



## SAMPLE SCIENCE TEST QUESTIONS

### Passage 1

Unmanned spacecraft taking images of Jupiter's moon Europa have found its surface to be very smooth with few meteorite craters. Europa's surface ice shows evidence of being continually resmoothed and reshaped. Cracks, dark bands, and *pressure ridges* (created when water or slush is squeezed up between 2 slabs of ice) are commonly seen in images of the surface. Two scientists express their views as to whether the presence of a deep ocean beneath the surface is responsible for Europa's surface features.

#### *Scientist 1*

A deep ocean of liquid water exists on Europa. Jupiter's gravitational field produces tides within Europa that can cause heating of the subsurface to a point where liquid water can exist. The numerous cracks and dark bands in the surface ice closely resemble the appearance of thawing ice covering the polar oceans on Earth. Only a substantial amount of circulating liquid water can crack and rotate such large slabs of ice. The few meteorite craters that exist are shallow and have been smoothed by liquid water that oozed up into the crater from the subsurface and then quickly froze.

Jupiter's magnetic field, sweeping past Europa, would interact with the salty, deep ocean and produce a second magnetic field around Europa. The spacecraft has found evidence of this second magnetic field.

#### *Scientist 2*

No deep, liquid water ocean exists on Europa. The heat generated by gravitational tides is quickly lost to space because of Europa's small size, as shown by its very low surface temperature ( $-160^{\circ}\text{C}$ ). Many of the features on Europa's surface resemble features created by flowing glaciers on Earth. Large amounts of liquid water are not required for the creation of these features. If a thin layer of ice below the surface is much warmer than the surface ice, it may be able to flow and cause cracking and movement of the surface ice. Few meteorite craters are observed because of Europa's very thin atmosphere; surface ice continually *sublimes* (changes from solid to gas) into this atmosphere, quickly eroding and removing any craters that may have formed.



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1. Which of the following best describes how the 2 scientists explain how craters are removed from Europa's surface?

Scientist 1

Scientist 2

A.

Sublimation

Filled in by water

B.

Filled in by water

Sublimation

C.

Worn smooth by wind

Sublimation

D.

Worn smooth by wind

Filled in by water

3. With which of the following statements about the conditions on Europa or the evolution of Europa's surface would both Scientist 1 and Scientist 2 most likely agree? The surface of Europa:

A. is being shaped by the movement of ice.

B. is covered with millions of meteorite craters.

C. is the same temperature as the surface of the Arctic Ocean on Earth.

D. has remained unchanged for millions of years.

5. Scientist 2 explains that ice sublimates to water vapor and enters Europa's atmosphere. If ultraviolet light then broke those water vapor molecules apart, which of the following gases would one most likely expect to find in Europa's atmosphere as a result of this process?

A. Nitrogen

B. Methane

C. Chlorine

D. Oxygen

2. According to the information provided, which of the following descriptions of Europa would be accepted by both scientists?

F. Europa has a larger diameter than does Jupiter.

G. Europa has a surface made of rocky material.

H. Europa has a surface temperature of 20°C.

J. Europa is completely covered by a layer of ice.

4. Which of the following statements about meteorite craters on Europa would be most consistent with both scientists' views?

F. No meteorites have struck Europa for millions of years.

G. Meteorite craters, once formed, are then smoothed or removed by Europa's surface processes.

H. Meteorite craters, once formed on Europa, remain unchanged for billions of years.

J. Meteorites frequently strike Europa's surface but do not leave any craters.

6. Based on the information in Scientist 1's view, which of the following materials must be present on Europa if a magnetic field is to be generated on Europa?

F. Frozen nitrogen

G. Water ice

H. Dissolved salts

J. Molten magma



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7. Assume Scientist 2's view about the similarities between Europa's surface features and flowing glaciers on Earth is correct. Based on this assumption and the information provided, Earth's glaciers would be *least* likely to exhibit which of the following features?
- A. Pressure ridges
  - B. Cracks
  - C. Meteorite craters
  - D. Dark bands