications of its results given the civil engineer?

9. What are some of the recognized engineering specialties?
10. In conclusion, what are the two impact resulting from the explosion of knowledge?

II. Contextual Reference

Considering the contexts of the sentences in the passage, find out what the following words refer to.

1. 'They' in …… because they were built ……. (paragraph 1)
2. 'Those' in …… were similar to those that modern engineers still must confront (paragraph 1)
3. 'Its' in …… and the practical applications of its results …… (paragraph 3)
4. 'They' in 'They have given the civil engineer ……' (paragraph 3)
5. 'He' in …… which he can use to calculate the stresses …… (paragraph 3)
6. 'This expansion' in 'This expansion has continued to the present day' (Paragraph 4)……

STRUCTURE: 1 (One) The Use Of To Be

A. Simple Present: He - She - It : is * I : am * You – We – They : are
B. Simple Past: He – She – It – I : was * You – We – They : were
C. Present Perfect: He – She – It : has been * I – You – We – They : have been
D. Past Perfect: He – She – It – I – You – We – They : had been

EXAMPLES: A. The tall boy is in this room now

B. The tall boy was in this room a few minutes ago

C. The tall boy has been in this room since a few minutes ago

D. The tall boy had been in this room for a few minutes before you came here

Exercise: Fill in the blanks with the appropriate form of 'to be': *is-am-are-was-were-has been-have been-had been*

1. When I ……(1)…… a little boy there ……(2)…….. so many big trees in front of my house but now there ……(3)…… only some left.
2. Both my brother and sister ……(4)…… very smart students. There ……(5)…… no score below 8.
3. I ……(6)……only a room boy in one hotel ten years ago, but now I …(7)……. a professional manager of this company.
4. …(8)..…… you Mr. John, the owner of this house? No, I …(9)……. his driver. He…(10)..…. out of town today. But he …(11)..……still at home a few minutes ago..
5. Those children ….(12)…… quite happy with their new toys a few minutes ago, but suddenly one of them ……..(13)…. crying loudly.
6. Before you came, your friend…..(14)…… here for more than one hours. Now I don't know where he …….(15)……. going.
7. Mitha and Mila……(16)…… good friends since in Senior High School until now although they ……(17)…… studying in a different University.
8. Who ……(18)…….those gentlemen? …(19)…..they Mr. Johan and Mr. Teguh? They …….. (20)……there since an hour ago.
9. Where ……(21)…….. you when I called you just now? O., I ……(22)….. …. in the canteen.
10. How ……(23)…… your brother and sister? ……(24)…… both good?

11. Where …(25a)……. you …(25b)……. away? Your friend ……(26)…… here for 2 hours.
12. What …….(27).….your parents doing? O., both my father and mother……(28)..…lecturers in Australia before they moved to Indonesia last year. Now my father ……(29)…..an entrepreneur and my mother …..(30)…….. a house wife.

UNIT 3 (Three)
PROGRAMMING LANGUAGES

Most courses in computer programming begin with a lesson on the binary system, although most programmers seldom have to use the binary numbers in actual practice. The reason for studying the binary system is to understand the nature system and its correspondence to the switches inside the machine helps to take the mystery out of computers. Above all it is the programmer who must realize that the machine is controlled by human beings, and he is the one who is going to control and direct it.

We know that the machine reacts to a series of electrical impulses that can be represented in binary numbers. This is called machine language, and the central processing unit has been designed to execute instructions given to it in machine language. We also know that all data are translated into binary code before being stored in main storage. It would, however be very tedious and difficult to write all information in a binary code. Most programmer therefore use one or more of the standard programming languages to prepare their programs. These programming languages use a combination of numbers, characters, and other symbols that is more convenient and easier to work with than machine language.

There are many programming languages. They are known by such names as BASIC, FORTRAN, COBOL, PL/I, ALGOL and APL. BASIC is a programming language specifically designed for beginners, FORTRAN is used primarily for scientific work, and ALGOL and APL are used primarily for scientific work, while PL/I is employed for general purpose programming.

How does the machine understand statements in one of these languages if the only language to which the machine can read is machine

language? It understands by means of an interpreter which is known as a system program. The system programs are part of the software, but they are supplied by the manufacturers of the machine. One of the systems is called compiler.

The compiler takes each instruction in the program and translates it into machine language, which is equivalent into a binary numbers. It is this translated program that activates the millions of switches in the machine during processing.

There is a separate compiler for each of the standard programming languages. While most programmers have experience in several languages, they generally specialize in one programming language. This is because each language has many intricacies and peculiarities that make it necessary for a programmer to use one in which he specializes constantly in order to do an efficient job.

Program written in a programming language are referred to as source programs. The same programs are called object programs when they have been transformed into a machine language so that they can be executed. Programs that are designed to solve specific problems in business or science are called application programs. They are distinguished from system program, which direct the processing and also organize and coordinate the flow throughout the entire computer system including the input or output and secondary storage devices.

Comprehension:

A. Answer the following questions

1. Why do most courses in computer programming begin with a lesson on binary system?
2. What must the programmer in particular realize about the machine?
3. What does the machine react to? What is this called? What has the Central Processing Unit been designed to do?
4. What else is translated into binary code?

5. Why do most programmers use standard programming languages for their work?
6. What are the names of some of the standard programming languages?
7. How does the machine understand the programming languages?
8. What is the system program that translates from programming language to machine language? How many of this kind of system programs are there?

B. State whether each of the following statements is true or false according to the reading passage

1. Binary system is always taught in programming courses because programmers have always to use it in their actual practice.
2. The computer can control itself by its Central Processing Unit.
3. All instructions in machine language are executed by the Central Processor Unit.
4. To be practical, most programmers write their programs directly in machine language.
5. COBOL and FORTRAN are two of the most common programming languages used for scientific works.
6. To make the machine understand statements made in a specific programming language, a compiler is generally used as a translator.
7. System programs are part of the software supplied by the manufacturer of the machine.
8. The difference between source programs and object programs lies on whether they have been transformed into a machine language or not.

Exercises:

Fill in the spaces in the following with appropriate word or phrase!

1. A program that gives instructions or directions to the machine is called a …… program.
2. Machine language is coded in …… numbers.
3. A program written in one of the standard programming languages is known as a …… program.
4. When the program has been coded in machine language it is known as an …… program.
5. …… is a programming language used for most commercial applications.
6. Mr. Black is a programmer for an engineering company. He probably writes his programs in……
7. Mr. While works for a university and prepares programs for close schedules for each of the faculties. He writes his programs most likely in ……
8. The …… is system program that translates the source program into machine language.

STRUCTURE 2: (Two): TENSES

1. Present Continuous / Progressive Tense :

Subject + be (is – am – are) + Verb I + ing + Object / Adverb

*Time Signals: now, right now, right away, soon, at present, at this moment, soon after

Example: 1. Mitha is studying English in her room now.
2. The students are listening to the teacher very attentively at this moment.
3. I am reading a newspaper right now.

2. Simple Present Tense:

A) He – She – It : Subject + Verb I + s/es/ies (+)

Subject + does + not + Verb I (-)

Does + Subject + Verb I (?)

B) I – You – We – They: Subject + Verb I (+)

Subject + do + not + Verb I (-)

Do + Subject + Verb I (?)

*Time Signals: everyday, every week, always, usually, generally, often, sometimes, seldom, ever, once in a while, etc.

Example: A) Mitha stud***ies*** English ***everyday*** (+)

Mitha does not study English everyday (-)

Does Mitha study English everyday?

B) I study English everyday (+)

I do not study English everyday (-)

Do I study English everyday?

Exercise: Structure 3 (Three):

A. Put the Verb in brackets into Simple Present or Present Continuous Tense:

1. Mira usually (do) her homework before she (go) to bed.
2. (not talk) in the class while the teacher (explain) the new lesson seriously
3. Sally (not want) to go before her friend Santi (come) to pick her up.
4. Look., The old woman (cross) the street. Please (help) her.
5. Some students often (play) in the yard when they (not have) any work to do.

6. What (do) you here? -- I (look) for my friend's address but I (not know) where he (live) in this town.
7. Don't just (listen) to the speech. Now (start) practicing to speak.
8. Donny (be) always diligent, but now he (come) very late.
9. My father (not smoke) cigarettes but he (have) a cough every morning.
10. Your teacher (not be) angry if we (do) our assignments regularly.

B. Change the Sentences above into Negative and Interrogative!

UNIT 4 (Four)
SANITARY ENGINEERING

Environmental or sanitary engineering is concerned with providing clean, safe water supply systems for towns, cities, and rural areas. It is also concerned with disposing of excess water and waste materials by means of sewer systems. Many aspects of environmental or sanitary engineering are directly related to hydraulic engineering.

A great deal of archeological evidence has revealed the importance of water supply systems in the ancient world. Probably the most impressive systems were built by the Romans, whose aqueducts still stand in modern Italy, Spain, France, and Turkey. Rome itself had a water supply estimated at 50 million gallons a day, or about 50 gallons a day for each resident of the city. The water was delivered to fountains, where people collected it in pots and then carried it to their homes; only a few buildings and residences had connections to the main pipelines. Rome also has a sewer, the Cloacoa Maxima, part of which is still used today. Like other sewer systems of ancient times, it was intended to carry off the water from storms or the waste water from the public baths. There were penalties for disposing of solid wastes in it.

After the fall of the Roman Empire, water supply and sewer systems received relatively little attention until modern times. In the middle ages in Europe, water came from steams and wells, while wastes were disposed of in cesspools or even returned to the same streams from which the water was taken. After the connection between water supply and certain diseases such as typhoid was established in the nineteenth century cities and towns all over the world built safe water supply systems.

Providing water for the fast growing population has been a problem to many big cities in the world. Many of them have had to

construct systems that bring water to the city from considerable distances due to unavailability of clean water.

In addition to transporting water over long distances, modern water supply systems also use several techniques for purification. One of them is filtration. The water is passed through a filter that consists of a bed or sand or gravel, which removes a large proportion of solids that might otherwise contaminate the supply. Another process is aeration. Sprays of water are shot into the air, where sunlight and oxygen. Help kill bacteria and also remove gasses with an up leasing odor or taste; or air is bubbled into or through the water. A third method involves treatment with chemicals, usually chlorine, to kill harmful bacteria. The process is known as chlorination.

Part of providing a safe water supply is disposing of liquid and solid water. This problem has become acute in recent years not only because of world-wide population growth, but also because of the vast amount of waste created by industrial processes and by the great mountains of trash.

There are a number of different methods by which solid wastes can be removed or rendered harmless. Several of them are ordinary used in combination in treatment plants. One of the processes is filtration. Another is sedimentation, in which wastes are allowed to settle until they become solid or semisolid and can be removed. There are also techniques in which water can be treated by biological means, by using some kinds of bacteria to kill other kinds, or by chemical means, as in chlorination. One of the most successful methods is called the activated-sludge process. It involves using compressed air to increase and control the rate of biological reactions that purify the wastes. In effect, treatment plants speed up natural purification processes so that the water that is finally released from them is essentially harmless. Present-day concern over environmental pollution has increased the demand that waste water should be treated to the fullest degree possible before it is returned to the environment.

Comprehension:

1. What is sanitary engineering concerning with?
2. To what other branch of engineering are many aspects of sanitary engineering directly related? Give an example!
3. What evidence do we have of the existence of Roman water supply system?
4. What kind of sewer system did Rome have? What kind of waste was it not used for?
5. What was done about water supply and waste disposal in the Middle Ages in Europe?
6. Why did cities and towns all over the world begin Building safe water supply systems in the nineteenth century?
7. What problem has been faced by many big cities in the world? Why?
8. What are some of the water purification techniques that are currently used?

Fill in each of the blanks in the following sentences with the appropriate word or phrase!

1. …… engineering systems provide clean water supply, drainage, and waste disposal services.
2. Some …… are used only for excess water runoff, but others also carry domestic wastes.
3. Water can be stored in a ……, which is an artificial lake or body of water.
4. The process of passing water through sand or gravel to remove so lines is known as ……
5. In aeration, sprays of water are shot into the air where …… kills many of the bacteria.
6. …… is a chemical that kills bacteria and is often used therefore in water purification systems.

3. Present Perfect Tense: Subject + has / have + Verb III (+)
Subject + has / have + not + Verb III (-)
Has / have + Subject + Verb III (?)

Example: I have studied English for 7 years (+)

I have not studied for 7 years (-)

Have I / you studied English for 7 years?

4. **Present Perfect Continuous / Progressive Tense,** and the other Tenses are used as the student's Task / Assignment:

*******Make small groups consisting of 2 0r 3 students to do this assignment: - to explain about the usage, pattern, time signals, examples not less than 4 with different Subjects and Verbs. Those sentences should be in positive (+); negative(-) and interrogative (?)

A. Supply the Verbs in bracket into Simple Past or Past Continuous Tense

Pattern:

1. **Subject + was / were + Verb-1 + ing + When + Subject + Verb-2**
2. **Subject + was / were + Verb-1 + ing + While + Subject + was / were + Verb-1 + ing**
    1. It (rain) very hard when I (get) up this morning
    2. I (have) my dinner when some of my friends (come) to my house and (ask) me to go out with them.
    3. What you (do) when I (call) you on the phone last night?
    4. While Mrs. Rachmat (wash) the dishes, her children (play) in the yard.
    5. The people (work) when the fire (break) out yesterday afternoon.
    6. I (not want) anything on my last birthday. I just (want) my computer (repair)
    7. My father (read) the news paper when I (arrive) home from campus.

8. I (listen) to the music in my bedroom when you (knock) at the door.
9. Last Semester holiday I (go) out of town and (visit) some recreation places, but this semester I (not go) anywhere.
10. The teacher (explain) in front of the class while the students (listen) to him seriously.
11. Why (not attend) you the seminar last Saturday? There (be) two guest speakers from America.
12. I (be) absent a week ago because I (have) to pick up my father in the airport.

B. Supply the Verb in brackets into Present Perfect, Present Perfect Continuous, Past Perfect, or Future Perfect Tense

1. Mr. Ahmad (not see) his family since last month.
2. I (know) my friend well since we were kids.
3. My father (work) since 6 o'clock in the morning, and now he is still completing his work.
4. By this time next October the students (study) at this campus for 2 years.
5. When the world war broke out, the Dutch (colonize) Indonesia for hundreds of years.
6. By the end of this year that man (drive) his car more than a million miles
7. The students (learn) English for more than 10 years, but up to now they are not able to speak it well.
8. If you (finish) your work, you may leave the class
9. Before I went to bed, I (close) all the doors and (switch) off the lights.
10. By this time next month, Mitha (live) in this town for seven months.

11. I left home after I (have) my breakfast and (get) some pocket money.
12. After the teacher (give) some quiz to his students, he left the class right away.
13. Don’t disturb your mother. She busily (cook) in the kitchen all morning
14. He thanked me for what I (do) for him.
15. My sister (finish) her study within less than 4 years.

UNIT 5 (Five)
WASTE DISPOSAL

Part of providing a safe water supply is disposing of liquid and solid wastes. This problem has become acute in recent years not only because of world-wide population growth, but also because of the vast amount of waste created by industrial processes and by the great mountains of trash that are by-product of increased consumption.

There are a number of different methods by which solid wastes can be removed or rendered harmless. Several of them are ordinary used in combination in treatment plants. One of the processes is filtration. Another is sedimentation, in which wastes are allowed to settle until they become solid or semisolid and can be removed. There are also techniques in which water can be treated by biological means, by using some kinds of bacteria to kill other kinds, or by chemical means, as in chlorination. One of the most successful methods is called the activated-sludge process. It involves using compressed air to increase and control the rate of biological reactions that purify the wastes. In effect, treatment plants speed up natural purification processes so that the water that is finally released from them is essentially harmless. Present-day concern over environmental pollution has increased the demand that waste water should be treated to the fullest degree possible before it is returned to the environment.

Vast amount of trash have also posed problems in disposal. Much of it has been used as landfill by dumping in swampy areas or in shallow water so that the area can be made useful. A great deal of it has also been burned in incinerators, where wastes are reduced to ash. Incinerators, however, are out of fashion today because they release harmful fumbes into the air. Many of them are being redesigned to control these emissions more effectively; at the same time other solutions are being sought.

One modern method of disposing trash and domestic wastes is recycling, which simply means using the waste material again. The wastes from treatment plants, for example, can be used as fertilizer; it can also be used as fuel. In fact, some treatment plants fill their own energy by burning their waste products to provide steam for generating electricity. Similarly some kinds of trash can be collected separately-glass, newspapers, and aluminum cans, for example. All of these materials can be processed for reuse. In some cases, trash has also been compacted to serve as fuel.

The concern for a cleaner environment together with the need to converse and reuse our resources has created a challenge for which sanitary engineers, working with environmentalists, will be called upon to find new solutions over next few years.

Comprehension Questions:

Answer the following questions, basing your answer on the text above.

1. Why has the problem of liquid and solid waste disposal become acute in recent years?
2. What are some of the different methods by which solid wastes can be removed or rendered harmless?
3. How does the biological water treatment work?
4. What is meant by "activated sludge process"?
5. What demand has present-day connect our environmental pollution increased?
6. How have people treated much of the trash in solving the disposal problem?
7. Why are incinerators out of fashion today? What is being done about this?
8. What is the advantage of the recycling method over the other methods?
9. What has been done to the trash and domestic wastes in the recycling method?
10. What challenge has concern for the environment created?

Exercise 1:

Fill in each of the blanks in the following sentences with the appropriate word or phrase!

1. ……. Is a purification process in which wastes are allowed to settle until they become solid enough to be removed.
2. Process of purifying water by training it with chlorine is called ……
3. Waste material such as paper, cans, bottles, etc is called ……
4. We can dispose trash in wet areas for the purpose of reclaiming them by using it as ……
5. Treating wastes with compressed air in order to encourage biological reactions that destroy harmful bacteria is termed as ……
6. Trash which can be burned in a furnace is called ……
7. Reclaiming some kinds of trash so that the material in them can be melted down and reused is called ……

STRUCTURE 4 (Four): Passive Voice

Passive form is the most frequently used sentences in English for science and engineering. The general pattern of a passive sentence is:

Subject + be + past-participle / Verb III + adverbial

Example :

People make new experiments from time to time. (active)

➔ New experiments are made from time to time.

Note: The form of 'Be' can be in 'Present (is-am-are); Past (was-were); Perfect (been); and remains the same ' BE' for Simple Future or Continuous Tense.

More Examples:

A. Active Sentence:

1. We speak English in class everyday (Simple Present)
2. We are speaking English in class now (Present Continuous)

3. We will speak English in class tomorrow (Simple Future)
4. We spoke English in class yesterday (Simple Past)
5. We have spoken English in class for two years (Present Perfect)

B. Passive Voice

1. English is spoken in class (by us) everyday
2. English is being spoken in class now
3. English will be spoken in class tomorrow
4. English was spoken in class yesterday.
5. English has been spoken in class for two years.

Exercise 1 (One):

Change the following sentences into passive. Omit the unspecified agent (doer of the action)

1. People apply mathematics in many different activities.
2. Every programmer uses the binary scale in electronic computers.
3. In the future, people will develop more applications of mathematics in the modern and sophisticated technology.
4. They form the square of number by multiplying the number by itself.
5. A scientist has made a lot of attempts to deceive the ordinary citizens.
6. People believe that science and technology will help the nation to reach the goal of the development.
7. Many scientists made a lot of scientific discoveries during the renaissance.
8. Mr. Joe is making an experiment to prove his new theory.
9. We should use statistics for analysis of data in all branches of science.
10. Mathematicians usually use decimals rather than fractions for scientific purposes.

11. They often call mathematics the language of science.
12. In the binary scale, people express numbers by combinations of zero and one.
13. It is easier to perform mathematical operations with computers if we use the binary system instead of the decimal one.
14. Susy is writing some letters to her friends
15. The students have to do their assignment regularly
16. I have finished my homework already
17. My family will visit my grandparents in the village next Lebaran Day
18. Many people enjoyed Metallica performance last month.
19. The teacher would not lock the door if some students didn't come very late.
20. Are the students studying English or French in this College?
21. Have you closed the door and switched off the lights before you go to bed?
22. Does your mother usually make some special cakes on Lebaran Day?
23. I have not done my homework yet.
24. You must finish the written test before the manager interview you (2)
25. Mira has to do the house works before she goes to school.

EXERCISE: 2 (Two)

A: Choose the correct answer

1. The blue whale _____ the largest creature on earth.
   a. Generally classified as is
   b. As is generally classified
   c. Is generally classified as
   d. Is classified generally as

2. The seminar was ……because the invitations were not _____ in time.
   a. Cancelling ---------Printer
   b. cancelled ----------Printed
   c. cancelling----------Printing
   d. cancelled----------to Print

3. Mammals _____ into the placental, marsupials, and monomers.
   a. Which are generally classified
   b. Classified are generally
   c. Are generally classified
   d. Being generally classified

4. Many issues _____ by the committee, but they were unable to amid at any conclusions.
   a. Were seriously discussing
   b. Being seriously discussed
   c. Which were seriously discussing
   d. Were seriously discussed

5. The tropical storms that occur each year in the North Atlantic and have winds reaching speeds of at least 117 kilometers per hour _____ hurricane.
   a. Which are commonly called
   b. Commonly called
   c. Is commonly called
   d. Are commonly called

6. Mila …… by her parents to go alone last night.
   a. did not permit
   b. were permission
   c. was not permitted
   d. is not permitted

7. The transfer of science and technology has to ……. If we want to…….. nation

a. Be encouraged------- be developed
b. Encouraged---------- developed
c. encourage-------develop
d. encouraging------- developing.

8. While a new lesson is …….. by the teacher, the students are listening to him very attentively.
   a. explaining c. being explained
   b. explained d. explain

B. Find the Incorrect Structure, Word(s), or Phrase Underlined Below:

9. One of *the world's* best-selling authors,
   A
   Louis L'amour *said* *to have written* 101 books *mostly* westerns.
   B C D

10. For many years, space enthusiasts harbored hope *that*
    A
    the atmosphere of Venus *could support* life, *but* now it is *know* to be extremely dead.
    B C D

11. The result of the failure to plan for the future *is that* a child
    A
    from *an urban* area must be *took* to the country to *see nature*.
    B C D

12. Aspirin is *recommends* to *many* people for *its* ability *to thin* the blood.
    A B C D

13. Mr. Andi will not let his son play before *his homework* is *doing*
    A B C D

14. Some *punishment* will be *giving* to you by *the police* if you
    A B C
    don't obey the *traffic* Regulation.
    D

15. *Are* the data always *update* before your *program* is *closed*?
A B C D

16. The computer *system* was *developing* by *adapting* the binary
A B C

scale to *the off-on pulses* of electricity.
D

UNIT 6 (Six)
STRUCTURE OF BUILDING

When structure is to be erected, a foundation is needed to carry the weight of the structure to the stratum of soil of which it rests. It is called the foundation bed. Depending on the locality, one of the several types of foundation beds may be used. Although any kind of foundation beds will settle somewhat, rock is usually preferred because it will support bearing pressure up to 15 tons per square foot. Gravel will support loads of 4 tons per square foot. Sand will support an equal weight if the lateral pressure can be held back. Clay, if it can be kept dry, will support 2 tons per square foot.

The foundation itself, which is usually made of reinforcement concrete, may be a single unit or a separate unit. A mat, or raft, which is a single slab over entire foundation bed, is often used. A bearing will around the outer limits of the structure is supported by a continuous footing. Separate footing, may be used to support columns.

When the surface soil stratum is too weak to support the structure, piles and piers may be used to transfer the weight to stronger substrata. Concrete piles are either precast or cast-in site. The pre-cast type is formed of steel bars set in concrete, which is then driven into the soil. To construct the cast in site type, a hole first drilled into the soil at the desired location and then filled with concrete. It may or may not be reinforced. This type is often preferred because it takes less time and requires. This type is often preferred because it takes less time and requires no molding.

There are other types of structures used in building bridges, piers, and docks. Examples of these are the open caisson, the pneumatic caisson, the sheet piling, and coffer dam.

Comprehension:

Answer the following questions briefly

1. What is the function of a foundation when the structure is constructed?
2. What are the special of using rock as a foundation bed?
3. Differentiate between continues and separate footings!
4. In what condition should piles and piers be used?
5. In what way do pre-cast and the cast in site types differ?
6. What are the advantages or reinforcing the above type?
7. What's the main idea of the passage?

Exercise 1

Mention the type of the foundation and explain the differences in the function of each!

Exercise 2

Bearing	wall	foundation bed	concrete
Cast in site	mat	footing	arch
Piles	footings	substrata	wood

Fill in the blanks with the proper terms provided!

1. This building has a complex foundation. Around the outer limes it is a _____ to support most of the weight.
2. Beneath this is a continuous _____ to spread the weight over a large area.
3. Then the entire _____ is covered by a slab to resist the upward soil pressure.
4. This is called a _____.
5. The columns in the center, hovered, are supported by separate _____.

6. But the bed on which the rest of the foundation is supported will not bear the weight of the columns. They must be supported on _____.
7. These will transfer the weight to stronger _____.
8. We can call them the _____ type because holes were dug at the locations of the columns and were then filled with concrete.

Exercise 3

Find words or phrases in the text which closed in meaning with the following words!

a. Construct (a building) :
b. Thickness of material :
c. Support :
d. The building slowly sink :
e. Soil usually used for making bricks :
f. Building material made by mixing cement with sand and gravel:
g. Upright pillar to support part of a building:
h. Chamber in which men work underwater:

STRUCTURE 5 (Five): A. Conditional Sentence (If Clause)

*There are three (3) types of conditional Sentence:

I. Type One (1) refers to something which is possible to happen in the future

Tense: Simple Present -→ Simple Future

Ex: a) If I have much money, I will buy a new car

b) If she is a popular singer, she can sing on television everyday

II. Type Two (2) refers to something that is impossible to happen at the present time.

Tense: Simple Past Tense -→ Past Future

Ex: a) If I had much money, I would buy a new car

b) If she were a popular singer, she could sing on television everyday

III. Type Three (3) refers to something that is impossible to happen in the past

Tense: Past Perfect -→ Past Future Perfect

Ex: a) If I had had much money, I would have bought a new car last month

b) If she had been a popular singer, she could have sung on television

Exercise 1 (One): Change the Following Sentences into Conditional Sentence Type I – II – or III.

1. If she is not busy, she can help you whenever you want ..... (Type I)
   ..... (II)
   ..... (III)
2. If the students did not study hard, they would not pass their exam..... (II)
   ..... (I)
   ..... (III)
3. You will not catch the train if you do not leave home earlier..... (I)
   ..... (II)
   ..... (III)
4. If she gets a good score of English, her father will give some reward ..... (I)
   ..... (II)
   ..... (III)
5. If you do not eat too much, you will not be ill ..... (I)
   ..... (II)
   ..... (III)

6. If I am a famous architect, I will design such beautiful buildings around the world..... (I)
   ..... (II)
   ..... (III)
7. He could not do his work properly if he did not practice regularly..... (II)
   ..... (I)
   ..... (III)
8. If he did not have any experiences, he could not finish his works perfectly ..... (II)
   ..... (I)
   ..... (III)

B. CONDITIONAL CLAUSES WITH UNLESS

In many sentences, *unless* is equivalent of *If …… not*.

If you don't get off my property, I'll call the police; or

➔ Unless you get off my property, I'll call the police.

Use unless to replace *if …… not* in the following sentence.

EXAMPLE:

If it doesn't stop raining soon, they'll have to cancel the ball game.

➔ Unless it stops raining soon, they'll have to cancel the ball game.

Exercise 1

1. If he doesn't study harder, he won't pass the examination.
2. If she doesn't learn to be more courteous, she will never have any friends.
3. If there isn't more snow, we can't go skiing.
4. If he doesn't get better soon, he may have to drop out of school.
5. We will sue you if we don't get the money by tomorrow.
6. If we don't leave right away we'll miss our bus.

7. I wouldn't be bothering you now if I didn't need help desperately.
8. If we don't start out now, we won't get there before dark.
9. You'll lose the money if you don't put it in a safe place.
10. If he can't pay cash, they won't sell to him.
11. The strikers won't go back to work if a contract isn't signed.
12. If you don't watch your diet, you may become sick.
13. Don't give this package to him if he doesn't sign a receipt for.
14. If he doesn't get here soon, we'll have to leave without him.

REAL CONDITIONS (1): FUTURE TIME

Real conditions are conditions that are possible to be realized. They often refer to one event in the future.

1. With future main verb-***if the weather*** is good, I'll go to the break.
2. With imperative main verb-***if he calls,*** tell him to come here at once.

Usually the correct to verb forms for future conditions. Note where should may also be used in the conditional clauses.

Exercise 2

a. If they (not get) …… here soon, we (leave) …… without them.
b. If you (need) …… more help, please (ask) …… the janitor.
c. If you (not understand) …… this math problem, I (explain) …… it to you.
d. We (take) …… the train if the weather (be) …… very bad.
e. (Telephone) …… me at once if you (not find) …… the address.
f. We (not go) …… skating if you (think) ……the ice is dangerously thin.

g. If you (come) …… over now, (give) …… you the money.
h. You (have) …… enough time to buy the tickets if you (leave) …… half an hour early.
i. If you (see) …… Robert, (give) …… him my best regards.
j. If you (not drive) …… more carefully, you (have) …… and accident.
k. If a customer (want) …… to see me, (tell) …… him I'll be back in ten minutes.
l. If I (go) …… to the post office, I (get) …… you some stamps.
m. If you (eat) …… those green apples, you (may get) …… sick.

UNREAL CONDITIONS: CONTRARY TO FACT (Type II)

Such conditions are either impossible to realize or are not likely to be realized in the near future.

A. USE THE VERBS FORMS FOR PRESENT UNREAL CONDITIONS

EXAMPLE:

If he (study) studied harder he (pass) would pass his examinations.

Exercise 3

1. If he (love) …… her, he (not behave) …… so badly.
2. If he (attend) …… classes more often, he (be) …… a better student.
3. I (may speak) …… English better if I (have) …… more practice.
4. If I (be) …… in the library, I (look up) …… that information in the encyclopedia.

5. If I (have) …… a lot of money, I (help) …… the poor.
6. If I (know) …… more Spanish, I (visit) …… South America.
7. If I (have) …… more leisure time, I (take up) …… painting.
8. She (look) …… better if she (not use) …… so much make up.
9. If it (not be raining) …… I (go) …… fishing.
10. We (can play) …… tennis if we (have) …… some rackets.
11. If I (earn) …… enough money, I (buy) …… a car.
12. If I (be) …… in his place, I (accept) …… the job that was offered him.
13. I (lend) …… him money if he really (need) …… it.
14. If I (not be) …… so busy, I (go) …… to the movies with you.

B. USE THE VERBS FORMS FOR PAST UNREAL CONDITIONS FOR ALL THE SENTENCES IN "A"

EXAMPLE:

If he (study) had studied harder, he (pass) would have passed his examinations.

REAL AND UNREAL CONDITIONS CLAUSES

Exercise 4

Complete the following sentences containing either real or unreal conditional clauses.

1. If I feel better today, _____
2. If you get sick, _____

3. If he had done what I told him, _____
4. If anyone asks for me, _____
5. If anyone insults me, _____
6. If we don't understand our teacher, _____
7. If Johan exercised more often, _____
8. If Mila had known you were coming, _____
9. If You had told me the truth, _____
10. If we had enough time, _____
11. If everybody feels this a good idea, _____
12. If the students don't stop talking, _____
13. If we had had more money, _____
14. If the world population continues to grow, _____
15. If the fire had spread, _____

Exercise 3 (Three): Select the Correct Answer:

1. If Jane had come with us, she …….. a good time.
   a. Would have
   b. Would have had
   c. Will have
   d. Would had

2. If two waves ……. a given point simultaneously, they would have no effect on each other's subsequent.
   a. passed
   b. passes
   c. are passed
   d. had passed

3. If the customer …… not satisfied, he could call the manager right away.
   a. Is b. was c. were d. had

4. If the waiter …….not served the customers very well, the manager would have discharged him.
   a. Were b. Did c. was d. had

5. Peter would have gone on the trip to Las Vegas If he……..much money.
   a. Had c. has had
   b. Had had d. is

6. If I ……not… ……. to Jane's wedding party, I would not come.
   a. Did----- invited c. was------- inviting
   b. Am----- invited d. were ------ invited

7. It would be impossible to get a hotel room this weekend because of the jazz festival if you …… a reservation before.
   a. Did not have c. are not have
   b. Do not have d. had not

8. Unless the students ……. Hard, they could not do the test successfully

a. Studied c. studying
b. Have studied d. were studying

9. She would *have* *to* go *as soon as* possible *if she wants*
   A B C
   to catch *the last flight*.
   D

10. *If* potatoes were *cultivated* in every state, Idaho *produced*
    A B C
    the *largest* crop of all.
    D

11. If the Democratic Party *had reorganized* on a *more* moderate
    A B
    platform, *it* could have win the next *election*.
    C D

12. If the proposal *were* submitted last week, the resignation of
    A
    the director would not *had made* necessary *to revise* the entire
    B C
    set of options.
    D

13. If the new Congress *involved* itself in the issue of the environment,
    A
    some plants and *animal species* might *have had* a chance
    B C D
    of surviving a few more years.

14. If the company *appreciated* Jane's success in *increasing* the *market*
    A B C
    share, he would not have *thought* of leaving the company.
    D

15. You would not get a great success unless you did not work very
    A B C
    hard.
    D

UNIT 7 (Seven)
MODERN BUILDING PROBLEMS

Very tall building present technical design problems. The two most common ways of providing a safe building are the *rigid* frame and the *core* structure. With the rigid frame, all parts of the frame can resist bending forces caused by winds, heat from the sun, and heavy rain.

In the core structure, a central *concrete* core carries the load and support elevator *shafts*. The framework round the edge of the building has to carry only the weight of the cladding. It is worth remembering that these buildings are so high that the temperature and weather at the top can be very different from those at the bottom, adding to the stresses.

Sweeping winds create unusual and disturbing conditions near high building, particularly on confined sites or where the building is a tall slab. This has produced such problems as windblown rain penetrating the protective walling or even more frightening sections about building materials, placement of *ducts* and water supplies, provide a high level of protection.

Comprehension:

Answer the following questions based on the text!

1. How can skyscrapers be safe from hazards?
2. What causes problems in tall buildings?
3. How can bending forces occur?
4. What is the function of the rigid frame?
5. What are the advantages of providing the core structure?
6. What is the possible problem arising during construction?
7. How can modern building use prefabricated materials greatly?
8. What must a building do to provide protection of high-rise building?

Exercise 1

Answer the following questions!

1. What are the advantages and disadvantages of a tall building?
2. What is the absolute aspect that should be taken into account in building a high-rise building?

Exercise 2

Find the meaning of the italic word on the other sentence of the same number!

1. A *skyscraper* building brings effective and efficient ways in using limited land. However, this tall building endangers people inside and around the building when the hard wind blows.
2. Painting steel and iron can *resist* rust. The mason paints the bending iron to protect from corrosion caused by weather.
3. The architect has *carried out* his duty perfectly. He has done a work that may be possible for some people to do it.
4. Is that ornament *worth* setting up? Yes, I think it's necessary to put it on the interior walls.
5. A storm *sweeps* the city. Many high-rise building are destroyed by the wind which blows very hard.

Exercise 3

Match the phrases or the words in the right with the word on the left!

1. Cannot be bent	rigid
2. Out of straight line	concrete
3. Long narrow space	bend
4. Wood or other solid substance	load
5. Thing to be supported if heavy	shaft
	framework
	slab

STRUCTURE: Subjunctive

Some Special Patterns are used after certain Adjectives or Verbs as the Following:

a. Adjective: important, essential, necessary, imperative

Example: It is important that she study hard regularly (not studies)
It is essential that Mira be on time (not is)
It is important that mathematics be learnt by all levels of students.

b. Verbs: insist, recommend, suggest, request, urge, demand

Example: Mr. Andy suggested that his wife speak English clearly (not speaks or spoke).

1. It is important that the TOEFL office _____ your registration.
   a. Will confirms
   b. Confirm
   c. Confirms
   d. Must confirm
2. It is essential that the Princess of Wales _____ the United States.
   a. Visit
   b. Visits
   c. Has visited
   d. Visited
3. After the assassination attempt, President Reagan's doctor suggested that he _____ a short rest on Niagara.
   a. Takes
   b. Must take
   c. Take
   d. Would take
4. It is imperative that you _____ there in person.
   a. Be
   b. Will be
   c. Should be
   d. Are

5. Albert's doctor insisted _____ for a few days.
   a. That he is resting
   b. His resting
   c. Him to rest
   d. That he rest

6. Growing urban populations requested that public facilities such as hospitals and higher education _____ with computer-based tools.
   a. Equipped
   b. Are completely equipped
   c. Be completely equipped
   d. Should be completely equipped

7. The researchers recommended that deforestation _____ because created land erosion the rainy season.
   a. Be ceased
   b. Was ceased
   c. Is ceased
   d. Cease

8. It is important that an athlete _____ warming up before playing.
   a. Does c. doing
   b. Do d. to do

9. The project manager suggested that the team _____ closely together.
   a. Worked
   b. Are worked
   c. Be worked
   d. Work

10. Nutritionists urge *that* food is *chewed* *thoroughly* before
    A B C
    being swallowed
    D

11. *The accused* demanded that she is permitted *to call* her lawyer,
    A B C
    who was unaware of her arrest.
    D

12. The non-government organizations insist that the *project is cancelled* because *of* the *economic* crisis *in* our country.
A B C D

13. When a patient's *blood pressure* is *much higher* than it *should be*,
A B C
a doctor usually insists that he *does not* smoke cigarettes.
D

14. *The Project* manager *suggested* that the team *worked closely* together.
A B C D

15. The teacher has *insisted* that every *student* with no exception *did*
A B C
his work *regularly*.
D

UNIT 8 (Eight)
BUILDING MAINTENANCE

Providing services creates many problems because of the great heights involved. Air-conditioning, heating, all the various *ducts* and drains, need special consideration. In modern *skyscrapers* these services are zoned throughout the height of the building, which means that one failure does not affect the entire building. Elevators need complex control systems that can deliver hundreds of people quickly and safely to the right levels.

Maintenance, repair, and cleaning systems also have to be thought about. The 6500 windows of the Empire State Building are cleaned by window cleaners twice. Modern buildings have automatic equipment that *travels* up and down the face of the building. Even the water is automatically recycled to cut the waste. Many of these buildings have permanent *cradle* systems that can carry workers up and down the *exterior* of the building to perform repairs or simple maintenance.

Another new method of building that makes for added safety is to place the outside framework well clear of the external walls. This means there is no need for added fire protection for the steel, although *hollow*, water-filled external columns are used to prevent damage from fire. The headquarters of the U.S. Steel Corporation in Pittsburgh uses this special technique.

Skyscrapers have brought new social difficulties-people who once lived side by side in a neighborhood street, and who move to a high-rise block; often find it difficult for families with themselves both physically and psychologically separated from daily contact with other people.

H.S. STUTTMAN Inc. *Growing Up with Science*

Comprehension:

Answer the following questions based on the text!

1. Which parts of the building should be maintained?
2. Which systems should we think about?
3. Mention the cleaning systems in paragraph two!
4. What is the new alternative method to save workers? Explain!
5. What problems do the people who live near skyscrapers have?

Exercise 1

1. What is your own solution to solve the problems of the people who live near the skyscrapers?
2. What is your alternative method to make surely safety for the outside frameworks of the workers?

Exercise 2

Fill in the blanks with provided words below!

Elevator	Buildings	Construction	Temperature
Concrete	Skyscrapers	Materials	Mechanized

In the core structure, a central (1) _____ core carries the load and supports (2) _____ shafts. The framework round the edge of the building has to carry only the weight of the cladding. It is worth remembering that these (3) _____ are so high that (4) _____ and weather at the top can be very different from those at the bottom adding to the stresses.

Another problem is likely to arise during the actual construction of the (5) _____. This normally involves a vast operation that has to be carried out on a small and congested site. As a result, modern high-rise construction makes great use of perfected (6) _____ delivered to a site which is heavily (7) _____, according to a carefully planned schedule.

Exercise 3
Match the most appropriate words below!

1. Avoid the dirty and even broken condition
2. Lifting up and down the people to the right levels
3. The smart equipment that travels up and down the face of the modern building
4. The high buildings that are placed in the middle of the city
5. Arranging the flowing water
6. Make a fresh condition in such a room
7. The ventilation of the building
8. To avoid the fire of building

(a) Air-conditioning	(b) Windows	(c) Fire protection
(d) Automatic equipment	(e) Skyscrapers	(f) Elevators
(g) Maintenance	(h) Drains	

STRUCTURE 5 (Five): Adjective Clause

*Adjective clause is a clause that functions as an Adjective in a complex sentence. Adjective clause is usually preceded by : *who, whom, whose, which, that.*

Example: 1) - The new apartment will be built not far from this campus.
- It is designed by my brother

→ The new apartment ***that / which*** will be built not far from this campus is designed by my brother

2) - The gentleman is the president director of big Company.
- He will become the keynote speaker of the seminar

→ The gentleman ***who*** will become the keynote speaker of the seminar is the president director of big Company.

Exercise 1 (One):

1. The notebook _____ on the bus was reported to the chief division of the security.
   a. Whom he had lost
   b. Which he had lost
   c. Had lost
   d. Who had lost

2. The Saiga, which _____ as the Russian antelope, is famous for the medical properties attributed to its horns.
   a. Is also known
   b. Also it is known
   c. Twice is the largest known
   d. More the largest is known

3. Artifacts are ancient objects _____ archeological site during excavation.
   a. Which were found in
   b. Which founded
   c. Which found in
   d. In the finding of

4. About 75 percent of the nation's two-and-four-year universities offer online courses _____ to continue the education at home.
   a. Give people opportunities
   b. Who give people opportunities
   c. That give people opportunities
   d. Have given people opportunities

5. Ecologists are trying to preserve our environment for future generations by protecting the ozone layer, purifying the air, and planting _____
   a. The trees that have been cut down
   b. The trees have been cut down
   c. The trees to cut down
   d. To cut down the trees

6. The geographic position of North America, *laying* between the
   A
   Atlantic and the Pacific *oceans*, isolated *it* in the early days of
   B C
   European *settlement*.
   D
7. Food as tonic *refers* to using food to treat individual *who* *have* a
   A B C
   general *weakness*, but no specific disease diagnosis.
   D
8. *To maintain* the flow of energy and nutrients through the system,
   A
   Ecosystems *have* a *structure* which *consisting* of producers,
   B C D
   consumers, and decomposers.

9. An isotope is one *of* two or more specimens of the same chemical
   A
   who have *different* anatomic *weight*.
   B C D
10. The small Pennsylvania *town of* Jim Thrope *was named* for the
    A B
    famous Indian football player *whom* is buried there.
    C D
11. It is not *surprised* that the Arabs, *which* *possessed* a remarkable gift
    A B C
    of astronomy, mathematics, and geometry, *were* also skillful mapmakers.
    D

12. *In the mid-nineteenth century*, land was *expensive* in large cities
    A B
    who architects began to conserve space by *designing* skyscrapers.
    A B

13. *Unlike* many *other* West African countries, Cameroon is a country
A B
of ten million people *who has* been very successful in *growing* food
for its people. C D

14. The teacher *who* son will be *sent* by this University to *continue*
A B C
studying in UK has *taught* there for more than ten years.
D

UNIT 9 (Nine)
THE BUILDING SITE

George and Angela had been married for two years. At first they lived with Angela's mother, but they very much wanted at home of their own. So they put down a deposit on a new flat.

The builders had demolished two big, old houses with large gardens and they were building ten small, modern flats on the site. Most weekends George and Angela went to see how much progress the builders had made.

When the workers had cleared the site, they dug deep trenches for the foundations, the drains, the gas and water pipes, and the electricity supply. Then they began to build the bricks walls. Unlike so many modern buildings, these flats were not made of concrete.

There was a lot of equipment on the site. A big crane was used to unload the Lorries and there were several cement mixers. Neatly stacked in one corner there were a big pile of bricks and thirty or forty bags of cement covered with plastic sheets.

The workers had erected a small wooden hut where they made their tea and ate their sandwiches. They were bricklayers who built the walls, carpenters who were responsible for the woodwork, and plumbers who installed the water pipes. There were also gas fitter and electricians' who came and went.

The foreman, responsible for coordinating the work of all these people, was a large, red-faced man called Bill. George and Angela got to know him quite well and occasionally he would invite them to sit down in the workers hut and have a mug of strong tea.

As the building got higher a scaffold was built around it and the painters arrived and began to paint all the woodwork. One day George and Angela noticed a tall man, dressed in a dark suit, talking to Bill. Bill

told them later that it was the architect, who had designed the flats. He had called at the site to see how thing were progressing.

Exercise 1

Read the text carefully! Then, study this list of twelve words and choose the ten most suitable to fill the gaps in the sentences below:

Architect	bricklayers	carpenters	cement	mixer
Drains	electrician	fitters	foreman	plumbers
Trenches	crane	scaffold		

1. The _____ build the walls.
2. The _____ is in charge of the other workers.
3. The _____ will install the baths, showers, and toilets.
4. The gas _____ will be responsible for installing the gas pipes.
5. The _____ will fit the wooden window frames.
6. The _____ drew the original plans for the building. He designed the flats.
7. The foundations of the building are sunk in deep _____
8. The dirty water from the kitchen will escape down the _____
9. Building materials are unloaded from the lorries with a _____
10. The painters don't stand on ladders to paint the upper windows. A _____ is built for them work on.

Find out the meaning of the two words you didn't use!

Exercise 2
Find words in the text that mean:

1. Stone or brick base on which a building stands.
2. Underground pipe that carries dirty water away.
3. Experienced worker in charge of other workers.
4. Place where building will stand.
5. Powder which is mixed with water and used to join bricks together.

6. Plan and draw.
7. Fit or fix.
8. Man or woman responsible for planning new buildings.
9. Structure made of poles and planks on which workers can stand while working.
10. Person who has been trained to fit new taps, water pipes, etc.

Exercise 3

Work in pairs. Draw plans for a single storey bungalow (a one-storeyed house) with a sitting-room, bedroom, kitchen, bathroom/toilet, and a small room for storing things in.

STRUCTURE

A. Indirect Speech-Noun Clauses from Statements

Present Main Verb (No Sequence of Tenses)	Past Main Verb (Sequence of Tenses)
He representing verb (that)	He said (that):
The train always arrives late	The train always arrived late
The train is arriving	The train was arriving
The train arrived late	The train had arrived soon
The train will arrive soon	The train would arrive

That is omitted in informal usage. The present tense may be retained in a "that" clause object expressing a generalization (he said that the train always arrives late). No comma precedes or follows a noun clause.

B. Indirect Speech can also be formed from Positive and Negative Command.

1. Positive Command

Ex: a. Help me: My father told me to help him

b. Wait for me here: Mrs. Ida told her son to wait for her there

c. Be patient: Mila told her friend to be patient

2. Negative Command

a. Don't go anywhere before I come back: My mother told me not to go anywhere before she came back home.

b. Don't be angry with me: My friends told me not to be angry with them.

Change into indirect speech.

1. 'Don't smoke in class'
   The teacher told the students .....
2. Help me if you are free
   My friend told me .....
3. Bring me a glass of coffee
   Mr. Dony told his wife .....
4. Don't talk too much while I am teaching in class.
   The teacher told his students .....
5. Let me help you whenever you need my help.
   Rudy told his friend Shinta .....
6. Don't be late to come to my birthday party next week.
   Mira told her friends .....
7. Don't spend your money too much to buy clothes.
   Mrs. Sally told her son .....

8. Go to bed after you do your home work.
   Mr. Ahmed told his children .....

Change into indirect speech Observe the sequence of tenses. Makes the necessary changes in pronouns.

EXAMPLE:

He said, "I need more time to get ready".

➔ He said that he needed more time to get ready

Exercise 1

1. Shinta said, "I have already finished my work".

   _____

2. Andy said, "Construction on your house will begin as soon as the lumber arrives".

   _____

3. The technician said, "The laboratory was repaired before 5 p.m".

   _____

4. The mechanic said, "Your car was painted and you could pick it up at the garage at any time".

   _____

5. The lady said, "We are planning a farewell party for our two guests".

   _____

6. Ronny said, "I could not meet you at the airport whenever you wished".

   _____

7. Our visitor said, "It rains a great deal in my country".

   _____

8. My father said, "The weather was so bad that I couldn't go out at all".

   _____

9. The gardener said, "The bushes should be trimmed once a month".

   _____

10. Sally said, “My parents’ do not live too far away for me to visit them often”.

    _____

11. Robby said, “I would like to see a good movie but I don’t see anything in the paper that interests me”.

    _____

B. Indirect Speech Noun Clauses From Questions A

Change to indirect speech. Observe the sequence of tenses and make necessary changed in pronouns. Use a period at the end of the sentence.

EXAMPLE:

He asked me, “Does the train always arrive late?”

➔ He asked me whether (or information it) the train always arrived late.

Exercise 2

1. Susy asked her friends, “Can you come to my home tonight?”

   _____

2. My friend asked me, “Do you come from Solo or Jogja?”

   _____

3. Someone asked me, “What is your name?”

   _____

4. Mr. Johan asked his daughter, “What color do you want?”

   _____

5. Husein asked his sister, “How many English books do you have?”

   _____

6. Shinta asked her friend Ahmad, “Can you play the guitar very well?”

   _____

7. Rudy asked his friends, “Have you done your assignment or not?”

   _____

8. Somebody asked me, “Where is the post office?”

   _____

9. Mila asked John: “Why didn’t you answer when I called you?”

   _____

10. Mr. Hassan asked his wife: “What were you doing when I called you last night?”

    _____

11. Andy asked me, “How long have you been waiting for me here?”

    _____

12. Deddy asked Sarah, “When will your father leave for Chicago?”

    _____

13. Somebody asked me, “Can you tell me where the bus stop is?”

    _____

14. The teacher asked his students: “Have you ever been to Singapore?”

    _____

15. My father asked me, “Which computer do you want to buy?”

    _____

16. Richard asked Sally, “Whom are you waiting here?”

    _____

17. Billy asked me, “What time did you depart from the station?”

    _____

18. Shinta asked Tony, “Whose dictionary is given me?”

    _____

19. Muhammad asked me, “Does your sister study at UGM or ITB?”

    _____

20. My mom asked me, “How long have you been waiting for me here?”

    _____

21. My friend asked me, “Would you go to the movies or Concert?”

    _____

Exercise 3: STRUCTURE (General Review)

A. Select the Correct Answer:

1. If Jane …… a professional architect, she could design beautiful buildings.
   a. is
   b. was
   c. were
   d. would be

2. If the customers had been satisfied, they …… here to complain.
   a. Will not come
   b. were not came
   c. would not came
   d. would not have come

3. If Peter ……..much money, he would have renovated his house last year.
   a. Had had
   b. had
   c. Has
   d. have had

4. Professor Baker…… we picked up in Juanda Airport was the keynote speaker of the International Seminar …….. we held in our campus last week.
   a. who….whom
   b. whose…… that
   c. whom…….which
   d. which… whose

5. The transfer of science and technology must ……if the nation wants to …….
   a. be encourage-------- develop
   b. encourage --------- developing
   c. be encouraged --------- be developed
   d. have encouraged -------- developed

6. Industrial technology has to……..well in developing countries like Indonesia.
   a. Be implemented
   b. b. implemented
   c. c. is implemented
   d. d. implementing

7. All of the bad news about the new contract ……finally …… clearly.
   a. Have------ confirmed
   b. c. has------- been confirmed
   c. Has ------- been confirming
   d. d. have----- to confirm

8. In canning, heat can …….bacteria and halt enzymes activity in food.
   a. uses to destroy
   b. use to be destroying
   c. be used to destroy
   d. used to destroying

9. Not far from our campus, some new apartments …… recently.
   a. Are building
   b. are being built
   c. will be built
   d. have built

10. The teacher ……. the students if they …… or not before having the final exam.
   a. Said------- have studied
   b. Asked------ had studied
   c. told ---------- would study
   d. asked -------- were studying

11. It is essential that everybody of us…….. our health regularly.
   a. To check
   b. check
   c. is checking
   d. be checked

12. After the assassination attempt, President Reagan's doctor suggested that he ……..
   a short rest on Niagara.
   e. Take b. took c. is taking d. has taken

13. The mechanic said that my car would …… and ……..…be picked it up at the garage at any time.
   a. Repaired------ should
   b. Repair-------- can
   c. be repaired --------- could
   d. have repaired------- had

14. The teacher told the students …… too much in the class.
   a. Don't talk
   b. Are not talking
   c. not to talk
   d. should not talk

15. Mr. Andy asked his son why he ……his homework the night before.
   a. Did not do
   b. Does not do
   c. was not doing
   d. had not done

B. Find the Incorrect Structure or Word(s) Underlined Below

16. The result of the failure to plan for the future *is that* a child from
    A
    an urban area must be *take* to the country to *see nature*.
    B C D
17. She would *have* gone *as soon as* possible *if she wanted* to catch
    A B C
    the last flight.
    D
18. *If* potatoes were *cultivated* in every state, Idaho *produced* the
    A B C
    largest crop of all.
    D
19. *The project* manager *suggested* that the team *worked closely*
    A B C D
    together.
20. One *professional* manager *who* we invited
    A B
    to be the keynote speaker in International Seminar
    C
    a week ago was from USA.
    D
21. Mr. Robby asked his daughter *that she* had *done her home work*
    or not. A B C D
22. Mrs. Mira asked *her friend how far* she *had been* waiting *for her*
    in a parking area. A B C D

23. Mr. Robby told his son *did not* smoke *cigarettes* before he *got*
    some *work*. A B C
    D
24. The teacher asked the students *that* they had *studied* hard *or not*
    A B C
    before they *had* an English examination.
    D

UNIT 10 (Ten)
THE DOMESTIC WATER SUPPLY

The domestic water supply depends upon rainfall which is collected in reservoirs. Before the water is pumped to people's homes, it is cleaned. This is done by passing it through a number of filters. The water is also treated with chemicals.

If there is a shortage of rainfall over an extended period the water company may introduce measures to limit demand. In an extreme case they might take the decision to cut off the supply from the mains for several hours a day. When the water in the reservoirs is low, domestic users may notice a loss of pressure in the taps. In the event of a severe water shortage stand pipes are sometimes set up in the street, or tankers are used to bring water to householders in the affected areas.

In some areas the water supplied to domestic users is hard, hard water furs the inside of the kettle and pipes by depositing lime scale. It is possible to have a plumbed-in water softener fitted, or specials crystals can be purchased which will combat the build-up scale. However, hard water contains calcium and many other essential minerals. Soft water is particularly good for washing clothes.

Exercise 1
Complete the following sentences!

1. The rainfall is collected in _____.
2. The water is passed through _____ in order to clean it.
3. It necessary the supply of water can be cut off from the _____.
4. Hard water _____ the inside of a kettle.
5. The best water for washing clothes is _____ water.
6. The water supply is carried along _____.
7. A gas water heater has a _____ which burns constantly.
8. You obtain water in a house by turning on the _____.

9. When the _____ is low, the water flows into the bath very slowly.
10. _____ is one of the minerals contained in hard water.

Exercise 2

Find words used in the text or in the explanation of the diagram that mean:

1. The sort of pipe that carries away excess water.
2. Stream of gas coming out of a small hole.
3. Metal container, with a lid and handle, used for heating water.
4. Grey material which forms on the side of hot water pipes.
5. Interrupt (the flow of gas, water, etc.).
6. Device through which water passes before reaching people's homes so that the water is clean.
7. Small flame which burns all the time in gas water heaters.
8. Force of the flow of water.
9. Man-made lake where rainfall is collected.
10. Large container where water is stored in home.

Exercise 3

Work in pairs. Shut your books and see if you can reproduce the sketch illustrating how water is supplied to a two-storey house. When you have finished, compare your sketch with the one in the book.

STRUCTURE: PARALLEL STRUCTURE

Parallel Structure indicates a sentence which has the same kind of Part of Speech**:**

Noun-Verb-Adjective-Adverb.

Examples:

1. My mother bought some *fruit and vegetable* (Noun)
2. *Swimming* and *running* are good sports (Noun / Gerund)
3. She is not only *beautiful* but also *smart* (Adjective)
4. The lady is speaking very *slowly* and *clearly* (Adverb)

Exercise:

1. Industrial growth and demand for raw materials from a burgeoning population have caused soil degradation, water shortages, and _____
   a. Deforested widespread
   b. To deforest widespread
   c. Which widespread deforested
   d. Widespread deforestation

2. Locally and regionally, deforestation is associated with declines in rainfall _____ and the alteration of local hydrology.
   a. To increase surface temperatures
   b. Increased surface temperatures
   c. And increase surface temperatures
   d. Increase surface temperatures

3. Log cabins originated in New England *but* *were used* by pioneers
   A B
   because of their inexpensiveness, durability, and *were warm*.
   C D

4. In almost all *developing countries,* the lack of *adequate supplies*
   A B
   of cheap, *convenience*, and reliable fuel is a *major problem*.
   C D

5. The value of television *is* *not only* in providing *inexpensive*
   A B C
   entertainment but also in *the education of* its viewers.
   D

6. Astronomers all over the world gather *data* *by* accurately and
   A B
   careful *observing* the heavens.
   C D

7. *Many* *living* creatures may follow the Dodo, the blue whale,
   A B
   and to eliminate the carrier pigeon into *extinction*.
   C D

8. *Geologists* classify rocks by *patient* and painstakingly noting
   A B
   their *physical* features and chemical *composition*.
   C D
9. *The difference* between a non-profit and a profit-making
   A
   organization is that the letter may *distribute* property or
   B C
   profitable to its stockholders.
   D
10. Any community *depends on* its department's ability *to respond*
    A B
    quickly to fires, manage *effective* fire-fighting tactics, and
    its organization. C
    D
11. *Perennially*, soldiers *complain* *about* the poor food, the boring
    A B C
    work, and *the pay is low*.
    D
12. The main reasons that *tourists* flock to Hawaii are *because* it has
    A B
    warm weather not beautiful scenery and *cultural*.
    C D
13. The Severe Acute Respiratory Syndrome (SARS) *outbreak* is
    A
    causing growing unease in Hong Kong, *emptying* restaurants and
    B
    shopping malls, and *force* most residents to wear face masks in public.
    C D
14. Federal policy *toward* the native American *has* a long history of
    A B
    inconsistency, reversal, and *fail* in the late *1700*.
    C D

UNIT 11 (Eleven)
THE CITY EXPORTS SOME DIRTY AIR

The worst effects of photochemical air pollution originating in New York City and the immediately surrounding area are visited on the neighboring states to the northeast, researchers have found.

Connecticut and Massachusetts pay for the area's environmental sins because of a delayed chemical reaction. Ozone, which in heavy concentrations is an irritating and possibly dangerous pollutant, is created by the reaction of the sun's rays on certain compounds emitted by autos and industry. But the reaction takes a few hours. By that time, air currents can have carried the irritant as much as 200 miles northeastward.

This pattern, discovered through computer analysis by Bell Laboratory researchers, concurs with previous studies of regional air pollution. Scientists at the Boyce Thompson Institute, a plant research center, have found that prevailing winds and storm trajectories across the United States often carry air pollutants hundreds of miles away. So it is probable that while Connecticut and Massachusetts are the unfortunate recipients of the New York City area's dirty air, the city and its environs are likewise inheriting pollutants from industrial centers elsewhere.

Comprehension:

Answer the following questions based on the text!

1. Who suffers the most from New York City air pollution?
2. Who discovered this problem?
3. What kind of air pollution comes from New York City?
4. Why does this polluted air hurt northeastern states more than New York City?
5. What happens during this process?
6. Is ozone dangerous to living thing? Yes no maybe

7. What moves the polluted air to the northeast?
8. How was this pattern discovered?
9. Does other research support this discovery?
10. Why does the polluted air usually move in the same direction?

STRUCTURE: Agreement

*Agreement is used to adjust between the subject and its verb as a Predicate, Object or other Pronouns of a Sentence.

Example: *Mrs. Rachma* *was* a carrier woman. *She* *was* a manager of one National Bank. But when she got married, *her* husband wanted *her* to resign from her main job. Mrs. Rachma and her husband were actually old friends. Now Mrs. Rachma *is* a house wife. She *does* all the house works. She *cooks*, *washes* the dishes, *cleans* the house, and many others. Sometimes when *her husband has* a holiday *he* helps her, clean the house or cook in the kitchen. *Mrs Racha and her husband* *work* together for *their* small family. They feel very happy when *they have* a new baby.

1. No country *is immune* (A) to the *threat* (B) of counterfeit drugs, which *kill* (C) a large number of *patients* (D) every day.
2. Food as tonic *refers* (A) to using food to treat individual *who* (B) *have* (C) a general *weakness* (D), but no specific disease diagnosis.
3. Only one *of* (A) all the states *in* (B) the United States *are* (C) *larger* (D) than Texas.
4. If *both* (A) the President and Vice-President should be *simultaneously* (B) incapacitated, *it is* (C) the speaker of the House of Representatives *which* (D) is next in line.
5. *The first* (A) electric lamp had two carbon rods from *which* (B) vapor

serve *to conduct* the current across the gap.
C D

6. *A* thunderhead, dense clouds that *rise* *high* into the sky in the
A B C
huge columns, *produce* hail, rain, or snow.
D

7. Never before *has* *so many* people *in* the United States been
A B C
interested in soccer.
D

8. *Almost all* books have a few errors in them *in spite of* the care
A B
taken to check *its* proof pages before the final printing.
C D

9. Our biggest and most serious problem *are* *that* the supplies
A B
are not readily *available*.
C D

10. Awards annually *given* *to* the company *is* displayed *in the lobby*.
A B C D

11. All of *the* bad *news* about *the* new contract *have finally been*
A B C D
confirmed.

12. Although *isolated* pockets of hunger still *remain*, the World
A B
Bank nowadays gives some African countries money *to sustain*
C
its self-sufficiency in food production.
D

13. There *is* separate sources of *hazard* in the process of *supplying*
A B C
energy by *nuclear* power.
D

14. All nuclear power stations *produces* wastes *that* in most cases
A B
will *remain* radioactive *for* thousands of years.
C D

15. *Among* the various effects of air pollution, climatic changes are
A
slow, the deterioration of health *is* insidious, and the damage to
B C
plants, animals, or materials *seem* to remote to those not directly involved.
D

UNIT 12 (Twelve)
ADVANCED TECHNOLOGY

Recent technological advances in manned and unmanned undersea vehicles along with breakthroughs in satellite technology and computer equipments have overcome some of the limitations of divers and diving equipment. Without a vehicle, divers often became sluggish and their mental concentration was limited. Because of undersea pressure that affected their speech organs, communication among divers was difficult or impossible. But today, most oceanographers make direct observations by means of instruments that are lowered into the ocean, from samples taken from water, or from photographs made by orbiting satellites. Direct observations of the ocean floor are made not only by divers but also by deep diving submarines and aerial photography. Some of the submarines can dive to depths of more than seven miles and cruise at depths of fifteen thousand feet. In addition, radio-equipped buoys can be operated by remote control in order to transmit information back to land-based laboratories. Often via satellite particularly important are data about water temperature, currents and weather. Satellite photographs can show the distribution of sea ice, oil slicks, and cloud formations over the ocean. Maps created from satellite pictures can represent the temperature and color of the ocean's surface, enabling researchers to study the ocean currents. Furthermore, computers help oceanographers to collect and analyze data from submarines and satellites by creating a model of the ocean's movement and characteristics, scientists can predict the patterns and possible effects of the ocean on the environment.

Recently, many oceanographers have been relying more on satellites and computers than on research ships or even submarine vehicles because they can supply a greater range of information more quickly and efficiently. Some of mankind's most serious problems, especially those concerning energy and food, may be solved with the help of observations made possible by this new technology.

Comprehension:

Answer the following questions based on the text!

1. With what topic is the passage primarily concerned?
   a. Technological advances in oceanography.
   b. Communication among divers.
   c. Direct observation of the ocean floor.
   d. Undersea vehicles.

2. The word "sluggish" in line 3 is closest in meaning to…
   a. Nervous
   b. Confused
   c. Slow moving
   d. Very weak

3. Divers have had problems in communicating underwater because…
   a. The pressure affected their speech organs.
   b. The vehicles they used have not been perfected.
   c. They did not pronounce clearly.
   d. The water destroyed their speech organs.

4. This passage suggests that the successful exploration of ocean depends upon…
   a. Vehicles as well as divers.
   b. Radios that divers use to communicate.
   c. Controlling currents and the weather.
   d. The limitation of diving equipment.

5. Undersea vehicles…
   a. Are too small for a man to fit inside.
   b. Are very slow to respond.
   c. Have the same limitations that divers have.
   d. Make direct observations of the ocean floor.

6. The word "cruise" in line 10 could best be replaced by…
   a. Travel at a constant speed.
   b. Function without problems.
   c. Stay in communication.
   d. Remain still.

7. How is radio-equipped buoy operated?
   a. By operators inside the vehicle in the part underwater.
   b. By operators outside the vehicle on a ship.
   c. By operators outside the vehicle on a diving platform.
   d. By operators outside the vehicle in a laboratory on shore.

8. Which of the following are NOT shown in satellite photographs?
   a. The temperature of the ocean's surface.
   b. Cloud formations over the ocean.
   c. A model of the ocean's movements.
   d. The location of sea ice.

9. The word "those" in line 22 refers to…
   a. Energy and food
   b. Problems
   c. Observations
   d. Vehicles

10. According to the author, what are some of the problems the underwater studies may eventually resolve?
   a. Weather and temperature control.
   b. Food and energy shortages.
   c. Overcrowding and housing problems.

UNIT 13 (Thirdteen)
ORGANIC ARCHITECTURE

Organic architecture-that is, natural architecture-may be varied in concept and form, but it is always faithful to natural principles. Organic architecture reject rules imposed by individual preference or more aesthetics in order to remain true to the nature of the site, the materials, the purpose of the structure, and the people who will ultimately use it, if these natural principle are upheld, then a bank cannot be built to look like a Greek temple. Form doesn't follow function; form is inseparable from function. In other words, a building should be inspired by nature's forms and constructed with materials that retain and respect the natural characteristics of the setting to create harmony with its natural environment. It should maximize people's contact with and utilization of the outdoors.

Natural principles then, area principles of design, not style, expressed by construction that reflects unity, balance, proportion, rhythm, and scale. Like a sculptor, the organic architect views the site and materials as an innate form that shapes and developed organically from within. Truth in architecture results in a natural, spontaneous structure in total harmony with the setting. For the most part, these structures find their geometric themes in the contours of the land and their colors in the surrounding palette of nature.

From the outside, an organic structure is so much a part of nature that is often obscured by it. In other words, it may not be possible for the eye to easily separate the man-made structure from the natural terrain. From the inside, tooms open into the each other. Natural light, air, and view permeate the whole structure, providing a sense of communication with the outdoors.

Comprehension:

Answer the following questions based on the text!

1. What is another name for organic architecture?
   a. Natural architecture
   b. Aesthetic architecture
   c. Principle architecture
   d. Varied architecture

2. The word "ultimately" in line 4 could best be replaced by …
   a. Fortunately
   b. Eventually
   c. Supposedly
   d. Obviously

3. The word "it" in line 2 refers to…
   a. Architecture
   b. Site
   c. Purpose
   d. Structure

4. The word "upheld" in line 5 is closest meaning in to …
   a. Invalidated
   b. Disputed
   c. Promoted
   d. Perceived

5. In organic architecture, which of the following is true?
   a. Form follows function
   b. Function follows form
   c. Function is not important to form
   d. Form and function are one

6. A good example of natural principles is a …
   a. Bank that is built to look like a Greek temple.
   b. Bank built so that the location is unimportant to the structure.
   c. Bank that is built to conform to the natural surroundings.
   d. Bank that is built to be beautiful rather than functional.

7. Why does the author compare an organic architect to a sculptor?
   a. To emphasize aesthetics.
   b. To give an example of natural principles.
   c. To make a point about the development of geometry.
   d. To demonstrate the importance of style.

8. Where in the passage does the author mention the source of geometric themes?
   a. Lines 14-15
   b. Lines 16-17
   c. Lines 17-18
   d. Lines 19-20

9. The word “obscured” in line 16 is closest in meaning to …
   a. Difficult to see
   b. In high demand
   c. Not very attractive
   d. Mutually beneficial

10. Which of the following statements best describes the architect’s view nature?
   a. Nature should be conquered.
   b. Nature should not be considered.
   c. Nature should be respected.
   d. Nature should be improved.

Structure: Present Habit, Past Habit and Some Special Patterns

1. **Present Habit: Subject + be (is-am-are) + used to + Verb-1 + ing**

   Ex: - I am used to reading the news paper in the morning.
   - The teacher is used to explaining the new material before he gives some quiz.

2. **Past Habit:**

   a. Subject + used to + Verb-1.

   Ex: Donny used to play kites with his friends when he was a small boy.

   b. Subject + be (was/were) used to + Verb-1 + ing

   Ex: Donny was used to playing kites with his friends when he was a small boy.

3. **Some certain Verbs** such as: ask, request, demand, permit, use, prohibit in Passive Construction, consider (ing form):

   Subject + Passive Construction + to + Verb-1

   Ex: You *are demanded to work* hard; Sheila is not permitted to go out with her boy friend.

4. **Verbs such as: want, decide, like, have, expect, need, plan, (+ to + Verb-1)**

   Ex: I *expect to get* a good score for my English subject this semester.

5. **Some other Verbs such as: stop, like, start, practice, avoid, keep on, can't help, enjoy, fail, finish, look forward to (+ Verb-1 + Ing).**

   Ex: I enjoy(ed) ***listening*** to the classical music very much.

6. **Subject + (Had better – Would rather) + Verb-1**

   Ex: I would rather ***go*** home earlier

Exercise:

1. Many students _____ having lunch at the campus cafeteria before having a math class.
   a. Are used to
   b. Used to
   c. Use to
   d. Were used
2. Mila _____ her seat a week before the departure if she wants to go to Jakarta.
   a. Had better to reserve
   b. Had to better reserve
   c. Had better reserve
   d. Had to reserve better
3. Unlike most Europeans, many Americans _____ a bowl of cereal for breakfast every day.
   a. Used to eating
   b. Are used to eat
   c. Are used to eating
   d. Use to eat
4. In Indonesia as early as ten years old, young boys enjoyed _____ football.
   a. To play
   b. Playing
   c. Played
   d. The play
5. The hotel manager looked forward _____ from you as soon as possible before Winter season.
   a. To hear
   b. To hearing
   c. Hearing
   d. To be heard

6. The architect is considering _____ an apartment in the coastal areas of the tropical countries.
   a. Building
   b. To build
   c. Built
   d. To be built

7. Some foreign postgraduate students at Wisconsin University failed _____ the entrance exam because they had not been admitted yet.
   a. To take
   b. Take
   c. Taking
   d. Taken

8. In canning, heat can be used _____ bacteria and halt enzymes activity in food.
   a. To destroy
   b. Destroy
   c. Destroying
   d. Destroyed

9. Mr. Guzman wanted *spending* *more* money on advertising *after*
   A B C
   consulting *a* marketing expert.
   D

10. *Mr. Gilden's* friends *thoroughly* enjoyed *to plan* his *retirement* party
    A B C D
    two weeks ago.

11. *Guests* *who* possibly *delayed* are asked *registering* for late arrival.
    A B C D

UNIT 14 (Fourteen)
NOISE POLLUTION

Noise, commonly defined as unwanted sound, is another environmental pollutant. Particularly in congested urban areas. The noise produced as a byproduct of our advancing technology causes physical and physiological harm, and detracts from the quality of life for those who are exposed.

Unlike the eye, the ear has no lid, therefore noise penetrates without protection. Loud noises instinctively signal danger to any organism with a hearing mechanism, including human beings. In response, heartbeat and respiration accelerate, blood vessels constrict, the skin pales, and muscles tense. In fact, there is a general increase in functioning brought about by the flow of adrenaline released in response to fear, and some of these responses persist even longer than the noise, occasionally as long as thirty minutes after the sound has ceased.

Because noise is unavoidable in a complex, industrial society. We are constantly responding in the same ways that we would respond to danger. Recently, researchers have concluded that noise and our response may be much more than an annoyance. It may be a serious threat to physical and psychological health and well-being, causing damage not only to the ear and brain but also the heart and stomach. We have long known that hearing loss is America's number one nonfatal health problem, but now we are learning that some of us with heart disease and ulcers may be victims of noise is very important. Nervousness, irritability, tension, and anxiety increase affecting the quality of rest during sleep, and the efficiency of activities during waking hours.

Comprehension:

Answer the following questions based on the text!

1. What is the author's main point?
   a. Noise may pose a serious threat to our physical and psychological health.
   b. Loud noises signal danger.
   c. Hearing loss is American's number one.
   d. The ear is not like the eye.
2. What is the author's definition of noise?
   a. Unwanted sound
   b. A byproduct of technology
   c. Physical and psychological harm
   d. Congestion
3. What is probably the topic of the paragraph that preceded this passage?
   a. Environmental pollutants
   b. Urban areas
   c. Technology
   d. Disease
4. The word "congested" in line 2 could best be replaced by …
   a. Hazardous
   b. Polluted
   c. Crowded
   d. Rushed
5. It can inferred from this passage that the eye …
   a. Responds to fear
   b. Enjoy greater protection than ear
   c. Increases functions
   d. Is damaged by noise
6. According to the passage, people respond to loud noises in the same way that they respond to …
   a. Annoyance
   b. Danger
   c. Damage
   d. Disease

7. The word “accelerate” in line 7 is closest in meaning to …
   a. Decline
   b. Interrupt
   c. Increase
   d. Cease

8. The word “it” in line 4 refers to …
   a. Noise
   b. Harm
   c. Life
   d. Technology

9. According to the author, which of the following is true?
   a. Noise is not a serious problem today.
   b. Noise is American’s number-one problem.
   c. Noise is an unavoidable problem in an industrial society.
   d. Noise is a complex problem.

10. The phrase “as well” in line 17 is closest in meaning to which of the following?
    a. After all
    b. Also
    c. Instead
    d. Regardless

STRUCTURE

NOUN CLAUSES AFTER WISH (1)

REFERRING TO PRESENT TIME

After the verb wish, a noun clause may refer to present or past time. The introductory that is often omitted, especially in informal language.

Wishes referring to present time are the often contrary to fact. The past subjunctive form of the verb is used for such wishes. Supply the correct form the following present contrary to fact wishes. Omit the introductory that:

EXAMPLE:

a. I’m at home now. I wish (be at the beach).
   I wish I were at the beach (only the form were is used for the verb)
b. That’s a beautiful picture. I wish (know how to paint).
   I wish I know how to paint.

c. Our refrigerator is always reaking now. I wish (can afford to buy a new refrigerator).
I wish I could afford to buy a new refrigerator.

Exercise 1

1. I have black hair. I wish (have a red hair).

_____

2. Our apartments are very noisy. We wish (can move away from here).

_____

3. I'm only a housewife. I have often wished (be a glamorous movie star).

_____

4. They live in tropical climate now. They wish (can live in a moderate climate).

_____

5. We have to go to work on our income tax tonight. Don't you wish (can go to a good movie instead)?

_____

6. It's very cold outside. I wish (be warmer).

_____

7. She lives in the eastern part of the country. She wishes (live in the west).

_____

8. It's hard for me to express myself in English. I wish I (can speak English well).

_____

9. We are sorry you have to leave now. We wish (can stay longer).

_____

10. Our television set isn't working. I wish (know how to fix it).

_____

11. It's winter now. I wish (be summer).

_____

12. It takes me a long time to get work by bus. I wish (have a car) and (can drive to work).

_____

13. The cat isn't eating. I wish (know what the matter is).

_____

NOUN CLAUSES AFTER WISH (2)

REFERRING TO PAST TIME

Wishes referring to past time are not realized. Past perfect forms are used in such wishes. Supply the correct form the following past unrealized wishes. Omit the introductory that:

EXAMPLE:

a. I feel very uncomfortable. I wish (not eat so much)
   I wish I had not eaten so much.
b. I don't have enough money with me when I left the house. I wish (take more money)
   I wish I had taken more money with me when I left the house.

Exercise 2

1. She lives in the city now. She wishes (never leave the country).

_____

2. This house is too small. I wish (not be in such a hurry to sell it).

_____

3. I can't come to the meeting. I wish (know about it yesterday).

_____

4. Everyone at the party is dressed do formally. I wish (put on my new suit).

_____

5. I'm catching a cold. I wish (not go out in the rain yesterday).

_____

6. The car is out of gas. I wish (think of getting some before we started out trip).

_____

7. He has undertaken an impossible task. In a few weeks he will wish (never start it).

_____

NOUN CLAUSES WITH INFINITIVE ABRIDGEMENT

Replace the word *this* with an abridged noun clause based on the second sentence in each group of sentences.

EXAMPLE:

a. We haven't decided this.
   When should we hold the dance?
   We haven't decided when to hold the dance.
b. She is showing the children this.
   How should they draw a tree?
   She is showing the children how to draw a tree.

Exercise 2

1. I can remember this. How can start your car?

_____

2. We must find out this. Where should we deliver these packages?

_____

3. I have forgotten this. Which road should I take to get to the lake?

_____

4. I can't decide this. Should I go to the movies or should I stay home and watch television?

_____

5. Please tell me this. What should I buy?

_____

6. The office manager will explain this to the new typist. Where should she work and what should she do?

_____

7. I don't know this. Whom should I see about my taxes?

_____

8. The committees must decide this soon. When should it have its next meeting?

_____

9. I don't know this. Should I buy the red dress or the blue one?

_____

10. We must decide this. Where shall we put all the new furniture?

_____

11. We will soon let you know this. Where should you deliver the merchandise?

_____

12. She asked the doctor this. When should I change the bondages?

_____

13. They are considering this. Should they buy a new car?

_____

Present participle (example, offering): The time of the main verb determines the time of participle

EXAMPLE:

a. The woman who is washing the dishes is our new cook.
   The woman washing the dishes is our new cook. (The participles is derived a progressive verb)
b. Anyone who violates this law will be punished.
   Anyone violating this law will be punished. (The participle is derived from non progressive verb)

Exercise 3

1. The gentlemen who are crossing the street is an old friend of my father's.

_____

2. Anyone who travels in a foreign land should make sure that he has the proper documents.

_____

3. All passengers who are not going to rockaway must change trains at the next stop.

_____

4. We need a room which seats one hundred people.

_____

5. Anyone who doesn't enter the country legally will be immediately deported to the country he comes from.

_____

6. The young woman who was running to each the bus stumbled and fell.

_____

Past participles (example, offered)

The time of the main verb determines the time of the participles.

EXAMPLE:

Doctors often recommend rabies shot for anyone who is bitten by strange dog.

➔ Doctors often recommend rabies shot for anyone bitten by a strange dog.

Exercise 4

1. The jewelry which was stolen from neighbor's house was found by police.

_____

_____

2. A letter which is sent by air mail should arrive sooner than one which is sent by regular mail.

_____

_____

3. We will prosecute anyone who is caught trespassing on this property.

_____

_____

4. Mr. X, who has been exiled from his homeland for many years, began to make inquiries about whether. He could return.

_____

_____

5. The young violinist, who was encouraged by his teacher, decided to enter his name in the music contest.

_____

_____

6. The two women, who were dressed in their Sunday best, proceeded into church.

_____

7. Any package which is not wrapped properly will not be accepted by the post office.

_____

_____

STRUCTURE:

Preposition + Gerund

1. An organ *is* a group *of tissues* capable *to perform* some special
   A B C
   function, as, *for example*, the heart, the liver, or the lungs.
   D
2. Sustainable development calls for *improving* the quality of life
   A
   for all of *the world's people* without *increase* the use of natural
   B C
   resources *beyond* the earth's carrying capacity.
   D
3. New synthetic materials *have* improved *the construction* of
   A B

artificial *body parts* by *provide* the power and the range of action
C D
of a natural limb.

4. In *the* year 1864, Robert E. Lee concentrated *all his* attention on
A B C
win the civil war.
D

5. Many modern *architects insist on use* materials *native to* the
A B C D
local region.

6. The *scientific* revolution of the early 1990's *affected* education
A B
by *change* the nature of *technology*.
C D

7. Last summer the bank *defined* the *finance* ministry by *raise*
A B C
short-term rates *from* zero to 0.25.
D

8. Very few *people* in the modern world obtain *their* food supply by
A B
hunt in the natural environment *surrounding* their homes.
C D

9. The Federal Reserve System's *primary* function is *to control*
A B
monetary policy by *influence* the cost and *availability* of money
C D
and credit through the purchase and sale of government securities.

10. *Fresh* from *his* Virgin Blue success, Richard Branson has
A B
expressed interest in *invest* in a low fare operation specifically in
C D
Asia.

UNIT 15 (Fifteen)
PURE AND APPLIED SCIENCE

The terms '**pure science**' and '**applied science**' are frequently confusing to many students. Are these two totally different activities, or are they interconnected ones? Let us begin by examining what each of them does.

Pure science deals primarily with the development of theories. These theories establish relationships between the phenomena of the universe. When people validate them sufficiently, such theories (hypotheses, models) become the working laws or principles of science. In carrying out this work, the pure scientist usually disregards its application to practical affairs, and he confines his attention to explanations of how and why events occur. Hence, in physics, the equations describing the behavior of fundamental particles, or in biology, the establishment of the life cycle particular species of insects, are said to be examples of pure science, since they have no apparent connection (for the moment) with any application to the practical affairs of life.

Applied science, on the other hand, deals directly with the application of the working laws of pure science to the practical affairs of life, and to increasing man's control over his environment. Thus, it leads to the development of new techniques, processes, and machines. In many cases, people call this development "**technology**".

Such activities as investigating the strength and uses materials, extending the findings of pure mathematics to improve the sampling procedures in statistical works, and developing the potentialities of atomic energy, are all examples of the work of the applied scientist or technologist.

It is evident that many branches of applied science are practical extensions of purely theoretical or experimental work. Thus the study of radioactivity began as a piece of pure research, but its results are now applied in a great number of different ways such as in cancer treatment in medicine, the development of fertilizers in agriculture, the study of metal fatigue in engineering, in methods of estimating the ages of objects in anthropology and geology, etc.

Conversely, work in applied science and technology acts as a direct stimulus to the development of pure science. Such an interaction occurs, for examples, when the technologist, in applying a particular concept of pure science to a practical problem, reveals a gap or limitation in the theoretical model. Thus, he points the way for further research until another technologist provides him with more highly-developments.

It seems, then, that these two branches of science are mutually dependent and interacting, and that the so called division between the pure scientist and the applied scientist is more apparent than real.

*Adapted from "**A Course in Scientific English**" by **J. R. Ewer***

Answer the following questions based on the text!

1. What is the objective of a pure scientific investigation?
2. Under what condition do the theories developed by pure scientists become the principles of science?
3. Name examples of pure scientific research!
4. Is it possible that applied science develops by itself, apart from basic research findings? Explain!
5. What is the work of applied scientists?
6. Name some examples of applied science!
7. How does applied science relate to technology?
8. How do pure science and applied science interact? Give an example of this interaction!

Exercise 1

Complete the following sentences, choosing one of the phrases in the brackets!

1. The results of research on radioactivity are applied in …… (**electronic computer; sampling procedures; cancer treatment; pure science**)
2. Many branches of applied research have developed out of …… (**the work of technologists; pieces of basic research; equations describing the behavior of fundamental particles; new processes**)
3. Pure science relates to …… (**more highly developed instruments; sampling procedures; solving practical problems; developing theories explaining the relationships between phenomena**)
4. New types of instruments are frequently essential for …… (**developing basic research; improving fertilizers in agriculture; describing the life cycles of insects; finding the cube root of fractions**)
5. Investigating the strength and uses of materials is an example of …… (**the principles of pure science; technology; the interaction of basic and applied research; a theoretical model**

Exercise 2

Complete the following sentences with suitable verbs from the list!

1. A scientist must …… adequate evidence to …… a theory.
2. We must …… many experiments in order to …… a new process.
3. If an experiment is not successful, we must …… it.
4. An experiment must be carefully ……ed if we want it to …… a theory properly.

5. Technologists …… new machines to increase production.
6. If a series of carefully ……ed experiments dis…… a hypothesis.
7. Engineers …… experiments to …… information about the strength of materials.
8. When new instruments are ……ed, the scientist is able to …… further experiments, frequently with the result of ……ing or ……ing well-established theories.

UNIT 16 (Sixteen)

THE SYMBOLISM OF MATHEMATHICS

People even consider mathematics a difficult and mysterious science, because of its numerous complicated symbols. Of course, nothing is more incomprehensible than a symbolism when we do not understand it. Besides, a partially understood symbol is difficult to follow. In exactly the same way the technical terms of any profession are incomprehensible to common people. But this is not because they are difficult in themselves. On the contrary, scientists or technologists have introduced them to make things easy. So in mathematics, granted that we are giving any serious attention to mathematical ideas, the symbolism is an immense simplification. It is not only of practical use, but is of great interest. For it represents an analysis of the ideas of the subject and an almost pictorial representation of their relations to each other.

Let us assume for the present that we have sufficiently clear ideas about the integral numbers, represented in the Arabic notation by 0, 1, 2, …, 9, 10, 11, …, 100, 101, … and so on. The Arabs introduced this notation into Europe, but they apparently obtained it from Hindu sources. In a good symbolism, the juxtaposition of important symbols should have an important meaning. This is one of the merits of the Arabic notation for numbers. By means of ten symbols, 0 to 9, and by simple juxtaposition it symbolizes any number whatever. Before the introduction of the Arabic notation, multiplication was difficult, and the division was even more complicated.

If anyone doubts the utility of symbols, let him write out in full, without any symbol whatever, the whole meaning of the following equations.

X + Y	=	Y + X	(1)
(X + Y) + Z	=	X + (Y + Z)	(2)
X * Y	=	Y * X	(3)
(X * Y) * Z	=	X * (Y * Z)	(4)
X * (Y + Z)	=	(X * Y) + (X * Z)	(5)

These equations represent some of the fundamental laws of algebra. Here (1) and (2) are the commutative and associative laws for addition. (3) and (4) are the commutative and associative laws for multiplication, and (5) is the distributive law relating addition and multiplication. For example, without symbols, (1) becomes: if we add a second number to any given number the result is the same as if we had added the first given number to the second number. This example shows that, by the aid of symbolism, we can take transitions in reasoning almost mechanically by the eye. This would otherwise need the higher faculties of the brain.

It is interesting to note how important for the development of science a modest-looking symbol may be. It may stand for the emphatic presentation of an idea, often a very subtle idea, and by its existence make it easy to exhibit the relation of this idea to all the other complex idea.

*Condensed from "**An Introduction to Mathematics**" by **Alfred North Whitehead***

Answer the following questions based on the text!

1. What makes mathematics look difficult to common people?
2. What was the scientists' objective when they introduced the various symbols in mathematics?
3. What does the symbolism mean to those specially interested in mathematical ideas?
4. What is the result of the symbolism to common people?
5. Why is that people specially interested in mathematics can practically use the symbolism and are interested in it?
6. Does the Arabic notation originally come from Arab? Explain!
7. What is one of the merits of the Arabic notation for numbers?
8. How does the Arabic notation symbolizes any number whatever?
9. What is the merit of the Arabic notation particularly for arithmetical operation?

10. How does the symbolism help people in writing out the whole meaning of mathematical equations?
11. Explain what is meant by the clause "by the aid of symbolism, we can make transitions in reasoning almost mechanically by the eye" in paragraph 3 of the text!
12. In conclusion, what is the role of particular symbols in the development of science?

To read mathematical operations, values, expressions, and equations we should use particular ways. Here are some of them:

EXAMPLES:

1.) 4 + 3 = 7	Four plus three equals seven
2.) 5 – 2 = 3	Five minus two equals three
3.) 5 * 3 = 15	Five times (multiplied) three equals fifteen
4.) 20 : 2 = 10	Twenty divided by two equals ten
5.) X^2	X squared
6.) Y^3	Y cubed
7.) X^6	X to the power of six (X to the sixth)
8.) $\sqrt{x}$	The square root of X
9.) $\sqrt[3]{Y}$	The cube root of Y
10.) $X = \frac{1}{(y+1)}$	X equals one over Y pus one
11.) $a_{\log x}$	log of X to the base a

L equals the integral from two to three of four X cubed times.

Practice reading out these operations, values, expressions and equations!

1. 27 : 3 = 9
2. 6 * 7 = …
3. 4 + 6 – 3 = 7
4. X^{n-1}

5. $\sqrt[n]{X}$
6. $b^2 = a^2(1 - e^2)$
7. $x = \frac{a+b}{c}$
8. $a_{\log x^n} = n\, a_{\log x}$
9. $\int (3x^2 + 2x - 4)\, dx = x^3 + x^2 - 4x + c$
10. $\frac{x^5}{a^5} + \frac{y^5}{b^5} + \frac{z^5}{c^5} = 1$
11. $\frac{\sqrt[3]{(x^2+y^2)}}{x}$

STRUCTURE:

Used To / Be Used To:

I. Present Habit : Subject + is / am / are /+ used to + verb I + ing

Ex: I am used to drinking plain water in the morning

II. Past Habit :

a) Subject + used to + Verb I

Ex: - I used to play in the rain when I was a small boy

b) Subject + was / were / used to + Verb I + ing

Ex: - I was used to playing in the rain when I was a small boy

1. Your sister used to _____ you quite often.
   a. Visit
   b. To visit
   c. Visiting
   d. Visited
2. John _____ in the rain with friends when he was a little boy.
   a. Is used to playing
   b. Is used to play
   c. was used to playing
   d. Were used to playing

3. Many students _____ their lunch at the campus cafeteria.
   a. Are used to having
   b. Used to have
   c. Used to having
   d. are used to have

4. Unlike most Europeans, many Americans _____ a bowl of cereal for breakfast every day.
   a. Used to eating
   b. Are used to eat
   c. Are used to eating
   d. Use to eat

5. Ancient civilizations such as those of the Phoenicians and the Mesopotamians _____ goods rather than use money.
   c. Use to trade
   d. Is used to trade
   c. Used to trading
   d. Were used to trading

6. *As* (A) a young child, the author *was used to sit* (B) for hours on the river bank *fishing* (C) in the river and *thinking about* (D) life.

7. In Asian countries, *such as* (A) China, India, and Malaysia *restrictive* (B) policies on foreign exchange are used to *limit* (C) what the bank *can actually do* (D).

8. Adidas was used to *split* (A) its operations in the region: the *distribution* (B) and marketing and the sourcing side which is a global *sourcing* (C) business *based* (D) in Hong Kong.

9. Chinese second *largest* (A) mobile phone and consumer electronics manufacturer, TCL Corp, *is* (B) used to *engineer* (C) a *novel* (D) restructuring.

10. The Asian Development Bank (ADB) *is* (A) used to *support* (B) power plant projects in Thailand to help *meet* (C) the country's long-term need for *reliable* (D) energy.

UNIT 17 (Seventeen)
ORGANIC CHEMISTRY

Organic chemistry is the chemistry of the compounds of carbon.

The misleading name "**organic**" is a relic of the days when chemical compounds were divided into two classes. Inorganic and organic, depending upon where they had come from. Inorganic compounds were those obtained from minerals; organic compounds were those obtained from vegetable or animal sources, that is, from material produces by living organisms. Indeed, until about 1850 many chemists believed that organic compounds must have their origin in living organisms, and consequently could never be synthesized from inorganic material.

These compounds from organic sources had this in common: they all contained the element carbon; even after it had become clear that these compounds did not have to come from living sources but could be made in the laboratory. It was convenient to keep the name *organic* to describe them and compounds like them. The division between inorganic and organic compounds has been retained to this day.

Today, although many compounds of carbon are still most conveniently isolated from plant and animal sources, most of them are synthesized. They are sometimes synthesized from inorganic substances like carbonates or cyanides, but more often from other organic compounds. There are two large reservoirs of organic material from which simple organic compounds can be obtained: *petroleum* and *coal*. (Both of these are "**organic**" in the old sense, being products of the decay of plants and animals.) These simple compounds are used as building blocks from which larger and more complicated compounds can be made.

What is so special about the compounds of carbon that they should be separated from compounds of all the other hundred-odd

elements of the Periodic Table? In part, at least, the answer seems to be this: there are so very many compounds of carbon, and their molecules can be so large and complex.

The number of compounds that contain carbon is many times greater than the number of compounds that do not contain carbon. These organic compounds have been divided into families, which generally have no counterparts among the inorganic compounds.

Organic molecules containing thousands of atoms are known, and the arrangement of atoms in even relatively small molecules can be very complicated. One of the major problems in organic chemistry is to find out how the atoms are arranged in molecules, that is, to determine the structures of compounds.

There are many ways in which these complicated molecules can break apart or rear ranges themselves, to form new molecules; there are many ways in which atoms can be added to these molecules, or new atoms substituted for old ones. Much of organic chemistry is devoted to finding out what these reactions are, how they take place, and how they can be used to synthesize compounds we want.

Carbon atoms can attach themselves to one another to an extent not possible for atoms of any other element. Carbon atoms can form chains thousands of atoms long, or rings of all sizes; the chains and rings can have branches and cross-links. To the carbon atoms of these chains and rings, there are attached other atoms, chiefly hydrogen, but also fluorine, chlorine, bromine, iodine, oxygen, nitrogen, sulfur, phosphorus, and many others.

Each different arrangement of atoms corresponds to a different compound, and each compound has its own characteristic set of chemical and physical properties. It is not surprising that close to a million compounds of carbon are known today and that thousands of new ones are being made each year. It is not surprising that the study of their chemistry is a special field.

Organic chemistry is a field of immense importance to technology: it is the chemistry of dyes and drugs, paper and ink, paints and plastics, gasoline and rubber tires; it is the chemistry of the food we eat and the clothing we wear.

Organic chemistry is fundamental to biology and medicine. Aside from water, living organisms are made up chiefly of organic compounds: the molecules of "**molecular biology**" are organic molecules. Ultimately, biological processes are a matter of organic chemistry.

*Adapted from "**Organic Chemistry**" by*
Robert T. Morrison & Robert N. Boyd

Answer the following questions based on the text!

1. What is the old definition of organic and inorganic compounds?
2. Is the division between inorganic and organic compounds still used today? Why?
3. What is the misconception concerning this division in terms of the new development in chemistry?
4. What happened to the concept of organic compounds after 1850?
5. From what sources are compounds of carbon isolated today?
6. Why is it that the compounds of carbon should be separated from compounds of the other elements of the Periodic Table?
7. What is one of the major problems in organic chemistry?
8. What is organic chemistry concerned with?
9. What specialty do carbon atoms have as compared with atoms of any other element?
10. It is not surprising that the study of organic chemistry is a special field. Why?
11. Name some examples of the important merits of organic chemistry to technology?
12. Why it is that organic chemistry is fundamental to biology and medicine?

Exercise 1

Match the word in list A to the phrases in list B according to their meanings in the passage!

	A	B
1.	Compound	a. A colorless, tasteless, odorless gaseous element that combines with oxygen to form water.
2.	Carbon	b. Living being with parts that work together.
3.	Mineral	c. A light yellow substance that burns with a bright flame and strong smell, used in medicine and industry.
4.	Organism	d. A colorless, tasteless, odorless element occur ring free in the atmosphere and necessary to the existence of all forms of life.
5.	Element	e. A combination of two or more elements.
6.	Molecule	f. A colorless, tasteless, odorless gaseous element that forms about four-fifths of the atmosphere by volume.
7.	Hydrogen	g. A non-metallic element found in all organic substances and in some inorganic substances.
8.	Oxygen	h. A substance that has not so far been split up into a simple one by ordinary chemical methods.
9.	Nitrogen	i. A substance (not vegetable or animal) got from earth.
10.	Sulfur	j. The smallest unit into which a change in its chemical nature.

DID YOU KNOW?

A relative clause can be reduced to a phrase with either a present participle or past participle verb as a post modifier. The following is possible:

1. When the defining relative clause contains a verb in the passive.
   e.g. inorganic compounds were those **which were obtained** from minerals.
   = inorganic compounds were those **obtained** from minerals.
2. When the defining relative clause contains a verb in the simple present or continuous tense.
   e.g. organic molecules **that contains** thousands of atoms are known.
   = organic molecules containing thousands of atoms are known.
3. When the defining relative clause begins with "**Which has/have**"
   e.g. the coke obtained from paraffin-base crude oil consists of complex hydrocarbons **which have** a high carbon-to-hydrogen ration.
   = the coke obtained from paraffin-base crude oil consists of complex hydrocarbons **having** a high carbon-to hydrogen ratio.

Exercise 2

Reduce the following relative clauses if they can be reduced.

1. The forces that hold atoms together are known as chemical bonds.
2. There are different kinds of orbital, which have different size and different shapes
3. The amount of energy that is given off when a bond is formed is called the bonds dissociation energy.
4. The two electrons that occupy a bond orbital must have opposite spins.
5. Bond orbital that have a sausage shape with its long axis lying along the line that joins the nuclei are called sigma orbital.
6. Optical inactivity is not a property of individual molecules, but rather of the random distribution of molecules that can serve as mirror images of each other.

7. Dienes are usually prepared by adaptations of the methods which are used to make simple alkenes.
8. Dienes are simply alkenes that contain two carbon-carbon double bonds.
9. Hydrogen which is attached to triply-bonded carbon, as in acetylene or any other alkyne with the triple bond at the end of the chain, shows appreciable acidity.
10. Other alkynes that have a hydrogen that is attached to triply bonded carbon show comparable acidity.

Exercise 3

Split up these sentences containing the relative clauses into two parts as shown in the example

e.g. There are two large reservoirs of organic material from which simple organic compounds can be obtained.

➔ There are two large reservoirs of organic material.
➔ Simple organic compounds can be obtained from these reservoirs.

1. There are many ways in which the complicated molecules can break apart.
2. The structural theory is the basis upon which millions of facts about hundreds of thousands of individual compounds have been brought together and arranged in a systematic way.
3. The exceptional molecules are just those for which the localized molecular orbital approach does not work.
4. Melting occurs when a temperature is reached at which the thermal energy of the particles is great enough to overcome the intracrystalline forces holding them in position.
5. Chlorination of methane may yield any one of four organic products, depending upon the stage to which the reaction is carried.
6. Chlorination gives mixtures in which no isomer greatly predominates.
7. By '**selectivity**' we mean here the differences in rate at which the various classes of free radicals are formed.
8. Methods have been developed by which a single amino acid can be polymerized to yield polypeptides of high molecular weight.

UNIT 18 (Eighteen)
EFFICIENCY IN ENGINEERING OPERATIONS

Unlike the scientist, the engineer is not free to select the problem which interests him. He must solve the problems as they arise, and his solutions must satisfy convicting requirements. Efficiency costs money, safety add complexity, performance increases weight. The engineering solution is the optimum solution, the most desirable end result taking into account many factors. It may be the cheapest for a given performance, the most reliable for a given weight, the simplest for a given safety, or the most efficient for a given cost. Engineering is optimizing.

To the engineer, efficiency means output divided by input. His job is to secure a maximum output for a given input or to secure a given output with a minimum input. The ratio may be expressed in terms of energy, materials, money, time, or men. Most commonly the denominator is money. In fact, most engineering problems are answered ultimately in dollars and cents. Efficient conversion is accomplished by using efficient methods, devices, and personnel organizations.

The emphasis on efficiency leads to the large, complex operations which are characteristics of engineering. The processing of the new antibiotics and vaccines in the test-tube stage belongs to the field of biochemistry, but when great quantities must be produced at low cost, it becomes an engineering problem. It is the desire for efficiency and economy that differentiates ceramic engineering from the work of the potter, textile engineering from weaving, and agricultural engineering from farming.

Since output equals input minus losses, the engineer must keep losses and waste to a minimum. One way is to develop uses for products which otherwise would be waste. The work of the chemical engineer in

utilizing successively greater fraction of raw materials such as crude oil is well-known. Losses due to friction occur in every machine and in every organization. Efficient functioning depends on good design, careful attention to operating difficulties, and lubrication of rough spots, whether they are mechanical or personal.

The raw materials with which engineers work seldom are found in useful forms. Engineering of the highest type is required to conceive, design, and achieve the conversion of the energy of a turbulent mountain stream in to the powerful torque of an electric motor a hundred miles away. Similarly many engineering operations are required to change the sands of the seashore into the precise lenses which permit us to observe the microscopic amoeba in a drop of water and study the giant nebulas in outer space. In certain sense, the successful engineer is a malcontent always trying to change things for the better.

Answer the following questions based on the text!

1. What is the difference between the engineer and the scientist in the selection of the problems they are interested in? Why is it so?
2. What is meant by "**engineering is optimizing**"?
3. What does efficiency mean to the engineer?
4. What is the job of the engineer?
5. What is meant by the statement "**in fact, most engineering problems are answered ultimately in dollars and cents**"?
6. What does the emphasis on efficiency result in? How does it relate to engineering?
7. Why is it that the engineer must keep losses and waste to a minimum?
8. What is one of the engineer's ways to minimize losses and waste? Give examples!
9. How does ceramic engineering, for example, differ from the work of the potter?
10. What characteristic do the raw materials with which engineers work commonly have?

Exercise 1

Fill in the blanks in the following sentences with the appropriate verbs from the list!

Perform	Optimize	Operate	Accomplish
Develop	Utilize	Organize	Design
Convert	Observe		

1. The function of this power plant is to …… the steam energy into electrical energy.
2. A lot of experiments have been conducted to …… new processes for these manufacturing works.
3. In order to increase its sales, the firm has employed surveyors to …… the market characteristics.
4. For the success of the project, all of the engineers are required to …… their duties to their best capability.
5. The manager has to …… the personnel in his department before he can start the operation.
6. One of the ways to overcome the decrease in our sales recently is to …… new products that will hopefully interest customers.
7. To …… the benefits expected from the project, the feasibility study should cover all social, economic, and engineering aspects.
8. It will take totally three years to …… the project.
9. We have to consult the manual to …… this new machine.
10. As far as the work is concerned, we can …… all of the existing facilities.

STRUCTURE: Causative

1. They really look good tonight because the coach had them _____ every night this week.
   a. Practice
   b. To practice
   c. Practiced
   d. The practice

2. Tommy had his big brother _____ his shoes for him.
   a. To tie
   b. Tie
   c. Tied
   d. Tying

3. General Grant had General Lee _____ him at Appomattox to sign the official surrender of the Confederation forces.
   a. To meet
   b. Met
   c. Meet
   d. Meeting

4. Mark got *his* *academic* transcripts *send* to the director of
   A B C
   Graduate Program Yale University.
   D

5. The *finance* manager of the computer company made the
   A
   customers *attended* the teleconference *held* at the *five-star* hotel
   B C D
   in the city.

6. *In order* to receive full reimbursement for jewelry *that* might be
   A B
   stolen, the owner must get all pieces *appraise*.
   C D

7. Most presidential candidates have *their* names *print* *on* the ballot
   A B C
   in the New Hampshire primary *election*.
   D

8. Psychologists *believe* that incentives make us *to want* *to increase*
   A B C
   our productivity.
   D

9. The nurse lets the baby *cries* *himself* into a rupture *while* his
   A B C
   mother is not able to handle *him*.
   D
10. The *loss* of his primary male role models made him *felt* alone and
    A B
    vulnerable, and he further intimated that he felt *like* some tried to
    C
    insinuate themselves *into* his life and take advantage of him.
    D

UNIT 19 (Nineteen)

MODERN BULDINGS

Many great buildings built in earlier ages are still in existence and in use. Among them are the Pantheon and the Colosseum in Rome, Hagia Sophia in Istanbul, the Gothic churches of France and England, and the Renaissance cathedrals, with their great domes, like the Duomo in Florence and St. Peter's in Rome. They are massive structures with thick stone walls that counteract the *thrust* of their great weight. Thrust is the pressure exerted by each part of a structure on its other parts.

All of these building and many others represent engineering solutions to challenging problems. The Romans made extensive use of the arch to distribute thrust more evenly, thus making larger openings possible. Architects and engineers before Romans had used a *post-and-lintel* construction for the most part, with two vertical columns supporting a horizontal beam. If the beam is too long, or if it has to support too much weight, it is subject to *shear*, the tendency to fracture or break along the lines of stress. Stress is the force or pressure that tends to strain or deform a structure or its various parts.

In the Gothic cathedrals, stone pillars that had comparatively thin walls between them were raised to great heights. The cathedral at Beauvals, France, reached a height of 157 feet, about the same as a modern building of fifteen floors. The vault collapsed on the first attempt to raise it to such a height, but it was later rebuilt and still stands. The great stone ribs of the Gothic cathedrals were supported by *flying buttresses* that absorbed the outward and downward thrust. In great domed structures like Hagia Sophia or St. Peter's, the thrust was distributes by a series of arches or half-arches that were supported by enormous piers (vertical supports).

These great buildings were not the product of knowledge of mathematics and physics. They were constructed instead on the basis of

experience and observations, often as the result of trial and error. One of the reasons they have survived is because of the great strength that was built into them-strength greater than necessary in most cases. But the engineers of earlier times also had their failures. In Rome, for example, most of the people lived in *insulae*, great tenement blocks that were often ten stories high. Many of them were poorly constructed and sometimes collapsed with considerable loss of life.

Today, however, the engineer has the advantage not only of empirical information, but also of scientific data that permit him to make careful calculations in advance when a modern engineer plans a structure; he takes into account the total weight of all its component materials. This is known as the *dead load,* which is the weight of the structure itself. He must also consider the *live load,* the weight of all the people, cars, furniture, machines, and so on that the structure will support when it is in use. In structures such as bridges that will handle fast automobile traffic, he must consider the *impact*, the force at which the live load will be exerted on the structure. He must also determine the safety factor, that is, an additional capability to make the structure stronger than the combination of the three other factors.

Answer the following questions based on the text!

1. What are some of the buildings built in earlier ages that are still in existence and in use?
2. What is thrust? How is it counteracted in these great buildings of earlier times?
3. How did the Romans solve the problem of thrust?
4. What kind of stress can post-and-lintel construction be subject to?
5. How were the high pillars and walls of Gothic cathedrals often supported?
6. How was thrust distributed in great domed structures like Hagia Sophia or St. Peter's?
7. Why have these buildings from earlier times survived? What is an example of engineering failure in ancient times?

8. What advantage do the engineers of modern times have over those of earlier days?
9. What four factors must an engineer take into account when he plans a structure?

Exercise 1

Match the expression on the left with the statement on the right. You will have 3 statements left on the right.

1. Thrust	_____	The force at which the live load will be exerted on a structure.
2. Stress	_____	A binding material made of lime stone and clay, heated and ground to a powder.
3. Shear	_____	The tendency of a material to weaken because of continual changes in stress.
4. Dead load	_____	A masonry material made of mixture of cement, aggregate, sand, and water.
5. Live load	_____	A wall supported by a steel or concrete frame; it does not bear the weight of the structure.
6. Impact	_____	The force that presses or pushes a material together.
	_____	The tendency of a material to break along lines of stress.
	_____	The weight of all the materials in a structure.
	_____	The pressure of force exerted by each part of a structure on the other parts.

Compound nouns are noun phrases consisting of a headword plus one or more modifiers.

The three form of compound nouns are:

1. Present – participle verb + noun
   e.g.: a towering building
2. Past – participle verb + noun
   e.g.: the broken wall
3. Noun + noun
   e.g.: a glass window

Whereas the first and the second forms have been discussed in the previous unit, the following is an exercise of the use of the third form.

Exercise 2
Replace the underlined phrases by compound nouns

1. The living area of the house is where the family meets friends, relaxes, dines, and entertains.
2. Areas constitute the main subdivisions of a structure but are also broken into subdivisions called rooms.
3. Many devices are used to separate the areas of building.
4. In most dwellings of two stories the living are is normally located on the first floor.
5. Is architecture just the vast collection of the various buildings which has been built to please the varying taste of the various lords of mankind?
6. The pillars and structures of cast iron have proved highly vulnerable to fire.
7. The quality of the communication becomes the basic for public criticism and the collective evaluation of a building.
8. Although a successful composition of architectural form is seldom consciously appreciated by users, this doesn't mean that it has not affected them in some way.

UNIT 20 (Twenty)
DIRECTED RESEARCH

A recent phenomenon in present-day science and technology is the increasing trend towards ‘directed’ or ‘programmed’ research, i.e. research whose scope and objectives are predetermined by private or government organizations rather than researchers themselves. Any scientist working for such organization and investigating in a given field therefore tends to do so in accordance with a plan or programs designed beforehand.

At the beginning of the century, however, the situation was quite different. At that time there were no industrial research organizations in the modern sense: the laboratory unit consisted of a few scientists at the most, assisted equipment in unsuitable rooms. Nevertheless, the scientist was free to choose predetermined programs to which he had to conform.

As the century developed, the increasing magnitude and complexity of the problems to be solved and the growing interconnection of different disciplines made it impossible in many cases, for the individual scientist to deal with the huge mass of new data, techniques, and equipment that were required for carrying out research accurately and efficiently. The increasing scale and scope of the experiments needed to test the hypotheses and develop new techniques and industrial processes led to the setting up of research groups or teams using highly-complicated equipment in elaborately-designed laboratories. Owing to the large sums of money involved, it was then felt essential to direct these human and material resources into specific channels with clearly-defined objective. In this way it was considered that the quickest and most practical result could be obtained. This, then, was programmed (programmatic) research.

One of the effects of this organized and standardized investigation is to cause the science which seem most likely to have industrial

applications, since private industry over government departments tend to concentrate on immediate result and show comparatively little interest in long-range investigation, there is a steady shift scientists from the pure to the applied field, where there are jobs available frequently more highly-paid and with better technical facilities than jobs connected with pure research in a university.

Owing to the interdependence between pure and applied science, it is easy to see that this system, if extended too far, carries considerable dangers for the future of science and not only pure science, but applied science as well.

Comprehension:

Answer the following questions based on the text!

1. What is programmed research?
2. What differences is working conditions are there between the present-day scientist and scientists working at the beginning of the century?
3. Describe laboratory conditions at the beginning of the century!
4. What were the origins of programmed research?
5. Why is it difficult nowadays for the individual scientist to make significant contributions to science?
6. Mention one of the effects of organized research on the attitudes of scientists!
7. What is a common attitude of private industry and government departments towards scientific investigation?
8. What part does money play in the situation discussed in the passage?
9. How is the situation likely to affect the future of science?
10. Give another word meaning the same as ‘applied science’!
11. Give two other words for ‘directed research’!

UNIT 21 (Twenty One)
SOLAR ENERGY

In one year the world uses as much energy as that contained in 12 billion barrels oils and the amount of fuel needed is growing by leaps and bonds. What will the future needs be? And how can they be filled? The supplies of fossil fuel – coal, oil and gas – are limited. They may not last for a century. Then what will take their place?

Let's look to the sky. Each day the sun showers the world with several thousand times as much energy as men uses. The sunshine on your housetop has more than a hundred times more energy than the amount your house receives through the wires which bring electricity to it. It has been estimated that enough energy falls in the 100 square miles of Arizona desert in one day to run all the industries in the USA for a day a night.

Here, in a sense, is energy unlimited. And the sun's energy is free for the taking. But materials needed to capture the sun's energy and put it to work are still expensive. If man could capture even a small part of the sun's energy at low cost, no one would worry about running out of fossil fuel or atomic – energy ores. The sun energy can be used in your house for heating and cooking.

Imagine cooking your dinner on an outdoor solar stove which uses the sun for its source of heat. You could do it in the winter sun, too, for solar stoves are built to focus the sun's energy on a particular area and concentrate the heat. In countries where the supply of fuel is scarce, solar cookers are being used on a limited scale. Unfortunately, for the average user everywhere the price of the solar cooker is too high. The sun can also be used as a source of fuel for power solar heater that will produce steam power at a reasonable cost.

Such experimental power plants may lead the way to more extensive use of solar energy in running machinery and producing light.

Solar energy can be used in telephone communication, in space travel, and in farming. Solar cells have been used experimentally for a number of years to power telephone lines, and they are now being used to recharge batteries which power space instruments. Solar pumps that can raise water for irrigation have also been developed, but they are seldom used because they are too expensive.

One of the practical problems in controlling solar energy is making it continuous, what can be done when the sun is not shining on the heating system? If you were using a solar pump for irrigation, the interruption of sunlight would not matter, since plants do not need a continuous supply of water, day and night.

But suppose you were heating your house by solar energy. A number of experimental houses that are heated in this way use storage tanks to hold the heat for night time and rainy spells, or they must have supplementary heating supplied by ordinary fuels. Once the sun is harnessed, the supply of energy will be inexhaustible. No wonder those who look to the sky see their starling changes in your future way of life.

Comprehension:

Answer the following questions based on the text!

1. How much oil do we use?
2. Is the fuel supply sufficient?
3. Why is the solar energy a useful source of energy?
4. Why don't we worry about the running out of oil?
5. Is it cheap to build such an instrument using the solar energy?
6. What is the advantage of solar energy?
7. What is the disadvantage of solar energy?
8. What problem arises in using solar energy?
9. How does a heater work?
10. How does a stove work?

Unit 22 (Twenty Two)
THE IMPORTANCE OF WATER

Water on the earth is being recycled continuously in a process known as the hydrologic cycle. The first step of the cycle is the evaporation of water in the oceans. Evaporation is the process of water turning into vapor, which then forms clouds in the sky. The second step is the water returning to the earths in the form of precipitation either rain, snow, or ice. When the water reaches the earth's surface, it runs off into the rivers, lakes, and the ocean where the cycle begins again.

Not all water, however, stay on the surface of the earth in the hydrologic cycle. Some of it seeps into the ground through infiltration and collects under the earth's surface as groundwater. This groundwater is extremely important to life on earth, since 95 percent of the earth's water is in the oceans and is too salty for human beings or plants. Of the 5 percent of land, only 0.5 percent is above ground in rivers or lakes. The rest is underground water. This groundwater is plentiful and dependable, because it doesn't depend on seasonal rain or snow. It is the major source of water for many cities. But as the population increases and the need for water also increases, the groundwater in some areas is getting dangerously low. Added to this problem is an increasing amount of pollution that seeps into the groundwater. In the future, with a growing population and more toxic waste, the hydrologic cycle we depend on could become dangerously imbalanced.

Comprehension:

Answer the following questions based on the text!

1. Clouds are formed from…
    a. Water vapor
    b. Evaporation
    c. The hydrologic cycle
    d. Groundwater
2. Water returns to the earth by…
    a. Infiltration
    b. Pollution
    c. Precipitation
    d. Evaporation
3. Groundwater…
    a. Depends on seasonal rain
    b. Comes from toxic waste
    c. Is 0.5 percent of all water
    d. Collects under the earth
4. The amount of groundwater is…
    a. About 95 percent of all water
    b. Less than 5 percent of all water
    c. 0.5 percent of above – ground water
    d. 95 percent of above – ground water
5. The supply of groundwater is getting low because of…
    a. Conservation
    b. Toxic waste
    c. Pollution
    d. Population increase
6. The best title for this passage is…
    a. Water Conservation
    b. The Hydrologic Cycle
    c. Underground Water
    d. Polluted Groundwater

MORE READING TEXTS

A. Environmental Engineering

Unit 1 (One): Definition of Solid Waste Management

Solid waste is the material arising from human and animal activities that is normally solid and is discarded as being either useless or unwanted. It encompasses the heterogeneous mass and of throwaways from urban communities and agricultural, mineral and industrial wastes as well. In contrast to a liquid, solid material has an angle of repose that allows it to form a pile. The angle that the surface of the material's pile makes to the horizontal is called the angle of repose, and it is a characteristic of the fluidity (i.e., it has the ability to move and change shape). A material that does not form an angle of repose will form a flat, horizontal surface if it is allowed to stand unconstrained.

In the U.S Resource Conservation and Recovery Act (RCRA) of 1976, solid waste is defined as "garbage, refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining and agricultural operations and from community activities". Solid waste does not include solid or dissolved materials in domestic sewage, and it does not include solid or dissolved materials in irrigation return flows or industrial discharges.

Management can be defined as the carefully planned, judicious use of means to achieve an end. In this case, an "end" is the removal and disposal of unwanted material. To achieve this, technical, environmental, administrative, economic and political problems must be resolved. The effort to address these problems is usually referred to as the practice of solid waste management. It encompasses the planning, design, financing, construction and operation of facilities for the collection, transportation,

processing, recycling and final disposal of residual solid waste materials. All this is based on sound principles of public health, engineering, economics, aesthetics, conservation and environmental considerations, along with social and ethical issues (2).

1. What is solid waste?
2. How does solid waste differ from liquid?
3. In what way, does the definition of solid waste made by the writer differ from the one made by RCRA?
4. What is solid waste management?
5. Where in text does the writer discuss how to treat solid waste?
6. 'It encompasses the planning, design, financing, construction and....' What does the word *it* in the sentence refer to?
7. What does the word *this* in the last sentence refer to?
8. What does the writer likely discuss in the paragraph that follow the text?

Unit 2 (Two): RECYCLING

Recycling is the separation of a given waste material from the waste stream for reuse or processing to be suitable for use as a raw material for manufacturing. Since 1970, recycling programs have increased. Initially, it was viewed as a singular activity (i.e., segregation and collection of glass, papers and so on) rather than as a holistic activity that "close the loop", as symbolized by the familiar recycling logo shown in figure 14-1.

After source reduction, which is given top priority in the solid waste management hierarchy, recovery of materials for recycling and composting is the next important activity. The commonly accepted definition of solid waste recycling is to use one or more components in a way that they are not deposited in a sanitary landfill and that conserves natural resources. Most recycling programs are subsidized financially,

because the collection and transport of waste for recycling require substantial amounts of labor and energy. The recycling process itself includes separating recyclables by type, collecting them, processing them into new forms, manufacturing them into products and marketing them as goods made from reprocessed materials.

Usually, separation comes before collection. Separation is generally done by the generators (i.e., citizens, businesses, industries, institutions). Recyclables are then delivered or picked up for delivery to a materials-processing center or a scrap processor. In a few instances, mixed materials are collected and then separated. Source separation, however, provides the cleanest, most well-defined fractions of waste suitable for subsequent recycling or reuse. Mechanical or manual sorting at the destination is not always well defined.

Source-separated wastes may be collected at the curbside or delivered to a drop off center. In some areas, drop-off centers are in convenient locations, such as supermarket parking lots or a town's municipal warehouse and they accept recyclables that the consumer delivers in person. In rural areas, these centers may provide the only recycling service in a community or may supplement curbside collection.

Questions

1. What does the writer mainly discuss in the text?
2. What is recycling according to the text?
3. How can recycling be carried out according to the text?
4. What does the writer mainly discuss in last paragraph?
5. Where in text does the writer discuss about recycling technique?
6. What does the word *it* in the sentence 'Initially, it was viewed as a singular activity...' refer to?
7. According to the text, why is recycling quite costly?

Unit 3 (Three) : Sources, Composition, and Characteristics of Solid Waste

The sources of solid waste in a community are generally related to land use and zoning. These wastes can be grouped or classified in several ways, but classifications are necessary to address effectively the complex challenges of solid waste management. As a basis for later discussion, solid waste is divided into four general catagories: *municipal waste, industrial waste, agricultural waste, hazardous waste*.

1. **Municipal Waste**

Municipal solid waste includes waste from household, institutional, commercial, municipal and industrial sources (excluding process wastes).

a. **Residential Waste**

This category of waste includes the rejected solid material that originates from single-family, multifamily and high-rise dwellings. These wastes are often called household wastes, and they consist of garbage, rubbish and trash, bulky waste and ash.

Garbage. This type of waste results from food preparation, packaging, consumption and associated activities. Most of this waste is putrescible. Quick removal from the place of generation, careful storage and disposal are necessary, because such waste tends to attract rats and flies and to produce strong odors.

Rubbish and Trash. This category consist of paper and paper products, cans, bottles, plastics, old clothes, leather products, metal products, glass, ceramics, dirt, dust, garden wastes and so on. In this category, however, only the garden wastes are putrescible.

Bulky Waste. This category includes heavy and large wastes, such as appliances, furniture, mattresses, toys, tires, consumer electronics (e.g., computers, television sets, stereos), and similar items. Because of the size, weight, and irregular generation of these items, special handling and collection techniques are needed.

Ash. This waste is the end product from burning firewood, coal and so on for the heating of residential units.

b. **Municipal Service**

Municipal solid waste also includes the solid residue from municipal functions and services.

Water and Wastewater Plant Sludge. Sludge that is generated by water and wastewater treatment plants (especially wastewater sludge) needs to be disposed of properly to prevent ground or surface water contamination. These treatment systems are operated either by the municipality, public utility companies, or a sanitary district.

Street Refuse. This type of waste results from the collection of street sweepings and debris that are primarily inorganic in nature (e.g., sand, dirt, grit). The quantity and content of this solid waste depends on the season and the frequency of cleaning operations. For example, during the fall, it may consist of leaves, whereas during the winter, it may consist of sand or cinders used for snow and ice control. When storms strike, there may be branches and leaves from fallen trees.

Public Park and Beach Refuse. People using these facilities also generate refuse, which includes bottles, cans, paper products, food products, ashes and so on. In addition, waste result from the maintenance of trees, lawns, bushes, and the debris from

storm damage. In most cities, an arbor department has the responsibility of maintaining trees and other vegetation in the parkways of streets and other public lands. This may be the responsibility of the park district as well.

Dead Animals. This is a major problem in areas close to habitats with a large population of wild animals (e.g., deer, gophers) or in communities that either do not have animal control laws or do not enforce them. The municipality is responsible for the removal and disposal of dead animals.

"Abandoned" Waste. Even though it is against the law, people still pitch bottles, cans, and paper products into streets, drainage ditches, and parks. Occasionally, junked appliances are also abandoned on public grounds and old automobiles abandoned on streets after removing their license plates. Most cities have a towing and disposal system for such vehicles, which includes legal steps such as title clearance.

Commercial and Institutional Waste. Solid waste also originates from stores, restaurants, markets, offices, hotels, printing businesses, service stations, repair shops, educational and research institutions, hospitals, prisons, and so on and is subdivided into garbage and rubbish. Garbage is generated in restaurants, cafeterias, and fast-food establishments. Rubbish is generated in commercial establishments because of packaging material; in offices and institutions because of paper, and in stores because of plastic, wood, and metal. In addition, there are special wastes generated by hospitals and research laboratories which are solid and semisolid materials. These may include toxic chemicals, radioactive materials, explosive materials or pathological materials. Pathological materials may include used surgical items, and materials (blood vials, bags, etc) associated with humans and animals in hospitals and research laboratories. Because of the

hazardous nature of wastes, they require special collection, handling, and disposal, depending on the characteristics of the material. More discussion on hazzardous wastes is in part III of this book. Commercial waste is generated by stores, restaurants, hotels, motels, markets, offices, service stations and so on. It includes paper, cardboard, wood, plastics, metals, glass and bulky items. Institutional waste is generated by schools, universities, hospitals, government centers, and so on. It includes items similar to those in commercial waste.

Demolition and Construction Waste. This class of solid waste includes wood, metal, concrete, bricks, glass, plastics, plumbing, wiring, and so on. These are the materials used in the construction of buildings and pavement and that are removed by the destruction of such structures. The quantity and components of such waste can be highly variable.

2. **Industrial Waste**

Industrial process wastes are excluded from the category of municipal wastes (though wastes such as corrugated boxes, office papers, cafeteria wastes, wood pallets and so on are included). There are two general sources of solid waste at industrial sites: the commercial and institutional components, and the process solid waste. The quantities and characteristics of these types of waste are different.

a. **Commercial and Institutional Waste**

This type of waste is generated by office, cafeteria, and other personnel-related activities. These wastes are included in the category of municipal waste.

b. **Process Waste**

These wastes are generated by various industrial processes. These industries include chemical plants, refineries, electrical, printing, wood, and many others. Some of this waste may be hazardous and is handled accordingly (see part III). Much of this waste is managed on site by the generating industries, but some is landfilled. The end product (i.e., output) from an industrial process may be less than the input, but the balanceof the material may end up as solid waste. Because of economic considerations and waste reduction efforts, secondary products are manufactured by recovering a certain portion of this waste.

c. **Agricultural Waste**

In rural areas, the removal and disposal of solid waste resulting from agricultural activities present a significant problem. These wastes are not discussed in any detail in this text, except to indicate that such wastes are generated from animal feedlots and crops. Substantial quantities of manure are generated from feeding operations of cattle, hogs, chickens or turkeys and managing these large quantities is a major cost to feedlot owners.

Solid waste associated with raising vineyards and orchards results from prunings and cuttings. The large volume of this material has the potential to harbor insects and plant diseases. Many other disposal problems are also associated with agricultural production. For example, empty containers and bags of fertilizer, insecticide, or pesticide may have some residuals and chemicals, which have the potential for water and land contamination during their disposal.

Questions

1. What does the writer mainly discuss in the text?
2. What is commercial and institutional waste according to the text?
3. In what way, does municipal waste differ from industrial waste?
4. What does the writer mainly discuss in the first paragraph?
5. Where in text does the writer discuss about garbage?

Unit 4 (Four): WASTEWATER CHARACTERISTICS

Prior to about 1940, most municipal wastewater was generated from domestic sources. After 1940, as industrial development in the United States grew significantly, increasing amounts of industrial wastewater have been and continue to be discharged to municipal collection system. The amounts of heavy metals and synthesized organic compounds generated by industrial activities have increased, and some 10.000 new organic compounds are added each year. Many of these compounds are now found in the wastewater from most municipalities and communities.

As technological changes take place in manufacturing, changes also occur in the compounds discharged and the resulting wastewater characteristics. Numerous compounds generated from industrial processes are difficult and costly to treat by conventional wastewater treatment processes. Therefore, effective industrial pretreatment becomes an essential part of an overall water quality management program. Enforcement of an industrial pretreatment program is a daunting task, and some of the regulated pollutants still escape to the municipal wastewater collection system and must be treated. In the future with the objective of pollution prevention, every effort should be made by industrial dischargers to assess the environmental impacts of any new compounds that may enter the wastewater stream before being approved for use. If a compound cannot be treated effectively with existing technology, it should not be used.

Improved Analytical Techniques

Great strides in analytical techniques have been made with the development of new and more sophisticated instrumentation. While most constituent concentrations are reported in milligrams per liter (mg/L), measurements in micrograms per liter (μg/L) and nanograms per liter (ng/L) are now common. As detection methods become more sensitive and a broader range of compounds are monitored in water supplies, more contaminants that affect humans and the environment will be found. Many trace compounds and microorganisms, such as *Giardia lamblia* and *Cryptosporidium parvum*, have been identified that potentially may cause adverse health effects. Increased analytical sophistication also allows the scientist and engineer to gain greater knowledge of the behavior of wastewater constituents and how they affect process performance and effluent quality.

Importance of Improved Wastewater Characterization

Because of changing wastewater characteristics and the imposition of stricter limits on wastewater discharges and biosolids that are used beneficially, greater emphasis is being placed on wastewater characterization. Because process modeling is widely used in the design and optimization of biological treatment processes (e.g., activated sludge), thorough characterization of wastewater, particularly wastewaters containing industrial waste, is increasingly important. Process modeling for activated sludge as it is currently conceived requires experimental assessment of kinetic and stoichiometric constants. Fractionization of organic nitrogen, chemical oxygen demand (COD), and total organic carbon into soluble and particulate constituents is now used to optimize the performance of both existing and proposed new biological treatment plants designed to achieve nutrient removal. Techniques from the microbiological sciences, such as RNA and DNA typing, are being used to identify the active mass in biological treatment processes.

Because and understanding of the nature of wastewater is fundamental to the design and operation of wastewater collection, treatment, and reuse facilities, a detailed discussion of wastewater constituents is provided in Chap. 2.

Questions

1. What does the writer mainly discuss in the text?
2. What is the difference between municipal wastewater before and after 1940?
3. In what way, does manufacturing technology influencc the quality of wastewater?
4. Where in text does the writer discuss that a more sophisticated waterwaste treatment must be of necessity to treat waterwaste after 1940 ?
5. 'If a compound cannot be treated effectively with existing technology, it should not be used. What does the word *it* in the sentence refer to?
6. How effective are the detection methods for waterwaste's content innovated by the scientists and engineers?
7. What does the writer mainly discuss in the last paragraph?
8. What does the writer likely discuss in the paragraph that follow the text?

Unit 5 (Five): WASTEWATER TREATMENT

Wastewater collected from municipalities and communities must ultimately be returned to receiving waters or to the land or reused. The complex question facing the design engineer and public health officials is: What levels of treatment must be achieved in a given application— beyond those prescribed by discharge permits— to ensure protection of public health and the environment? The answer to this question requires detailed analyses of local conditions and needs, application of scientific knowledge and engineering judgment based on past experience, and

consideration of federal, state and local regulations. In some cases, a detailed risk assessment may be required. An overview of wastewater treatment is provided in this section. The reuse and disposal of biosolids, vexing problems for some communities, are discussed in the following section.

Treatment Methods

Methods of treatment in which the application of physical forces predominate are known as *unit operations*. Methods of treatment in which the removal of contaminants is brought about by chemical or biological reactions are known as *unit processes*. At the present time, unit operations and processes are grouped together to provide various level of treatment known as preliminary, primary, advanced primary, secondary (without or with nutrient removal), and advanced (or tertiary) treatment (see Table 1 – 4). In preliminary treatment, gross solids such as large objects, rags, and grit are removed that may damage equipment. In primary treatment, a physical operation, usually sedimentation, is used to remove the floating and settleable materials found in wastewater (Fig. 1 – 4). For advanced primary treatment, chemicals are added to enhance the removal of suspended solids and, to a lesser extent, dissolved solids. In secondary treatment, biological and chemical processes are used to remove most of the organic matter. In advanced treatment, additional combinations of unit operations and processes are used to remove residual suspended solids and other constituents that are not reduced significantly by conventional secondary treatment. A listing of unit operations and processes used for the removal of major constituents found in wastewater and addressed in this text is presented in Table 1 – 5.

Table 1 – 4 Levels of wastewater treatment

Treatment Level	Description
Preliminary	Removal of wastewater constituents such as rags, sticks, floatables, grit, and grease that may cause maintenance or operational problems with the treatment operations, processes, and ancillary systems
Primary	Removal of a portion of the suspended solids and organic matter from the wastewater
Advanced primary	Enhanced removal of suspended solids and organic matter from the wastewater. Typically accomplished by chemical addition or filtration
Secondary	Removal of biodegradable organic matter (in solution or suspension) and suspended solids. Disinfection is also typically included in the definition of conventional secondary treatment
Secondary with nutrient removal	Removal of biodegradable organics, suspended solids, and nutrients (nitrogen, phosphorus, or both nitrogen and phosphorus)
Tertiary	Removal of residual suspended solids (after secondary treatment), usually by granular medium filtration or microscreens. Disinfection is also typically a part of tertiary treatment. Nutrient removal is often included in this definition
Advanced	Removal of dissolved and suspended materials remaining after normal biological treatment when required for various water reuse applications

About 20 years ago, biological nutrient removal (BNR)— for the removal of nitrogen and phosphorus— was viewed as an innovative process for advanced wastewater treatment. Because of the extensive research into mechanism of BNR, the advantages of its use, and the

number of BNR systems that have been placed into operation, nutrient removal, for all practical purposes, has become a part of conventional wastewater treatment. When compared to chemical treatment methods, BNR uses less chemical, reduces the production of waste solids, and has lower energy consumption. Because of the importance of BNR in wastewater treatment, BNR is integrated into the discussion of theory, application, and design of biological treatment systems.

Land treatment processes, commonly termed "natural systems", combine physical, chemical, and biological treatment mechanisms and produce water with quality similar to or better than that from advanced wastewater treatment. Natural systems are not covered in this text as they are used mainly with small treatment systems; descriptions may be found on the predecessor edition of this text (Metcalf & Eddy, 1991) and in Crites and Tchobanoglous (1998) and Crites et al. (2000).

Questions

1. What does the writer mainly discuss in text?
2. What is the essential purpose of wastewater treatement?
3. How many wastewater treatment methods are mentioned by the writer in the text? Please Mention them!
4. Which treatment method is the most effective according to the writer?
5. How does biological nutrient removal (BNR) differ from chemical treatment?
6. What is the synonymous term for land treatment method?
7. Where in text does the writer discuss the least effective treatment method ?
8. What does the writer likely discuss in the paragraph that follow the text?

Unit 6 (Six) : COMPONENTS OF WASTEWATER FLOWS

The components that make up the wastewater flow from a community depend on the type of collection system used and may include:

1. *Domestic (also called sanitary) wastewater*. Wastewater discharged from residences and from commercial, institutional, and similar facilities.
2. *Industrial wastewater*. Wastewater in which industrial wastes predominate.
3. *Infiltration/inflow (I/I*). Water that enters the collection system through indirect and direct means. Infiltration is extraneous water that enters the collection system through leaking joints, cracks, and breaks or porous walls. Inflow is stormwater that enters the collection system from storm drain connections (catch basins), roof leaders, foundation and basement drains, or through access port (manhole) covers.
4. *Stormwater*. Runoff resulting from rainfall and snowmelt.

Three types of collection systems are used for the removal of wastewater and stormwater: sanitary collection systems, storm collection systems, and combined collection systems. Where separate collection systems are used for the collection of wastewater (sanitary collection systems) and stormwater (storm collection systems), wastewater flows in sanitary collection systems consists of those major components: (1) domestic wastewater, (2) industrial wastewater, and (3) infiltration/inflow. Where only one collection system (combined) is used, wastewater flows consists of these three components plus stormwater. In both cases, the percentage of the wastewater components will vary with local conditions and the time of the year.

3 – 2 WASTEWATER SOURCES AND FLOWRATES

Data that can be used to estimate average wastewaters flowrates from various domestic, commercial, institutional, and industrial sources and the infiltration/inflow contribution are presented in this section. Variations in the flowrates that must be established before collection systems and treatments facilities are designed are also discussed.

Domestic Wastewater Sources and Flowrates

The principal sources of domestic wastewater in a community are the residential areas and commercial districts. Other important sources include institutional and recreational facilities. For areas now served with collection systems, wastewater flowrates are commonly determined from existing records or by direct filed measurements (see Fig. 3 – 1). For new developments, wastewater flowrates are derived from an analysis of population data and estimates of per capita wastewater flowrates form similar communities.

Water consumption records may also be used for estimating flowrates. These records are especially useful in other parts of the world where water use for landscape irrigation is limited and 90 percent or more of the water used becomes wastewater. In the United States, on the average 60 to 90 percent of the per capita water consumption becomes wastewater. The higher percentages apply to the northern states during cold weather; the lower percentages are applicable to the semiarid region of the southwestern United States where landscape irrigation is used extensively. When water consumption records are used for estimating wastewater flowrates, the amount of water consumed for purposes such as landscape irrigation (that is not discharged to the collection system), leakage from water mains and service pipes, or product water that is used by manufacturing establishments must be evaluated carefully.

Questions

1. What does the writer mainly discuss in text?
2. What factors influence wastewater flow from a community?
3. What is collective system?
4. How can we estimate wastewater flowrate?
5. What does the writer discuss in paragraph 3?
6. Where in text does the writer discuss the way to estimate wastewater flowrate?

Unit 7 (Seven): Wastewater Treatment Plants

The most common municipal wastewater treatment plants are primary and secondary treatment plants, tertiary treatment plants, and physical-chemical treatment plants.

Primary treatment consists of removing a substantial amount of the suspended solids from a wastewater. The collected solids must be treated, in most cases, followed by proper disposal. Secondary treatment consists of bio-oxidizing the remaining organic suspended solids and the organic dissolved solids. The flowsheet of a conventional activated sludge plant, shown in Figure 1.3. consists of screening, grit removal, primary clarification, activated sludge treatment, and chlorination. The coarse solids are removed by screening, and the sand and silt are removed by the grit removal system. Primary clarification removes as many suspended solids as possible, and the primary effluent is mixed with the return activated sludge. The mixed liquor then flows to the aeration tank. Bio-oxidation of most of the remaining organic matter occurs in the aeration tank, and the final clarifier removes the biological solids, which are returned to mix with the incoming primary effluent. The effluent from the final clarifier is disinfected to kill pathogenic organisms and then discharged to the receiving body of water. The primary clarifier sludge and the waste activated sludge (in other words, the excess activated sludge produced by the microbial solids, which has to be wasted form the

system) are mixed together, then thickened to increase the solids content. The thickened sludge is sent to the anaerobic digester for bio-oxidation of the organic solids. The digested sludge is dewatered by vacuum filtration and the dewatered sludge is disposed of in a sanitary landfill. Minor flows, such as the thickener supernatant, the anaerobic digester supernatant, and the vacuum filter filtrate are returned to the head of the plant. Although the solids handling system shown consists of thickening, anaerobic digestion, and vacuum filtration, other solids handling systems, such as aerobic digestion and centrifugation, are used. This flowsheet gives about 85 to 95 percent five-day biochemical oxygen demand (BOD_3) and suspended solids removal.

Tertiary treatment of a secondary effluent consists of providing further treatment to increase the quality of the affluent. The flowsheet for a tertiary treatment plant is shown in Figure 1.4. It consists of lime coagulation, flocculation, sedimentation, ammonia stripping, recarbonation, sedimentation, multimedia filtration, carbon adsorption, and breakpoint chlorination. The coagulant used is quicklime (calcium oxide), which is reacted with water to produce slaked lime (calcium hydroxide), which is added ahead of the mixing basin. Lime coagulation, flocculation, and sedimentation at a high pH removes most of the suspended solids and phosphorus. Ammonia stripping at a high pH removes most of the ammonia. Recarbonation is provided is provided to lower the pH and stabilize the wastewater. The settling basin downline from the recarbonation basin removes the calcium carbonate precipitated by recarbonation. Multimedia filtration removes most of the nonsettling floc, and carbon adsorption removes most of the remaining dissolved organic compounds. In addition to disinfection, breakpoint chlorination chemically oxidizes the remaining ammonia to chloramines and the remaining organic matter to other end products. The solids handling system shown permits recovery of the quicklime coagulant, thus reducing the lime requirements and the amount of lime sludge to be disposed. The coagulant is recovered by lime recalcination in which the calcium carbonate precipitate in the sludge is heated at a high temperature to

produce the coagulant, calcium oxide. In addition to coagulant recovery, the organic solids in the sludge are incinerated. The flowsheet in Figure 1.4. will produce and effluent approaching drinking water quality when treating municipal secondary effluents.

In recent years, the success of physical-chemical treatment in tertiary treatment has led to the use of physical-chemical treatment of raw municipal wastewaters. In lieu of conventional biological treatments, since a higher quality effluent can be obtained. The flowsheet of a physical-chemical treatment plant for raw municipal wastewaters is shown in Figure 1.5. It consists of lime coagulation, flocculation, sedimentation, recarbonation, sedimentation, multimedia filtration, carbon adsorption, and breakpoint chlorination. Lime coagulation, flocculation, and sedimentation remove most of the suspended solids, phosphorus, and organic nitrogen. Recarbonation lowers the pH and stabilizes the wastewater. The sedimentation basin downline from the recarbonation unit removes most of the calcium carbonate precipitated by recarbonation. Multimedia filtration removes most of the fine, nonsettling floc, and carbon adsorption removes most of the remaining organic compounds.

Questions

1. What does the writer mainly discuss in text?
2. What is the purpose of wastewater treatement plants?
3. How many types of wastewater treatment plants are discussed by the writer in the text? Please Mention them!
4. Which treatment plant do you think the most effective?
5. How does primary treatment differ from tertiary treatment?
6. ‘It consists of lime coagulation, flocculation, sedimentation, ...’ What does the word *it* refer to?
7. Where in text does the writer discuss the most complicated process of the treatment?
8. What does the writer maily discus in the last paragraph?

Unit 8 (Eight): SEDIMENTATION

Sedimentation is a solid-liquid separation utilizing gravitational settling to remove suspended solids. It is commonly used in water treatment, wastewater treatment, and advanced wastewater treatment. In water treatment its main applications are:

1. Plain settling of surface waters prior to treatment by a rapid sand filtration plant;
2. Settling of coagulated and flocculated waters prior to rapid sand filtration;
3. Settling of coagulated and flocculated waters in a lime-soda type softening plant;
4. Settling of heated waters in an iron or manganese removal plant.

In wastewater treatment its main uses are:

1. Grit or sand and slit removal;
2. Suspended solids removal in primary clarifiers;
3. Biological floc removal in activated sludge final clarifiers;
4. Humus removal in trickling filter final clarifiers.

In advanced wastewater treatment and tertiary treatment, its main purpose is the removal of chemically coagulated floc prior to filtration.

Sedimentation is one of the earliest unit operations used in water or wastewater treatment. The principles of sedimentation are the same for basins used in either water or wastewater treatment; the equipment and operational methods are also similar.

Sedimentation basins are usually constructed for reinforced concrete and may be circular, square, or rectangular in plain view. Circular tanks may be from 15 to 300 ft in diameter and are usually from 6 to 16 ft deep. The most common sizes are form 35 to 150 ft in diameter and depths are usually 10 to 14 ft. standard-size tanks have diameters with 5-ft intervals in order to accommodate commercially built sludge rake mechanisms. Square tanks have widths from 35 to 200

ft and depths from 6 to 19 ft. Standard-size square tanks have widths with 5-ft intervals. The freeboard for circular or square tanks is from 1 to 2.5 ft. Tanks that are not standard-size may be furnished with specially built sludge rake mechanisms. Also, collectors for tanks with depths greater than those stated can be obtained by special order. Rectangular tanks usually have three types of sludge rake mechanisms: (1) sprocket and chain driven rakes, (2) rakes supported from a traveling bridge, and (3) tandem scrappers built for square basins. Rectangular tanks with sprocket and chain drives have widths from 5 to 20 ft, lengths up to about 250 ft, and depths greater than 6 ft. Widths up to 80 to 100 ft are possible by using four or five multiple bays with individual cleaning mechanisms. Rectangular tanks with traveling bridges that support the sludge rakes have widths from about 10 to 120 ft and lengths from 40 to 300 ft. Traveling bridges have rapid sludge removal, and the rakes may be removed for inspection or repair without draining the basins. Rectangular tanks using two square tank sludge rake mechanisms in tandem give a settling tank with a 2:1 length to width ratio. Tanks as large as 200 ft by 400 ft have been built in this manner, and this type of tank construction is particularly well suited for large water treatment plants. Rectangular tanks can use common wall construction and also occupy less land space than circular clarifiers of equal volume.

Questions

1. What does the writer mainly discuss in the first paragraph?
2. What is sedimentation?
3. 'In water treatment <u>its</u> main applications are...' What does the word *it* in the sentence refer to?
4. 'In <u>advanced</u> wastewater treatment and tertiary treatment, ...'. The word *advance* in the sentence has closest meaning to the word _____.
5. Where in text does the writer discuss the tool's characteristics used to treat sedimentation?
6. In what shape are sedimentation basins are normally constructed?
7. What does the writer likely discuss in the paragraph that follow the text?

B. Architecture-Civil Engineering*

Unit 9 (Nine): ARCHITECTURE AS IDENTIFICATION OF PLACE

Before we can get on to looking at some of the conceptual strategies of architecture in detail, it is necessary to lay out some ground work with regard to the nature of architecture, and its purpose. Before we can get onto the 'how?', we need to look briefly at the 'what?' and 'why?'; i.e. 'what is architecture?', and 'why do we do it?'.

It is probably fair to say that the matters of the definition and the purpose of architecture have never been settled. These are issues about which there is a great deal of confusion and debate, which is strange considering that architecture as a human activity is literally older than pyramids. The question 'what is one doing when one is doing architecture?' appears are simple, but it is not an easy one to answer.

Various ways of framing an answer to this question is seem to have contributed to the confusion; some of these relate comparison of architecture with other forms of art. Is architecture merely sculpture – the three-dimensional composition of forms in space? Is it the application of aesthetic considerations onto the form of buildings – the art of making buildings beautiful? Is it the decoration of buildings? Is it the introduction of poetic meaning into buildings? Is it the ordering of buildings according to some intellectual system – classicism, functionalism, post-modernism…?

One might answer 'yes' to all these questions, but none seems to constitute the rudimentary explanation of architecture that we need. All of them seem to allude to a special characteristic, or a 'superstructural' concern, but they all seem to miss a central point which one suspects should be more obvious. What is needed for the purposes of this book is much more basic, and accessible, understanding of the nature of

architecture, one that allows those who engage in it to know what they are doing.

Perhaps the broadcast definition of architecture is that which one often finds in dictionaries: 'architecture is the design of buildings'. One cannot contradict this definition, but it does not help very much either, in a way it actually diminishes one's conception of architecture, by limiting it to 'the design of buildings'. Although it is not necessary to do so, one tends to think of 'a building' as an object (like a vase, or a cigarette lighter), and architecture involves rather more than the design of objects.

One more useful way of understanding architecture can be gleaned, ironically, from the way the word is used in regard to other art forms, music in particular. In musicology the *architecture* of a symphony can be said to be the conceptual organization of its parts into a whole, its intellectual structure. It is strange that the word is rarely used in this sense with regard to architecture itself.

1. What does the writer mainly discuss in text?
2. What is the conventional purpose of architecture accoridng to text?
3. According to the writer, why is it difficult to come to the definition of architecture?
4. What dimensions should normally architecture cover on common perspective?
5. '...the rudimentary explanation of architecture that we need ...' What word can best replace the word *rudimentary* in the sentence?
6. 'Although it is not necessary to do so, one tends to think of 'a building' as an object...' What does the word *it* refer to?
7. 'All of them seem to allude to a special characteristic...'. What does the word *them* refer to?
8. What does the writer maily discus in the last paragraph?

Unit 10 (Ten): MODIFYING ELEMENTS OF ARCHITECTURE

The basic elements of architecture as described in the previous chapter are abstract ideas. (That is why they were illustrated in such a spare way). When, by being built, they are given physical form, various additional factors come into play.

In their physical realization and our actual experience of them, basic elements and the places they identify are modified: by light, by colour, by sounds, by temperature, by air movements, by smells (and even possibly by tastes), by the qualities and textures of the materials used, by use, by scale, by the effects and experience of time…

Such modifying forces are part of the conditions of architecture; they can also be elements in the identification of place.

The possible configurations of basic and modifying elements are probably infinite. The inside of a cell might be dark, or bright; it might muffle sound, or have an echo; it might be warm , or cool; it might be dank, or fresh; it might smell of expensive perfume, or of stale sweat, of fruit, or of fresh cooking. A pavement may be rough, or as smooth and slippery as ice. An enclosure (a garden) might be sunny, or shady. A platform (a seat) might be as hard as stone or metal, or soft, padded with foam or feathers. An aedicule may be sheltered from wind, or be exposed and breezy. And so on.

As abstract ideas, basic elements are subject to complete control by the designing mind; modifying elements may be less compliant. One might decide on the precise shape and proportions of a *column*, a *cell*, or an *aedicule*, but the matter of how it sounds, or is lit, or smells, or changes with time, is a more subtle issue. Control over modifying elements is a continuing and evolving battle. For example: in primitive times, light would have been that provided by the sky, and not subject to

control; now there is electric light which can be controlled precisely. In the distant past, materials for building, whether stone or timber, were rough hewn; now their textures and qualities can be finely controlled.

Though use of the basic elements may be the primary way in which a designing mind conceptually organizes space into places, modifying elements contribute a great deal to the experience of those places.

Light

First amongst the modifying elements of architecture is light.

Light is a *condition* of architecture, but it can also be used as an element. Light form the sky is the pervasive through which sighted people experience the products of architecture; but light, both natural and artificial, can be manipulated by design to identify particular places and to give places particular character.

If one is thinking of architecture as sculpture it is by light that it is seen and its modeling appreciated. If one is thinking if architecture as identification of place, then one is aware that there can be light places and dark places, places with a soft even light and places with the strong brightness and sharp shadows of sunlight; places where the light is dappled, or constantly but subtly changing; places, such as theaters, where there is a stark contrast between light (the stage – the place of the action) and dark (the auditorium – the place of the audience).

Light can be related to the activity in a place. Different kinds of light can be appropriate for different kinds of activity. A jeweler at his workbench needs strong light over a particular area. An artist in her studio needs constant and even light by which to paint. Children in school need good general lightning for work and play. In all instances light contributes to the identification of place.

Light changes and can be altered. Light from the sky varies through the cycles of night and day, and during different times of the year; sometimes it is shaded or defused by clouds. The variations can be stimulating.

Daylight can be exploited in making places. Its qualities can be changed by the ways in which it is allowed into building.

Some old houses have bread chimney stacks. Open to the sky they allow a dim 'religious' light to illuminate the hearth (when there is no fire). Le Corbusier used a similar effect in the side chapels of Notre-Dame du Haut at Ronchamp. Using light 'scoops' he identified the places of the side altars with daylight softened by its reflection off white roughcast walls.

Questions

1. What does the writer mainly discuss in the text?
2. What are the elements of architecture according to the writer?
3. 'Such modifying forces are part of the conditions of architecture...'. The word forces in the sentence can be best replaced by the word .....
4. '... it might muffle sound.' What does the word *it* in the sentence refer to?
5. What does the writer mainly discuss in paragraph 4?
6. In the process of designing, why it is important to control over modifying elements?
7. According to the text, how far can light be utilized as a modifying element of architecture?
8. What does the writer likely discuss in the paragraph that follow the text?

Unit 11 (Eleven): SPACE AND STRUCTURE

Both structure and space are media of architecture. It is by reason of its structure that a building stands. Structure also plays a part in organizing space into places. The relationship between space and structure is not always simple and straightforward; it is subject to different approaches.

In terms of attitudes, one can either choose and allow a structural strategy to define the places one wishes to create, or one can decide on the places, and in a way, force structure to cope with them.

There are thus three broad categories of the relationship between space and structure: the dominant structural order; the dominant spatial order; and the harmonic relationship between the two, in which spatial and structural order seem in agreement. In the history or architecture, there have been champions of all three relationships, as evident in the examples below.

There have also been protagonists for a fourth category of relationship, in which spatial organization is said to be separated from structural, so that they may coexist, each obeying its own logic free of the constrains associated with the other.

As we have seen in the chapter on *Geometry in Architecture*, regarding 'the geometry of making', structure tends to its own geometries. In the sections of that chapter regarding 'the geometry of being' and 'social geometry' we have seen that objects and people, individually and in groups, can evoke their own geometries. In architecture there are vital relationships between these geometries: sometimes they are in tension; sometimes they can be resolved into harmony; sometimes they can be overlaid but remain conceptually separate.

An extra complication is that once a structural strategy is established it can influence (not merely respond to) spatial organization.

An important aspect of the art of architecture is to choose a structural strategy that will be in some sort of accord with the intended spatial organization.

The way in which ancient Greek architects evolved indoor theatric places is a good illustration of how spatial organization can conflict with structural, and how this can be resolved by compromises of different types, in both.

The classic Greek amphitheater was a geometric formalization of the social geometry of people sitting on the slopes of a hill watching a performance. Its three-dimensional form was a fusion of social geometry, ideal geometry, and the lie of the land. With no roof it did not have to take account of the geometry of structure.

Questions

1. What does the writer mainly discuss in the text?
2. What is the role of structure and space in architecture?
3. 'In terms of attitudes, one can either choose and allow a structural strategy...'. The word *one* in the sentence can be best replaced by the word .....
4. '...in a way, force structure to cope with them.' What does the word *them* in the sentence refer to?
5. What are the relationship between space and structure in architecture according to the text?
6. 'In architecture there are vital relationships between these geometries...' What does the word *them* in the sentence refer to?
7. According to the text, how is the relationship between objects and people, individually and in groups, as seen within te perspective of social geometry?
8. What does the writer mainly discuss in the last paragraph?

Unit 12 (Twelve): PARALLEL WALLS

One of the simplest, oldest, and yet most enduring of architectural strategies is based on two straight parallel walls.

This strategy is found in prehistoric architecture, and it continues to be useful. Architects have explored its possibilities right into the twentieth century, developing variants and hybrids. It is unlikely that its potential has yet been exhausted.

The obvious attraction of this most uncomplicated arrangement is its structural simplicity – it is easier to span a roof between two parallel walls than any other form.

But although it is simple, the parallel wall strategy is not without its subtleties. As with many ancient forms of architecture these subtleties may have caused a sense of wonder in the minds of those who first used them; a wonder that we have only lost through familiarity. The causes of that wonder are still available for rediscovery and ise in design.

In the chapter on *Geometry in Architecture*, and in particular the section on the 'six-dimensions-plus-centre', it was said that terrestrial architecture relates, in some way or another, to the earth, the sky, the four horizontal directions, and the idea of centre. The strategy of parallel walls related particularly to the four horizontal directions. Its power lies in its control over these directions, in definite ways which can be used to create a sense of security, direction, and focus.

Protection is provided by the roof which shelters the 'inside' from the rain or the sun, but also by the side walls which limit the directions of approach to two – 'front' and 'back' – or, with the addition of a non-structural rear wall, to one – 'front' – making this simple building like a cave.

The sense of direction, or dynamic, is created by the long shape of the space between the walls. The line direction can run either way, straight through between the walls or culminate within the building, terminated by a back wall.

These characteristics of the parallel wall strategy are to be found in some of the most ancient buildings on earth.

Questions

1. What does the writer mainly discuss in the text?
2. In what way do two straight parallel walls function in architecture?
3. '...the parallel wall strategy is not without its subtleties'. The word subtleties in the sentence can be best replaced by the word .....
4. 'The obvious attraction of this most uncomplicated arrangement is *its* structural simplicity.' What does the word *its* in the sentence refer to?
5. What does the writer mainly discuss in paragraph 4?
6. What is the role of strategy of parallel walls as seen from the perspective of *Geometry*.
5. What are the relationship between space and structure in architecture according to the text?
6. 'In architecture there are vital relationships between these geometries...' What does the word *them* in the sentence refer to?
7. According to the text, how is the relationship between objects and people, individually and in groups, as seen within te perspective of social geometry?
8. What does the writer mainly discuss in the last paragraph?

Unit 13 (Thirteen): The New Media Designer

For centuries, most people believed the world was flat. This idea had to be rethought when it was proved completely incorrect. Today, new media designers are faced with the same sort of revolution of ideas. Several decades ago, it was proposed that the personality of a designer and that of a person who worked with technology were completely different. It was thought that the traits of each would rarely if ever be present in the same person. Even after scientific study has proved otherwise, the idea still persists, as well as the belief that the designer and the technophile are locked into their own worlds with no hope for escape.

New media designers use both technology and design skills, so the continued acceptance of this idea places them in an awkward position. In essence, it means that the new media designer does not exist.

The good news is that recent studies have shown that people might be different in how they organize information, but now in what they are capable of doing. This means that people are free to use technology or creativity whenever it suits them and are no longer limited by stereotypes. The world is no longer thought to be flat, and the new media designer has been placed in the role of a world explorer to prove that the old ideas no longer apply.

Charting The Course

The journeys of early explorers like Columbus or Magellan might have ended in disaster had they not first understood a few things about seamanship, such as principles regarding the nature of the sea and what it means to be a sailor. Likewise, this chapter covers a few things that are important to new media designers, such as principles regarding the nature of new media and what it means to be a designer who works with technology.

What is New Media?

What is **new media**? (if you can figure this out, don't bother writing it down because the answer might change by the time you get around to reviewing your notes.)

A large part of the confusion over a specific definition of new media comes from the aggressive sales pitches of the various software companies. Each company has their own version of what they claim will be hot new media and they will try to sell it to you as fast as they can. Yet each version of what is being called new media might be different from the next version. If the people who develop the new media software can't agree on what it is, then perhaps it is better to look elsewhere for a solid definition.

The Evolution of New Media

Understanding what new media is can be gained by first establishing what old media is. The place to begin is with the word *media*. Media is the plural form of *medium,* which refers to some material or technique used for communication.

One of the oldest examples of a medium used to communicate are *cave paintings*. Early humans created this pictorical works by using pigments and stains on cave walls. This method of communication remained basically the same for several thousand years. It is true that artistic styles evolved and that people started painting on things other than cave walls, but really little else was different: the medium was still a mark or pigment on a surface, and only a single medium of communication was used.

Eventually, advances in technology brought new methods of communication, and inventors began experimenting in areas that led to the development of photography, the telegraph, and recorded sound. Although these new methods revolutionized communication, each still relied on a single medium to send a message.

14 (Fourteen): The Design Process

The term design is usually used to refer to one of two concepts. The first has to do with planning the construction of some new thing such as a house, a bridge, or a piece of software. In this instance, the purpose of the design is to create something that fulfills certain needs, and a part of the design process is to plan ways the new thing will meet those needs.

For example, an engineer might be required to design an aircraft that does more than just fly. In the case of this hypothetical aircraft, it is also required to carry a large number of passenger over a long distance. To achieve this, the designer plans for larger fuel tanks (so the aircraft can travel without stopping to refuel) and for more powerful engines (so it can lift the combined weight of all the people and the additional fuel). How the designer solves each of these problems influences the end result. The word *design* is also used to refer to work of art, so an image or an illustration also can be called a design.

Defining *Design* for The Media Designer

For the new media designer, both of the previously mentioned definitions are technically correct, but the meaning of the word *design* is actually closer to a combination of the two. A new media designer working on a project is concerned with aesthetic value but also with planning the creation of a new thing. This thing might not be an actual object that a person could ride in or sit on, but it is still a new thing. More often than not, this new thing is a communication. That is, the designer is using visual elements and design in the artistic sense to make something that can convey an idea to other people.

Just like the engineer who begins the planning of an aircraft, the designer must take into consideration additional needs that the creation will have to meet. Instead of being concerned with the problems of weight or fuel capacity, the designer also will deal with issues such as who will receive the message and how that message will meet a client's needs.

A Designer Designs

Design can be looked at as a working progress or as solving a problem to meet a need. The important part of that statement is *working progress*. Different designers work in different ways, but all plan and then adjust those plans along the way to complete a product. Some plan most of a design in their heads before ever starting, while others sit down and start drawing, working out the details along the way. Most media designers do combination of both.

Pitfall of The Process

As a design evolves to provide solutions to specific problems, it might grow beyond the purpose of the original idea. This is an important part of the process, but a designer must be careful not to become so engrossed in the details that sight of the original purpose is lost. To return to the example of the aircraft, it would be as if the designing engineer became so concerned with the weight and fuel capacity of the airliner that the main purpose was forgotten. The result might be a jet that could hold plenty of fuel and passengers but that could not fly.

The Design Process

The development of a Website is used in Figure 2.1 to illustrate several steps in the design process, which is broken down into three different phases. The first of these is the **information** phase. During this phase, information is gathered about the site. The second part of the design process is the **interaction** phase, which is concerned with how visitors will interact with and navigate the site. The final part of this process is the **presentation** phase, which determines how the site will look.

Unit 15 (Fifteen): Texture in Design

In the physical world, we generally think of texture as something we experience with our sense of touch. The texture of an actual object might be rough or smooth, soft or hard, and how it feels to the touch is how we classify it. Design can also include texture, but because the viewer is unable to feel the texture, the designer must rely on visual information to convey how it might feel. This makes the use of texture one of the more peculiar elements of visual design. When using texture, a designer substitutes the sense of sight for the sense of touch.

When looking at an object, one can usually make a good guess as to how it might feel to the touch. This ability might be based on past encounters with objects that appear the same way or due to our ability to see things in such fine detail that we can distinguish small surface differences. The result is that when we look at a texture, our brains can translate the appearance of a surface into how it might feel to our sense of touch. To explore this further, look at the rows of different textures in figure 7.1. Imagine how each would feel to the touch if it made up the surface of an object. As you can see, it is relatively easy to determine how something might feel through visual information alone.

The Magic of Texture

As an elements of design, texture can be used in some remarkable ways. It can transform a plain image into one that is full of richness and detail, or, without altering the composition of the piece, texture can be used to fill empty areas of an image. It can add depth to space, create detail in an illustration, or define the style of an entire project. Texture can do so much as a design tool that it almost seems to be magic.

For the new media designer, the use of texture as an element of design can be simple. Most imaging software includes applications that allow a designer to create interesting textures with just a few clicks of the mouse. If the texture isn't quite right, it can be instantly removed and replaced with a different one just as easily as the first. For a designer

who works with brush, pen, or pencil, the creation of texture is one of the most tedious and time-consuming tasks, but for the new media designer, it is one of the quickest and easiest elements to incorporate into a piece.

Uses for Texture

The different ways texture can be used in design are as numerous as different design ideas. This section identifies several of the major ways that texture can be used in imagery. The information covered will provide a firm foundation on which you can build your own work, but how you will use texture is up to you.

Texture as Detail

One the most common uses of texture is to provide detail within an image. Designers and non designers alike can appreciate well-crafted detail in any image. Some artists and designers have made careers of creating images that capture and reproduce the finest of details of objects that exist in the real world. Used this way, texture makes the image more realistic and brings the association of touch to an illustration.

Unit 16 (Sixteen): Style in Design

In design, the term style is often used in more than one way. It either refers to the overall appearance of the design (often made by a certain approach or technique applied to it) or it is used to mean a specific recognized historical style. To prevent confusion, a detailed definition is given for both uses of the world.

Style as technique. The word *style* is used to refer to the treatment of the visual elements in a design. For example, if an image is made to look torn, scratched, and faded, it can be said that it has a worn or rough style. In this example, the word *style*refers to the overall look and the techniques used to create the piece. This is similar to drawing a line in a certain way to convey an emotion. The definition for this use of the word is a technique used to convey

information beyond plain representation (e.g., the designer drew the logo in a style that made it look cold and metallic).

Style as an artistic movement. The word *style*also is used to identify a design in reference to a recognized historical period of art (e.g., the designer created a logo that captured the look of art deco).

In this context, style usually reflects when and where something was made. For example, an image from an interior wall of an Egyptian pyramid looks different in many ways from a Renaissance painting. Much of this has to do with the different ideas held in each culture as well as how those ideas were used in the art of the period. This is not to say that a contemporary designer could not emulate a style from the past, only that the original version of that style was a product of that culture and time period.

Using Style as Technique

Style as a technique can have very strong associative qualities for the viewer. This association is usually why a particular style is used. An illustration of association and style can be seen in figure 16.1.

Four illustrations are shown in figure 16.1. The first image is the original; the other three have been altered using different styles. Notice how the approach to each of the other images affects the meaning of the work through association. Each illustration is basically the same in content and composition, but the style causes the viewer to make assumptions about each message's author. These associations add meaning to the image.

Style as Context

A powerful way that style can be used is as a **context**. Style used as context creates a world in which the information can exist. For example, the style of a Web site might make it look trendy and fashionable, high tech, or even business-like. In new media design, this use of style is often called a **theme** (e.g., an interactive project that uses circusimagery could be said to have a circus theme).

Using style as context can be a helpful vehicle for giving the viewer additional information – especially if the goal and the intended audience of a project are taken into consideration. For clients, this use of style should reflect the impression they want the viewer to have about the project and about the client themselves.

Unit 17 (Seventeen) : COPYWRITERS AS COMMUNICATORS (Advertising Copywriter)

Advertising copywriters are employed to convey messages and persuade people into a certain course of action, whether that is to feel tempted by a new aftershave, to realize the dangers of casual sex or to donate money to a children's charity*****.

It's therefore important for copywriters to be able to communicate their ideas successfully. And that quality of communications is not restricted to advertising copy alone; copywriters should also be able to write proposals and talk about their work clearly and persuasively. Once again, the ability to use language effectively is essential if you want to get your points across.

On a positive note for people wishing to climb the agency career ladder, this is one of the reasons why so many Creative Directors, Managing Directors, and Chief Executives of advertising agencies turn out to have served their time as copywriters.

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If we want to be clever with words, it must always be with the aim of communicating the right message in a memorable way and with maximum impact.

As a copywriter you are meant to have a good command of language and to have developed at least a basic understanding of marketing and consumer psychology. These practical skills not only enable you to come up with effective concepts but also to explain them concisely and precisely for the benefit of account handlers and clients alike.

Although advertising is a creative discipline, writers who work in this industry must never lose sight of the fact that we're putting words together for a particular purpose. Our intention is usually to increase awareness and sales of our clients' products, although our skills might equally be employed for other reasons. For example, some advertising is created to address public health concerns – perhaps to encourage people to give up a harmful habit such as smoking.

Whatever the purpose of the advertisement – and that requirement should be clearly stated in the 'brief' – we need to achieve effects that produce specific results. This means we have to shape our ideas and copy to suit that particular purpose.

Word-check***

Brief – a clear written instruction for the creative team, usually created by an agency's account management team working closely with the client's marketing personnel.

An advertising brief may take many forms but essentially it needs o describe *what*, *who*, *why*, and *where*. *What* it is you are going to be advertising, *who* you are advertising to, *why* you are carrying out this work, and *where* it's going to appear.

Oh, and there will also be some deadlines for the delivery of your material and a budget – just to stop you getting carried away with some

over-elaborate and expensive advertising concepts such as painting the Eiffel Tower pink and transporting it to Brighton to promote *Gay Paree*.

Unit 18 (Eighteen) : GENERATING CREATIVE IDEAS (Creative Concept of Advertising)

Creative concepts are essential in advertising, but is it possible to teach someone how to be creative – or maybe just that little bit more imaginative? Well, as a copywriter and sometime lecturer who is looking to encourage creativity in myself and others, I'm keen to promote the idea of reading widely and listening carefully. To stay sharp, writers need to be interested in all forms of writing and be aware of all aspects of culture.*****

You need to consider writing as a skill that you are continually developing. In the same way that a musician improves his playing by listening to other musicians perform and through dedicated practice, so writers can enhance their skills through wide reading and regular writing. A dull and rather obvious statement and therefore true. But if you find reading dull, well, as I've said before, maybe you're not really cut out for a career in copywriting.

By all means seeks inspiration and ideas from the advertising that you see and hear around you or that you find in advertising books and archives, but don't restrict your enquiring mind to advertising alone. Try and absorb as much knowledge as you can about popular and high culture because you never know when an obscure piece of information or an unusual idea is going to prove useful.

Magazine articles, short stories, novels, newspaper columns, comic books, art galleries, graffiti, plays, musicals, opera, TV drama, comedy, soaps and documentaries, radio, movies (old and new), sport: they all add to your knowledge of styles and creative references that you can then adapt or adopt in adept ways in your own advertising work.

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Creativity is often about putting old ideas together in a new way. It's about making unusual connections that surprise, delight and inform.

Word-check***

Soap opera – you might be aware of this already, so forgive me if I'm acting like the pub bore, but did you know that the term 'soap opera' has intimate links with advertising and the early days of radio shows in the USA?

Weekday radio dramas in the 1930s were often sponsored by soap manufacturers, such as Procter & Gamble, who hoped to influence housewives to buy their products.

It has been suggested that the 'opera' element was an ironic comment on the quality of the drama, and yet all forms of opera – whatever their setting – deal with heightened, emotional storylines, whether it's *EastEnders* in Albert Square or *Aida* in ancient Egypt.

Thankfully, advertising copywriters can benefit from a broad interest in all aspects of culture in an industry where soap opera is as relevant as grand opera.

Unit 19 (Nineteen) : CREATIVITY AND ORIGINALITY OF ADVERTISING

A lot of advertising doesn't make sense. Many headlines make use of contradictions: surprising statements that don't appear to make sense until you investigate further to find out their true meaning. The idea is to draw people in with these paradoxical headlines so they read on to gain the explanation.

Of course, this can only work if the headline is sufficiently intriguing but, luckily, it's part of human nature that we want to know the answer to a mystery, no matter how minor. We just can't help ourselves, which is just as well or a lot of body copy would never get read. However, you don't want to make the puzzle too complicated.

Intriguing riddles and wordplays play a major role in advertising and, despite reservations on the part of some critics, they appear to work. In fact they have the merit of involving your audience, actively engaging their interest as they seek to unravel your meaning. So let's take a look at a few press ads and posters which use this technique.

Scandinavian Skin

The surprising contrast between cold weather and soft hands provides a good example of how to use contradiction to make a selling point. Neutrogena Hand Cream boldly claims in a press ad: 'In Norway it's always cold. Perfect weather for soft hands.' While most people would consider cold weather to be potentially damaging to their skin with the risk of sore hands, in this ad it is presented as 'perfect weather for soft hands'.

You have to turn to the body copy for the explanation. The text states that Norwegian Formula Neutrogena Hand Cream 'instantly relieves and intensely moisturizes even dry, chapped hands'. (note the effective use of the similar-sounding adverbs: 'instantly' and 'intensely') The overriding message is that, if this product can work in such tough and testing conditions as a Norwegian winter, then it should certainly perform its function well in less-demanding climates.

Enjoying the View?

A new housing development on a South Wales headland offered excellent views of the sea while the interiors of these homes were also quite attractive. This gave me the opportunity to create a contradiction in my headline: 'Step inside and admire the view'/ this line was supported by an image of a comfortable living room complete with French windows looking out over the sunlit bay.

One would usually expect to step outside to admire a view, while there is also an ambiguity about whether the view referred to in the headline is an external or internal one: both views are there to be admired. Furthermore, the headline can be seen to provide an open invitation to come along and view these homes.

Money-back Offer

Every year English Heritage attracts thousands of visitors to its historical sites around the country. Once on site, a marketing objective is to encourage people to take out annual membership. If you decide to take out membership there and then you can have your entrance fee for that day's visit refunded.

This fact enabled me to write an apparently contradictory headline for a poster that is displayed at their sites: 'If you enjoy today, get your money back.' Generally, you would only expect to get your money back if you'd had a bad experience. The idea was to intrigue viewers to read on about the low cost of membership and the opportunity to reclaim your entrance money.

Unit 20 (Twenty): ADVERTISING IN UNUSUAL PLACE

There are so many places where you're likely to find adverts these days. I'm sure there's a researcher who will offer a precise figure for the average number of ads you'll see in a day, although that rather depends on the kind of day you're having. All I know is that there is a huge number of advertising messages out there competing for our attention.*****

Take a trip to the supermarket and you'll find ads slotted into your shopping trolley. There will be further messages on the shopping bags plus various promotional leaflets and posters at the check-outs. Then as you've wandering round the aisles, you're likely to see 'floor vinyls' beneath your feet and perhaps some 'shelf wobblers' sticking out from the shelves promoting specific products.

It seems that ads are inescapable and advertisers and their media buyers are keen to find new ways to grab your attention and new places to place a promotional message when you're at least expecting it. Pubs and clubs even have small poster sites on the backs of their toilet doors. Talk about a captive audience. And what about those ads positioned over urinals? Who says blokes can't multi-task? Now there's something to hold a lad's attention while he's busy holding something else.

This more unusual kind of advertising is often called ‘ambient’ since it seems to pop up anywhere and appear all around us. There was a great example that featured a plastic splash mat positioned within a urinal which was used to recruit would-be firefighters! Another of these lavatorial ads showed the image of a car which, when you peed on it changed into the image of a smashed-up vehicle to warn you of the dangers of drink-driving.

This is all good stuff which demonstrates lateral creative thinking in action. The Edinburgh-based agency, Family, has the ability to conjure up some excellent ambient advertising. Take a look at these superb examples created on behalf of their client, Scottish Slimmers.

They’ve taken the idea of targeting people who would like to lose weight and then thought laterally – or perhaps I should say, widely – as to where best to position their ads. And so we have the tight squeeze on the station’s narrow entrance gates and the visual pun of weighted down taxi. Simply brilliant.

Unit 21 (Twenty One): ADVERTISING IN THE DIGITAL AGE

The importance of paring down your words and conveying information quickly is nowhere more important than in the brave new world of digital media.

Websites, online advertising, e-mails, and texting have joined the ranks of established advertising media – and even replaced some traditional forms in the promotional mix. For example, many companies no longer produce expensive printed brochures and newsletters but choose instead to convey that information online.

There’s really no need to be afraid of new media forms; you simply need to understand how they work and then adapt your content to fit that format. As in all advertising, I’m pleased to report that content is still king and, once again, it’s the most persuasive combination of words and images that’s going to prove most effective for websites. Although

you also need to be aware of how search engines rank sites and include appropriate key words.

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When it comes to writing text or websites, there really is a need for speed. Keep your message simple and direct – and relay your information quickly.

In the past, too many computer geeks have claimed to be 'website designers' when they should more aptly be termed website technicians. Please remember that the roles of graphic designer and copywriter are still of the greatest importance for digital media and their absence is all too apparent when you open up some websites with their poor layout, clunky appearance and woeful text riddled with typographical errors.

Copywriters working in this modern medium must be aware that people searching for information online are nearly always in a hurry. They want instant gratification, clear content, ease of navigation and simple instructions. They don't want to wait a long time for your pages to load and they don't want to wade through reams of text.

Reading on screen is not a very comfortable process. It's liable to lead to eye-strain so we all want websites to make their points quickly. We also want clear navigation that tells us where we can click for further information when we want to explore something in more detail.

That good old 'hierarchy of information' is critical in website design and you must put all the right details on the hard-working home page which often serves as your shop window, entrance door, billboard and table of contents all rolled into one.

Two fundamental tips for Web words: don't run your text over too great a width or its very difficult to read – and don't run it on at such length that your reader has to scroll down very far to find out more.

The ideal is to contain everything you need to say within the first screen and then let your reader decide if they want to ‘drill down’ for further information.

It’s not always easy to know how your text is going to appear on every screen since different computers running different programs can display your pages and run your text in different ways, but try and get your Web technician to limit the line width.

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