SECTION IV

Time—35 minutes

26 Questions

Directions: Each set of questions in this section is based on a single passage or a pair of passages. The questions are to be answered on the basis of what is stated or implied in the passage or pair of passages. For some of the questions, more than one of the choices could conceivably answer the question. However, you are to choose the best answer; that is, the response that most accurately and completely answers the question, and blacken the corresponding space on your answer sheet.

While the smallest of the Gallilean moons, Jupiter's sixth moon Europa has attracted considerable attention from scientists recently due to the considerable evidence of water beneath its surface. While the surface temperature in Celsius is an estimated 160 degrees below freezing, the general consensus of researchers is that Europa contains a subterranean ocean kept liquid by friction from tidal pull from the moon's orbit of Jupiter. Europa has a much more eccentric orbit than other moons of Jupiter, which astronomers estimate to produce a greater amount of tidal friction. Indeed, the idea of water on the moon was proposed based on this theoretical ground long before better evidence was available, such as the observation of a magnetic field which led researchers to conclude that Europa had a conductor beneath its surface which was almost certainly the saltwater of a liquid ocean.

What divides researchers, however, is the thickness of the ice on Europa, and two distinct theories have emerged. These, known as the "thick ice" and "thin ice" models, do not reach any consensus amongst themselves on how thick the ice on Europa is, but rather, they differ in that proponents of the thin ice view argue that Europa's surface ice has at times completely melted to give way to liquid on the surface.

The evidence for the thin ice model comes from the "chaos terrain" found on Europa – irregular ravines, ridges, and other geological features in the ice on the surface of the moon. Proponents argue that these are the result of ice having melted or broken and subsequently refrozen together. Thin ice proponents also refer to evidence of mineral deposits in Europa's surface ice, which arguably were deposited by mineral rich water from the moon's subterranean ocean.

The key objection made by opponents of the thin ice theory is evidence from the cratering activity on the surface of Europa. Like most celestial objects, Europa has been cratered from bombardment over the years. If Europa's surface was only a thin layer of ice, thick ice proponents argue, these impacts would have shattered that layer, which would have refrozen with an uneven chaos terrain of ice. However, this is not what is observed. In fact, even the largest, deepest of craters on the surface of Europa exhibit only a uniform fresh layer of ice. This leads thick ice proponents to the conclusion that the brittle, irregular surfaces of Europa contain several kilometers of fresh, regular ice below them.

Given its strong evidence from the craters, the thick ice theory is more common in the scientific community, but it leaves open the source of the chaos terrain on the surface of Europa. While some proponents asserts that these irregularities are the result of the bending and pulling of Europa's surface by its Jovian orbit, others have merely stood by the evidence for thick ice, remembering that a theory need not account for a phenomenon explained by an alternative theory to be correct.

1. Which one of the following most accurately states the main idea of the passage?

(A) Although scientists unanimously agree there is liquid water on the Jovian moon Europa, no theory of how deep this water is below the liquid has yet to achieve widespread support among those in the field.
(B) Researchers have conclusively established the existence of liquid water on the Jovian moon Europa through the observation of a magnetic field and "chaos terrain" on the surface which has been formed by water freezing and thawing.
(C) The Jovian moon Europa has been found to contain liquid water, and many scientists have authored publications describing their findings which articulate disparate theories on the nature of this water.
(D) The existence of liquid water on the Jovian moon Europa, while long thought to be a unlikely, has recently been confirmed with the documentation of a magnetic field emanating from salt water below the moon's surface.
(E) While the existence of liquid water on the Jovian moon Europa has long been established, disagreement among those in the field has led to two divergent schools of thought regarding the thickness of the surface ice above the water.

2. The "opponents" mentioned in line 35 would be most likely to agree with which one of the following statements?

(A) The "chaos terrain" on the surface of Europa has a layer of solid uniform ice underneath it.
(B) The ice ridges and ravines located on Europa's surface are the result of melting and refreezing of the ice.
(C) The force of Europa's orbit is not strong enough to form irregularities in the ice on the surface of Europa.
(D) Cratering activity melted and refroze the ice on the surface of Europa causing "chaos terrain."
(E) The ice on Europa has a higher salt content than the oceans on Earth.

3. The author discusses the mineral deposits (line 33) paragraph primarily in order to

(A) point out a fact that arguably supports one of the theories about Europa's water in the passage
(B) show why scientists are interested in studying Europa
(C) give an example of the effects of the cratering described in the passage
(D) bolster the evidence for the basic claim that there is liquid water on Europa
(E) give a counterexample to a recently stated principle

4. According to the passage, which one of the following must be true of the proponents of the "thick ice" theory on Europa?

(A) They do not believe any impacting asteroid could completely penetrate the layer of surface ice and expose Europa's water.
(B) At least some of them believe the "chaos terrain" on Europa is caused by the stress of the pull of the moon's orbit around Jupiter.
(C) The majority of them believe that the evidence of a magnetic field alone is sufficient to warrant the conclusion that Europa contains water.
(D) They believe that most of the ice on the surface of Europa contains irregular ravines and ridges.
(E) They do not believe the tidal heat generated by Europa's spin and orbit would ever be sufficient to melt most of the ice on Europa.

5. Which one of the following scenarios most illustrates the principle articulated in lines 55-57?

(A) Although the defendant could not explain how his fingerprints were found at the crime scene, the jury nonetheless found him "not guilty" since his alibi was strong.
(B) This grocery store stocks both popular types of flour because there is enough shelf space for each, and some consumers will not buy the other popular brand.
(C) Although it serves few customers, the post office in this area should remain open because without it, there will be no postal service in this region.
(D) These underground power lines are protected from the effects of storms and accidents, but this does not assure that customers will never experience a power outage.
(E) Runoff from a landfill is currently not a threat to the local water supply, but at some point it potentially could become one.

6. Which one of the following would most strengthen the view of the thin-ice proponents described in the passage?

(A) Ice on the Earth's surface often forms atypical structures such as ridges and ravines.
(B) The minerals contained in the surface ice on Europa are not typically found in water ice on other moons of Jupiter.
(C) The largest craters in the ice on the surface of Europa are limited to one particular region.
(D) The magnetic field which emanates from Europa does not vary in intensity depending on the vantage point of a measuring device passing the planet.
(E) Other celestial bodies with orbits similar in speed, force, and pull to Europa do not exhibit comparable "chaos terrain" on their surface.

7. According to the passage, each of the following must be true about Europa EXCEPT:

(A) It has an orbit that is more eccentric than other moons of Jupiter.
(B) Its composition includes a conductor that produces a magnetic field.
(C) It was subject to bombardment that formed craters.
(D) Its surface is complete composed of water ice.
(E) It is smaller than other moons.

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