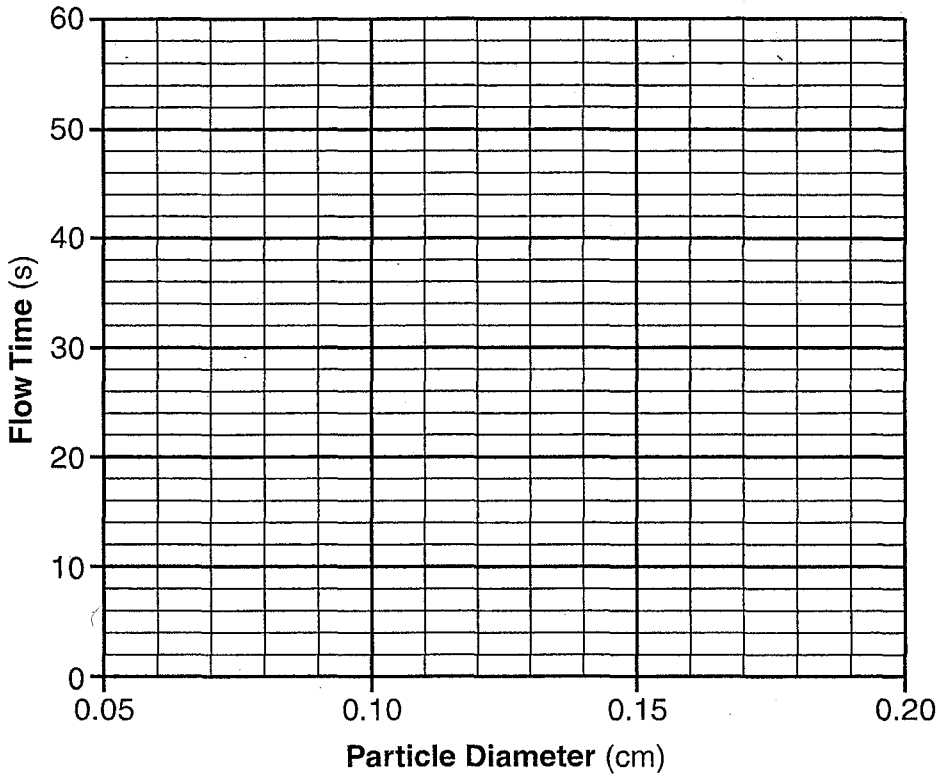
Free Response

Name _____ 2010-11 Midterm

1



1 ☐

2 _____ s 2 ☐

3 _____ 3 ☐

_____

4 _____ front 4 ☐

5 _____ 5 ☐

_____

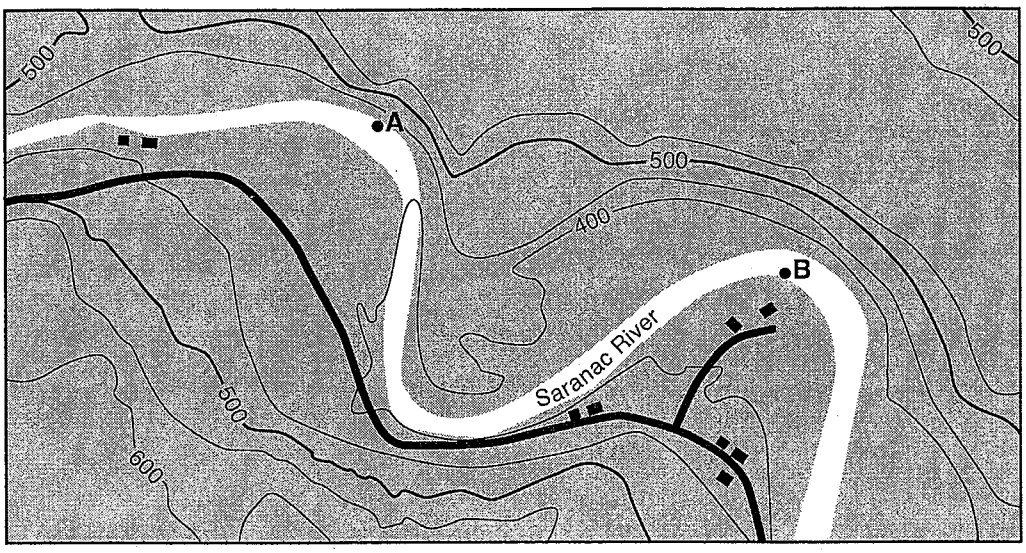
6 _____ front 6 ☐

7 _____ cm 7 ☐

8 _____ 8 ☐

_____

9



Key	
Road	Building

Contour interval = 50 ft

N

10 _____

_____

_____

11 _____

_____

12 _____

_____

13

Season	Earth's Position
spring	
summer	
fall	
winter	

14 _____ d

10

11

12

13

14

15 _____ 15 ☐

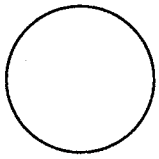
16 Diameter: _____ 16 ☐

Density: _____

17 Color: _____ 17 ☐

Luminosity: _____

18 18 ☐



19 W: _____ **tide** 19 ☐

X: _____ **tide**

Y: _____ **tide**

Z: _____ **tide**

20 _____ 20 ☐

21 A: _____ 21 ☐

B: _____

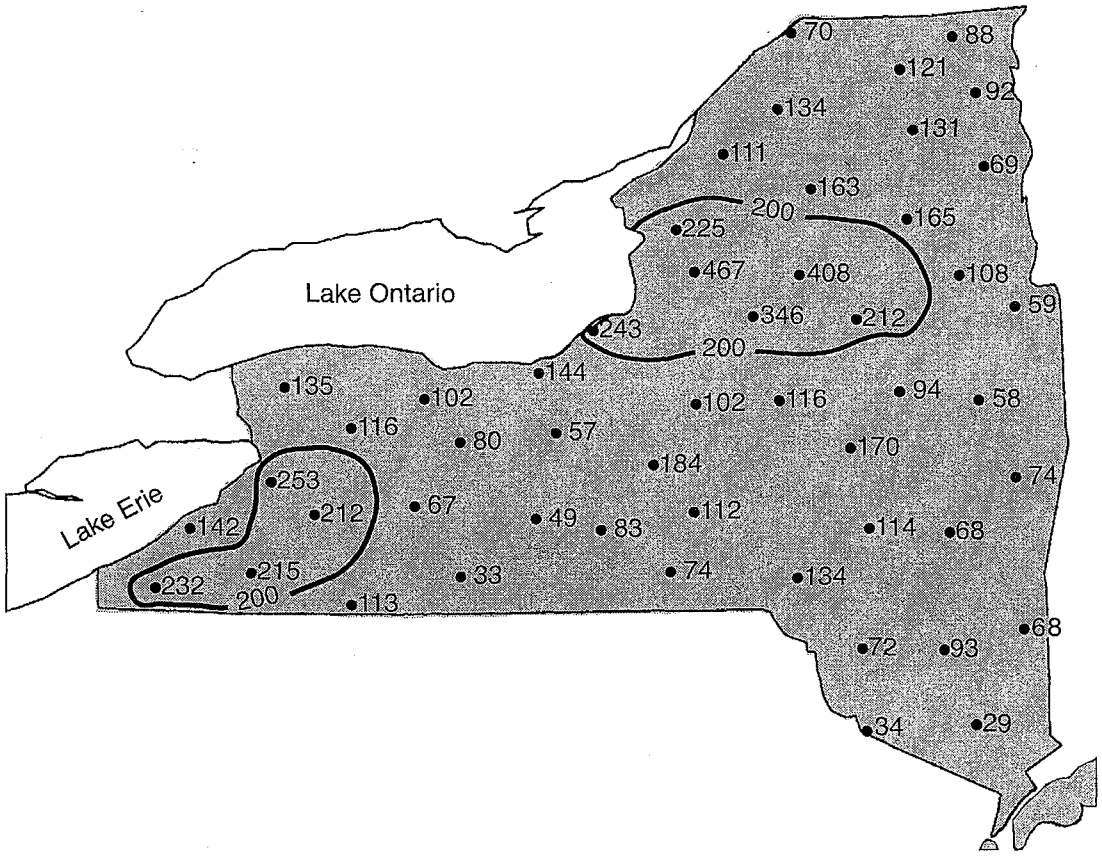
C: _____

D: _____

22 _____ 22 ☐

_____

23



23 ☐

24 _____ in

24 ☐

25 _____

25 ☐

26

26 ☐

27 _____

_____

27 ☐

28 _____

28 ☐

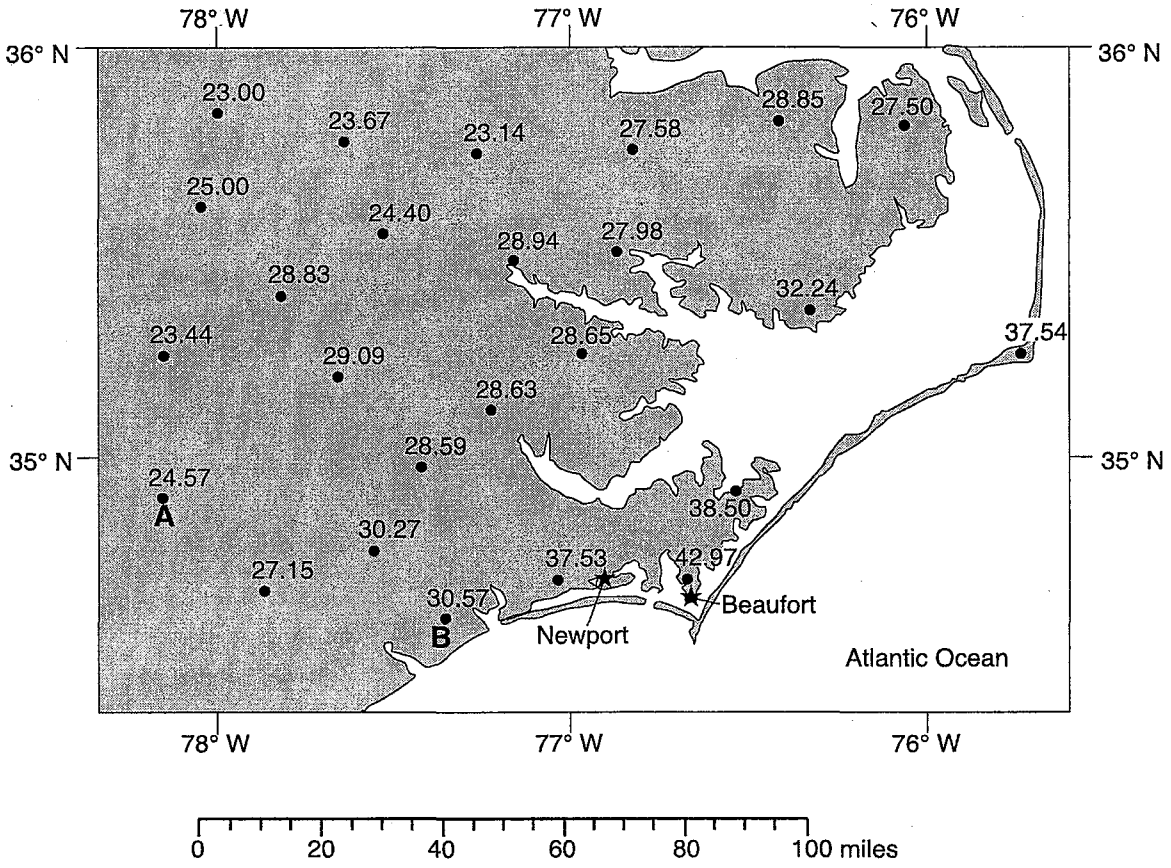
29 _____

_____

29 ☐

For Raters Only

30



30 ☐

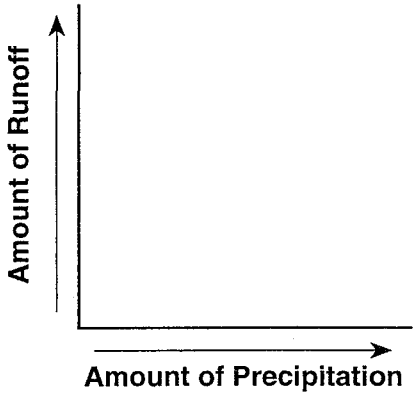
31 Gradient = _____ 31 ☐

32 _____ 32 ☐

33 _____ 33 ☐

_____

34



34 ☐

Name _____

Free Response
2010-11 Midterm

Base your answers to questions 1 through 3 on the data table below. Six identical cylinders, *A* through *F*, were filled with equal volumes of sorted spherical particles. The data table shows the particle diameters, in centimeters, and the amount of time, in seconds, for water to flow equal distances through each cylinder.

Data Table

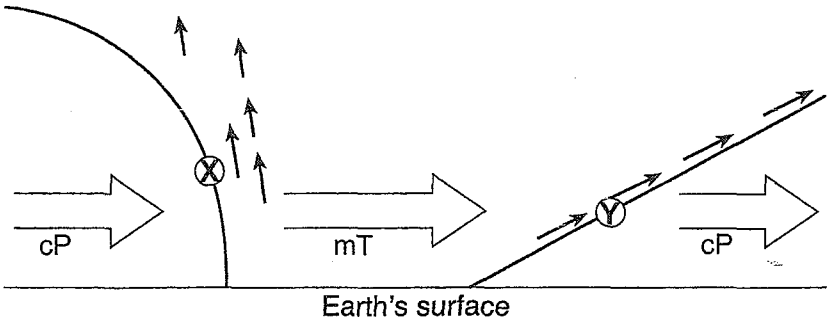
Cylinder	Particle Diameter (cm)	Flow Time (s)
A	0.07	51
B	0.08	39
C	0.10	25
D	0.14	13
E	0.16	10
F	0.18	8

1 Use the information in the data table to construct a line graph. On the grid *in your answer booklet*, plot the data for the flow time for each of the particle sizes given in the data table. Connect the plotted data with a smooth, curved line. [1]

2 Determine the flow time in a cylinder containing particles with a diameter of 0.13 centimeter. [1]

3 State *one* reason why the water flows faster through the cylinders containing larger particles than through the cylinders containing smaller particles. [1]

Base your answers to questions 4 through 6 on the cross section below, which shows two weather fronts moving across New York State. Lines *X* and *Y* represent frontal boundaries. The large arrows show the general direction the air masses are moving. The smaller arrows show the general direction warm, moist air is moving over the frontal boundaries.

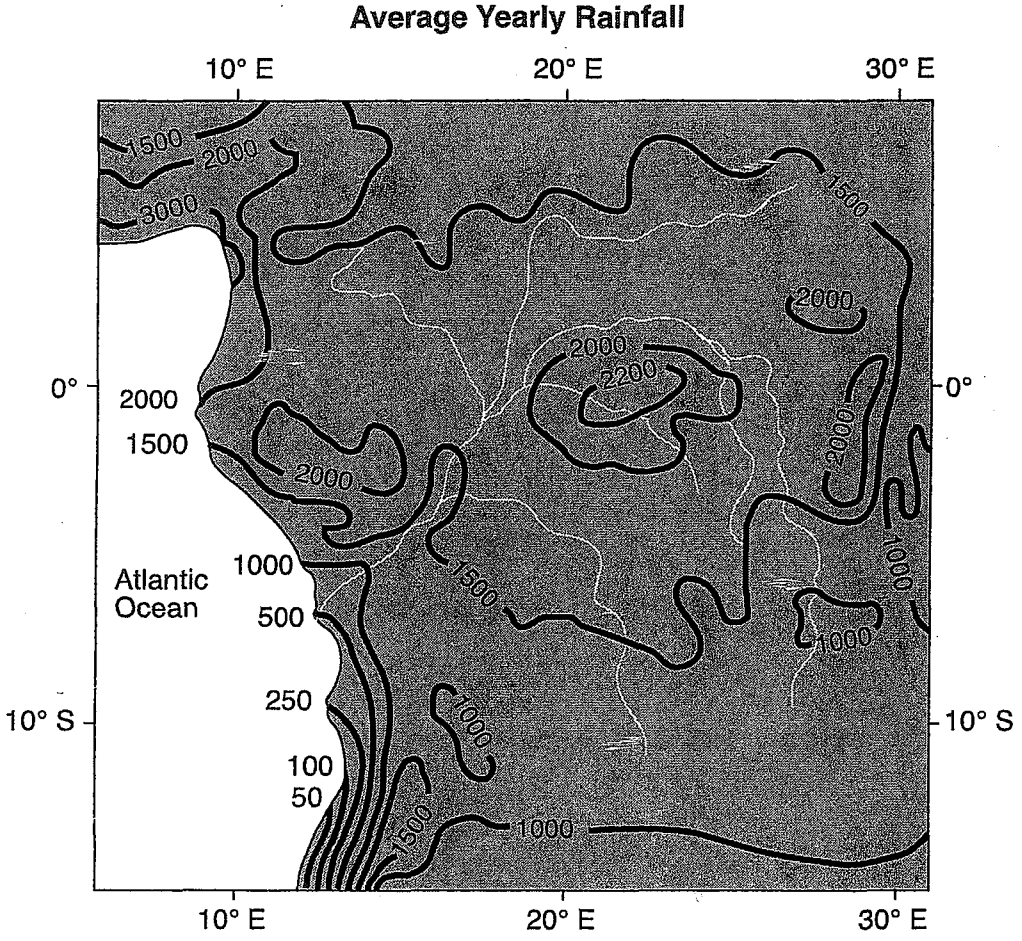


4 Which type of front is represented by letter *X*? [1]

5 Explain why the warm, moist air rises over the frontal boundaries. [1]

6 Which type of front forms when front *X* catches and overtakes front *Y*? [1]

Base your answers to questions 7 and 8 on the map and passage below. The map shows isolines of average yearly rainfall, in centimeters, for the Congo River region of Africa.



The climate of the Congo River region is mainly influenced by air from two source regions. One air-mass source region is over the Benguela Current along the west coast of Africa. This air mass moves at low altitudes toward the Congo River region. A second air-mass source region is located over the South Equatorial Current along the east coast of Africa. This air mass moves at higher altitudes over the Congo River region.

7 According to the map, what is a possible average yearly rainfall amount received on the equator (0°) at 20° E? [1]

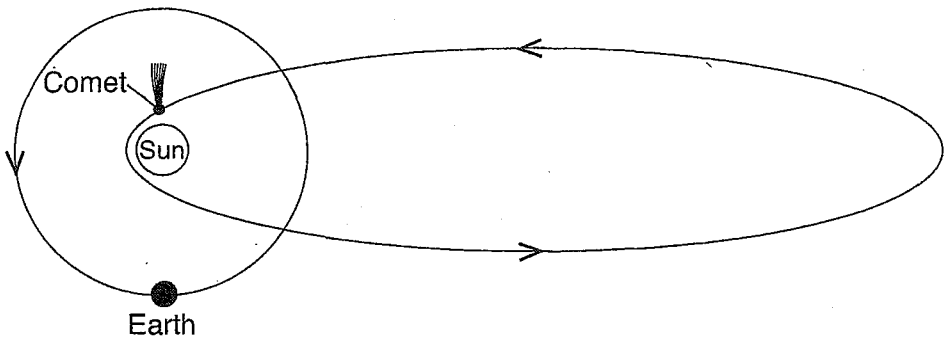
8 Explain why air masses that form over the South Equatorial Current move at higher altitudes than air masses that form over the Benguela Current. [1]

Base your answers to questions 9 through 10 on the topographic map in your answer booklet, which shows an area of the Saranac River just west of Plattsburgh, New York. Points *A* and *B* are locations in the river.

9 In this region of the Saranac River, the land area that is lower in elevation than 450 feet is a floodplain. On the map *in your answer booklet,* draw a diagonal-line pattern, ▨, to indicate the entire floodplain area. [1]

10 Describe how the contour lines shown on the map indicate that the Saranac River flows from point *A* to point *B*. [1]

Base your answers to questions 11 and 12 on the diagram below, which shows Earth's orbit and the orbit of a comet within our solar system.

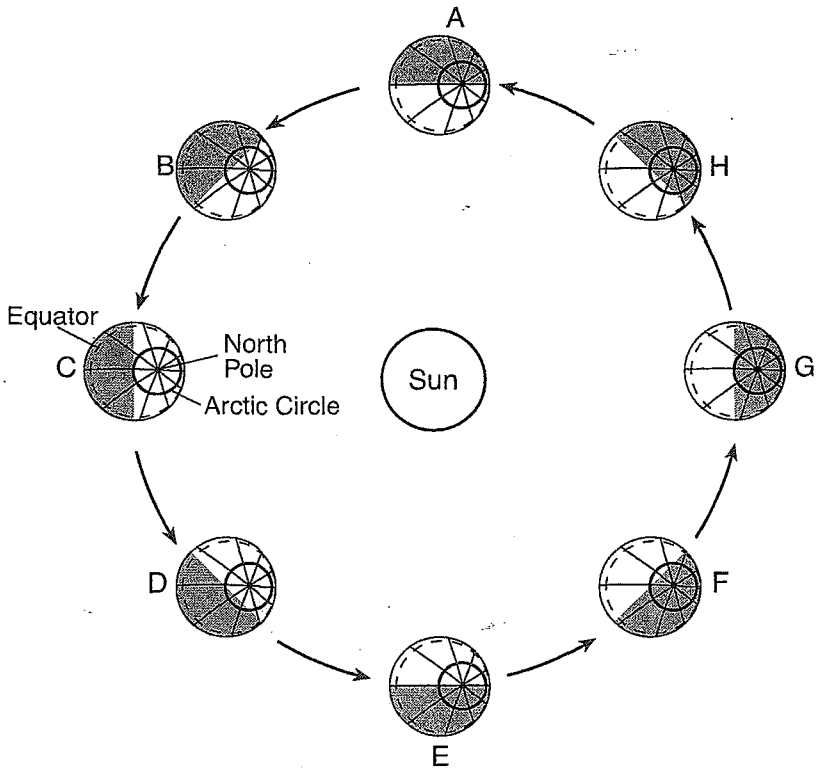


(Not drawn to scale)

11 Explain how this comet's orbit illustrates the heliocentric model of our solar system. [1]

12 Explain why the time required for one revolution of the comet is more than the time required for one revolution of Earth. [1]

Base your answers to questions 13 and 14 on the diagram below, which shows Earth's orbit around the Sun as viewed from space. Earth is shown at eight different positions labeled *A* through *H*. Earth's North Pole, Arctic Circle, and equator have been labeled at position *C*. The arrows show the direction of orbital motion.



(Not drawn to scale)

13 Complete the data table *in your answer booklet* by placing the letter that represents the position of Earth at the start of *each* season in the Northern Hemisphere. [1]

14 Approximately how many days does Earth take to move from position *A* to position *C*? [1]

Base your answers to questions 15 through 17 on the passage below.

Extrasolar Planets

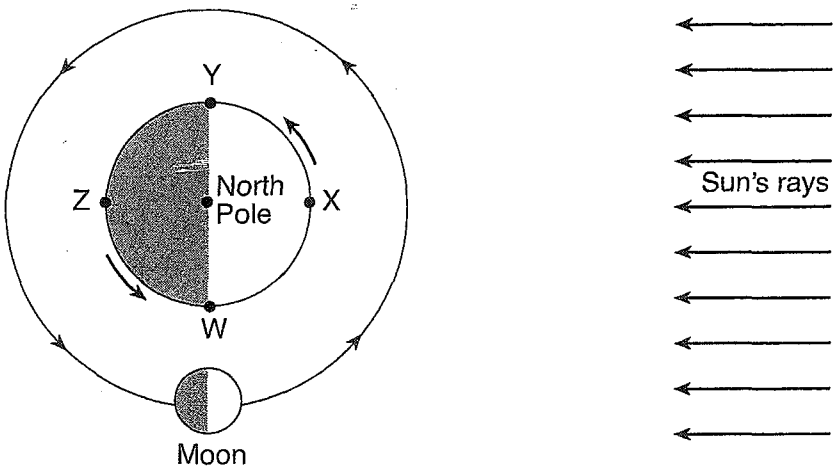
Astronomers have discovered more than 400 planets outside of our solar system. The first extrasolar planet was detected in 1995 orbiting a star known as *51 Pegasi*, which is similar in color and luminosity to our Sun. Astronomers can detect planets by identifying stars that move in response to the gravitational pull of planets revolving around them. Other planets have been discovered by finding stars whose luminosity varies as orbiting planets block outgoing starlight. Nearly all of these discovered planets are thought to be Jovian-like planets similar to Jupiter.

15 Other than Jupiter, identify *one* Jovian planet in our solar system. [1]

16 Compared to Jupiter, state how Earth's equatorial diameter and density are different. [1]

17 State the color and luminosity of *51 Pegasi*. [1]

Base your answers to questions 18 through 20 on the diagram below, which shows one position of the Moon in its orbit around Earth. Letters *W*, *X*, *Y*, and *Z* are locations on Earth's surface.



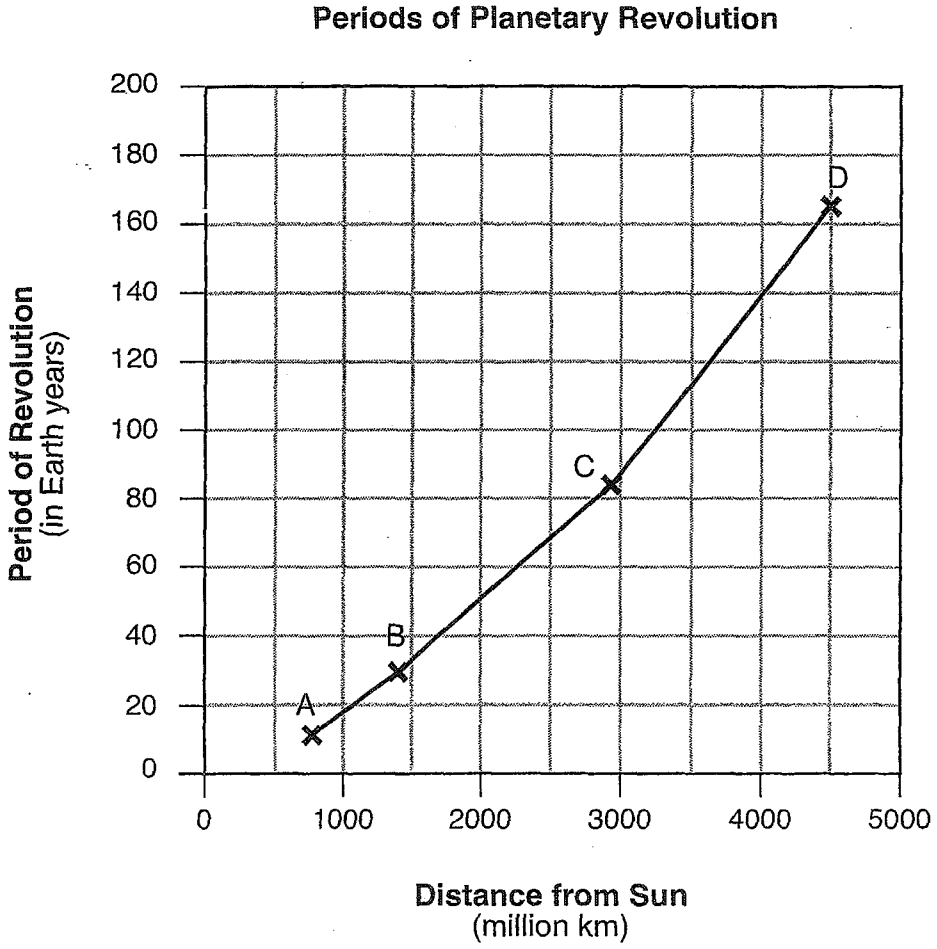
(Not drawn to scale)

18 On the diagram of the Moon *in your answer booklet*, shade the part of the Moon that appears dark to an observer in New York State when the Moon is at the position shown in the diagram. [1]

19 *In your answer booklet*, write "high" or "low" to indicate whether a high ocean tide or low ocean tide is occurring at locations *W*, *X*, *Y*, and *Z*. [1]

20 What is the solar time at location *Y*? Include a.m. or p.m. in your answer. [1]

Base your answers to questions 21 and 22 on the graph below, which shows the distance from the Sun and the period of revolution for four planets in our solar system labeled *A*, *B*, *C*, and *D*.



21 State the name of *each* of the planets represented by *A*, *B*, *C*, and *D*. [1]

22 Describe the relationship between the distance from the Sun and the period of revolution for these four planets. [1]

Base your answers to questions 23 through 25 on the map in your answer booklet, which shows the snowfall from the fall of 1976 through the spring of 1977, measured in inches, for most of New York State. The 200-inch snowfall isolines are shown on the map.

23 On the map *in your answer booklet*, draw the 100-inch snowfall isoline. Extend the isoline to the edges of New York State. [1]

24 The amount of snowfall for Massena is shown on the map. What was the amount of snowfall for Massena? [1]

25 Identify *one* factor that contributes to the high snowfall amounts at locations on the eastern side of *both* Lake Erie and Lake Ontario. [1]

Base your answers to questions 26 and 27 on the table below, which shows weather data recorded at Albany, New York.

Data Table

Location	Temperature (°F)	Dewpoint (°F)	Cloud Cover (%)	Pressure (mb)	Wind Direction	Wind Speed (knots)
Albany	58	36	25	1017.0	from the west	20

26 Complete the station model *in your answer booklet*, using the proper format to accurately represent these *six* weather conditions. [1]

27 State *one* reason why rain was unlikely at the time the data was collected. Support your answer by using the data. [1]

Base your answers to questions 28 and 29 on the passage below.

Average temperatures on Earth are primarily the result of the total amount of insolation absorbed by Earth's surface and atmosphere compared to the amount of long-wave energy radiated back into space. Scientists believe that the addition of greenhouse gases into Earth's atmosphere gradually increases global temperatures.

28 Identify *one* major greenhouse gas that contributes to global warming. [1]

29 Explain how increasing the amount of greenhouse gases in Earth's atmosphere increases global temperatures. [1]

Base your answers to questions through on the map in your answer booklet. The map shows the precipitation totals, in inches, from January 2003 through May 2003 for the North Carolina locations represented by dots. Precipitation totals for locations *A* and *B* are recorded on the map. The towns of Newport and Beaufort are labeled on the map.

30 On the map *in your answer booklet*, use a smooth, curved line to draw the 25.00-inch precipitation isoline. The isoline must extend to the edges of the map. [1]

31 Calculate the rainfall gradient between locations *A* and *B* on the map to the *nearest hundredth*. Label your answer with the correct units. [1]

32 Identify the city shown on the *Generalized Bedrock Geology of New York State* map in the *Earth Science Reference Tables* that is closest to the longitude of Newport, North Carolina. [1]

33 Explain why the intensity of insolation received at Beaufort, North Carolina, on a clear day is greater than the intensity of insolation received at Buffalo, New York, on the same clear day. [1]

34 On the grid *in your answer booklet*, draw a line to show the general relationship between the amount of precipitation and the amount of runoff in Beaufort, North Carolina, if the ground is saturated. [1]

Multiple Choice

2010-11 Midterm

Name _____

1 If an observer on Earth views *Polaris* on the horizon, the observer is located at the

(1) equator (0°)
(2) North Pole (90° N)
(3) Tropic of Cancer (23.5° N)
(4) Tropic of Capricorn (23.5° S)

2 The theory that the universe is expanding is supported by the

(1) blue shift of light from distant galaxies
(2) red shift of light from distant galaxies
(3) nuclear fusion occurring in the Sun
(4) radioactive decay occurring in the Sun

3 Heat energy from the lower latitudes is transferred to colder Earth regions by planetary wind circulation mainly through the process of

(1) conduction
(2) radiation
(3) convection
(4) reflection

4 During which month does the Sun appear to rise farthest north of due east for an observer in New York State?

(1) December
(2) January
(3) June
(4) July

5 How many degrees does the Sun appear to move across the sky in four hours?

(1) 60°
(2) 45°
(3) 15°
(4) 4°

6 Which type of land surface will most likely absorb the greatest amount of incoming solar radiation?

(1) rough, dark-colored surface
(2) rough, light-colored surface
(3) smooth, dark-colored surface
(4) smooth, light-colored surface

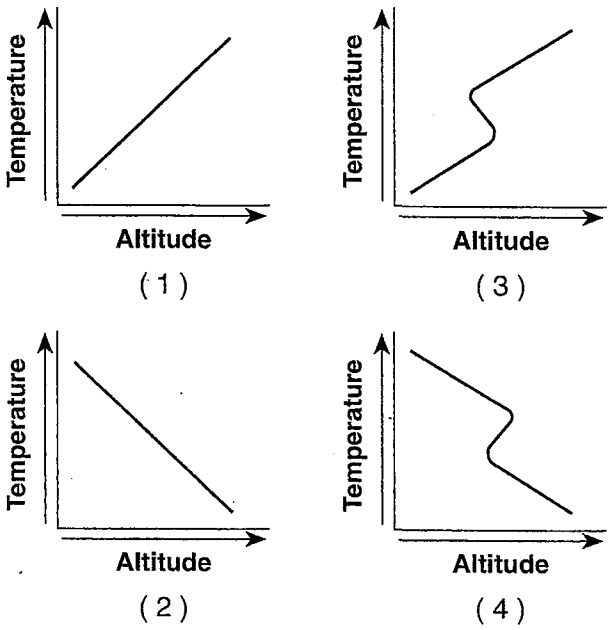
7. Compared to the other planets in our solar system, Jupiter, Saturn, and Neptune have

(1) shorter periods of rotation
(2) shorter periods of revolution
(3) greater eccentricities
(4) greater densities

8. Air pressure is usually highest when the air is

(1) cool and humid
(2) cool and dry
(3) warm and humid
(4) warm and dry

9. Which graph best shows the general relationship between altitude and temperature in the troposphere?



10. Which weather variable is measured by a barometer?

(1) dewpoint
(2) wind speed
(3) air pressure
(4) visibility

11. During which phase change will the greatest amount of energy be absorbed by 1 gram of water?

(1) melting
(2) freezing
(3) evaporation
(4) condensation

12. The Coriolis effect is a result of Earth's

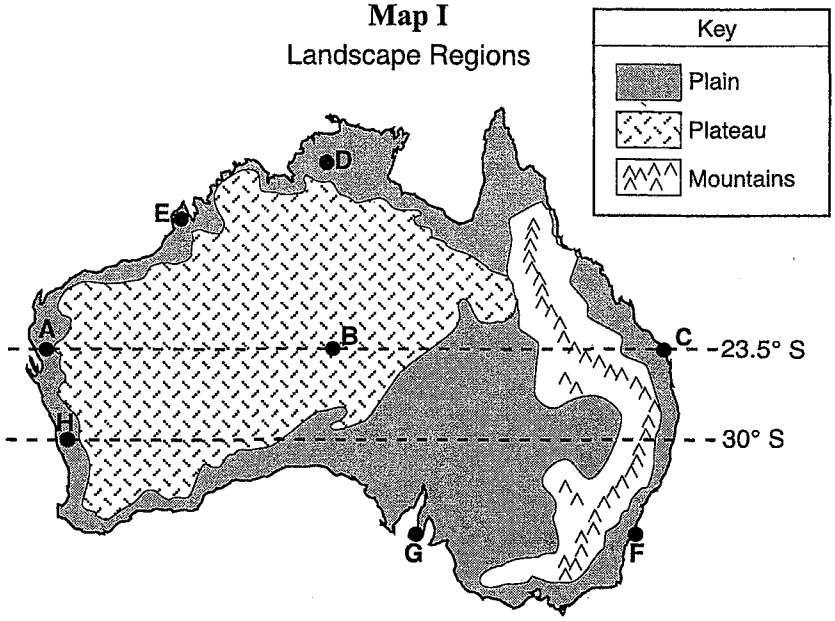
(1) tilted axis
(2) orbital shape
(3) revolution
(4) rotation

13. For weeks after a series of major volcanic eruptions, Earth's surface air temperatures are often

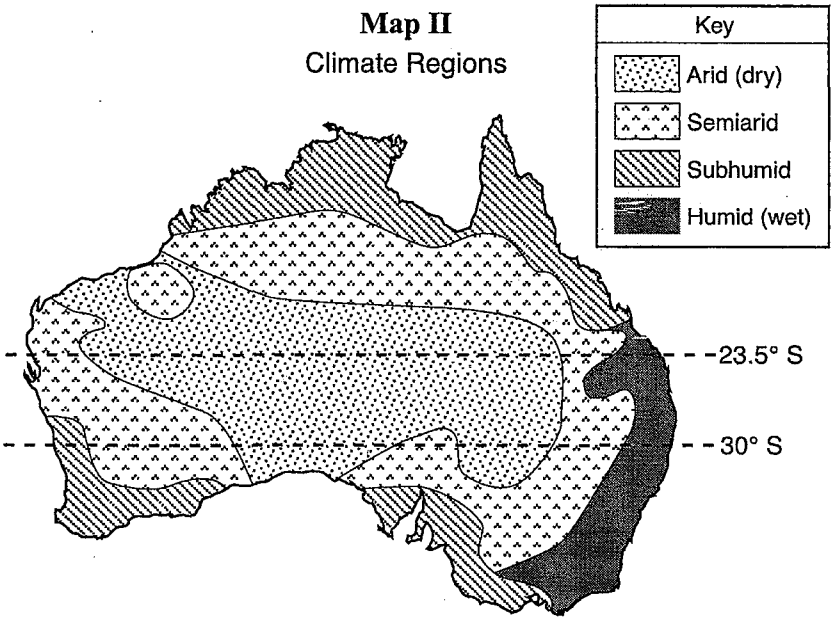
(1) warmer because ash and dust decrease atmospheric transparency
(2) warmer because ash and dust increase atmospheric transparency
(3) cooler because ash and dust decrease atmospheric transparency
(4) cooler because ash and dust increase atmospheric transparency

Base your answers to questions 14 through 17 on the two maps of Australia below. Map I shows Australia's major landscape regions. Letters *A* through *H* represent locations in Australia. Map II shows Australia's general climate regions.

Map I
Landscape Regions



Map II
Climate Regions



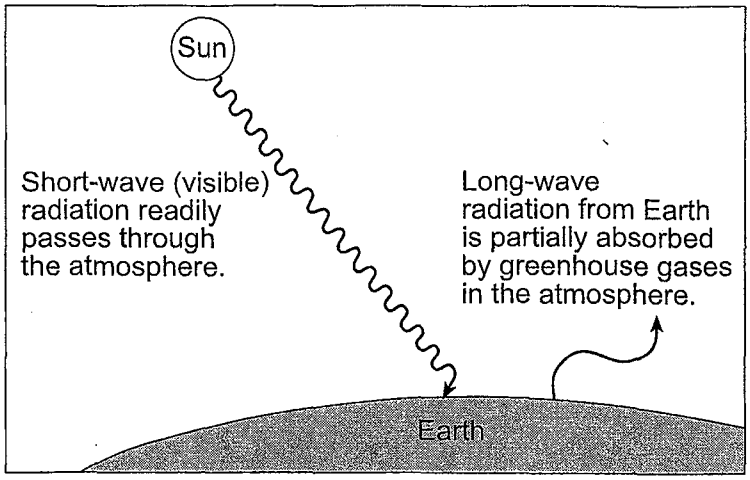
14. On which day will the noon Sun be directly overhead at location *C*?
(1) March 21
(2) June 21
(3) September 23
(4) December 21

15. The greatest yearly temperature range was most likely recorded at location
(1) *A*
(2) *B*
(3) *C*
(4) *D*

16. Which location's climate is most affected by the East Australia Current?
(1) *E*
(2) *F*
(3) *G*
(4) *H*

17. Which two locations have the driest climates?
(1) *A* and *B*
(2) *G* and *H*
(3) *C* and *F*
(4) *D* and *E*

Base your answers to questions 18 and 19 on the diagram below, which represents the greenhouse effect in which heat energy is trapped in Earth's atmosphere.



(Not drawn to scale)

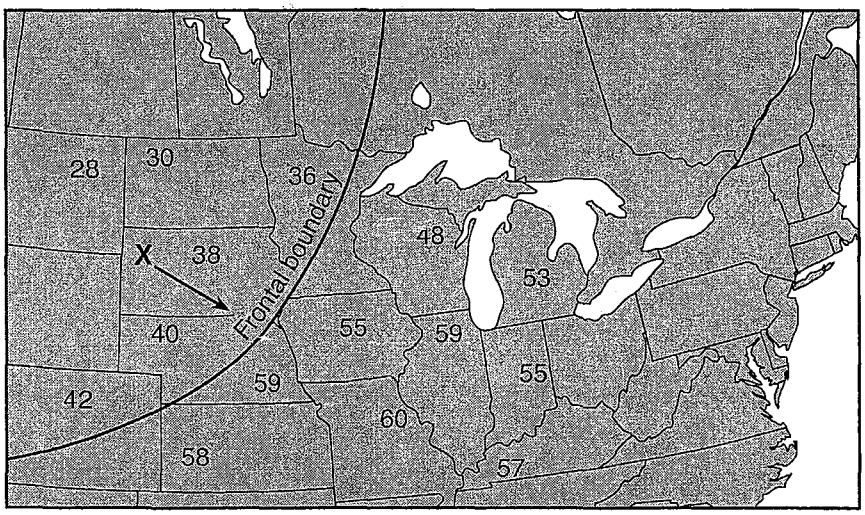
18. Which type of radiation from Earth is the long-wave radiation absorbed by greenhouse gases?

(1) ultraviolet
(2) visible light
(3) infrared
(4) radio waves

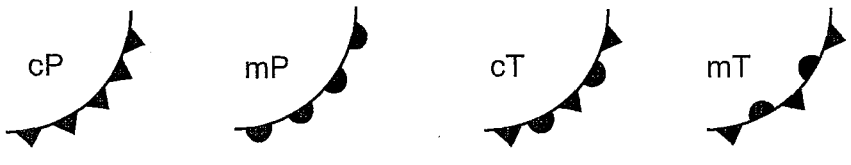
19. The Earth surface that best absorbs short-wave solar radiation has which characteristics?

(1) black and rough
(2) black and smooth
(3) white and rough
(4) white and smooth

20. The map below shows surface air temperatures, in degrees Fahrenheit, reported by weather stations in the north-central United States. Letter *X* represents an air mass moving in the direction shown by the arrow. A line marks a frontal boundary advancing in a southeasterly direction.

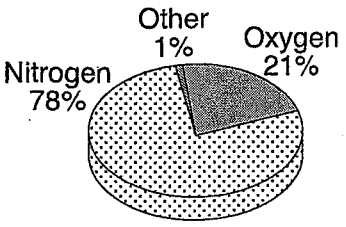


Which weather-map symbols best represent air-mass *X* and the frontal boundary shown on the map?

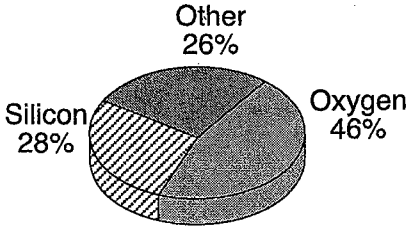


(1) (2) (3) (4)

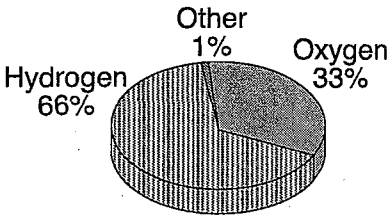
21. Which pie graph correctly shows the percentage of elements by volume in Earth's troposphere?



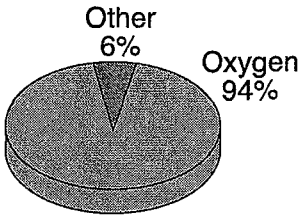
(1)



(3)



(2)

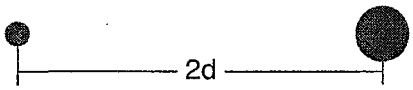


(4)

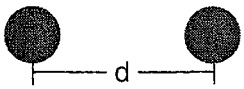
22. The symbols below represent star masses and distances.

●	represents a star with a mass the same as the Sun's mass
⬤	represents a star with a mass greater than the Sun's mass
d	represents a certain distance between star centers
2d	represents twice the distance between star centers

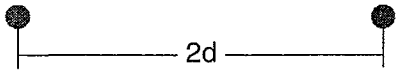
Which diagram shows two stars that have the greatest gravitational force between them?



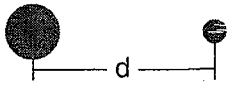
(1)



(3)

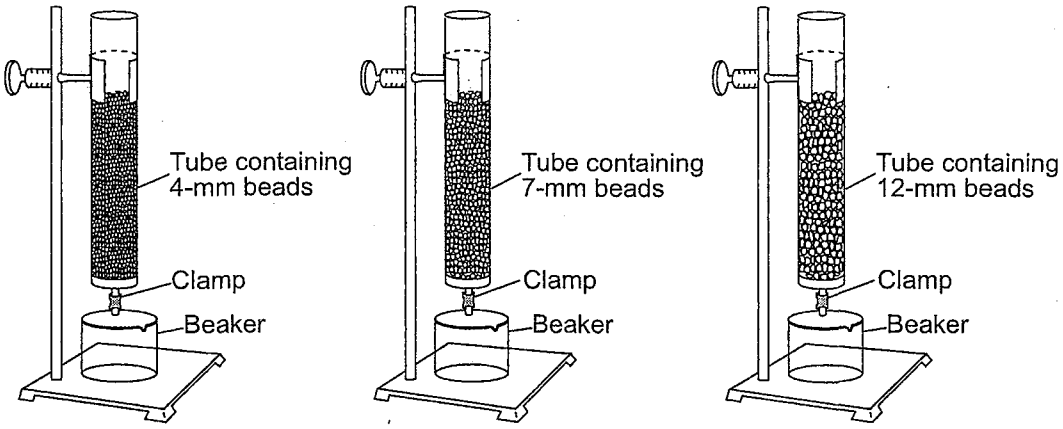


(2)



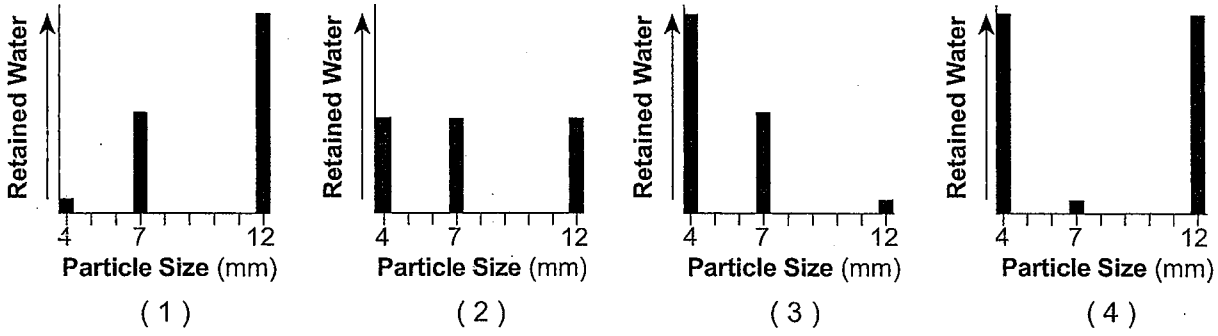
(4)

23. The diagram below shows three identical plastic tubes filled to the same level with spherical beads of different diameters. Each tube was filled with water to the top of the beads. The clamps were then opened to allow water to drain into the beakers.

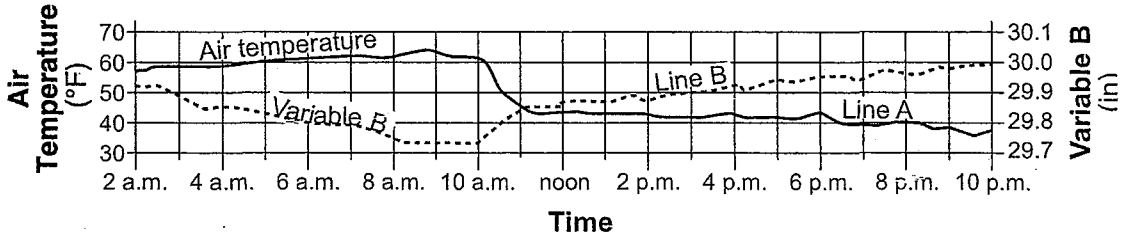


(Not drawn to scale)

Which graph best represents the relative amount of water retained by the beads in each tube?



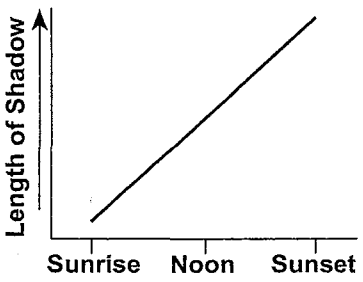
24. Data from two weather instruments have been recorded on the graph below. Line *A* on the graph represents air-temperature data. Line *B* was plotted using the scale for variable *B*.



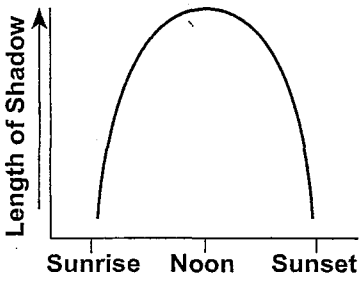
Line *B* on the graph represents data from which weather instrument?

(1) thermometer
(2) barometer
(3) psychrometer
(4) anemometer

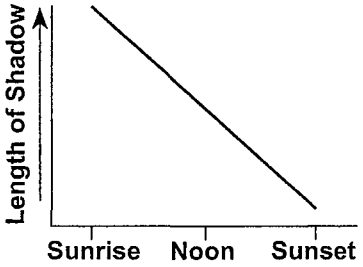
25. Which graph best shows the length of a shadow cast from sunrise to sunset by a flagpole in New York State?



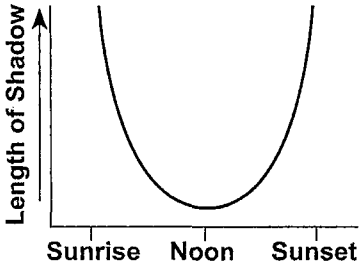
(1)



(3)

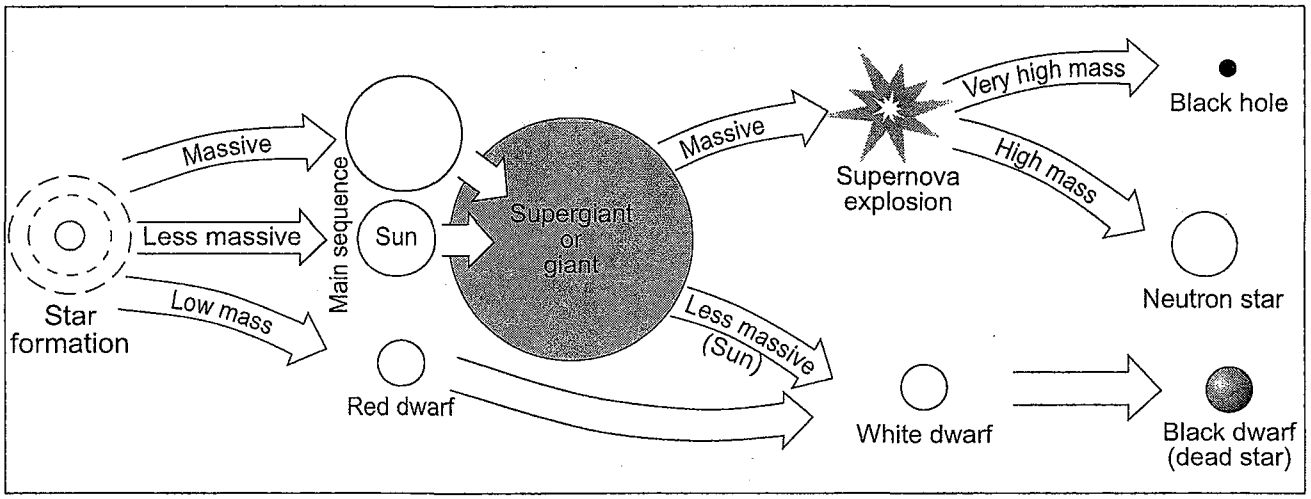


(2)



(4)

26. The diagram below represents possible stages in the life cycle of stars.

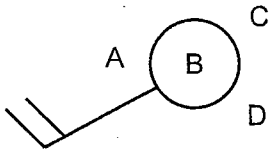


(Not drawn to scale)

Which star has the greatest probability of producing a supernova explosion?

(1) *Barnard's Star*
(2) *Betelgeuse*
(3) *Procyon B*
(4) *Sun*

27. Weather data is normally recorded at positions *A*, *B*, *C*, and *D* on the weather station model shown below.



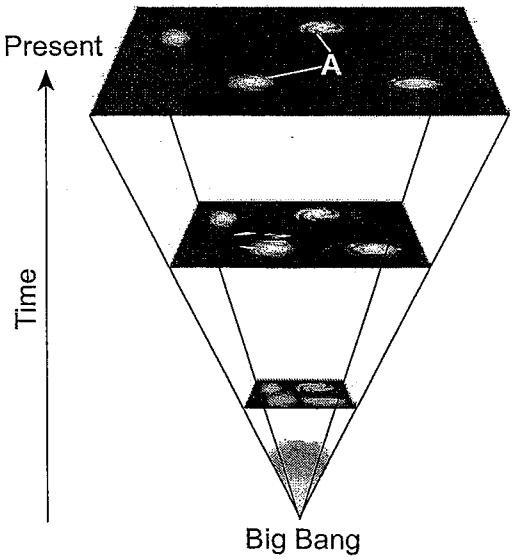
At which position should the measurements from a rain gauge be recorded?

(1) *A*
(2) *B*
(3) *C*
(4) *D*

28. By which process do stars convert mass into great amounts of energy?

(1) nuclear fusion
(2) heat transfer
(3) gravitational pull
(4) radioactive decay

29. The diagram below represents the development of our universe from the time of the Big Bang until the present. Letter *A* indicates two celestial objects.



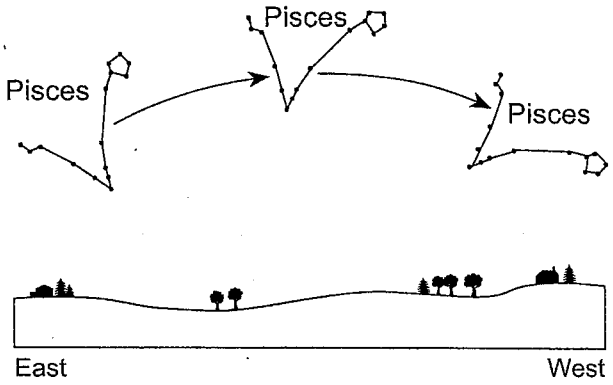
The present-day celestial objects labeled *A* are best identified as

(1) asteroid belts
(2) terrestrial planets
(3) spiral galaxies
(4) eccentric comets

30. The *least* amount of surface water runoff will occur when soil pore spaces are

(1) saturated and the slope is steep
(2) saturated and the slope is gentle
(3) unsaturated and the slope is steep
(4) unsaturated and the slope is gentle

31. The constellation Pisces changes position during a night, as shown in the diagram below.



Which motion is mainly responsible for this change in position?

(1) revolution of Earth around the Sun
(2) rotation of Earth on its axis
(3) revolution of Pisces around the Sun
(4) rotation of Pisces on its axis

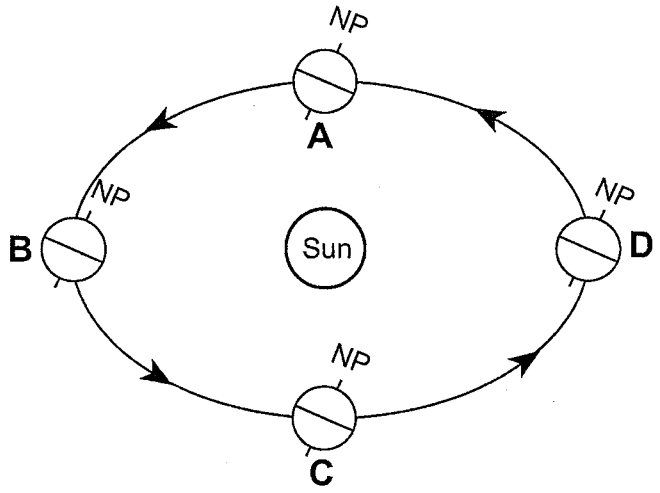
32. The diagram below represents the bright-line spectrum for an element.

The spectrum of the same element observed in the light from a distant star is shown below.

The shift in the spectral lines indicates that the star is moving

(1) toward Earth
(2) away from Earth
(3) in an elliptical orbit around the Sun
(4) in a circular orbit around the Sun

Base your answers to questions 33 through 35 on the diagram below, which represents Earth revolving around the Sun. Letters *A*, *B*, *C*, and *D* represent Earth's location in its orbit on the first day of the four seasons. NP represents the North Pole.



(Not drawn to scale)

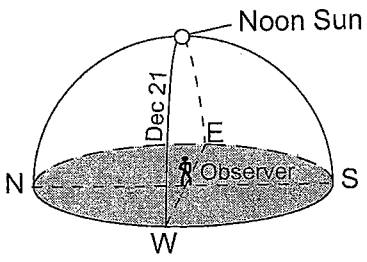
33. Which location in Earth's orbit represents the first day of summer in New York State?

(1) *A*
(2) *B*
(3) *C*
(4) *D*

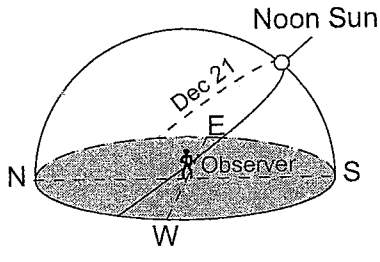
34. If the tilt of Earth's axis were decreased from 23.5° to 15°, New York State's winters would become

(1) warmer, and summers would become cooler
(2) warmer, and summers would become warmer
(3) cooler, and summers would become cooler
(4) cooler, and summers would become warmer

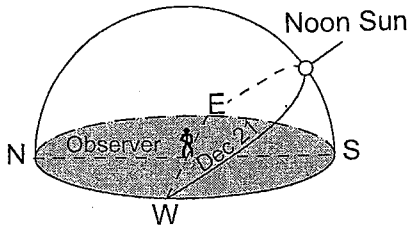
35. Which diagram best represents the Sun's apparent path as seen by an observer at 43.5° N latitude on December 21?



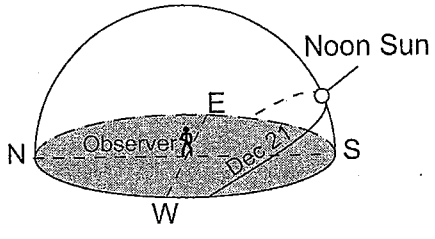
(1)



(3)

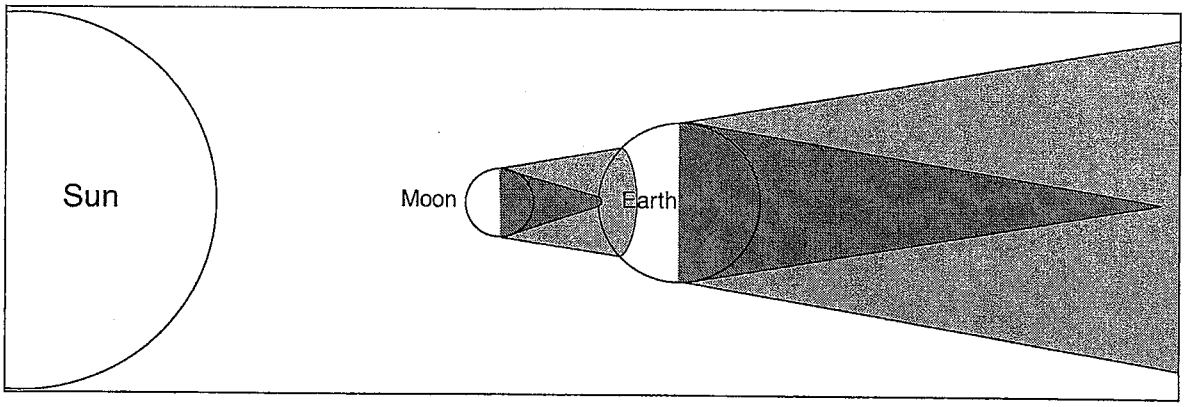


(2)

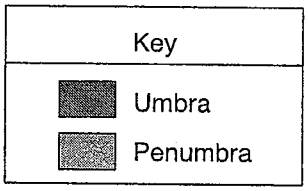


(4)

36. The diagram below shows the position of the Sun, the Moon, and Earth during a solar eclipse. The full shadow (umbra) and partial shadow (penumbra) of the Moon and Earth are shown.

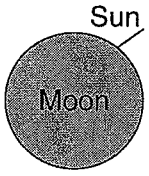


(Not drawn to scale)

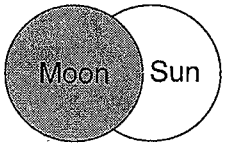


Which diagram best represents the appearance of the Sun and the Moon to an observer located within the umbra of the Moon's shadow on Earth's surface?

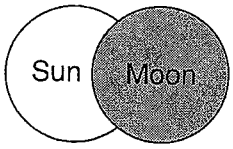
(1)



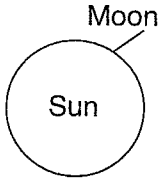
(3)



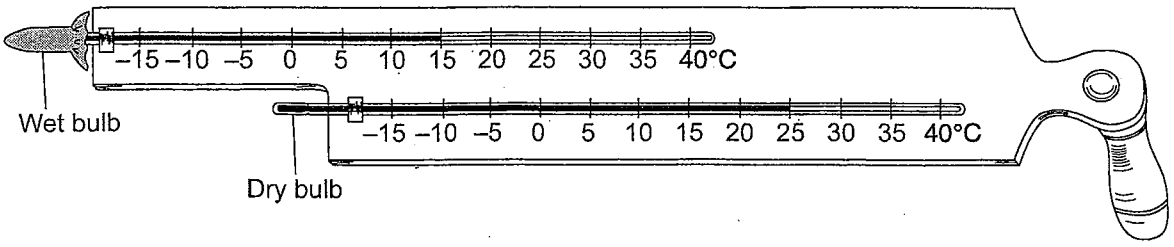
(2)



(4)



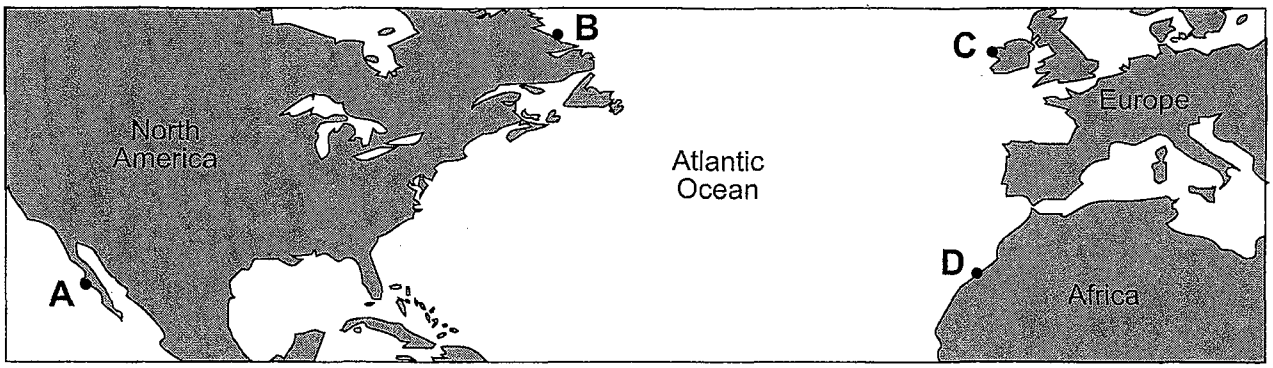
37. The diagram below shows the temperature readings on a weather instrument.



Based on these readings, the relative humidity of the air is closest to

(1) 8%
(2) 11%
(3) 32%
(4) 60%

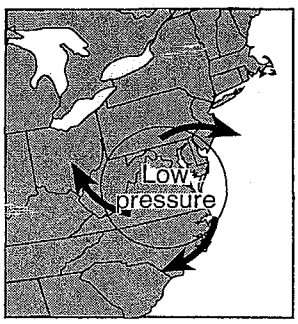
38. The map below shows four coastal locations labeled *A*, *B*, *C*, and *D*.



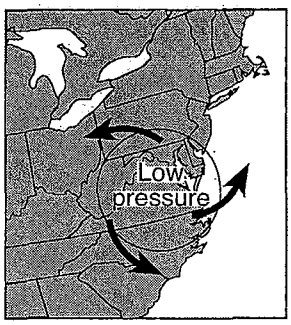
The climate of which location is warmed by a nearby major ocean current?

(1) *A*
(2) *B*
(3) *C*
(4) *D*

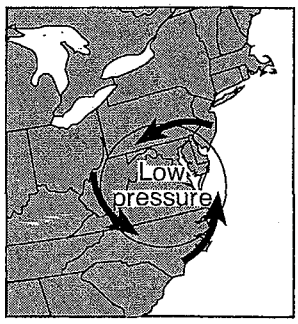
39. Which map best shows the general surface wind pattern in a low-pressure system located over the eastern United States?



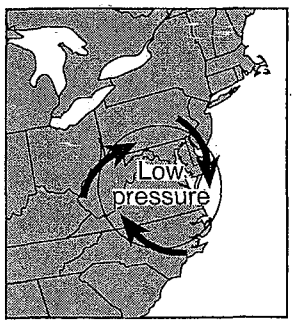
(1)



(3)

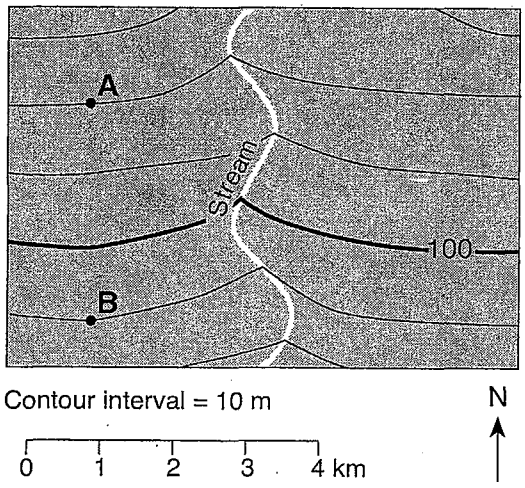


(2)



(4)

40. The topographic map below shows the location of a stream. Points *A* and *B* are locations on Earth's surface.



What is the gradient between points *A* and *B*?

(1) 1 m/km
(2) 2 m/km
(3) 10 m/km
(4) 20 m/km