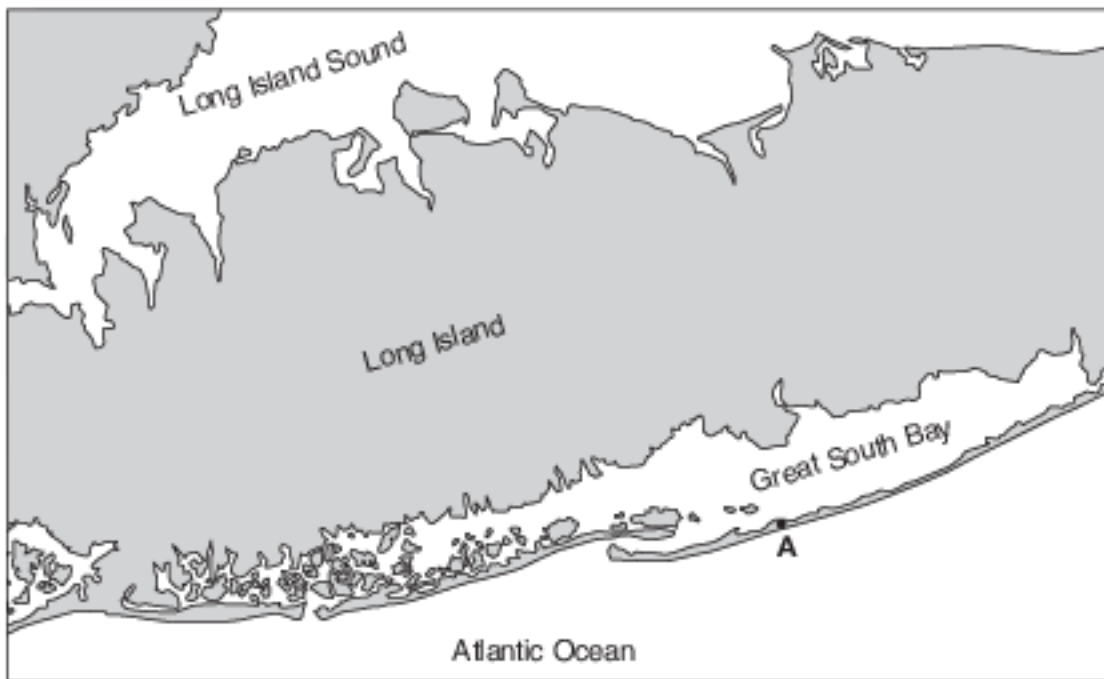


## Erosion And Natural Agents Of Erosion

- 1 A mudslide is most likely to occur on a hillslope having soil that is
- (1) saturated with water and without vegetation
  - (2) saturated with water and covered by vegetation
  - (3) unsaturated and without vegetation
  - (4) unsaturated and covered by vegetation

- 2 The map below shows coastal features of a portion of Long Island, New York. Point A represents a location on a landscape feature that resulted from wave action and longshore currents.



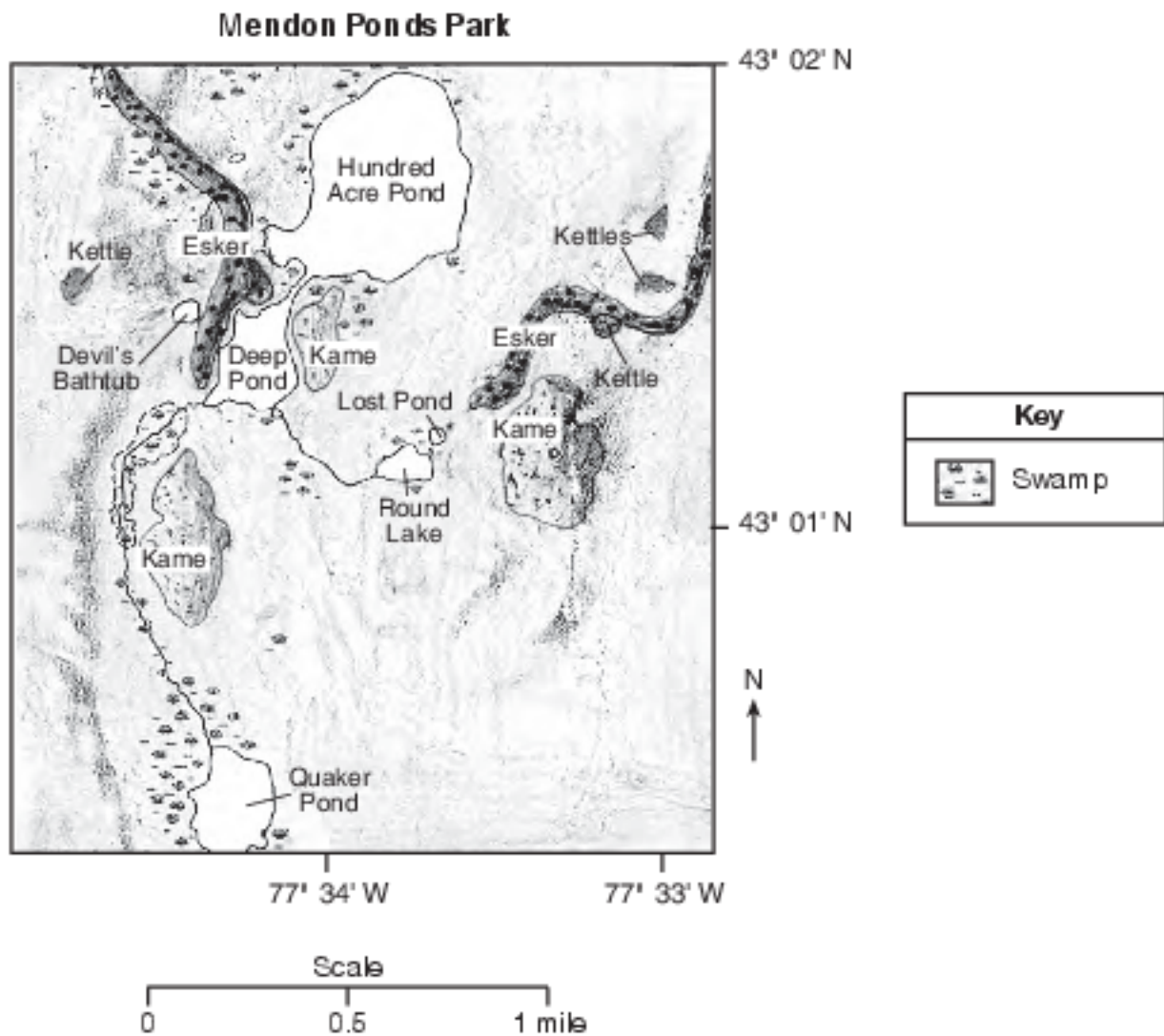
On which landscape feature is point A located?

- (1) moraine
  - (2) delta
  - (3) barrier island
  - (4) floodplain
- 3 Sandstone, limestone, and conglomerate cobbles are found in a streambed in New York State where the surrounding bedrock is composed of shales and siltstones. The most likely explanation for the presence of these cobbles is that they were
- (1) weathered from the surrounding bedrock
  - (2) formed when shale and siltstone bedrock were eroded
  - (3) transported to this area from another region
  - (4) metamorphosed from shale and siltstone

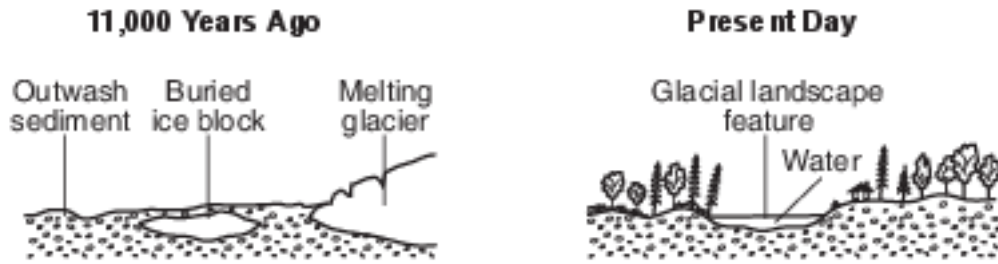
Base your answers to questions 4 on the passage and map below and on your knowledge of Earth science. The map shows glacial features found in Mendon Ponds Park.

Mendon Ponds Park

Mendon Ponds Park, in New York State, is listed in the National Registry of National Landmarks due to its outstanding glacial landscape features. Glacial ice that covered most of New York State retreated northward at the end of the last ice age. As this glacial ice melted, great amounts of sediments were deposited at the glacier's southern edge. Four glacial features dominate the park's landscape. Kettles are bowl-shaped depressions formed when buried blocks of glacial ice melt. If the depressions fill with water, they are called kettle lakes. The Mendon Park ponds are all kettle lakes. Eskers are ridges of sorted sediments deposited within streams flowing beneath the melting glacier. Kames are small hills of unsorted sediment deposited at the base of waterfalls formed by streams flowing over the edge of a melting glacier.



4 The cross sections below represent how a present-day glacial landscape feature was formed in Mendon Ponds Park and its appearance at present.



Which glacial landscape feature is indicated in the present-day cross section?

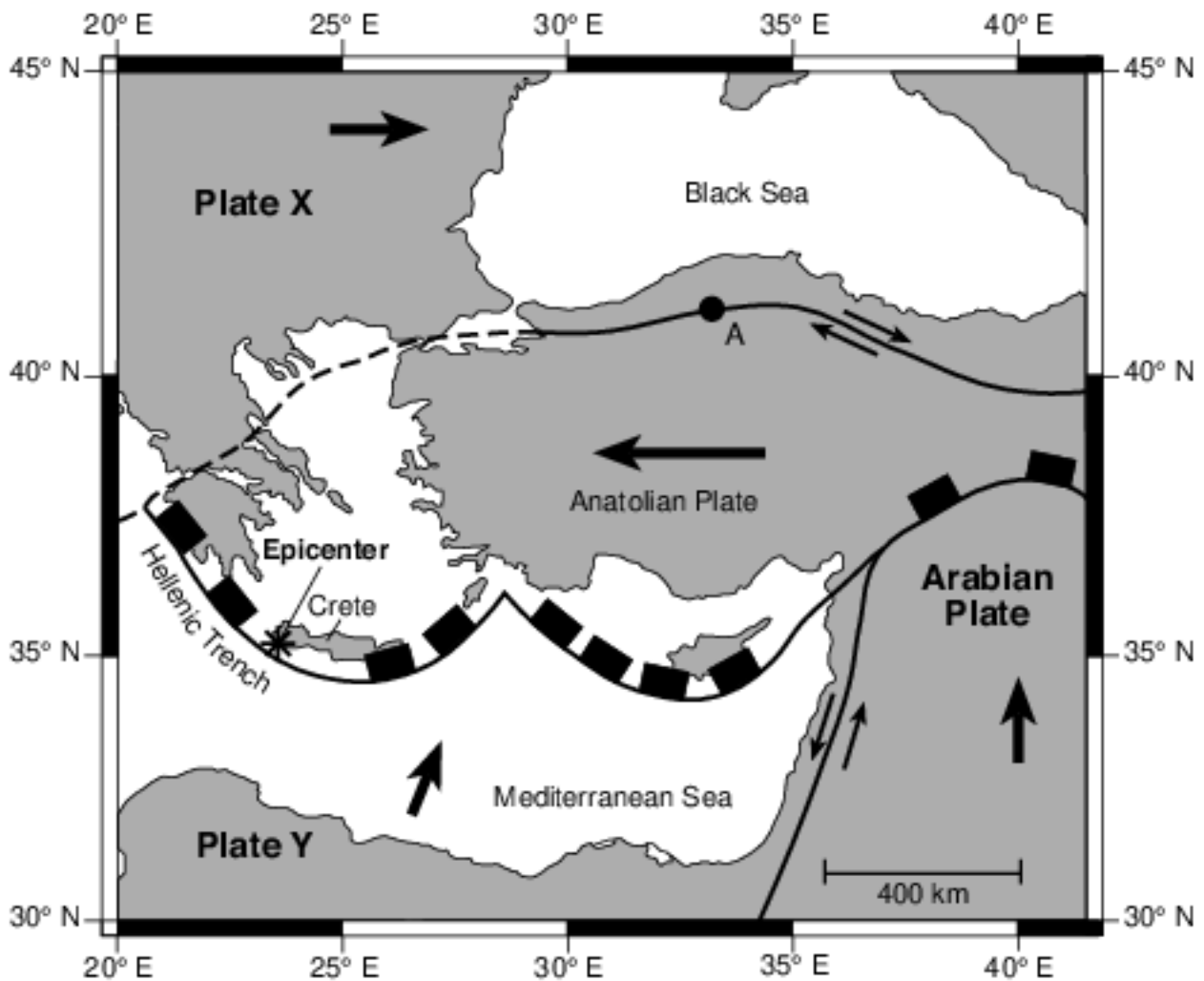
- (1) esker
- (2) kame

- (3) finger lake
- (4) kettle lake

Base your answers to questions 5 on the passage and map below and on your knowledge of Earth science. The map shows the location of the epicenter (■) of a major earthquake that occurred about 1700 years ago. Point A represents a location on a tectonic plate boundary. Plates X and Y represent major tectonic plates. The island of Crete; the Anatolian Plate, which is a minor tectonic plate; and the Hellenic Trench have been labeled. Arrows indicate the relative directions of plate motion.

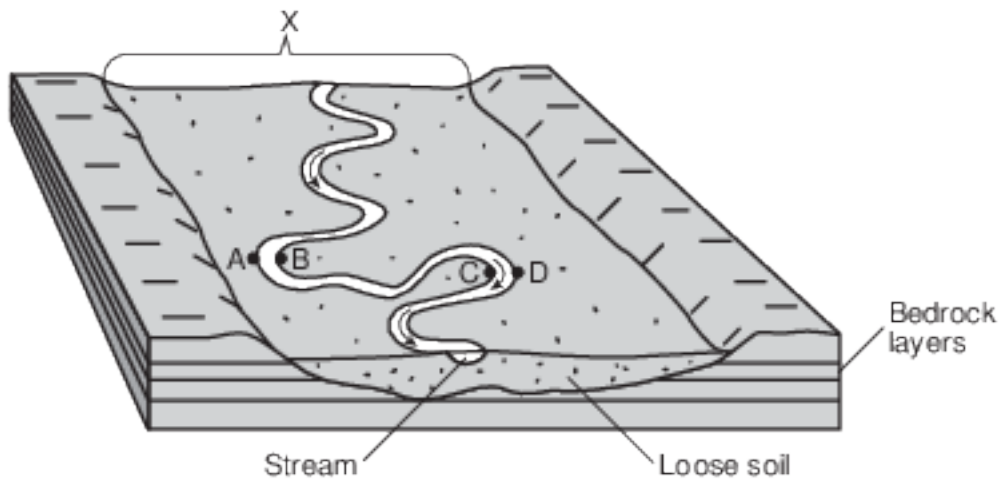
### Crete Earthquake

Scientists have located the geological fault, off the coast of Crete in the Mediterranean Sea, that likely shifted, causing a huge earthquake in the year 365 that devastated life and property on Crete. The southwestern coastal region of Crete was uplifted, as evidenced by remains of corals and other sea life now found on land 10 meters above sea level. Scientists measured the age of these corals to verify when this event occurred. This earthquake caused a tsunami that devastated the southern and eastern coasts of the Mediterranean Sea. It is estimated that earthquakes along the fault, associated with the Hellenic Trench, may occur about every 800 years.



- 5 Which activity could best prepare residents along the Mediterranean coast to reduce the loss of human life during a future tsunami?
- (1) Board up windows.
  - (2) Remove heavy objects from the walls in homes.
  - (3) Plan evacuation routes to higher ground.
  - (4) Build reinforced basements.

Base your answers to questions 6 on the block diagram below and on your knowledge of Earth science. The block diagram represents a landscape that was produced by a meandering stream. One landscape feature is labeled X. Letters A, B, C, and D represent locations on the stream banks.



- 6 The landscape feature labeled X is best described as
- (1) a flood plain
  - (2) a sand bar
  - (3) a delta
  - (4) an escarpment

- 7 The photograph below shows wire netting installed over a steep rock outcrop.



This wire netting has been installed to prevent loss of property or life resulting from

- (1) crosscutting and downwarping
- (2) folding and faulting
- (3) weathering and erosion
- (4) high winds and flooding

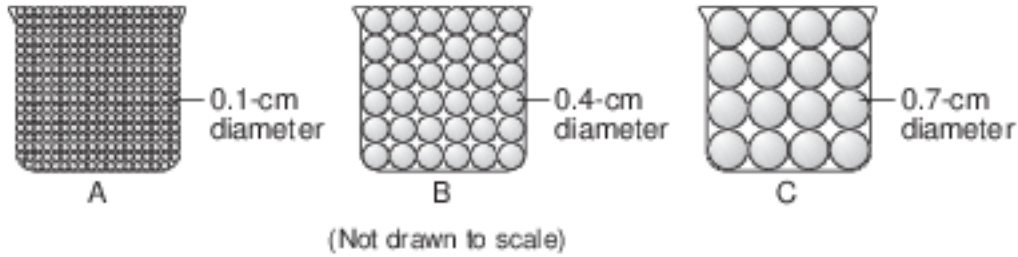
- 8 Which New York State river generally flows southward?

- (1) Genesee
- (2) Hudson
- (3) Niagara
- (4) St. Lawrence

- 9 The surface bedrock in the Hudson Highlands consists mostly of

- (1) diabase, dolostone, and granite
- (2) slate, siltstone, and basalt
- (3) gneiss, quartzite, and marble
- (4) limestone, shale, sandstone, and conglomerate

10 The diagram below represents three identical beakers, A, B, and C, each containing an equal volume of uniform-sized spherical beads. Water is poured into each beaker until all of the pore spaces are filled.



Which table best indicates the percentage of pore space compared to the total volume of each beaker?

Beaker	Percentage of Pore Space
A	40
B	40
C	40

(1)

Beaker	Percentage of Pore Space
A	60
B	40
C	20

(2)

Beaker	Percentage of Pore Space
A	20
B	40
C	60

(3)

Beaker	Percentage of Pore Space
A	20
B	40
C	20

(4)

(1) 1

(2) 2

(3) 3

(4) 4

Base your answers to questions 11 on the passage and data table below, which describe the exploration and characteristics of one of Saturn's moons, Titan.

### Huygens Probe Lands on Titan

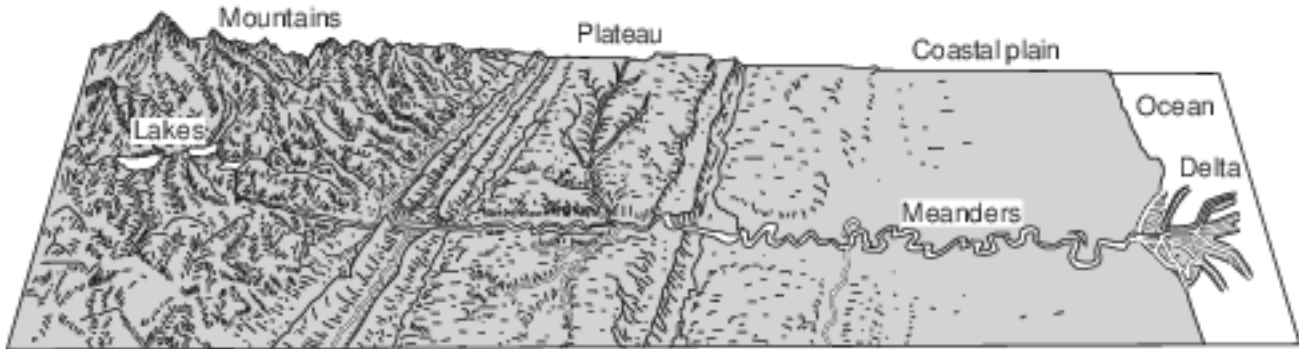
The Huygens probe was carried to Saturn by the Cassini spacecraft and parachuted to the surface of Saturn's giant moon, Titan. The Huygens probe's landing site was littered with smooth, rounded, rocklike objects. Photographs taken of Titan's surface show drainage channels leading to an apparent shoreline. The question is, what are they draining? One of the photographs seems to show ground fog consisting not of water, but perhaps of ethane or methane.

**Titan Data**

<b>Distance from Saturn</b>	1.22 million km
<b>Diameter</b>	5150 km
<b>Average Density</b>	1.881 g/cm <sup>3</sup>
<b>Atmospheric Pressure at Surface</b>	1500 mb
<b>Mass (Earth = 1)</b>	0.022
<b>Air Temperature at Landing Site</b>	-291°F

- 11 What natural process occurring on Earth produces smooth, rounded rocks similar to those found at the probe's landing site on Titan? [1]

Base your answers to questions 12 on the landscape diagram below and on your knowledge of Earth science. The diagram represents a long river system from its origin (source) in the mountains to its end (mouth) at the ocean.



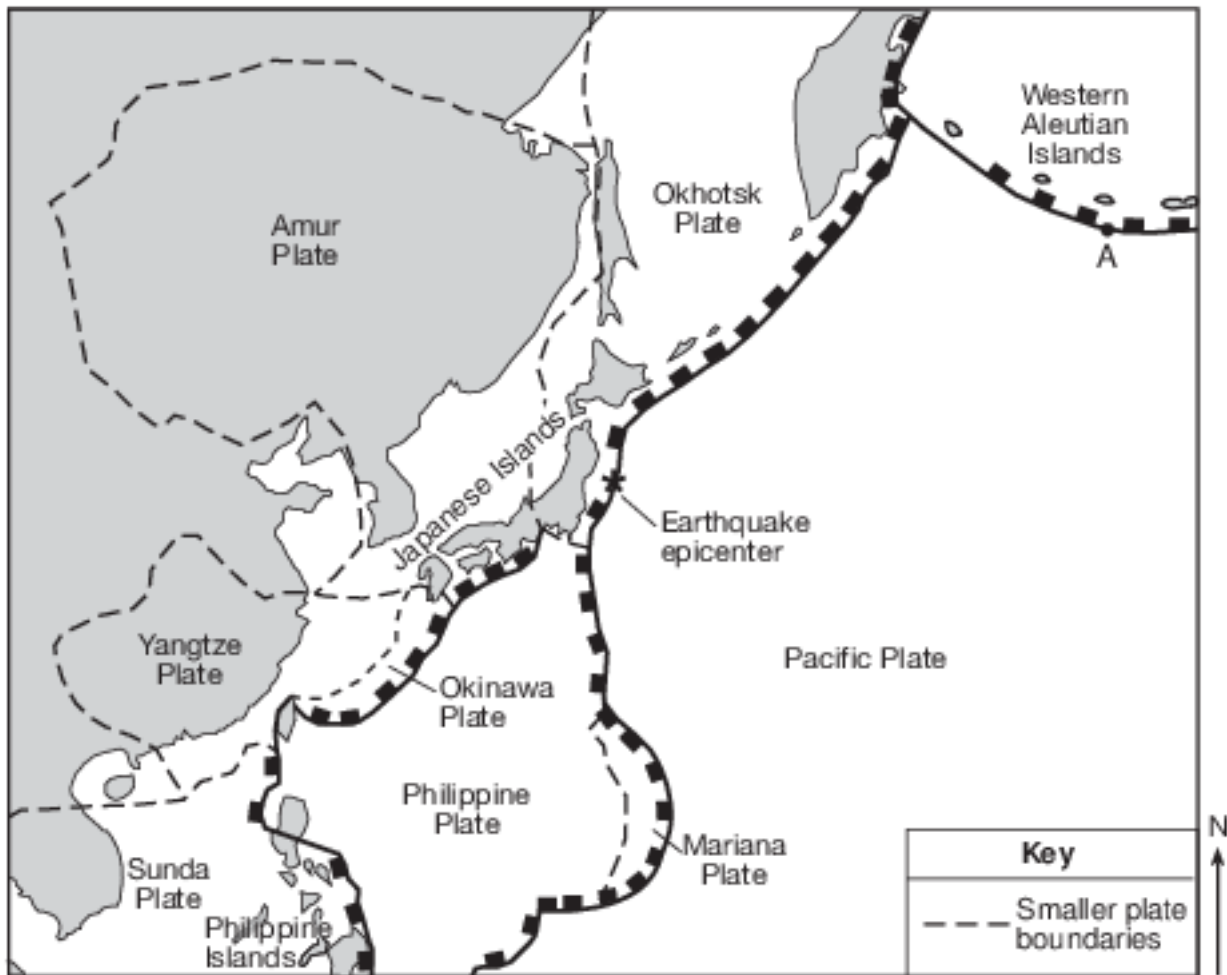
- 12 State one reason for the restriction of the construction of buildings near a meandering river on a coastal plain. [1]



Base your answers to questions 13 on the passage and the map below and on your knowledge of Science Earth science. The map indicates the epicenter (\*) of a major earthquake that occurred at 38° N 142° E. This map also shows some smaller plates believed to be part of the major tectonic plates shown in the Earth Reference Tables. Letter A represents a location on a plate boundary.

### Devastating Tsunami

On March 11, 2011, one of the largest earthquakes ever recorded (magnitude 9.0) produced a 7-meter-high tsunami that devastated Japan's eastern coast. Thousands of people died and billions of dollars in damage occurred. Several hours after the earthquake, the tsunami reached the Hawaiian Islands and parts of North America's west coast.



- 13 Describe one immediate action that was most likely taken in the Hawaiian Islands to prevent the loss of life as the tsunami approached. [1]

Base your answers to questions 14 on the modified Mercalli scale of earthquake intensity below, on the map of Japan in image provided, and on your knowledge of Earth science. The modified Mercalli scale classifies earthquake intensity based on observations made during an earthquake. The map indicates the modified Mercalli scale intensity values recorded at several locations in Japan during the March 11, 2011 earthquake, which triggered destructive tsunamis in the Pacific Ocean.

**Modified Mercalli Scale of Earthquake Intensity**

<b>Intensity Value</b>	<b>Description of Effects</b>
<b>I</b>	Not felt except by a very few under especially favorable conditions.
<b>II</b>	Felt only by a few persons at rest, especially on upper floors of buildings.
<b>III</b>	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Parked cars may rock slightly. Vibrations similar to the passing of a truck.
<b>IV</b>	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Parked cars rocked noticeably.
<b>V</b>	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
<b>VI</b>	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
<b>VII</b>	Damage minimal in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
<b>VIII</b>	Damage slight in specially designed structures; considerable damage with partial collapse in ordinary substantial buildings. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
<b>IX</b>	Damage considerable in specially designed structures; well-designed frame structures tilted. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
<b>X</b>	Most masonry and frame structures and foundations are destroyed. Train rails bent.
<b>XI</b>	Few, if any, structures remain standing. Bridges destroyed. Train rails bent greatly.
<b>XII</b>	Damage total. Objects thrown into the air.

- 14 A 25-foot high tsunami hit the Japanese city of Ishinomaki. Describe a precaution the city could take now to protect citizens from tsunamis in future years. [1]

Base your answers to questions 15 on the passage below.

### Meteorite Composition

Meteors that strike Earth's surface are called meteorites. Analysis of meteorite composition has provided scientists with information regarding the formation of Earth and our solar system, and possibly the development and evolution of life on Earth.

Two types of meteorites are iron meteorites and chondrites. Iron meteorites consist mostly of iron and nickel, and are inferred to be from core materials of early planetary bodies in our solar system. More than 60% of meteorites studied have been identified as chondrites. Chondrites are made of millimeter-sized spheres of olivine and pyroxene crystals embedded in a mass of mineral and metal grains. The chondrites are thought to represent fragments of the earliest solid materials in our solar system. One type of chondrite, the carbonaceous chondrite, contains water, organic compounds, and minerals that represent the chemical composition necessary for life to form.

- 15 Explain why there is little evidence of meteorite impact craters on Earth. [1]

## Answer Keys

1 1

2 3

3 3

4 4

5 3

6 1

7 3

8 2

9 3

10 1

11 Allow 1 credit. Acceptable responses include, but are not limited to:

- — weathering and/or erosion
- — rock abrasion
- — transport by running water
- — wave action

12 Allow 1 credit. Acceptable responses include, but are not limited to:

- — Buildings could be damaged or destroyed by flooding.
- — The river's course changes due to erosion and deposition.
- — It's on the floodplain.
- — The ground might be unstable.
- — The ground can become saturated/a swamp.
- — The meanders change positions over time.

13 Allow 1 credit. Acceptable responses include, but are not limited to:

- — Sound alarm for residents.
- — Move to higher ground.
- — Evacuate coastal areas.
- — Broadcast radio/TV bulletins.
- — Move ships away from the coast.
- — Follow evacuation routes.

14 Allow 1 credit. Acceptable responses include, but are not limited to:

- — install a tsunami monitoring and warning system
- — build a seawall/barricade/barrier
- — build tall structures on stronger foundations
- — designate or plan evacuation routes
- — prepare emergency kits/supplies
- — relocate buildings to higher ground
- Note: Do not allow credit for an action indicating an imminent tsunami (e.g., evacuate to higher ground).

15 Allow 1 credit. Acceptable responses include, but are not limited to:

- — Weathering and erosion on Earth's surface have erased many craters.
- — Most meteors are very small and burn up in Earth's atmosphere.
- — Most of Earth's surface is ocean, where sediments cover impact craters.
- — Crustal plate movement has destroyed the evidence.