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# UNIT 6 PETROLEUM BY JOHN W. HARBAUGH

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## 6.0 OBJECTIVES

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After completing the unit, you should be able to

- understand descriptive passages,
- identify the main features in descriptive passages,
- write definitions using its various forms,
- use the impersonal passive form correctly,
- describe functions,
- organize phrases into logical statements, and
- understand how various statements are logically related to each other in descriptions.

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## 6.1 INTRODUCTION

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In this unit, our aim is to give you practice in reading comprehension by giving you a passage to read entitled "Petroleum" by John W. Harbaugh. The exercises that we have set will enlarge your technical/scientific vocabulary, as well improve some of your reading skills.

The section on use of language introduces you to the rhetorical features of scientific discourse and allows you to practise relevant language items in context. The exercises in this section will develop your awareness of how we use the devices of language to express communicative functions. We shall discuss the following items in these sections.

- (i) Description of substances
- (ii) Description of function
- (iii) Nature of definitions

We shall also set exercises on organization in order to make you aware of **cohesion** (the ways in which the forms of the language are used to tie together ideas and build up stretches of the text) and **coherence** (the ways in which statements are linked and developed in terms of the ideas they convey) in scientific descriptions.

## 6.2 PASSAGE FOR READING

### 6.2.1 Study Guide

In this section, we shall help you read with understanding and guide you to develop your reading potential.

There is a pre-reading section followed by a reading text. You should first run your eyes through the text as quickly as you can (take no longer than one minute) in order to guess the information that the text contains. Pay particular attention to the heading, the first paragraph and the first sentence of each paragraph. Then solve the exercise in the pre-reading section. After that, you should read the whole text again, carefully and at a slower pace, to get all the details. You should also consult the glossary for the meanings of difficult and unfamiliar words as well as scientific and technical terms. In addition, notice the clues present in the text to recognize and guess the meanings of words and phrases. After you have read and understood the text, you should answer all the questions in the comprehension exercises.

### 6.2.2 Pre-reading

#### Exercise 1

Which of the following do you expect to read about in the text ?

- (a) petroleum production trends
- (b) occurrence of petroleum
- (c) physical composition of crude oil
- (d) world reserves of crude oil and natural gas
- (e) reservoir rocks and traps
- (f) forms of petroleum
- (g) importance of petroleum
- (h) uses of petroleum and its products
- (i) origin of petroleum
- (j) exploration for oil and gas
- (k) effects of temperature on petroleum origin
- (l) distribution of world oil and gas reserves

### 6.2.3 Text

1. Petroleum – the oil and gas in the Earth's crust – is of immense importance to humans. The word 'petroleum', derived from the Latin 'petra' and 'oleum', means literally " rock oil". Petroleum occurs widely in the sedimentary rocks of the Earth's crust and may occur as a gas, liquid, semi-solid, or solid, although mixtures of gas and liquids are most common. From a chemical standpoint, petroleum is an extremely complex mixture of HYDROCARBON compounds with minor amounts of nitrogen, oxygen, and sulphur as impurities. Forms of petroleum include crude oil, or unrefined liquid petroleum; NATURAL GAS, consisting of the compound methane, with lesser proportions of ethane, butane, and propane; asphalt, a solid or semi-solid bituminous substance obtained as a residue from certain petroleum; and gilsonite, one of a number of solid asphalt-like compounds. Commercially, crude oil is the most important form of petroleum, and natural gas is second.
2. Physically, crude oil is a mixture of different compounds that boil at different temperatures. The lightest fraction consists of gases that boil below atmospheric temperature. The next fraction, normally refined into GASOLINE, boils between about 30° and 200° C (85° and 390° F). The fraction boiling between about 140° and 320° C (285° and 610° F) is termed KEROSENE. The fraction boiling above about 320° C is commonly refined into heating, diesel, and lubricating oils. The remaining and heaviest fraction is the residue, which supplies waxes, asphalts, and some fuel oils.

3. Petroleum is enormously important from an economic, technological, and social standpoint. Fuels that are derived from petroleum supply more than half of the world's total supply of energy. Gasoline, kerosene, and diesel oil provide fuel for automobiles, tractors, trucks, aircrafts, and ships. Fuel oil and natural gas are used to heat homes and commercial buildings. Petroleum products are used in the manufacture of synthetic fibres for clothing, and in plastics, paints, fertilizers, insecticides, soaps, and synthetic rubber. The uses of petroleum as a source of raw material in manufacturing have progressively increased in importance.
4. The origin of petroleum has provoked extensive argument, and major gaps exist in understanding the process of its formation. Geologists generally agree, however, that petroleum is formed through progressive chemical change of materials provided by microscopic aquatic organisms incorporated in marine sedimentary rocks, where most of the world's petroleum occurs. These organisms apparently include microscopic marine plants and animals that settled to the sea bottom and were incorporated in the sediments.
5. Transformation of some of this sedimentary material to petroleum probably began soon after deposition, with bacteria playing some role in the initial stages, and clay particles serving as catalysts.
6. The transformation processes have been strongly influenced by temperature. Temperatures within the Earth's crust increase more or less directly with depth. Some evidence indicates that most petroleum has formed at temperatures not exceeding about 100° to 120° C (210° to 250° F), with the generation of petroleum hydrocarbons beginning as low as 65° C (150° F). At temperatures about 175° to 200° C (345° to 390° F) most liquid hydrocarbons are destroyed.
7. The effects of temperature on petroleum origin are time-related. Source beds of petroleum, presumed to consist generally of clay deposits containing organic material that has been exposed to lower temperatures over longer intervals of time, might be as effective in generating petroleum as younger deposits subjected to higher temperatures. The presence of liquid petroleum deposits is probable evidence that the rocks from which they were derived have not exceeded a temperature of about 200° C. Where liquid petroleum does not exist but natural gas is abundant, temperatures may have exceeded 200° C.

(Adapted from **Lexicon Universal Encyclopedia**, Lexicon Publications, N.Y. 1989)

## 6.2.4 Glossary

The numbers refer to the paragraphs in the text.

1. **sedimentary rocks** : rocks formed by accumulation and deposition of fragmentary materials or organic remains  
**hydrocarbon** : a compound of hydrogen and carbon with nothing else  
**proportion** : the relation of one thing to another in magnitude  
**bituminous substance** : a substance impregnated with various inflammable mineral substances  
**residue** : that which is left
2. **fraction** : a fragment
3. **synthetic** : artificially produced but of like nature with the natural product  
**insecticide** : an insect - killing substance
4. **progressive** : advancing by successive stages  
**microscopic** : minute  
**aquatic** : living in water  
**marine** : inhabiting, found in or got from the sea

- 5. **transformation** : change of form  
**deposition** : accumulation by sedimentation
  
- 6. **organic material** : material containing or combined with carbon

### 6.2.5 Exercises in Comprehension

#### Exercise 2

Read the passage quickly again in order to find the words or phrases below. (The numbers in brackets give the paragraphs in which the words can be found). Then try to decide which of the three alternatives can replace the underlined word or phrase without changing the meaning of the passage. Check your answers with the answers given by us at the end of the unit.

- 1. **Occurs** (1)
  - (a) takes place
  - (b) is found
  - (c) happens
  
- 2. **Provoked** (4)
  - (a) challenged (b) stimulated (c) exasperated
  
- 3. **Provided** (4)
  - (a) made ready beforehand (b) stipulated (c) supplied
  
- 4. **Incorporated** (4)
  - (a) incarnated (b) present (c) merged
  
- 5. **generation** (6)
  - (a) off spring (b) production (c) emergence
  
- 6. **presumed** (7)
  - (a) believed (b) understood (c) assumed provisionally
  
- 7. **exposed** (7)
  - (a) subjected to (b) presented to (c) allowed access of

#### Exercise 3

Answer the following questions on the reading text you have read. You may refer to the passage again to find the answers. Check your answers with the answers given by us at the end of the unit.

- 1. What are the various forms of petroleum ?  
.....  
.....
  
- 2. What is the other name of crude oil ?  
.....  
.....
  
- 3. What does natural gas consist of ?  
.....  
.....

4. Where does petroleum occur ?

.....  
.....

5. What does the lightest fraction of crude oil consist of ?

.....  
.....

6. What are the uses of petroleum products ?

.....  
.....

7. How is petroleum formed ?

.....  
.....

8. How do temperatures within the Earth's crust increase ?

.....  
.....

9. What is the lowest temperature at which the generation of petroleum hydrocarbons may begin ?

.....  
.....

10. How are liquid hydrocarbons destroyed ?

.....  
.....

**Exercise 4**

Answer the following questions by choosing the best alternative under each (Tick the correct answer).

1. The lightest fraction consists of gases. Fraction of what ?

- (a) natural gas
- (b) crude oil
- (c) asphalt

2. Kerosene does not boil below

- (a) 200° C
- (b) 610° F
- (c) atmospheric temperature

3. Waxes and asphalts are obtained from

- (a) gasoline
- (b) the heaviest fraction of unrefined liquid petroleum
- (c) the lightest fraction of crude oil

4. Forms of petroleum do not include
  - (a) unrefined liquid petroleum
  - (b) propane
  - (c) gilsonite
  
5. Fuels that are derived from petroleum supply
  - (a) more than 50% of the world's total supply of energy
  - (b) more than one third of the world's total supply of energy
  - (c) more than 75% of the world's total supply of energy
  
6. Petroleum is enormously important because
  - (a) its products are used in the manufacture of synthetic fibres for clothing
  - (b) its products are used in cosmetic industry
  - (c) it is a major source of energy
  
7. Major gaps exist in understanding the process of *its* formation  
"its" refers to
  - (a) extensive argument
  - (b) understanding
  - (c) petroleum
  
8. Transformation processes begin
  - (a) immediately before deposition
  - (b) immediately after deposition
  - (c) during initial stages of deposition
  
9. Liquid hydrocarbons may not be destroyed at temperatures below
  - (a) 250° F
  - (b) 340° F
  - (c) both of these
  
10. the rocks from which they were derived; "they" refers to
  - (a) younger deposits
  - (b) liquid petroleum deposits
  - (c) probable evidence

#### Exercise 5

Decide which point is the most important in each paragraph by choosing from the alternatives given below.

1. paragraph 1 :
  - (a) Crude oil is the most important form of petroleum.
  - (b) Forms of petroleum include crude oil, natural gas, asphalt and gilsonite.
  - (c) Petroleum is a complex mixture of hydrocarbon compounds.
  
2. paragraph 2 :
  - (a) The lightest fraction of crude oil consists of gases.
  - (b) Crude oil is a mixture of different compounds that boil at different temperatures.

(c) The heaviest fraction of crude oil is asphalt, and some fuel oils.

3. paragraph 3 :

- (a) Petroleum is very important from an economic, technological and social viewpoint.
- (b) Fuels derived from petroleum supply more than half of the world's total supply of energy.
- (c) Petroleum is used as a source of raw material in manufacturing.

4. paragraph 4 :

- (a) Marine sedimentary rocks play an important role in petroleum formation.
- (b) Marine plants and animals settled to the sea bottom are incorporated in marine sedimentary rocks.
- (c) Although the origin of petroleum has provoked extensive argument, geologists agree that petroleum is formed through progressive chemical change of materials.

5. paragraph 5 :

- (a) Transformation of marine sedimentary material to petroleum probably began soon after deposition.
- (b) Bacteria played some role in the initial stages of transformation.
- (c) Clay particles served as catalysts.

6. paragraph 6 :

- (a) Temperatures within the Earth's crust increase more or less directly with depth.
- (b) Most liquid hydrocarbons are destroyed at elevated temperatures.
- (c) Transformation processes have been strongly influenced by temperature.

7. paragraph 7 :

- (a) The effects of temperature on petroleum origin are time-related.
- (b) Source beds of petroleum are as effective in generating petroleum as younger deposits.
- (c) Rocks from which liquid petroleum deposits were derived have not exceeded a temperature of about 200° C.

## 6.2.6 Use of Language

### Exercise 6 : Description of substances

Most scientific writing is concerned with description. Scientific/Technical descriptions are impersonal, objective, factual, and accurate.

There are many types of descriptions and different purposes of descriptions. There are for instance, descriptions of objects, substances, conditions, and processes. Each type includes particular characteristics.

In this exercise, we shall concentrate on one type of description : **description of substances.**

While reading the passage, you might have noticed that most of the sentences used in the passage are in the form of direct statements, using simple present tense. The passage describes the occurrence, forms, uses and origin of petroleum. In fact, the main features found in descriptions of substances are normally as follows : forms, occurrence, structure, properties, reactions, uses.

1. Now, complete the following sentences which express some of these features, using information from the passage.

Forms : (i) Forms of petroleum include

.....

Occurrence : (ii) Petroleum is found in

(iii) ..... may occur as gas, .....

Properties : (iv) The lightest fraction of crude oil consists of gases .....

(v) Kerosene boils between .....

Uses : (vi) Fuel oil and natural gas..... for  
..... while petroleum products  
are used .....

2. Study the following information in note form about white phosphorous. Use this set of notes (not in the right sequence) in order to complete the description of white phosphorous.

- (i) incendiary and napalm bombs and in rat poison
- (ii) waxlike substance
- (iii) an alpha form and a beta form
- (iv) a greenish light and gives off white fumes
- (v) toxic and extremely inflammable
- (vi) apatite minerals
- (vii) ignite

White phosphorous is a ..... very .....

..... It is found most commonly in .....

..... such as fluorapatite. It exists in .....

..... When

it is exposed to air in the dark, it emits .....

..... It can .....

spontaneously. White phosphorous is used in .....

**Exercise 7 : The nature of definitions**

It is often necessary in scientific description and explanation to define certain substances, objects, operations, processes, or concepts. A definition provides a general statement to begin a description. It expresses the essential nature of a thing or concept. In making a definition we normally give,

- (a) the specific concept being defined
- (b) the class to which the specific concept belongs
- (c) the specific characteristics of the concept which make it distinct from other members of the same class.

Example :

An acid is a compound containing hydrogen which can be replaced directly or indirectly, by a metal.

Now, complete the following definitions.

- (a) It puts forward the author's views about petroleum.
- (a) Petroleum is a .....  
.....
- (b) Asphalt is a ..... or semisolid .....  
..... which is .....
- (c) Crude oil is .....  
..... which boil .....
- (d) Kerosene is a ..... of crude oil which .....
- (e) Sedimentary rocks .....

### 6.2.7 Organization

#### Exercise 8

Here are some sentences followed by some phrases connected with the next. Using all the phrases given, make a sentence which should logically follow the given sentence.

- (a) "Petroleum" literally means "rock oil".  
although mixtures of gas and liquids are most common  
in the sedimentary rocks of the Earth's crust.  
and may occur as a gas, liquid, semisolid, or solid  
it occurs widely.
- (b) Crude oil is the most important form of petroleum.  
that boil at different temperatures  
of different compounds  
it is a mixture  
physically.
- (c) Petroleum is very important from an economic viewpoint.  
in manufacturing  
fuels that are derived from petroleum  
petroleum products are used  
while  
supply more than half of the world's total supply of energy.
- (d) Geologists agree that petroleum is formed through  
progressive chemical change of materials.  
incorporated in marine sedimentary rocks  
these materials were provided  
where most of the world's petroleum occurs  
by microscopic aquatic organisms.
- (e) The transformation processes have been strongly influenced by temperature.  
with the generation of petroleum hydrocarbons beginning as  
low as 65° C  
that most petroleum has formed  
some evidence indicates  
at temperatures not exceeding about 100° to 120° C.

#### Exercise 9

Here are some sentences that make up the second paragraph of the text. But they are not in

the right sequence. Put them in the right order. Do not refer to the text.

- (a) The fraction boiling between about 140° C and 320° C is termed kerosene.
- (b) The lightest fraction consists of gases that boil below atmospheric temperature.
- (c) The remaining and heaviest fraction is the residue, while supplies waxes, asphalts, and some fuel oils.
- (d) Physically, crude oil is a mixture of different compounds that boil at different temperatures.
- (e) The next fraction, normally refined into GASOLINE, boil between about 30° and 200° C.
- (f) The fraction boiling above about 320° C is commonly refined into heating, diesel, and lubricating oils.

### Exercise 10

1. Look at the third paragraph of the text. What is the function of this paragraph in the context of the whole text ?
  - (a) It puts forward the author's views about petroleum.
  - (b) It contrasts the economic importance of petroleum with its technological relevance.
  - (d) It explains the importance of petroleum to humans.
2. Look at the last two paragraphs of the text. What do they have in common ?
  - (a) Both describe the processes of petroleum formation.
  - (b) Both give examples of how most liquid hydrocarbons are destroyed at elevated temperatures.
  - (c) Both provide a link between temperature and petroleum formation.
3. Look at the fourth and the fifth paragraphs of the text. What is the relationship between the fifth paragraph and the one preceding ?
  - (a) It develops the theme of the earlier paragraph.
  - (b) It contrasts what is known now with what the geologist agreed earlier.
  - (c) It shows that transformation of sedimentary materials into petroleum begins after deposition.

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## 6.3 LET US SUM UP

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In this unit we have given you practice in understanding a descriptive passage, i.e. "Petroleum". We have also introduced you to some of the features of scientific discourse – description of substances and functions and the nature of definitions. Exercises have been set to help you organise your writing coherently and cohesively.

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## 6.4 KEY WORDS

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**communicative function** : activity to communicate or give information

**comprehension** : the power of understanding

**contextual** : related to or connected with the parts of a discourse

**definition** : a description of a thing by its properties

**description** : an account of anything in words

**device** : that which is devised or designed

**explanation** : act of explaining

**factual** : pertaining to facts, actual

**glossary** : list and explanation of selected words, phrases or terms from a text

**impersonal** : without reference to any particular person, uncoloured by personal feeling

**organization** : structuring of information in a text

**objective** : actual, uncoloured by one's own sensations or emotions

**perceptual skills** : skills related to perception

**pre-reading** : an activity of glancing through a reading text to look for specific points of information or to get a general impression of the text before detailed reading

**process** : a sequence of operations or emotious

**rhetorical features** : features related to language/expression

**scanning** : reading quickly to get some specific information

**scientific discourse** : scientific language

**skimming** : reading superficially to get the main points or major details

## 6.5 ANSWERS TO EXERCISES

### Exercise 1

(b), (c), (f), (g), (h), (i), (k)

### Exercise 2

1. (b), 2. (b), 3. (c), 4. (c), 5. (b), 6. (c), 7. (a)

### Exercise 3

1. crude oil, natural gas, asphalt, gilsonite
2. unrefined liquid petroleum
3. compound methane, with lesser proportions of ethane, butane, and propane
4. in the sedimentary rocks of the Earth's crust
5. gases
6. in the manufacture of synthetic fibres for clothing, and in plastics, paints, fertilizers, insecticides, soaps, and synthetic rubber
7. through progressive chemical change of materials provided by microscopic aquatic organisms
8. with depth
9. 65° C (150° F)
10. due to high temperatures - about 175° to 200° C.

### Exercise 4

1. (b) 2. (c) 3. (b) 4. (b) 5. (a) 6. (c) 7. (c) 8. (b) 9. (a) 10. (b)

### Exercise 5

1. (b) 2. (b) 3. (a) 4. (c) 5. (a) 6. (c) 7. (a)

### Exercise 6

1. (i) crude oil, natural gas, asphalt, and gilsonite.  
 (ii) the sedimentary rocks of the Earth's crust  
 (iii) Petroleum . . . . . liquid, semi-solid, or solid.  
 (iv) that boil below atmospheric temperature.  
 (v) about 140° and 320° C.  
 (vi) are used, . . . . . heating homes and commercial buildings, . . . . . in the manufacture of synthetic fibres for clothing, and in plastic paints, fertilizers, insecticides, soaps, and synthetic rubber.
2. (ii), (v), (vi), (iii), (iv), (vii), (i)

### Exercise 7

(a) complex mixture of hydrocarbon compounds.

- (b) solid, bituminous substance, obtained as a residue from petroleum.
- (c) a mixture of different compounds that boil at different temperatures.
- (d) fraction, boils between about 140° and 320° C.
- (e) are rocks formed by accumulation and deposition of a fragmentary material or organic remains.

**Exercise 8**

- (a) Petroleum literally means rock oil. It occurs widely in the sedimentary rocks of the Earth's crust and may occur as a gas, liquid, semisolid or solid, although mixtures of gas and liquids are most common.
- (b) Crude oil is the most important form of petroleum. Physically it is a mixture of different compounds that boil at different temperatures.
- (c) Petroleum is very important from an economic viewpoint. Fuels that are derived from petroleum supply more than half of the world's total supply of energy while petroleum products are used in manufacturing.
- (d) Geologists agree that petroleum is formed through progressive chemical change of materials. These materials were provided by microscopic aquatic organisms incorporated in marine sedimentary rocks, where most of the world's petroleum occurs.
- (e) The transformation processes have been strongly influenced by temperature. Some evidence suggests that most petroleum has formed at temperatures not exceeding about 100° to 120° C, with the generation of petroleum hydrocarbons beginning as low as 65° C.

**Exercise 9**

The correct order is :

- (d), (b), (e), (a), (f), (c)

**Exercise 10**

1. (d) 2. (c) 3. (a)