

The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION



PHYSICAL SETTING EARTH SCIENCE

Wednesday, January 25, 2006 — 9:15 a.m. to 12:15 p.m., only

This is a test of your knowledge of Earth science. Use that knowledge to answer all questions in this examination. Some questions may require the use of the *Earth Science Reference Tables*. The *Earth Science Reference Tables* are supplied separately. Be certain you have a copy of the 2001 edition of these reference tables before you begin the examination.

Your answer sheet for Part A and Part B–1 is the last page of this examination booklet. Turn to the last page and fold it along the perforations. Then, slowly and carefully, tear off your answer sheet and fill in the heading.

The answers to the questions in Part B–2 and Part C are to be written in your separate answer booklet. Be sure to fill in the heading on the front of your answer booklet.

You are to answer *all* questions in all parts of this examination according to the directions provided in the examination booklet. Record your answers to the Part A and Part B–1 multiple-choice questions on your separate answer sheet. Write your answers to the Part B–2 and Part C questions in your answer booklet. All work should be written in pen, except for graphs and drawings, which should be done in pencil. You may use scrap paper to work out the answers to the questions, but be sure to record all your answers on your separate answer sheet and in your answer booklet.

When you have completed the examination, you must sign the statement printed at the end of your separate answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet and answer booklet cannot be accepted if you fail to sign this declaration.

Notice . . .

A four-function or scientific calculator and a copy of the 2001 *Earth Science Reference Tables* must be available for you to use while taking this examination.

The use of any communications device is strictly prohibited when taking this examination. If you use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part A

Answer all questions in this part.

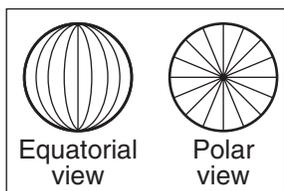
Directions (1–35): For *each* statement or question, write on your separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *Earth Science Reference Tables*.

- 1 Which event takes the most time?
 - (1) one revolution of Earth around the Sun
 - (2) one revolution of Venus around the Sun
 - (3) one rotation of the Moon on its axis
 - (4) one rotation of Venus on its axis

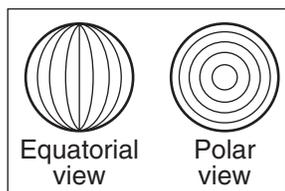
- 2 Compared to the Jovian planets in our solar system, Earth is
 - (1) less dense and closer to the Sun
 - (2) less dense and farther from the Sun
 - (3) more dense and closer to the Sun
 - (4) more dense and farther from the Sun

- 3 A Foucault pendulum appears to change its direction of swing due to the
 - (1) tilt of Earth's axis
 - (2) spin of Earth on its axis
 - (3) deflection of Earth's planetary winds
 - (4) movement of Earth in its orbit around the Sun

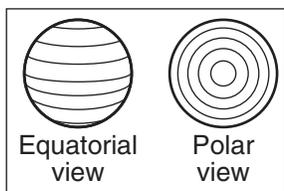
- 4 The lines on which set of views best represent Earth's latitude system?



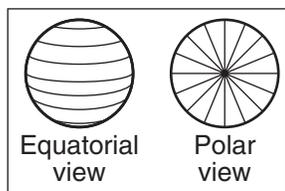
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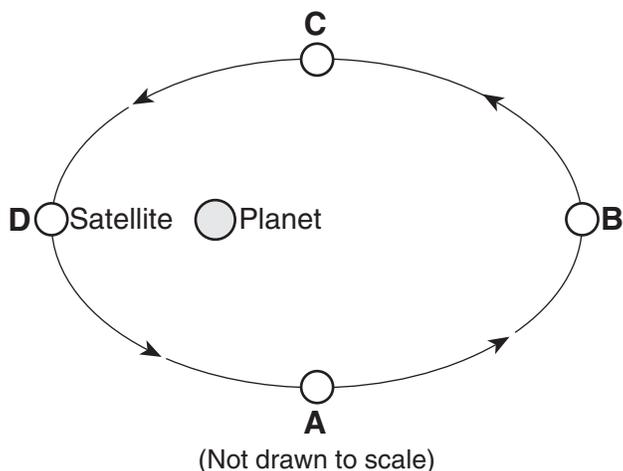


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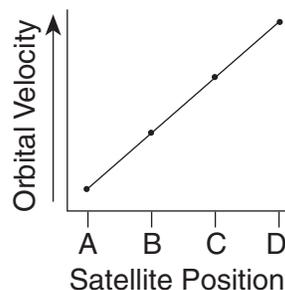


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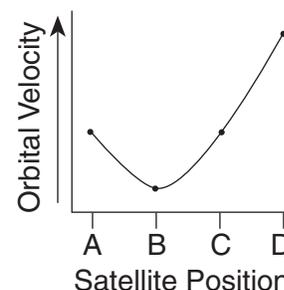
- 5 The diagram below shows a satellite in four different positions as it revolves around a planet.



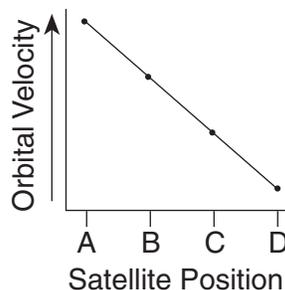
Which graph best represents the changes in this satellite's orbital velocity as it revolves around the planet?



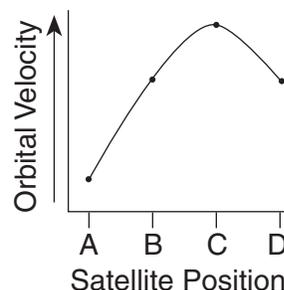
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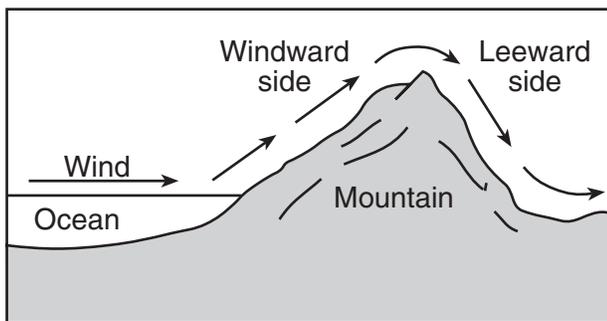
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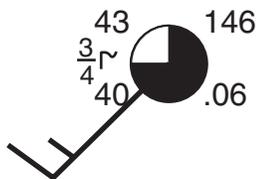
- 6 At which New York State location will an observer most likely measure the altitude of *Polaris* as approximately 42° ?
- (1) Jamestown (3) Oswego
(2) Plattsburgh (4) New York City
- 7 Which statement provides evidence that Earth revolves around the Sun?
- (1) Winds at different latitudes are curved different amounts by the Coriolis effect.
(2) Different star constellations are visible from Earth at different seasons of the year.
(3) The Sun follows an apparent arc across the sky during the day.
(4) The stars appear to circle Earth during the night.
- 8 Compared to the surface temperature and luminosity of massive stars in the Main Sequence, the smaller stars in the Main Sequence are
- (1) hotter and less luminous
(2) hotter and more luminous
(3) cooler and less luminous
(4) cooler and more luminous
- 9 Which factor most likely causes two cities at the same elevation and latitude to have different yearly average temperature ranges?
- (1) rotation of Earth
(2) duration of insolation
(3) distance from a large body of water
(4) direction of prevailing winds
- 10 Which set of surface soil conditions on a hillside would result in the most infiltration of rainfall?
- (1) gentle slope, saturated soil, no vegetation
(2) gentle slope, unsaturated soil, vegetation
(3) steep slope, saturated soil, vegetation
(4) steep slope, unsaturated soil, no vegetation
- 11 Scientists have inferred that Earth's original atmosphere was formed by the
- (1) outgassing from Earth's interior
(2) erosion of Earth's surface
(3) decay of microorganisms in Earth's oceans
(4) radioactive decay of elements in Earth's core
- 12 Most New York State sandstone bedrock was formed
- (1) in Earth's interior where temperatures exceeded the melting point of quartz
(2) on Earth's surface from the cooling of molten lava
(3) in a delta from sand grains deposited, buried, and cemented together by minerals
(4) in a desert when heat and metamorphic pressure caused quartz crystals to fuse together
- 13 Which statement best explains why no Permian-age bedrock is found in New York State?
- (1) The extinction of many life-forms occurred at the end of the Permian Period.
(2) Only rocks of igneous origin formed in New York State during the Permian Period.
(3) Permian-age rocks have been metamorphosed and cannot be identified.
(4) Permian-age rocks were either eroded away or never formed in New York State.
- 14 A fossil shell contains 25% of the original amount of its carbon-14. Approximately how many years ago was this shell part of a living organism?
- (1) 5,700 years ago (3) 17,100 years ago
(2) 11,400 years ago (4) 22,800 years ago
- 15 Which sequence shows the correct order of Earth's geologic time intervals from oldest to youngest?
- (1) Archean → Mesozoic → Cenozoic → Paleozoic → Proterozoic
(2) Archean → Proterozoic → Paleozoic → Mesozoic → Cenozoic
(3) Cenozoic → Mesozoic → Paleozoic → Proterozoic → Archean
(4) Cenozoic → Paleozoic → Archean → Mesozoic → Proterozoic
- 16 In which direction do the surface winds blow around a high-pressure system in the Northern Hemisphere?
- (1) clockwise and inward
(2) clockwise and outward
(3) counterclockwise and inward
(4) counterclockwise and outward

- 17 The cross section below shows the flow of winds over a mountain ridge.



The heaviest rainfall would most likely occur on which side of this mountain and in which type of air mass?

- (1) on the leeward side, in a mP air mass
 - (2) on the leeward side, in a cT air mass
 - (3) on the windward side, in a mT air mass
 - (4) on the windward side, in a cP air mass
- 18 Various weather conditions at LaGuardia Airport in New York City are shown on the station model below.



What were the barometric pressure and weather conditions at the airport at the time of the observation?

- (1) 914.6 mb of pressure and smog
- (2) 914.6 mb of pressure and a clear sky
- (3) 1014.6 mb of pressure and smog
- (4) 1014.6 mb of pressure and a clear sky

- 19 The properties of an air mass are mostly determined by the

- (1) rate of Earth's rotation
- (2) direction of Earth's surface winds
- (3) source region where the air mass formed
- (4) path the air mass follows along a land surface

- 20 Which list correctly matches each instrument with the weather variable it measures?

- (1) wind vane—wind speed
thermometer—temperature
precipitation gauge—relative humidity
- (2) wind vane—wind direction
thermometer—dewpoint
psychrometer—air pressure
- (3) barometer—relative humidity
anemometer—cloud cover
precipitation gauge—probability of precipitation
- (4) barometer—air pressure
anemometer—wind speed
psychrometer—relative humidity

- 21 What is the difference between the dry-bulb temperature and the wet-bulb temperature when the relative humidity is 28% and the dry-bulb temperature is 0°C?

- (1) 11°C
- (2) 2°C
- (3) 28°C
- (4) 4°C

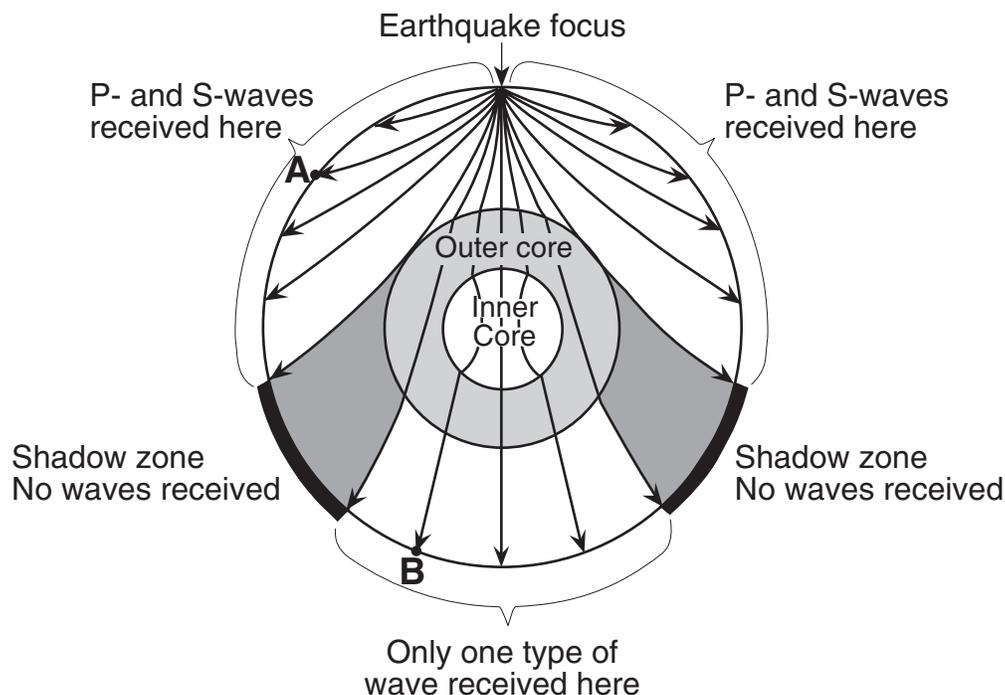
- 22 Based on the theory of plate tectonics, it is inferred that over the past 250 million years North America has moved toward the

- (1) northwest
- (2) southwest
- (3) southeast
- (4) northeast

- 23 According to tectonic plate maps, New York State is presently located

- (1) at a convergent plate boundary
- (2) above a mantle hot spot
- (3) above a mid-ocean ridge
- (4) near the center of a large plate

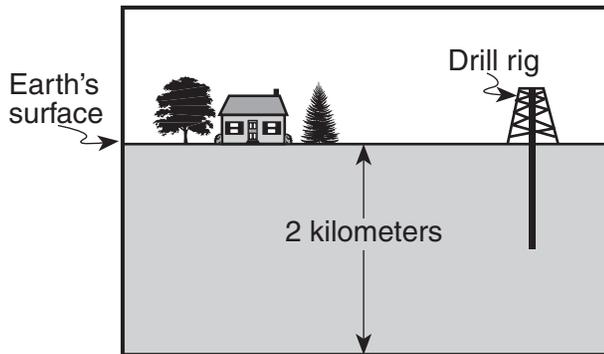
Base your answers to questions 24 and 25 on the cross-sectional view of Earth below, which shows seismic waves traveling from the focus of an earthquake. Points A and B are locations on Earth's surface.



- 24 Which statement best explains why only one type of seismic wave was recorded at location B?
- (1) S-waves cannot travel through the liquid outer core.
 - (2) S-waves cannot travel through the liquid inner core.
 - (3) P-waves cannot travel through the solid outer core.
 - (4) P-waves cannot travel through the solid inner core.

- 25 A seismic station located at point A is 5400 kilometers away from the epicenter of the earthquake. If the arrival time for the P-wave at point A was 2:00 p.m., the arrival time for the S-wave at point A was approximately
- (1) 1:53 p.m.
 - (2) 2:07 p.m.
 - (3) 2:09 p.m.
 - (4) 2:16 p.m.

- 26 The cross section below shows a drill rig used to collect rock samples from below Earth's surface.

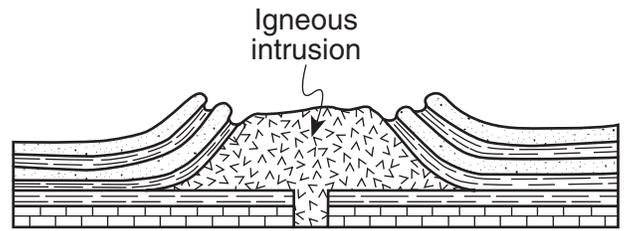


(Not drawn to scale)

The rock samples collected from the bottom of the drill hole came from which Earth layer?

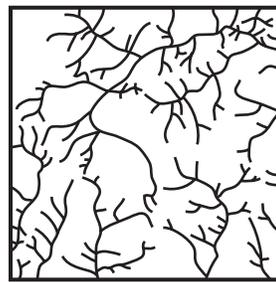
- (1) lithosphere (3) asthenosphere
 (2) hydrosphere (4) stiffer mantle
- 27 Which sequence shows the order in which landscape regions are crossed as an airplane flies in a straight course from Albany, New York, to Massena, New York?
- (1) plateau → plain → mountain
 (2) plateau → mountain → plain
 (3) plain → mountain → plain
 (4) mountain → plain → plateau
- 28 Why are Precambrian gneiss cobbles and boulders commonly found on top of the surface bedrock in the Catskills?
- (1) The surface bedrock of the Catskills is composed of Precambrian gneiss.
 (2) The surface bedrock of the Catskills has been overturned.
 (3) Many meteorites composed of gneiss have landed in the Catskills.
 (4) Glaciers transported these rocks from the Adirondacks to the Catskills.
- 29 Which component of Earth's atmosphere is classified as a greenhouse gas?
- (1) oxygen (3) helium
 (2) carbon dioxide (4) hydrogen

- 30 The cross section below shows the rock structure of a deeply eroded, domed mountain region.

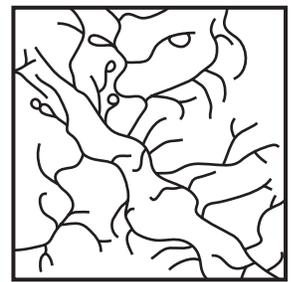


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Which map shows the stream drainage pattern that will most likely develop as the bedrock is weathered and eroded from this igneous dome?



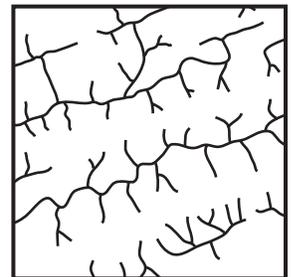
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(3)

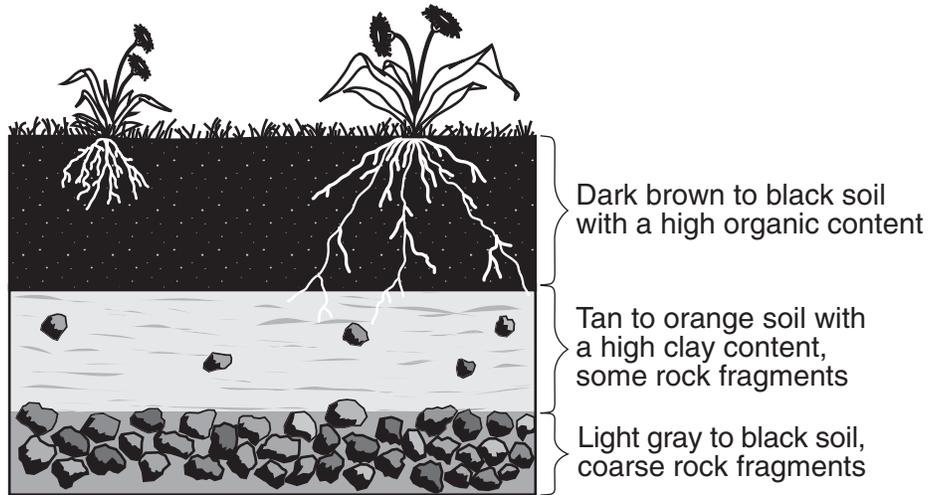


(2)



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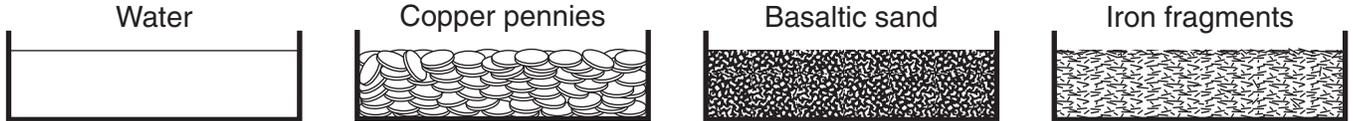
31 The cross section below shows layers of soil.



Which two processes produced the layer of dark brown to black soil?

- (1) melting and solidification of magma
- (2) erosion and uplifting
- (3) weathering and biologic activity
- (4) compaction and cementation

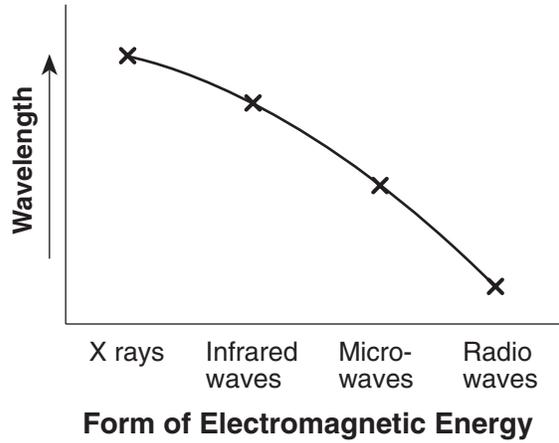
32 Equal volumes of the four samples shown below were placed outside and heated by energy from the Sun's rays for 30 minutes.



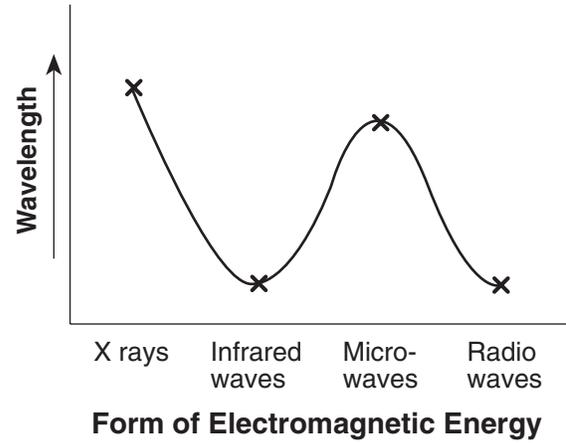
The surface temperature of which sample increased at the *slowest* rate?

- (1) water
- (2) copper pennies
- (3) basaltic sand
- (4) iron fragments

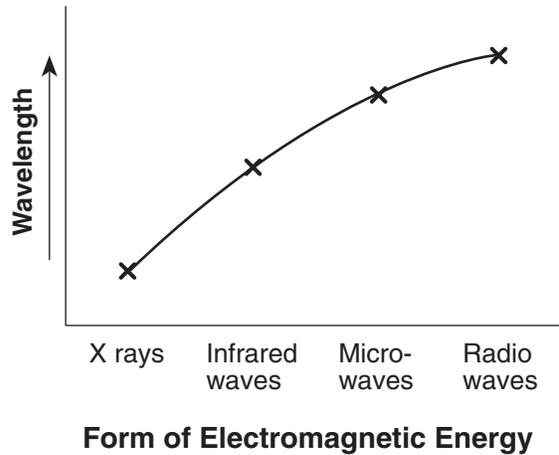
33 Which graph best represents the relative wavelengths of the different forms of electromagnetic energy?



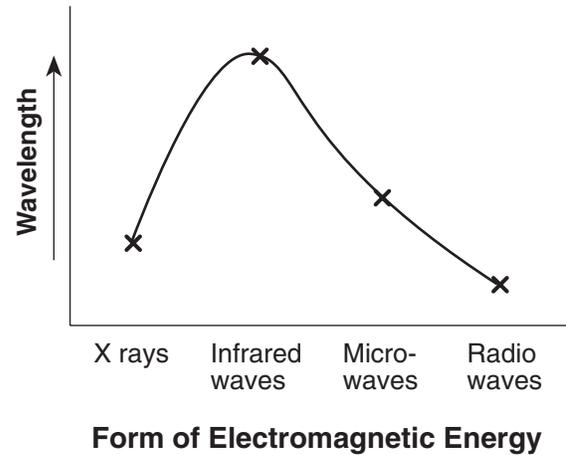
(1)



(3)



(2)



(4)

34 The three statements below are observations of the same rock sample:

- The rock has intergrown crystals from 2 to 3 millimeters in diameter.
- The minerals in the rock are gray feldspar, green olivine, green pyroxene, and black amphibole.
- There are no visible gas pockets in the rock.

This rock sample is most likely

- | | |
|---------------|--------------|
| (1) sandstone | (3) granite |
| (2) gabbro | (4) phyllite |

35 Most rock gypsum is formed by the

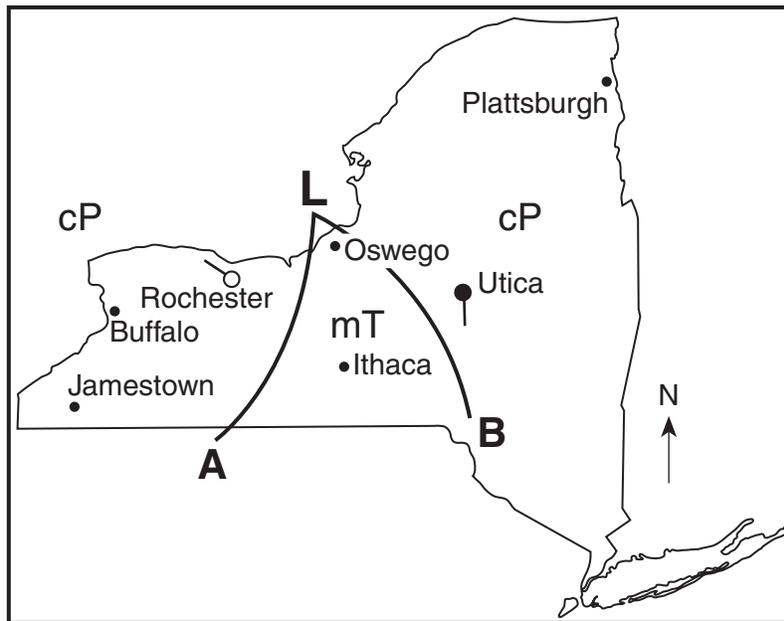
- (1) heating of previously existing foliated bedrock
- (2) cooling and solidification of lava
- (3) compaction and cementation of shells and skeletal remains
- (4) chemical precipitation of minerals from seawater

Part B-1

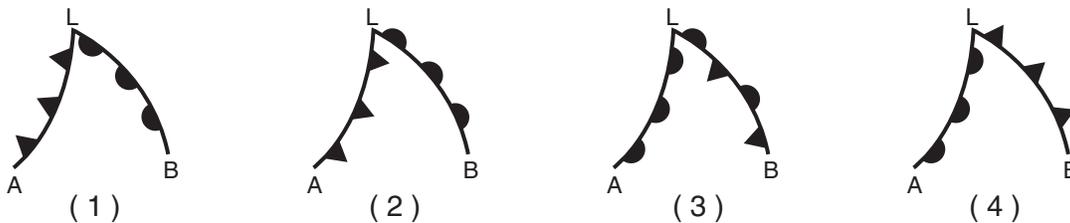
Answer all questions in this part.

Directions (36–50): For *each* statement or question, write on your separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *Earth Science Reference Tables*.

Base your answers to questions 36 through 38 on the weather map below and on your knowledge of Earth science. The weather map shows a typical low-pressure system and associated weather fronts labeled A and B. The L indicates the center of the low-pressure system. A few New York State cities are shown. Symbols cP and mT represent different air masses. The wind direction at Utica and Rochester is shown on the station models.



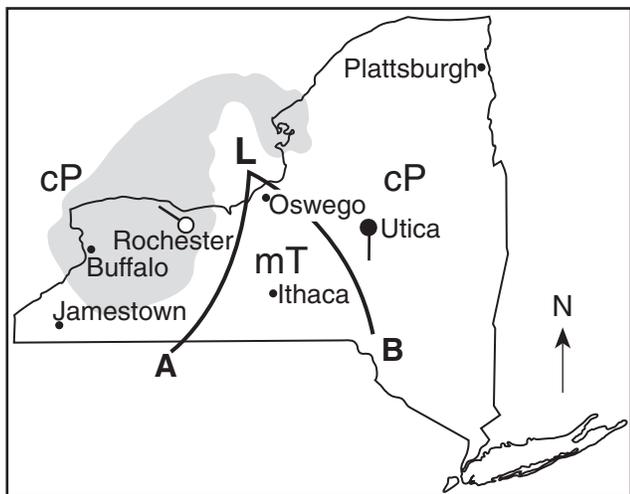
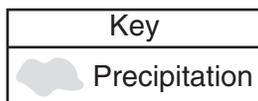
36 Which front symbols are drawn correctly, based on the air masses shown?



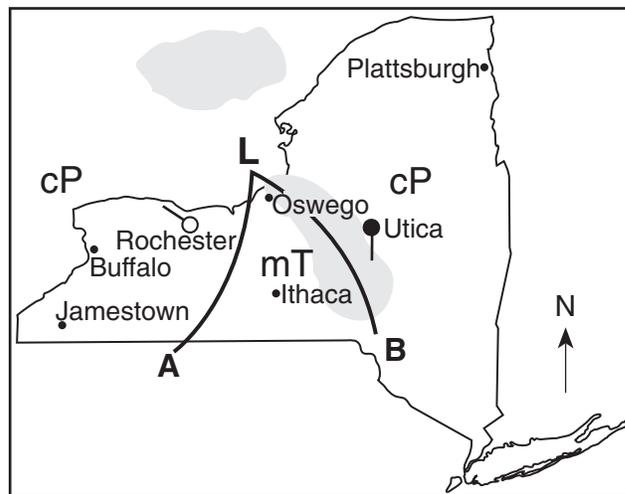
37 If this weather system is following a normal storm track, the center of this low is most likely moving toward which city?

- | | |
|-------------|-----------------|
| (1) Buffalo | (3) Utica |
| (2) Ithaca | (4) Plattsburgh |

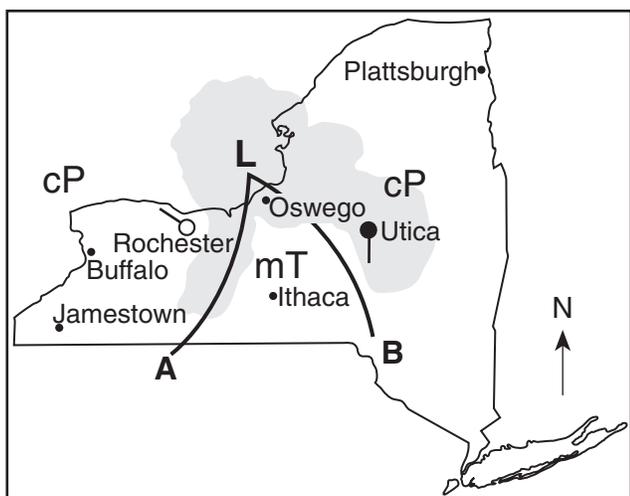
38 Which map shows the regions that are most likely experiencing the precipitation associated with this weather system?



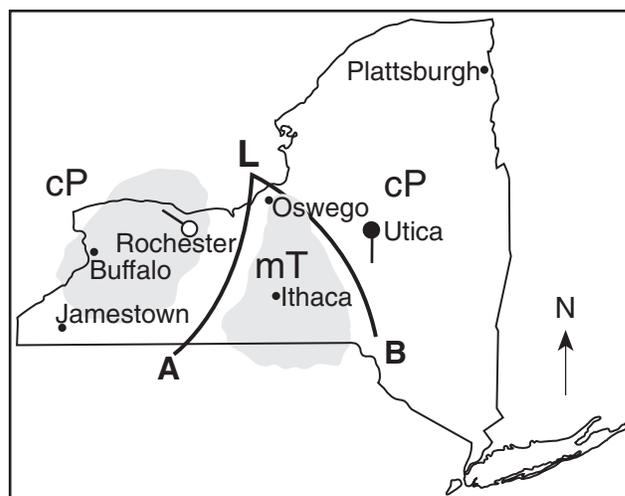
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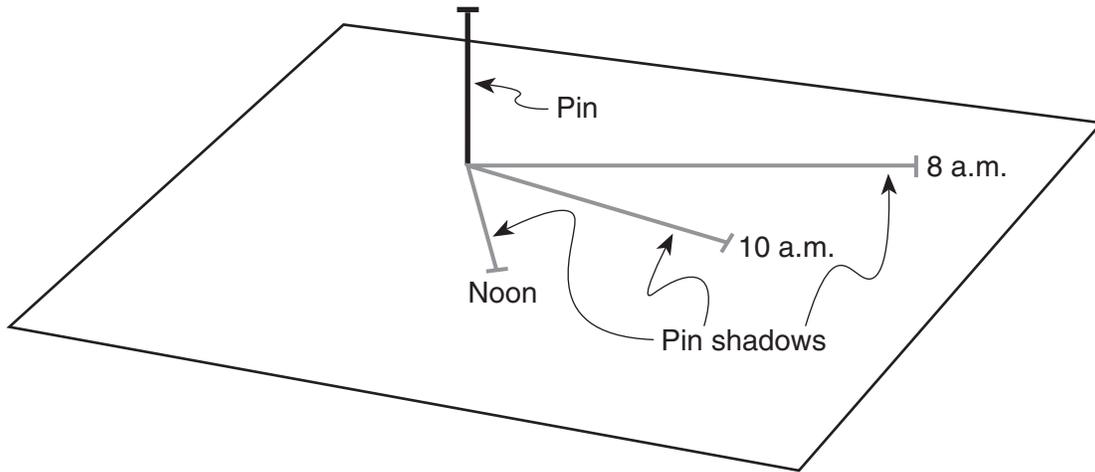


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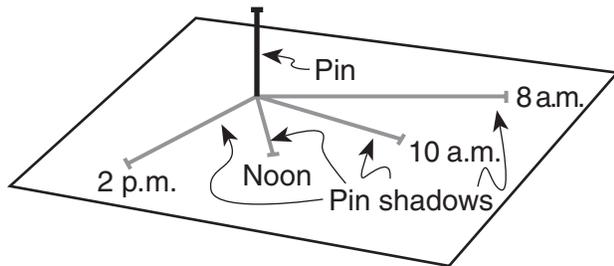
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Base your answers to questions 39 through 41 on the diagram below and on your knowledge of Earth science. The diagram shows a pin perpendicular to a card. The card was placed outdoors in the sunlight on a horizontal surface. The positions of the pin's shadow on the card were recorded several times on March 21 by an observer in New York State.

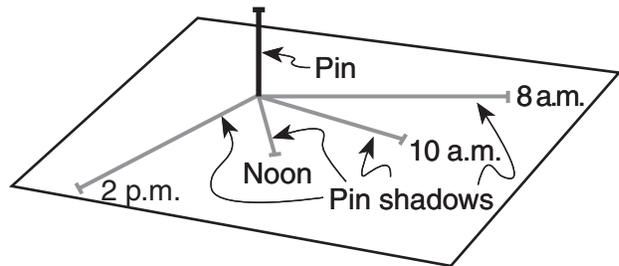


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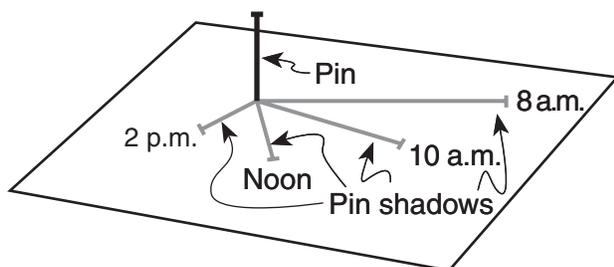
39 Which diagram best represents the length of the pin's shadow at 2 p.m. on March 21?



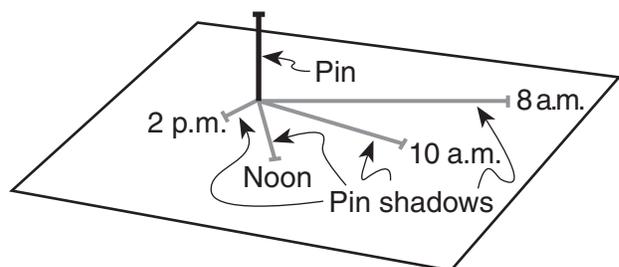
(1)



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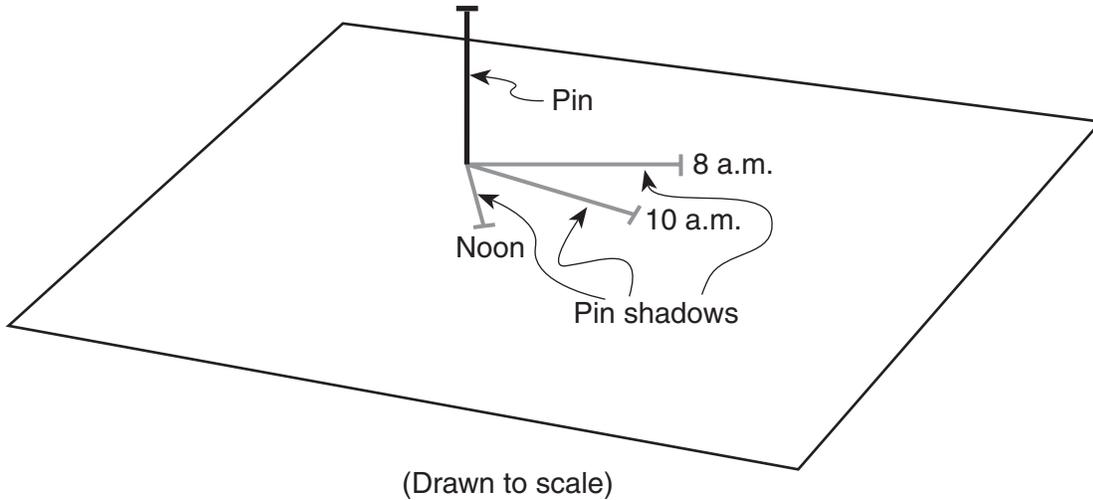


(2)



(4)

- 40 The changing location of the pin's shadow on March 21 is caused by
- (1) the Sun's rotation
 - (2) the Sun's revolution
 - (3) Earth's rotation
 - (4) Earth's revolution
- 41 On June 21, the card and pin were placed in the same position as they were on March 21. The diagram below shows the positions of the pin's shadow.



Which statement best explains the decreased length of each shadow on June 21?

- (1) The Sun's apparent path varies with the seasons.
 - (2) The Sun's distance from Earth varies with the seasons.
 - (3) The intensity of insolation is lower on June 21.
 - (4) The duration of insolation is shorter on June 21.
-

Base your answers to questions 42 through 46 on the two tables below and on your knowledge of Earth science. Table 1 shows the composition, hardness, and average density of four minerals often used as gemstones. Table 2 lists the minerals in Moh's Scale of Hardness from 1 (softest) to 10 (hardest).

Table 1

Gemstone Mineral	Composition	Hardness	Average Density (g/cm³)
emerald	Be ₃ Al ₂ (Si ₆ O ₁₈)	7.5–8	2.7
sapphire	Al ₂ O ₃	9	4.0
spinel	MgAl ₂ O ₄	8	3.8
zircon	ZrSiO ₄	7.5	4.7

KEY

Al = aluminum	O = oxygen
Be = beryllium	Si = silicon
Mg = magnesium	Zr = zirconium

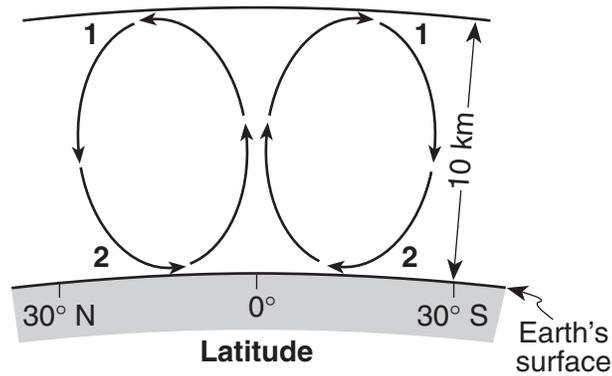
Table 2

Moh's Scale of Hardness
1 talc
2 gypsum
3 calcite
4 fluorite
5 apatite
6 feldspar
7 quartz
8 topaz
9 corundum
10 diamond

- 42 Part of a gemstone's value is based on the way the gemstone shines in reflected light. The way a mineral reflects light is described as the mineral's
- | | |
|--------------|------------|
| (1) fracture | (3) luster |
| (2) hardness | (4) streak |

- 43 Sapphire is a gemstone variety of which mineral on Moh's scale of hardness?
(1) corundum (3) fluorite
(2) diamond (4) topaz
- 44 If the mass of a spinel crystal is 9.5 grams, what is the volume of this spinel crystal?
(1) 0.4 cm³ (3) 5.7 cm³
(2) 2.5 cm³ (4) 36.1 cm³
- 45 The hardness and density of each gemstone is based primarily on the gemstone's
(1) internal arrangement of atoms (3) oxygen content
(2) geologic time of formation (4) natural abundance
- 46 Which gemstone minerals contain the two most abundant elements by mass in Earth's crust?
(1) emerald and spinel (3) sapphire and spinel
(2) emerald and zircon (4) sapphire and zircon
-

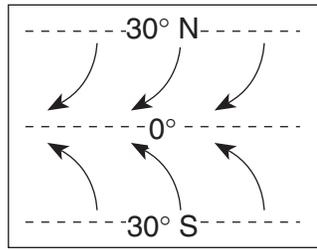
Base your answers to questions 47 through 50 on the cross section below and on your knowledge of Earth science. The cross section shows the general movement of air within a portion of Earth's atmosphere located between 30° N and 30° S latitude. Numbers 1 and 2 represent different locations in the atmosphere.



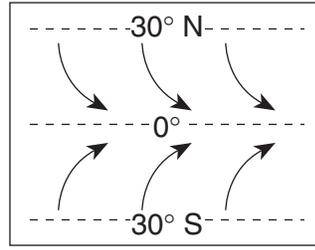
(Not drawn to scale)

- 47 Which temperature zone layer of Earth's atmosphere is shown in the cross section?
- | | |
|------------------|------------------|
| (1) troposphere | (3) mesosphere |
| (2) stratosphere | (4) thermosphere |
- 48 The air movement shown in the cross section is due to the process of
- | | |
|------------------|-----------------|
| (1) condensation | (3) evaporation |
| (2) conduction | (4) convection |
- 49 What is the approximate percentage by volume of oxygen present in Earth's atmosphere at location 2?
- | | |
|---------|---------|
| (1) 10% | (3) 33% |
| (2) 21% | (4) 46% |

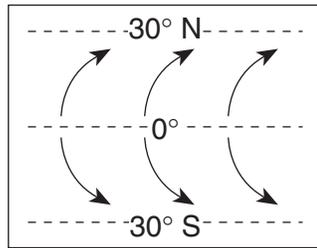
50 Which map best shows the surface movement of winds between 30° N and 30° S latitude?



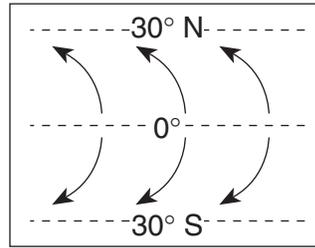
(1)



(3)



(2)



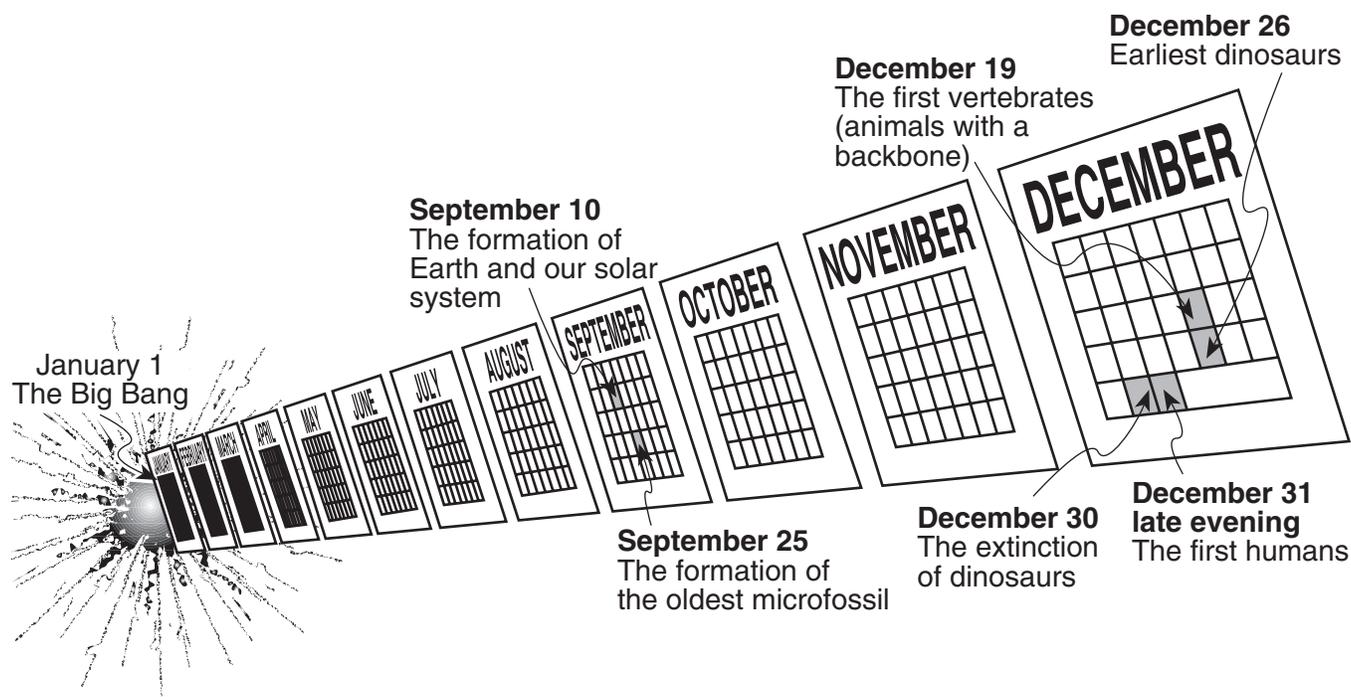
(4)

Part B-2

Answer all questions in this part.

Directions (51–65): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *Earth Science Reference Tables*.

Base your answers to questions 51 and 52 on the calendar model shown below of the inferred history of the universe and on your knowledge of Earth science. The 12-month time line begins with the Big Bang on January 1 and continues to the present time, which is represented by midnight on December 31. Several inferred events and the relative times of their occurrence have been placed in the appropriate locations on the time line.



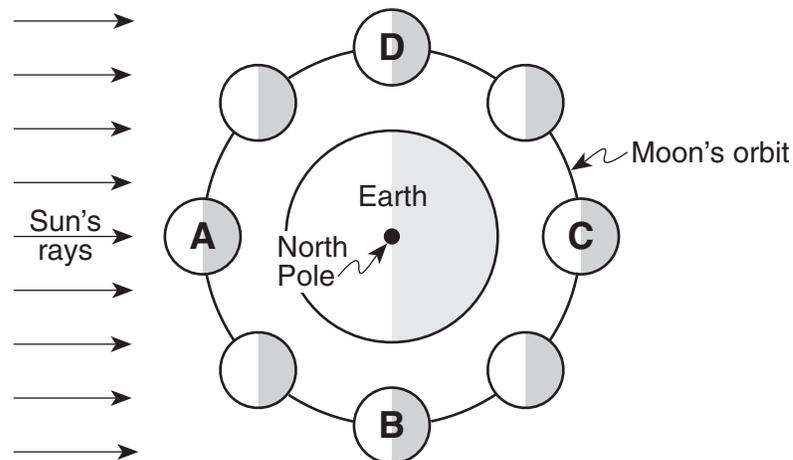
- 51 State *one* piece of evidence used by scientists to support the theory that the Big Bang event occurred. [1]
- 52 How many million years of Earth's geologic history elapsed between the event that occurred on September 10 and the event that occurred on September 25 in this model? [1]
-

Base your answers to questions 53 through 56 on the world map in your answer booklet and on your knowledge of Earth science. The map shows major earthquakes and volcanic activity occurring from 1996 through 2000. Letter A represents a volcano on a crustal plate boundary.

53 In your answer booklet, place an **X** on the map to show the location of the Nazca Plate. [1]

- 54 Explain why most major earthquakes are found in specific zones instead of being randomly scattered across Earth's surface. [1]
- 55 Identify the source of the magma for the volcanic activity in Hawaii. [1]
- 56 Identify the type of plate movement responsible for the presence of the volcano at location A. [1]
-

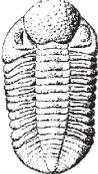
Base your answers to questions 57 through 59 on the diagram below, which shows the Moon's orbit around Earth. Four positions of the Moon are represented by letters A, B, C, and D. Earth's North Pole is labeled. The shaded areas on Earth and the Moon represent night.



(Not drawn to scale)

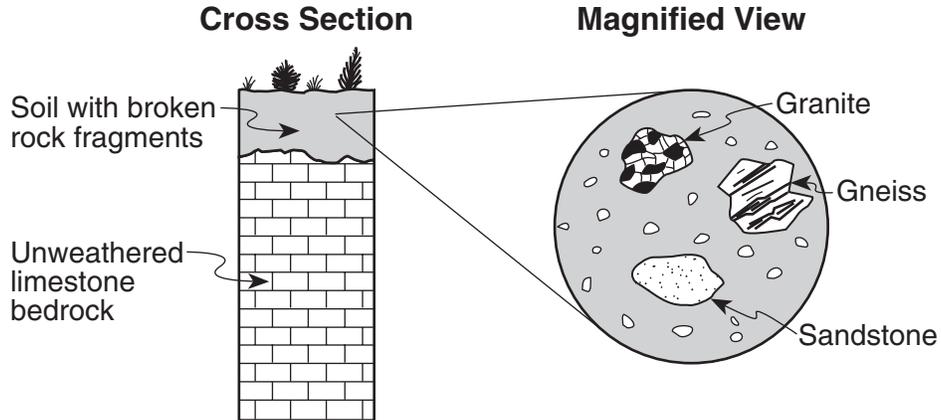
- 57 What motion of the Moon results in the Moon phases as viewed from Earth? [1]
- 58 A total solar eclipse sometimes occurs when the Moon is at position A. Explain why a total solar eclipse does *not* occur every time the Moon is at position A. [1]
- 59 State *one* season that begins when the line separating day and night passes through Earth's North Pole, as shown in this diagram. [1]
-

Base your answers to questions 60 through 62 on the table of index fossils shown below and on your knowledge of Earth science.

Table of Index Fossils		
		
Eospirifer	Manticoceras	Phacops

- 60 During what geologic time period did the oldest index fossil shown in this table exist? [1]
- 61 State *one* characteristic of a good index fossil. [1]
- 62 Complete the classification table *in your answer booklet* by filling in the general fossil group name for *each* index fossil. [1]
-

Base your answers to questions 63 through 65 on the cross section below, which shows an area near Watertown, New York. The top layer of soil contains broken rock fragments. A representative sample of this layer has been magnified.



- 63 Identify *one* mineral that could be found in all three rock fragments shown in the magnified view. [1]
- 64 State *one* observable characteristic, other than mineral composition, that could help identify the gneiss fragment. [1]
- 65 Rocks and minerals are natural resources that are mined in New York State. State *one* negative impact that should be considered before mining these natural resources. [1]
-

Part C

Answer all questions in this part.

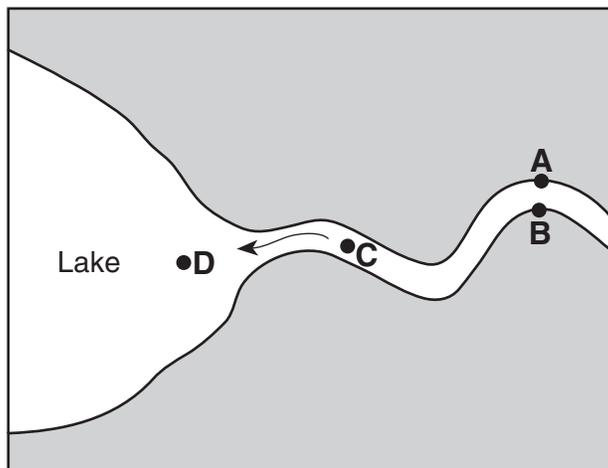
Directions (66–83): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *Earth Science Reference Tables*.

Base your answers to questions 66 through 68 on the information below, which describes the past and present climate of Antarctica, and on your knowledge of Earth science.

Antarctica's ice sheet has an average thickness of 6600 feet and holds approximately 70% of Earth's freshwater. Ice layers in Antarctica preserve information about Earth's history. Fossil evidence found in the bedrock of this continent shows that Antarctica was once tropical and is a potential source of untapped natural resources. Antarctica is now a frozen desert with very little snowfall.

- 66 Explain why Antarctica's cold climate is responsible for its very low amount of yearly precipitation. [1]
- 67 What evidence is preserved in Antarctica that provides information about Earth's past climates? [1]
- 68 Scientists are concerned that the Antarctic ice may melt as the result of global warming. State *one* effect that this melting would most likely have on Long Island, New York. [1]
-

Base your answers to questions 69 through 73 on the map below, which shows a meandering stream as it enters a lake. Points A through D represent locations in the stream.



69 In the box *in your answer booklet*, draw a cross-sectional view of the general shape of the stream bottom between points A and B. The water surface line has already been drawn. [1]

70 State the relationship between stream velocity and the size of the sediment the stream can carry. [1]

71 Describe how the size and shape of most pebbles change when the pebbles are transported in a stream over a great distance. [1]

72 The stream velocity at point C is 100 centimeters per second and the stream velocity at point D is 40 centimeters per second. Identify *one* sediment particle most likely being deposited between points C and D. [1]

73 Deposition is affected by particle density. On the grid *in your answer booklet*, draw a line to show the relationship between particle density and settling rate. [1]

Base your answers to questions 74 through 77 on the passage below, the map in your answer booklet, and your knowledge of Earth science. The map shows ocean depths, measured in meters, off the coast of Massachusetts. Points A, B, and C represent locations on the ocean floor. The Stellwagen Bank discussed in the passage is lightly shaded and labeled on the map.

The Stellwagen Bank

One of the most exciting adventures for a visitor to Cape Cod, Massachusetts, is going on a whale watch. Large boats leave port two to three times each day carrying passengers to a specific location in the Atlantic Ocean to see the whales. How do the captains of the boats know where to find the whales?

The answer is simple. They look for the whales over an area known as the Stellwagen Bank, which is a large undersea deposit of unsorted sand and gravel. The Stellwagen Bank is inferred by scientists to have formed during the Pleistocene Epoch from the slow retreat of massive Ice Age glaciers across this area. Today, cool ocean currents come from the north and flow up and over the Stellwagen Bank. These currents bring nutrients to the surface from deep in the ocean, providing food for oceanic phytoplankton (small plants). Small ocean creatures and fish feed on the phytoplankton. Whales can be found in abundance at the Stellwagen Bank feeding on the many ocean life-forms.

74 Most whale watching takes place at $42^{\circ} 25'$ N and $70^{\circ} 25'$ W. On the map *in your answer booklet*, place an **X** at this location. [1]



75 Identify the most probable cold ocean current causing the upwelling of nutrients over the Stellwagen Bank. [1]



76 What evidence indicates that the ocean floor has a steep slope at point C? [1]



77 Calculate the average ocean-floor gradient between point A and point B. Label your answer with the correct units. [2]

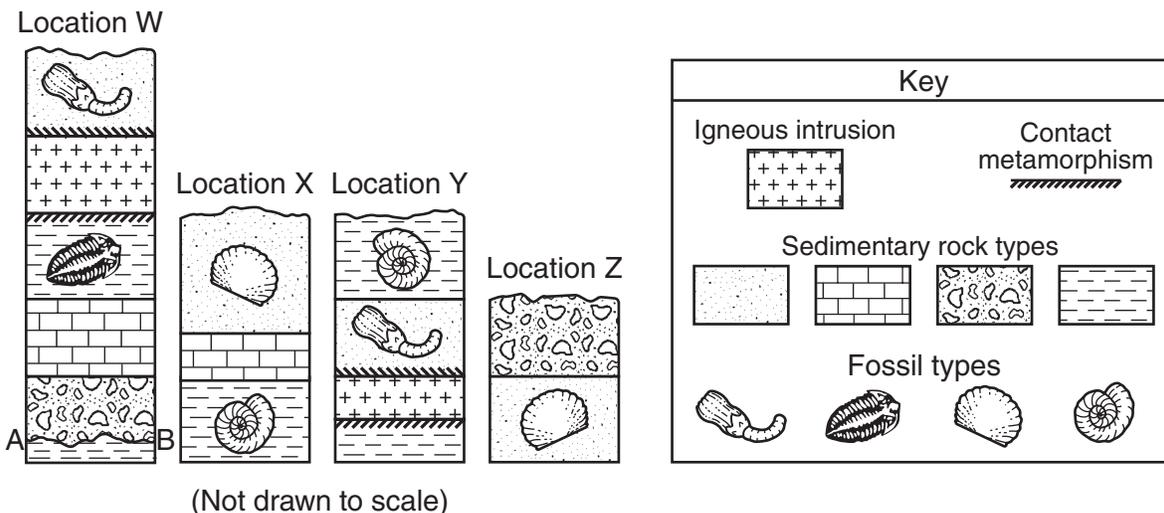
Base your answers to questions 78 through 80 on the data table below and on your knowledge of Earth science. Iridium is an element rarely found in Earth's lithosphere but commonly found in asteroids. The data table shows the abundance of iridium, in parts per billion (ppb), found in a rock core sample taken in Carlsbad, New Mexico.

Iridium Abundance in a Rock Core Sample

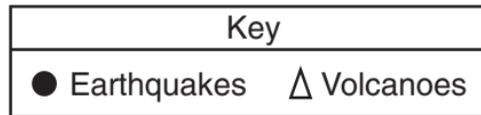
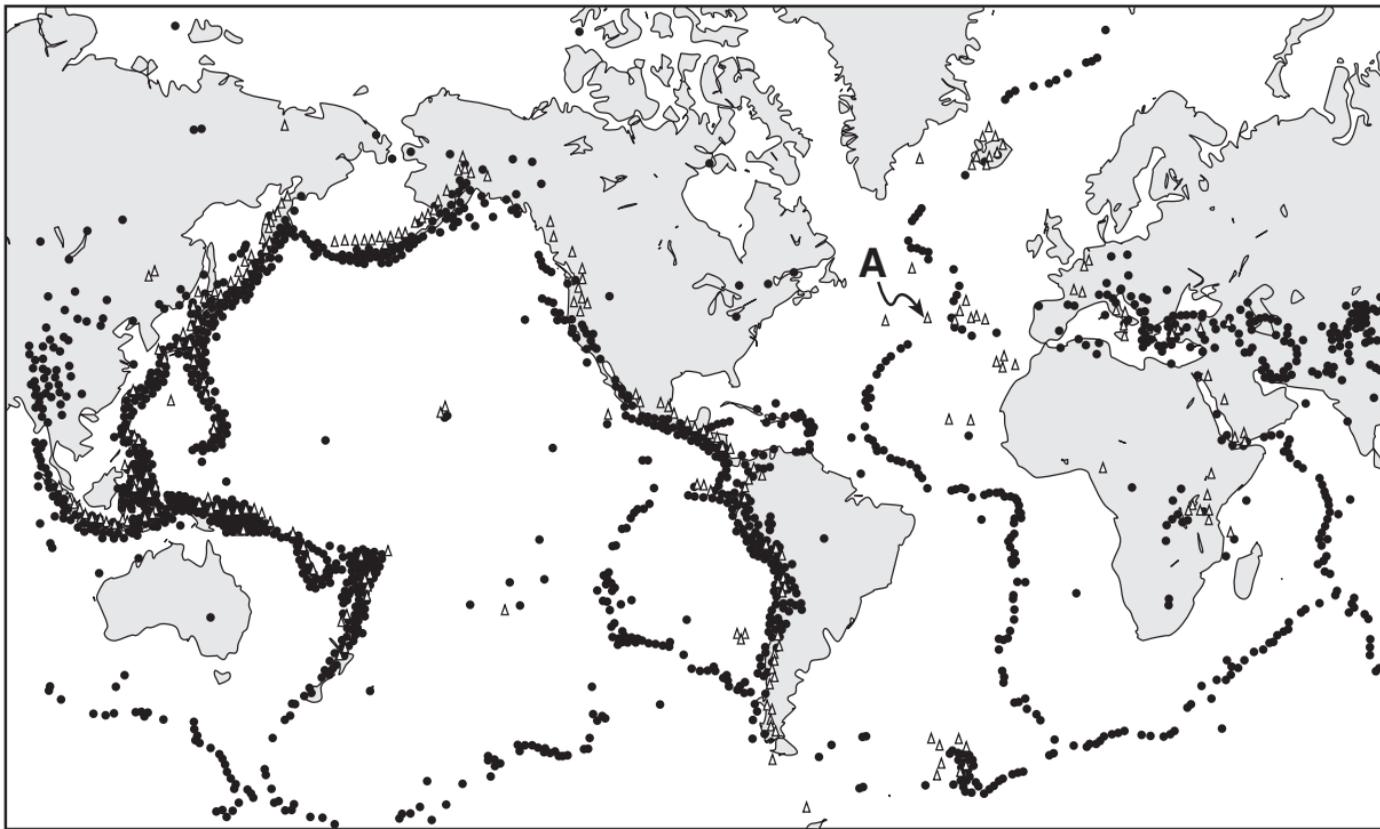
Depth Below Earth's Surface (m)	Iridium Abundance (ppb)
0	0
50	0
100	0.5
105	0.5
113	0.5
115	13.5
119	0.5
120	0.25
128	0.25
135	0

- 78 On the grid *in your answer booklet*, construct a line graph of iridium abundance at various depths. Place an **X** to show the iridium abundance at *each* depth shown on the data table. Connect the **X**s with a line. [2]
-  79 The high concentration of iridium in this rock core sample has been matched to rock layers that have been dated to the geologic time when dinosaur extinction from an asteroid impact may have occurred. Between which two geologic time periods did this inferred extinction occur? [1]
-  80 Other than iridium in the rock layers, what surface feature was most likely created when this asteroid impacted Earth's crust? [1]
-

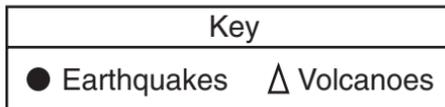
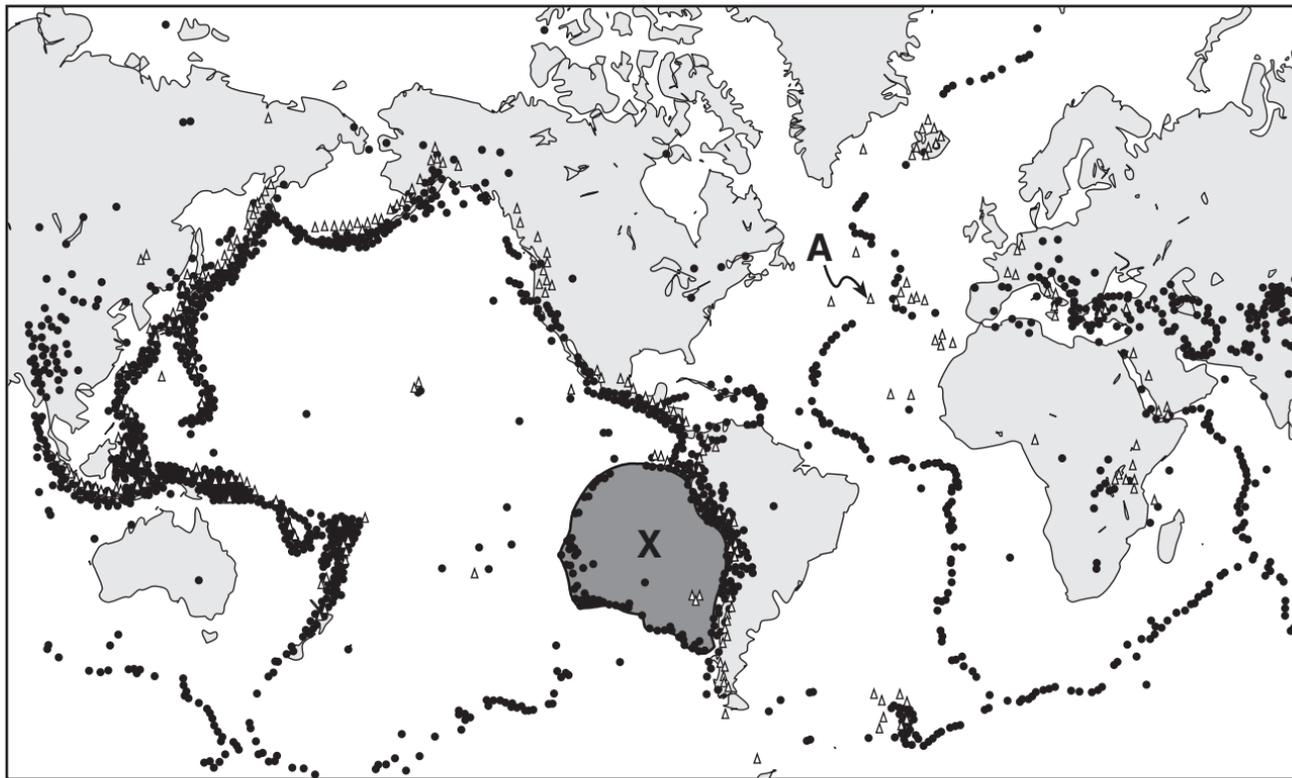
Base your answers to questions 81 through 83 on the cross sections below, which show widely separated outcrops at locations W, X, Y, and Z. The rock layers have not been overturned. Line AB in the cross section at location W represents an unconformity. Fossils are shown in some of the layers.



- 81 Determine the relative geologic age of the four fossils by correlating the rock layers between these outcrops. *In your answer booklet*, number the fossils from 1 to 4 in order of relative age, with 1 as the oldest and 4 as the youngest. [1]
- 82 What evidence shown in the outcrop at location W suggests that the igneous intrusion occurred after both fossils were deposited at location W? [1]
- 83 Identify *two* of the processes involved in the formation of the unconformity represented by line AB in the cross section at location W. [1]
-



[1] Allow 1 credit if the center of the student-drawn **X** is located somewhere on the Nazca Plate shaded below.



Fossil Classification

Index Fossil	<i>Eospirifer</i>	<i>Manticoceras</i>	<i>Phacops</i>
General Fossil Group			

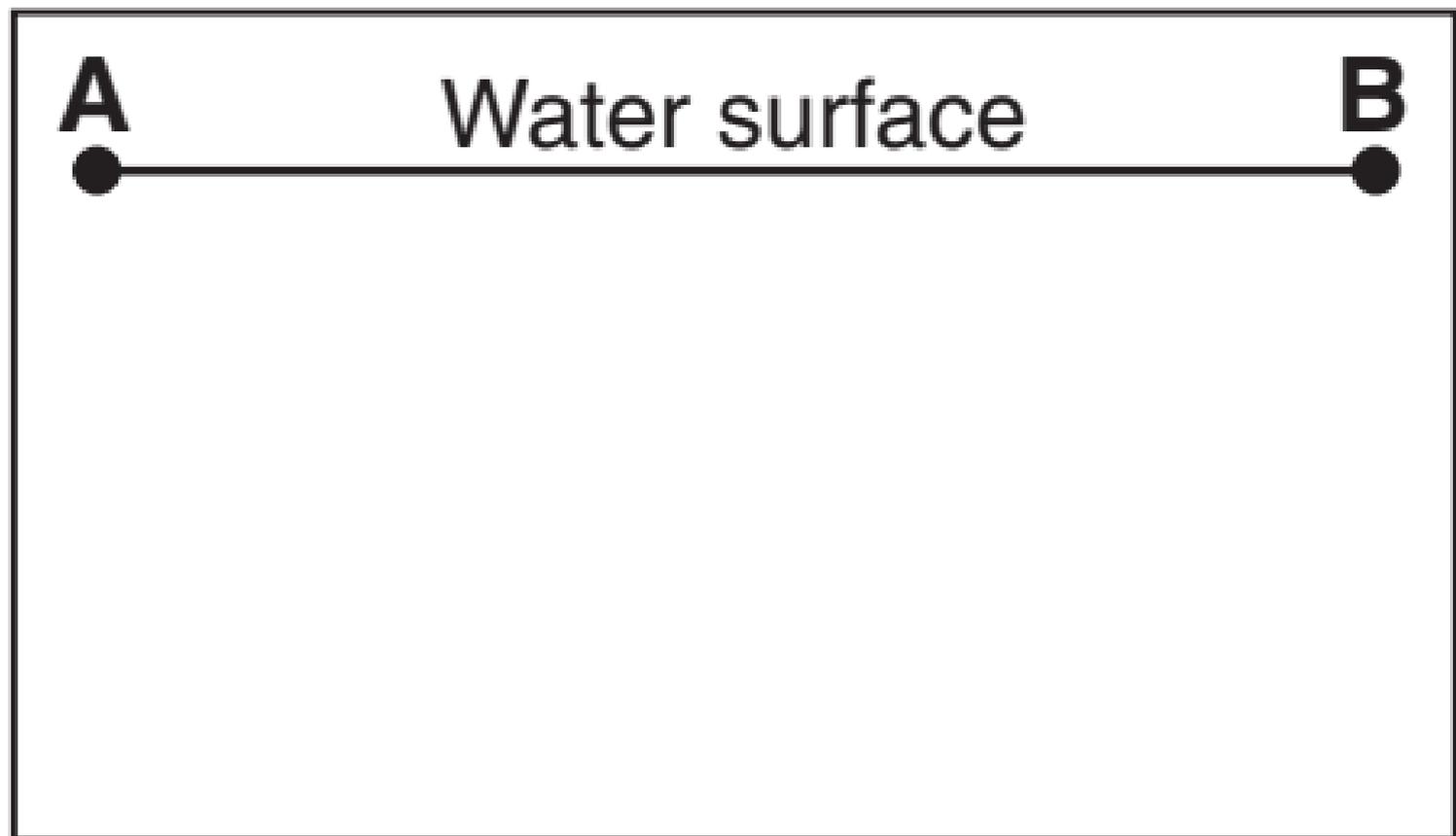
62

[1] Allow 1 credit if *all* three fossil groups are correctly identified as shown below.

Fossil Classification

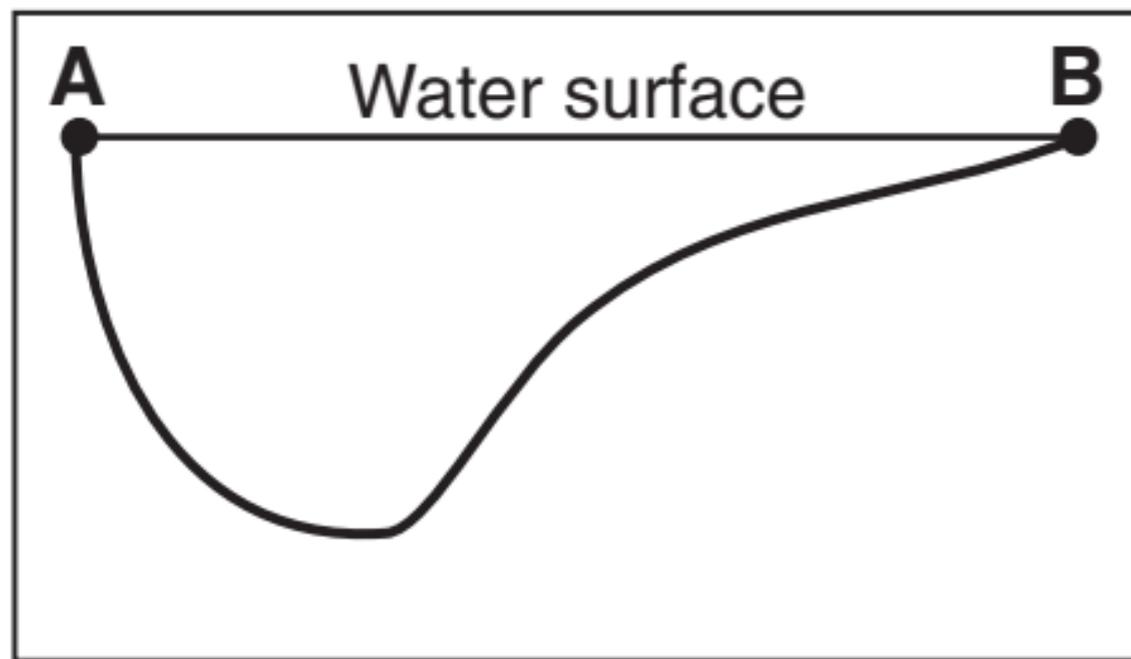
Index Fossil	<i>Eospirifer</i>	<i>Manticoceras</i>	<i>Phacops</i>
General Fossil Group	Brachiopod	Ammonoid	Trilobite

69



69 [1] Allow 1 credit if the student's cross section shows that the water is deeper near point A.

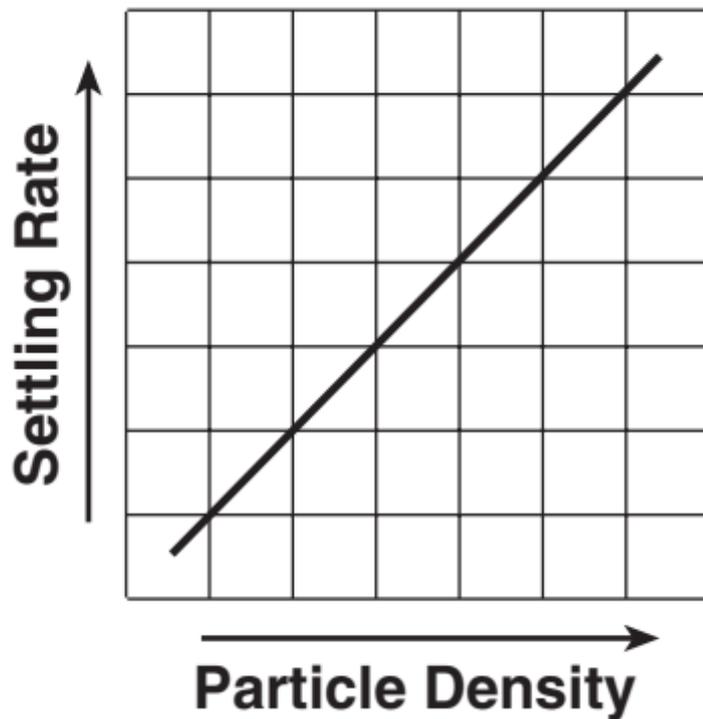
Example of a 1-credit response:



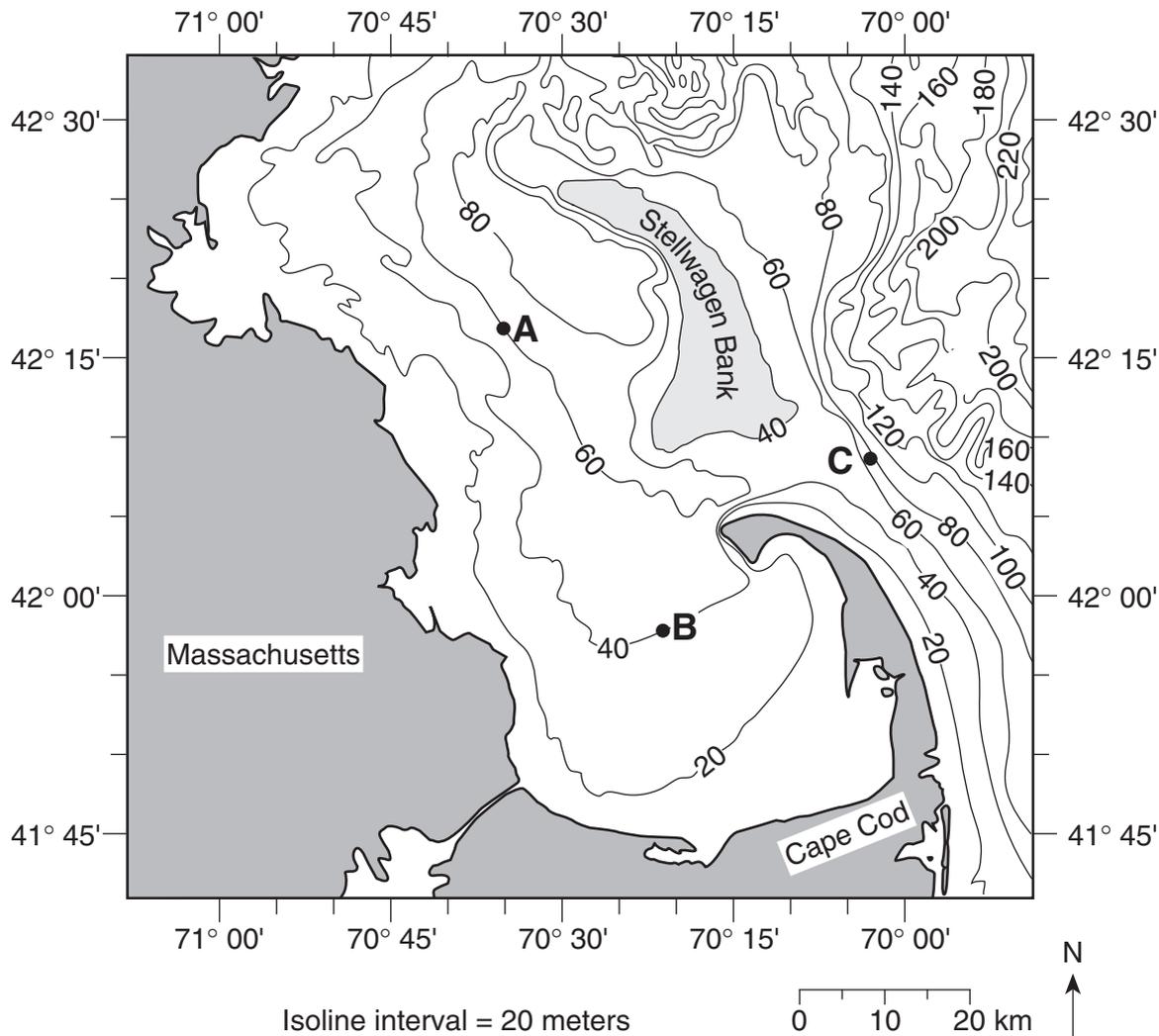
73

[1] Allow 1 credit for a straight or curved line that shows a direct relationship.

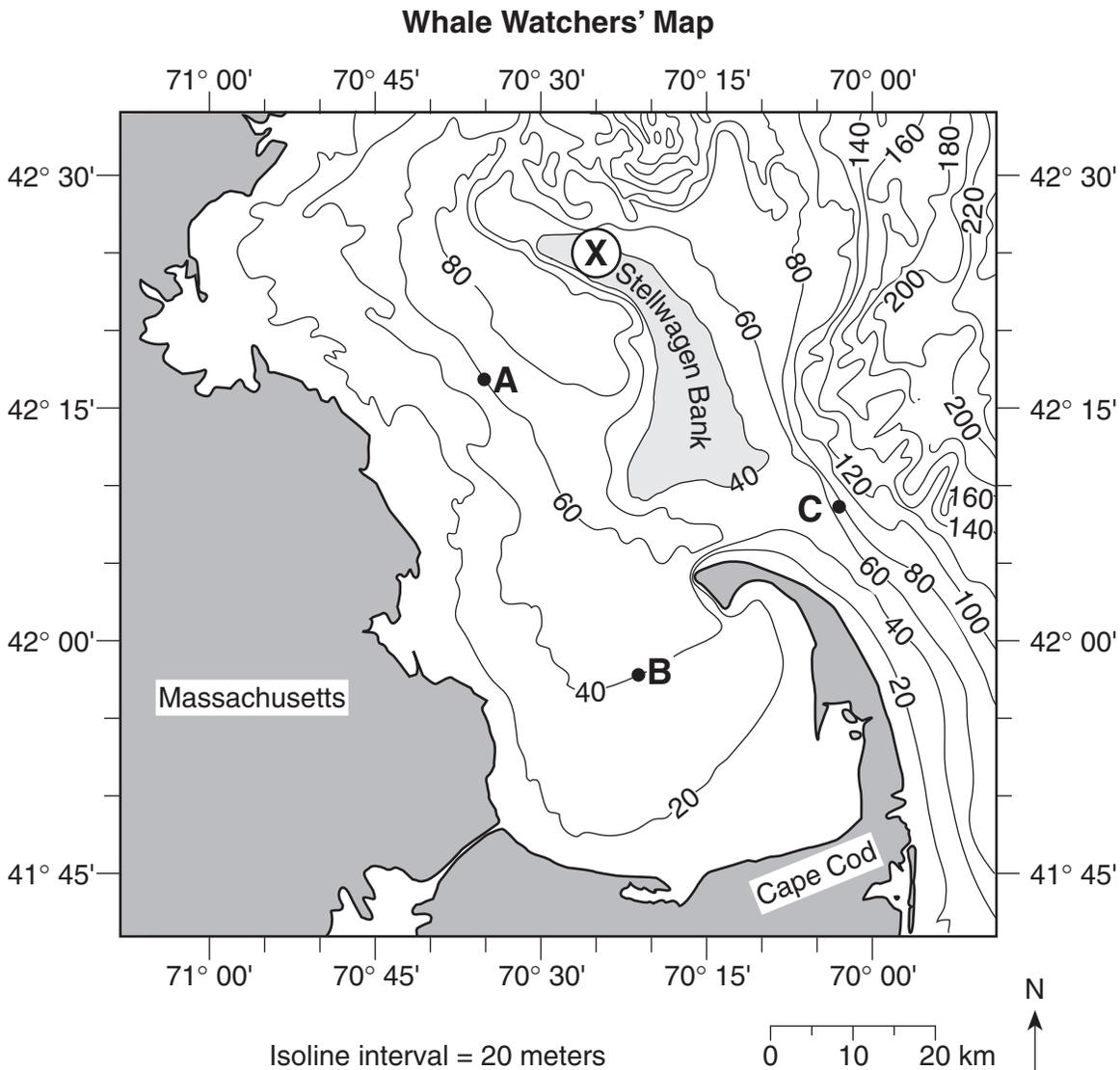
Example of a 1-credit response:



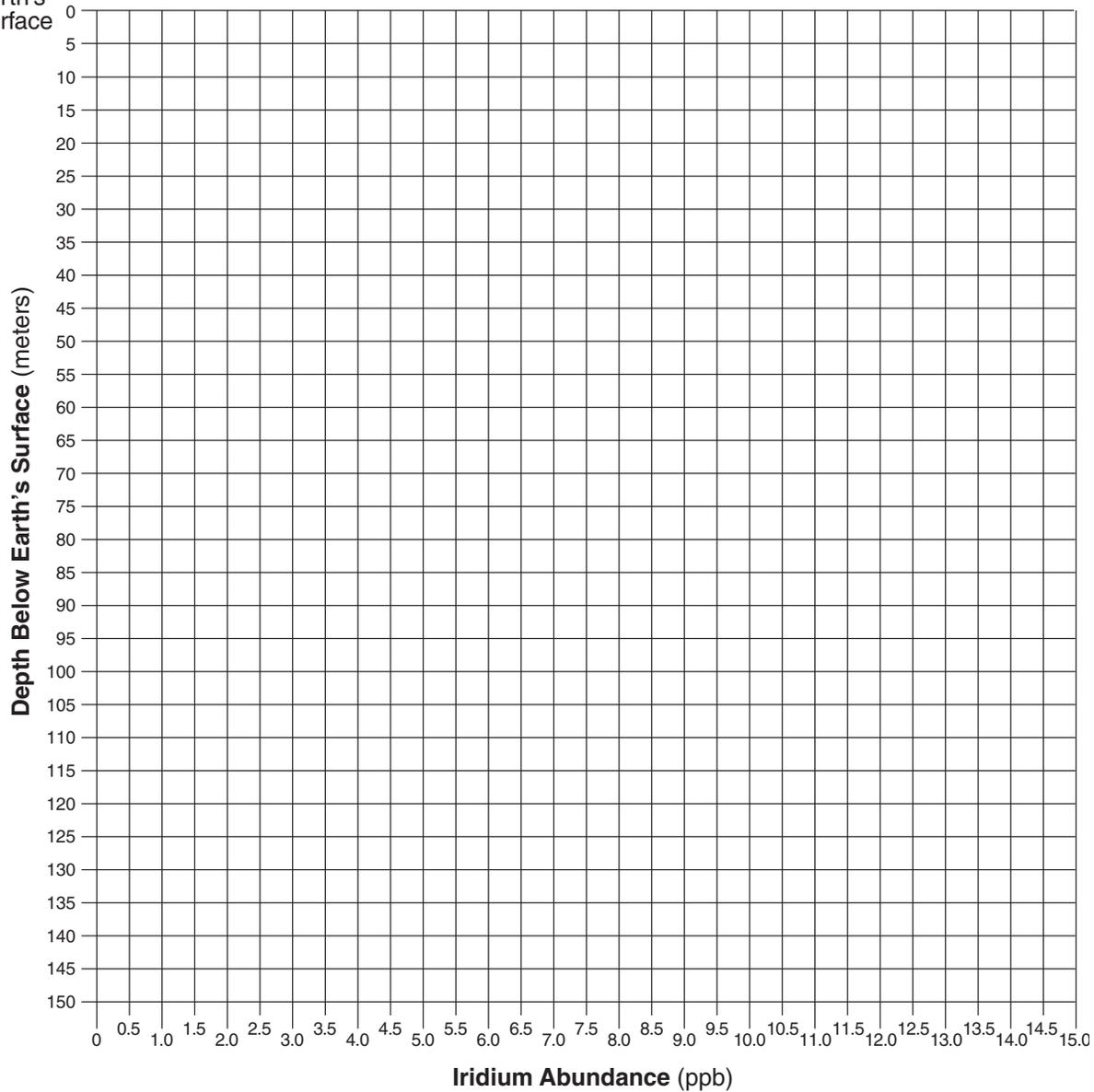
Whale Watchers' Map



[1] Allow 1 credit if the center of the student-drawn **X** is within the circle shown below.



Iridium Abundance at Various Depths Below Earth's Surface

Earth's
Surface

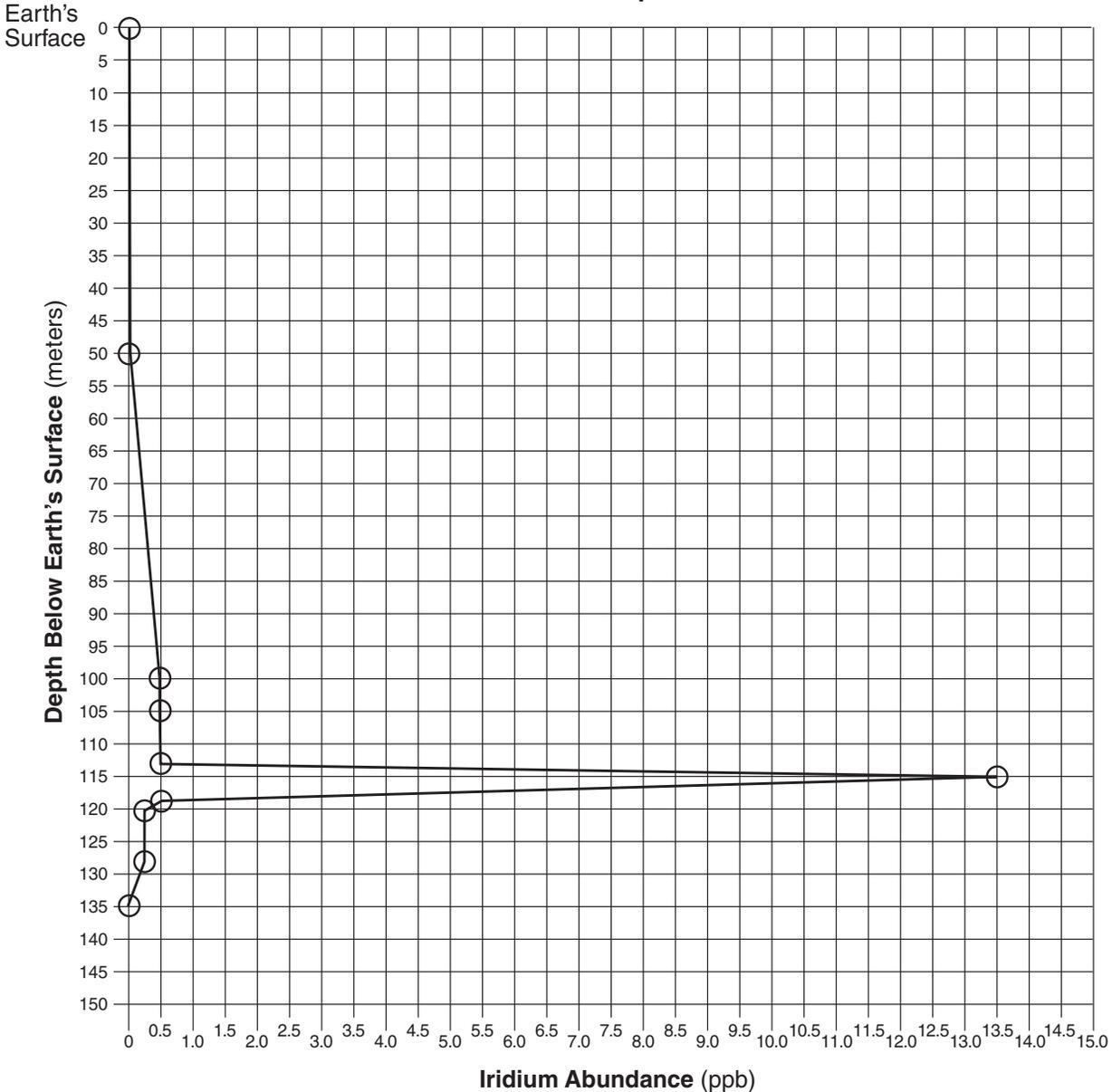
[2] Allow a maximum of 2 credits, allocated as follows:

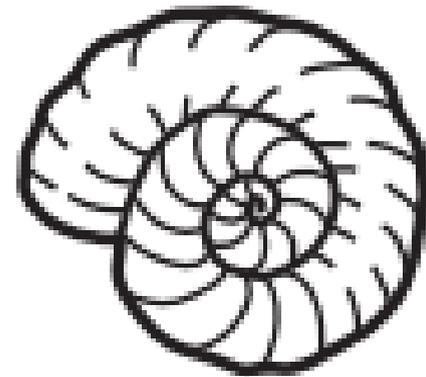
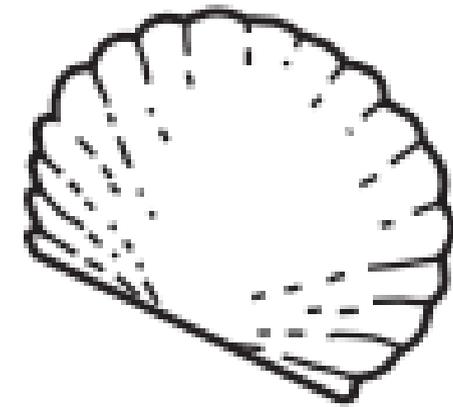
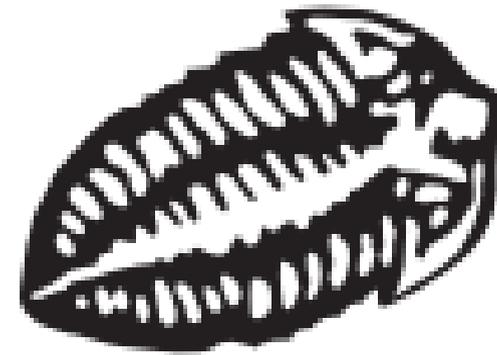
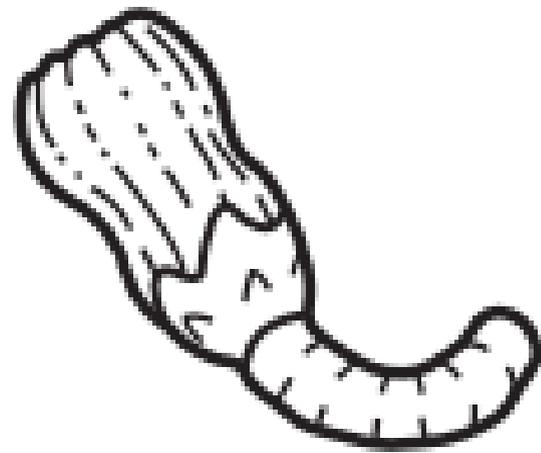
- Allow 2 credits if the center of all ten **Xs** are within the circles shown on the graph below, and the **Xs** are correctly connected with a line.
- Allow 1 credit if only seven to nine centers of the **Xs** are within the circles shown on the graph below, and the **Xs** are correctly connected with a line.

or

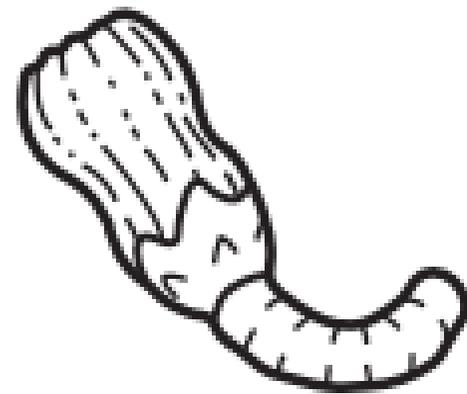
- Allow 1 credit if the center of all ten **Xs** are within the circles shown on the graph below, but the **Xs** are not correctly connected with a line.

Iridium Abundance at Various Depths Below Earth's Surface

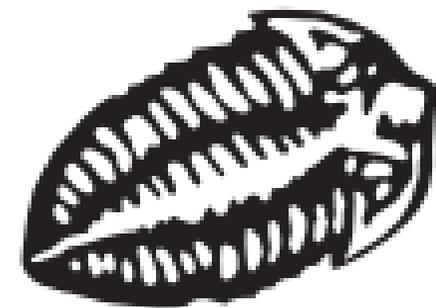




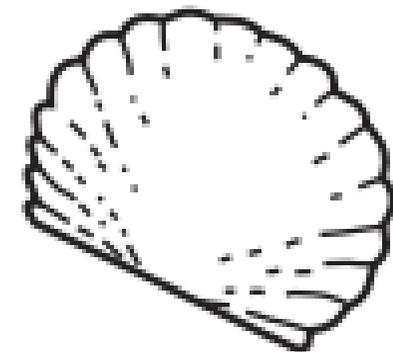
81 [1] Allow 1 credit for the correct response shown below.



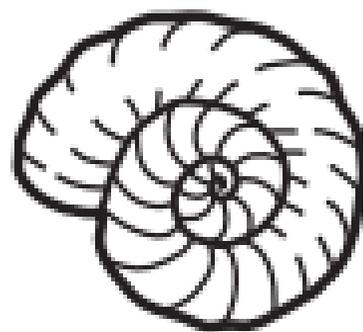
2



1



4



3