tpo_28_passage_1

Most of the world's potable water-freshwater suitable for drinking-is accounted for by groundwater, which is stored in the pores and fractures in rocks. There is more than 50 times as much freshwater stored underground than in all the freshwater rivers and lakes at the surface. Nearly 50 percent of all groundwater is stored in the upper 1,000 meters of Earth. At greater depths within Earth, the pressure of the overlying rock causes pores and cracks to close, reducing the space that pore water can occupy, and almost complete closure occurs at a depth of about 10 kilometers. The greatest water storage, therefore, lies near the surface. Groundwater is stored in a variety of rock types. A groundwater reservoir from which water can be extracted is called an aquifer. We can effectively think of an aquifer as a deposit of water. Extraction of water depends on two properties of the aquifer: porosity and permeability. Between sediment materials (such as sand or small rocks) that are deposited by water, wind, or glacial ice grains are spaces that can be filled with water. This pore space is known as porosity and is expressed as a percentage of the total rock volume. Porosity is important for water-storage capacity, but for water to flow through rocks, the pore spaces must be connected. The ability of water, or other fluids, to flow through the interconnected pore spaces in rocks is termed permeability. Fractures and joints have very high permeability. In the intergranular spaces of rocks, however, fluid must flow around and between grains in a tortuous path; this winding path causes a resistance to flow. The rate at which the flowing water overcomes this resistance is related to the permeability of rock. Sediment sorting and compaction influence permeability and porosity. The more poorly sorted or the more tightly compacted a sediment is, the lower its porosity and permeability. Sedimentary rocks-the most common rock type near the surface-are also the most common reservoirs for water because they contain the most space that can be filled with water. Sandstones generally make good aquifers, while finer-grained mudstones are typically impermeable. Impermeable rocks are referred to as aquicludes. Igneous and metamorphic rocks are more compact, commonly crystalline, and rarely contain spaces between grains. However, even igneous and metamorphic rocks may act as groundwater reservoirs if extensive fracturing occurs in such rocks and if the fracture system is interconnected. The water table is the underground boundary below which all the cracks and pores are filled with water. In some cases, the water table reaches Earth's surface, where it is expressed as rivers, lakes, and marshes. Typically, though, the water table may be tens or hundreds of meters below the surface. The water table is not flat but usually follows the contours of the topography the shape of a surface such as Earth's, including the rise and fall of such features as mountains and valleys . Above the water table is the vadose zone, through which rainwater percolates. Water in the vadose zone drains down to the water table, leaving behind a thin coating of water on mineral grains. The vadose zone supplies plant roots near the surface with water. Because the surface of the water table is not flat but instead rises and falls with topography, groundwater is affected by gravity in the same fashion as surface water. Groundwater flows downhill to topographic lows. If the water table intersects the land surface, groundwater will flow out onto the surface at springs, either to be collected there or to subsequently flow farther along a drainage. Groundwater commonly collects in stream drainages but may remain entirely beneath the surface of dry stream-beds in arid regions. In particularly wet years, short stretches of an otherwise dry stream-bed may have flowing water because the water table rises to intersect the land surface.

question 1

In paragraph 1, why does the author mention "the pressure of the overlying rock"?

A To show how water can be forced deep under Earth's surface

B To show why groundwater is more plentiful than surface freshwater

C To correct a commonly made error about the location of groundwater

D To explain why most groundwater lies near Earth's surface

question 2

According to paragraph 1, groundwater differs from the water in rivers and lakes in terms of its

A potability

B usefulness

C abundance

D cost

question 3

The word "termed" in the passage is closest in meaning to

A considered

B called

C limited to

D caused by

question 4

According to paragraph 2, what does porosity determine?

A The rate at which the aquifer’ s water overcomes resistance to flow

B The amount of water that the aquifer can hold

C The likelihood that fractures and joints will occur in the aquifer

D The depth underground at which the aquifer lies

question 5

According to paragraph 3, when can igneous rock serve as an aquifer?

A When it has many connected fractures

B When it lies next to metamorphic rock

C When it lies relatively near the surface

D When it is crystalline

question 6

According to paragraph 2, what is the relationship between permeability and porosity?

A The more pores a rock has, the higher its porosity but the lower its permeability

B Rocks with many internal spaces that are not connected with each other will have high porosity but low permeability.

C If water flows through a rock easily, it has high permeability but low porosity.

D Rocks that have high permeability have high porosity and vice versa.

question 7

Paragraph 4 implies which of the following about the roots of plants?

A They prevent water from reaching the vadose zone.

B They mark the boundary between the vadose zone and the water table.

C They do not typically get their water from the water table.

D They help keep the water table from dropping farther.

question 8

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 Groundwater only flows out of the ground if the water table intersects the land surface.

B If the land surface and the water table intersect, groundwater can flow underground.

C Groundwater may be drained if springs occur where the water table intersects the land surface.

D Where the water table meets the land surface, groundwater flows out through surface springs.

question 9

Look at the four squares [ ] that indicate where the following sentence could be added to the passage.

Most of the world's potable water-freshwater suitable for drinking-is accounted for by groundwater, which is stored in the pores and fractures in rocks. There is more than 50 times as much freshwater stored underground than in all the freshwater rivers and lakes at the surface. Nearly 50 percent of all groundwater is stored in the upper 1,000 meters of Earth. At greater depths within Earth, the pressure of the overlying rock causes pores and cracks to close, reducing the space that pore water can occupy, and almost complete closure occurs at a depth of about 10 kilometers. The greatest water storage, therefore, lies near the surface. Groundwater is stored in a variety of rock types. A groundwater reservoir from which water can be extracted is called an aquifer. We can effectively think of an aquifer as a deposit of water. Extraction of water depends on two properties of the aquifer: porosity and permeability. Between sediment materials (such as sand or small rocks) that are deposited by water, wind, or glacial ice grains are spaces that can be filled with water. This pore space is known as porosity and is expressed as a percentage of the total rock volume. Porosity is important for water-storage capacity, but for water to flow through rocks, the pore spaces must be connected. The ability of water, or other fluids, to flow through the interconnected pore spaces in rocks is termed permeability. Fractures and joints

have very high permeability. In the intergranular spaces of rocks, however, fluid must flow around and between grains in a tortuous path; this winding path causes a resistance to flow. The rate at which the flowing water overcomes this resistance is related to the permeability of rock. Sediment sorting and compaction influence permeability and porosity. The more poorly sorted or the more tightly compacted a sediment is, the lower its porosity and permeability. Sedimentary rocks-the most common rock type near the surface-are also the most common reservoirs for water because they contain the most space that can be filled with water. Sandstones generally make good aquifers, while finer-grained mudstones are typically impermeable. Impermeable rocks are referred to as aquicludes. Igneous and metamorphic rocks are more compact, commonly crystalline, and rarely contain spaces between grains. However, even igneous and metamorphic rocks may act as groundwater reservoirs if extensive fracturing occurs in such rocks and if the fracture system is interconnected. The water table is the underground boundary below which all the cracks and pores are filled with water. In some cases, the water table reaches Earth's surface, where it is expressed as rivers, lakes, and marshes. [] Typically, though, the water table may be tens or hundreds of meters below the surface. [] The water table is not flat but usually follows the contours of the topography the shape of a surface such as Earth's, including the rise and fall of such features as mountains and valleys . [] Above the water table is the vadose zone, through which rainwater percolates. [] Water in the vadose zone drains down to the water table, leaving behind a thin coating of water on mineral grains. The vadose zone supplies plant roots near the surface with water. Because the surface of the water table is not flat but instead rises and falls with topography, groundwater is affected by gravity in the same fashion as surface water. Groundwater flows downhill to topographic lows. If the water table intersects the land surface, groundwater will flow out onto the surface at springs, either to be collected there or to subsequently flow farther along a drainage. Groundwater commonly collects in stream drainages but may remain entirely beneath the surface of dry stream-beds in arid regions. In particularly wet years, short stretches of an otherwise dry stream-bed may have flowing water because the water table rises to intersect the land surface.

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. Sedimentary rock may make poor aquifers because of tightly compacted sediment, which reduces porosity and permeability.

B. Groundwater reservoirs are characterized by the porosity and permeability of the rock in which they lie, and these factors vary according to the type of rock.

C. Porosity is a measure of the empty space within rock, while permeability measures the degree to which water can flow freely through rock.

D. The vadose zone is typically dry because water does not stay in it, but instead percolates down to aquifers below or drains out through springs and streams.

E. In arid regions, the water tables remain at a constant level far below the surface, preventing stream-beds from filling up even during wet years.

F. Although the water table usually follows the contours of the land surface, its level may vary from year to year and may intersect the surface in places.