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Petroleum is defined as a gaseous, liquid, and semisolid naturally occurring substance that consists chiefly of hydrocarbons (chemical compounds of carbon and hydrogen). Petroleum is therefore a term that includes both oil and natural gas. Petroleum is nearly always found in marine sedimentary rocks. In the ocean, microscopic phytoplankton (tiny floating plants) and bacteria (simple, single-celled organisms) 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 a fine-grained sedimentary rock known as shale. During this conversion, organic compounds are transformed to oil and natural gas. Sampling on the continental shelves and along the base of the continental slopes has shown that fine muds beneath the seafloor contain up to 8 percent organic matter. 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. 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. It is now well established that petroleum migrates through aquifers and can become trapped in reservoirs. 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 (consisting of quartz grains) and limestones (consisting of carbonate minerals) are much more permeable than any shale. The force of molecular attraction between oil and quartz or carbonate minerals is weaker than that between water and quartz or carbonate minerals. Hence, 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. 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 that formed in the last 65 million years. 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. How much 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 lot 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 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 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 oil will eventually be discovered.

question 1

According to paragraph 1, petroleum is formed in which of the following ways?

A Bacteria and tiny plants 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.

question 2

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.

question 3

Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? 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.

question 4

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

question 5

The word “suitable” in the passage is closest in meaning to

A noticeable

B permanent

C protected

D appropriate

question 6

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.

question 7

Paragraph 4 supports which of the following statements about future petroleum discoveries?

- 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 65 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.

question 8

According to paragraph 5, eastern Texas is an example of a geologic region where

- A oil is located but has not yet been pumped out
- B experts accurately predicted the rock types and structures found there
- C the volume of oil can only be guessed at
- D intensive oil exploration has occurred over a long time

question 9

Look at the four squares [] that indicate where the following sentence could be

added to the passage.

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estimate that somewhere between 1,500 and 3,000 billion barrels of oil will eventually be discovered.

question 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.

- A. Petroleum comes from organic matter that has undergone a complex series of chemical changes under the seafloor.
- B. 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.
- C. Although most of the petroleum formed leaks away into the ocean, some migrates from shale to sandstone or limestone, and is caught in pools.
- D. More than 60 percent of the petroleum discovered so far has been found in rocks that are less than two-and-a-half million years old.
- E. Porous rocks made of quartz or carbonate minerals are particularly likely to house oil pools because of their strong molecular attraction with oil.
- F. It is difficult to estimate the total amount of petroleum in the world, but experts believe that 1,500-3,000 billion barrels will eventually be discovered.