

**Question 1**

The closer we get to Earth's surface, the stronger the force of Earth's gravity becomes. This force of gravity (measured in Newtons, or N) has a much stronger effect on an individual on Earth's surface than on someone who is thousands of kilometres above Earth's atmosphere. (Note: One kilometre equals 0.6 mile.)

**An Astronaut Floating in Earth's Atmosphere**

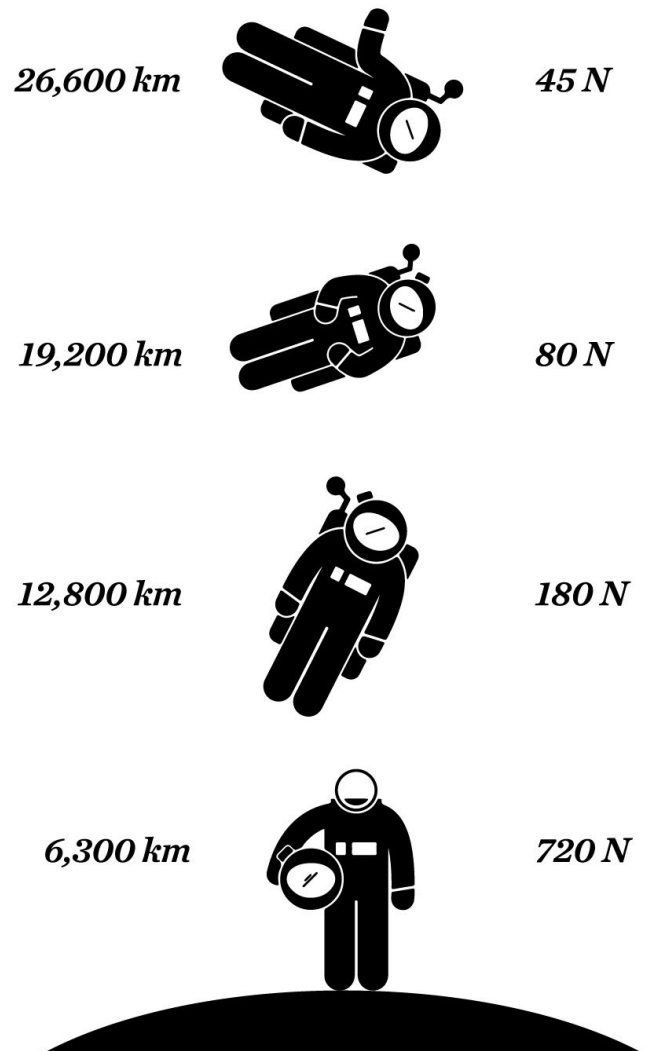
Which of the following statements best describes the force of gravity's effect on an astronaut floating more than 30,000 kilometres above Earth's surface?

**Gravity's effect**

- a) *is the same as on Earth's surface*
- b) *is much less than on Earth's surface*
- c) *is significantly affected by weather conditions*
- d) *varies with the astronaut's age, diet, and physical condition*
- e) *would be less on an astronaut than on people in other occupations*

**Answer: b**

The force of Earth's gravity lessens rapidly as an object (for example, an astronaut) gets farther from Earth's centre. This force of gravity is not affected significantly by weather conditions or the astronaut's physical characteristics or occupation.



## Question 2

Clay soil forms a fairly effective barrier against the movements of water. It also swells and shrinks significantly as its water content changes. Sandy soil, in contrast, allows water to move freely and does not change shape as the water content varies.

**In which statement is the appropriate soil selected for its intended site?**

- a) *Sandy soil would make a good lining for a toxic waste site.*
- b) *Clay soil would work well in a drain field.*
- c) *Clay soil would be a good foundation for a large building.*
- d) *Clay soil would form a good liner if a person built a pond.*
- e) *A sandy lake bottom would prevent water from seeping out of the lake.*

**Answer: d**

Clay soil absorbs and holds more water than sandy soil. Its ability to swell or shrink as the water content changes should help to maintain the pond by retaining more water. Because of its shifting characteristics, clay soil would not be a good choice for building a stable foundation.

**Question 3**

The root hair of a plant, shown in the diagram below, is the most efficient way for the plant to absorb water from surrounding soil.

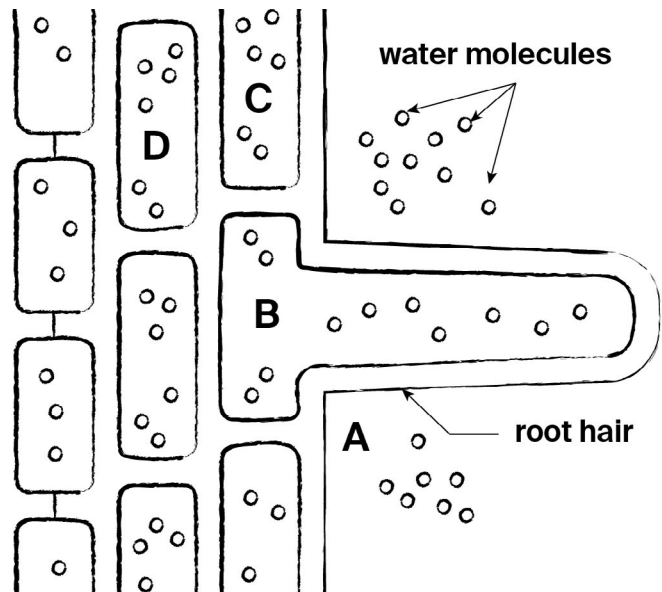
**Root Hair Growing among a Plant's Root Cells**

At what point is the flow of water the **GREATEST**?

- a) C to B
- b) C to A
- c) D to B
- d) A to B
- e) D to C

**Answer:** *d*

In osmosis, water flows through a cell membrane in the direction of a higher concentration of water molecules to a lower concentration. In this example, the highest initial concentration of water molecules is located in area A, the soil, and the lowest concentration of water molecules is found in area B—the large root hair. The process of osmosis will continue from area A to B until the concentration of water molecules is balanced between the root hair and the soil.



**Question 4**

A cook decides to recover some table salt that has been completely dissolved in water. Which of the following processes would be the most effective method of extracting salt from the solution?

- a) *spinning the solution in a mixer*
- b) *boiling away the water*
- c) *pouring the solution through cloth*
- d) *dripping the solution through a paper filter*
- e) *bubbling oxygen through the solution*

**Answer:** *b*

In a salt solution, microscopic particles of salt will pass through either a cloth or paper filter and will be unaffected by bubbling or spinning in a mixer, making (a), (c), (d), and (e) incorrect. Only (b), boiling the water, will leave a salty residue on the original container.

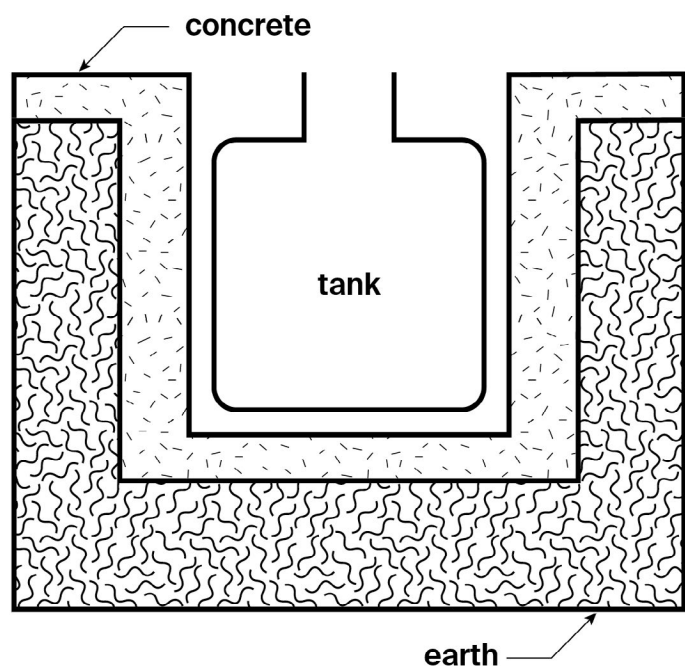
**Question 5**

A large fiberglass tank was placed in a pit, as shown below. Before pipes could be attached and the tank filled with gasoline, however, the workers were asked to move the heavy tank to another location.

**Buoyancy and a Tank**

Which of the following methods would be the best way to raise the tank off the bottom of the pit so that cables could be placed under the tank?

- a) *Fill the tank with gasoline.*
- b) *Fill the tank with water.*
- c) *Fill the pit with water.*
- d) *Fill the pit with water and fill the tank with gasoline.*
- e) *Fill both the pit and the tank with water.*



**Answer:** c

To be buoyant, an object must displace an amount of liquid at least equal to its weight. Any action that makes the tank heavier than the weight of the liquid it displaces will prevent the tank from floating. All the alternatives except (c) will make the tank heavier than the weight of the liquid displaced. Therefore, only (c) will allow the tank to float off the bottom of the pit.

**Question 6**

Viscosity is a measure of the internal resistance of a fluid to flow. For example, motor oil is more viscous than water. The viscosity of a fluid will change with temperature. The graph below illustrates how the viscosity of oil changes with temperature.

**Effect of Temperature on Viscosity**

Under which situation will the viscosity of the oil increase?

- a) *as temperature decreases*
- b) *when mixed with water*
- c) *as its volume decreases*
- d) *as its flow increases*
- e) *if its resistance stabilizes*

**Answer:** a

The viscosity of a liquid—its internal resistance to flow—is closely related to its temperature. As a liquid's temperature decreases, and it gets colder, the viscosity of that liquid will increase. Only alternative (a) mentions temperature as a factor.

