

# THE ORIGIN OF PETROLEUM

READING PRACTICE SETS

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## TOEFL iBT READING PRACTICE SET

**Directions:** Read the passage and answer the questions. Give yourself 18 minutes to complete this practice set.

### THE ORIGIN OF PETROLEUM

1 Petroleum is defined as a gaseous, liquid, and semisolid naturally occurring substance that is mainly composed of hydrocarbons, i.e., chemical compounds consisting entirely of hydrogen and carbon. Under surface pressure and temperature conditions, lighter hydrocarbons, such as methane, ethane, propane, and butane, exist as gases, while pentane and heavier hydrocarbons are in the form of liquids or semisolids. The proportion of light hydrocarbons in the petroleum mixture varies greatly among different oil fields, ranging from as much as 97 percent by weight in the lighter oils to as little as 50 percent in the heavier oils and bitumens. Petroleum is nearly always found in marine sedimentary rocks. In the ocean, microscopic phytoplankton and bacteria are the principal sources of organic matter that is trapped and buried in sediment. Most of the organic matter is buried in clay that is slowly converted to shale, a fine-grained sedimentary rock. During this conversion, organic compounds are transformed to oil and natural gas.

2 [A] Sampling on the continental shelves and along the base of the continental slopes has shown that fine muds beneath the seafloor contain as much as 8 percent organic matter. [B] Two additional kinds of evidence support the hypothesis that petroleum is a product of the decomposition of organic matter: oil possesses optical properties known only in hydrocarbons derived from organic matter, and oil contains nitrogen and certain compounds believed to originate only in living matter. [C] A complex sequence of chemical reactions is involved in converting the original solid organic matter to oil and gas, and additional chemical changes may occur in the oil and gas even after they have formed. [D]

3 It is now well established that petroleum migrates through aquifers and can become trapped in reservoirs. In fact, petroleum migration is analogous to groundwater migration. When oil and gas are squeezed out of the shale in which they originated and enter a body of sandstone or limestone somewhere above, they migrate readily because sandstones, which consist of quartz grains, and limestones, which consist of carbonate minerals, are much more permeable than any shale. Moreover, the force of molecular attraction between oil and quartz or carbonate minerals is weaker than that between water and quartz or carbonate minerals. Thus, because oil and water do not mix, water remains fastened to the quartz or carbonate grains, while oil occupies the central parts of the larger openings in the porous sandstone or limestone. Because oil is lighter than water, it tends to glide upward past the carbonate- and quartz-held water. In this way, oil becomes segregated from the water; when it encounters a trap, it can form a pool.

4 Most of the petroleum that forms in sediments does not find a suitable trap and eventually makes its way, along with groundwater, to the surface of the sea. It is estimated that no more than 0.1 percent of all the organic matter originally buried in a sediment is eventually trapped in an oil pool. It is not surprising, therefore, that the highest ratio of oil and gas pools to volume of sediment is found in rock no older than 2.5 million years – young enough so that little of the petroleum has leaked away – and that nearly 60 percent of all oil and gas discovered so far has been found in strata of Cenozoic age, i.e., not older than 66 million years. Nevertheless, this does not mean that older rocks produced less petroleum. It simply means that oil in older rocks has had a longer time in which to leak away.

5 How much crude oil is there in the world? This is an extremely controversial question. Many billions of barrels of oil have already been pumped out of the ground. A significant amount of additional oil has been located by drilling but is still waiting to be pumped out. Possibly a great deal more oil remains to be found by drilling. Unlike coal, the volume of which can be quite accurately estimated, the volume of undiscovered oil can only be guessed at. Guesses involve the use of accumulated experience from a century of drilling. Knowing how much crude oil has been found in an intensively drilled area, such as eastern Texas, experts make estimates of probable volumes in other regions where rock types and structures are similar to those in eastern Texas. Using this approach and considering all the sedimentary basins of the world, experts estimate that somewhere between 1,500 and 3,000 billion barrels of crude oil will eventually be discovered.

1. According to paragraph 1, in which of the following ways is petroleum formed?
  - (A) Phytoplankton and bacteria undergo a change while they are buried in clay.
  - (B) Carbon and hydrogen combine to form shale.
  - (C) Ocean rocks are converted into organic compounds.
  - (D) Oil and gas rise to the surface of sediment and are trapped in rocks.
  
2. All of the following are cited in paragraph 2 as evidence that petroleum is a product of the decomposition of organic matter EXCEPT
  - (A) the amount of organic matter found in layers of mud below the seafloor
  - (B) the chemical changes that occur in oil and natural gas after they have formed
  - (C) the optical properties of oil
  - (D) the fact that oil contains nitrogen and other compounds believed to be of organic origin
  
3. According to paragraph 2, which of the following is true of the change of solid organic material into oil and gas?
  - (A) It is more likely to occur along the base of continental slopes than on the continental shelves.
  - (B) It only takes place in areas where the seafloor contains at least 8 percent organic matter.
  - (C) It is a process that can be reversed through chemical changes that occur after the oil and gas have formed.
  - (D) It involves a complicated series of chemical reactions.
  
4. Which of the sentences below best expresses the essential information in the highlighted sentence in paragraph 3? Incorrect choices change the meaning in important ways or leave out essential information.
  - (A) When oil and gas are squeezed out of the rock in which they originated, it is probably because the layer of rock above them is much more permeable than shale.
  - (B) Sandstones, which are made of quartz grains, and limestones, which are made of carbonate minerals, can hold much more oil and gas than any shale can.
  - (C) When they are squeezed from the shale in which they were formed, oil and gas move easily into the much more permeable layers of sandstone or limestone above.
  - (D) Oil and gas are squeezed out of sandstones, consisting of quartz grains, and migrate readily into limestones, which consist of carbonate minerals and are much more permeable.
  
5. Why does the author include the information that **the force of molecular attraction between oil and quartz or carbonate minerals is weaker than that between water and quartz or carbonate minerals**?
  - (A) To help explain why petroleum behaves differently from water in bodies of sandstone and limestone
  - (B) To illustrate why petroleum migrates more rapidly through sandstone than it does through limestone
  - (C) To help explain how water and petroleum can mix in certain aquifers
  - (D) To account for the different molecular structures of oil and water
  
6. The word **encounters** in the passage is closest in meaning to
  - (A) meets
  - (B) forms
  - (C) escapes
  - (D) avoids

7. According to paragraph 4, what happens to most of the petroleum that forms in sediments?
- (A) It remains in underground pools.  
(B) It is buried under organic matter.  
(C) It rises to the surface of the ocean.  
(D) It combines with the minerals found in groundwater.
8. Which of the following statements about future petroleum discoveries does paragraph 4 support?
- (A) Less petroleum will be found than in the past because the ratio of petroleum pools to volume of sediment will decrease.  
(B) Most of the petroleum will come from rocks that are less than 66 million years old.  
(C) Petroleum that has leaked away from older rocks will be the source of most new discoveries.  
(D) More petroleum will become available because the amount of trapped organic matter will increase.
9. Look at the four squares [A-D] that indicate where the following sentence could be added to the passage.

**Because such muds are a major source of petroleum, scientists believe that petroleum originated as living organisms.**

Where would the sentence best fit?

10. **Directions:** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. **This question is worth 2 points.**

**Petroleum, which includes both oil and natural gas, can be a gaseous, liquid, or semisolid substance.**

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#### Answer Choices

- (A) Petroleum comes from organic matter that has undergone a complex series of chemical changes under the seafloor.
- (B) Although most of the petroleum formed leaks away into the ocean, some migrates from shale to sandstone or limestone, and is caught in pools.
- (C) Porous rocks made of quartz or carbonate minerals are particularly likely to house oil pools because of their strong molecular attraction with oil.
- (D) Petroleum forms best when organic matter is evenly distributed over a large area and does not exceed 8 percent of the material in the clay.
- (E) More than 60 percent of the petroleum discovered so far has been found in rocks that are less than 2.5 million years old.
- (F) It is difficult to estimate the total amount of petroleum in the world, but experts believe that between 1,500 and 3,000 billion barrels will eventually be discovered.