

Please PRINT your name, school, area, and which test you are taking onto the scan-tron.

Choose the answer that best completes the statements or questions below and fill in the appropriate response on the form. If you change an answer, be sure to completely erase your first choice. Reference tables are located at the end of the test. A ruler is also on the reference sheets.

1. Hardness is an important property used to identify minerals. According to Mohs Scale, which of the following lists of minerals is arranged in order of increasing hardness? Mohs Scale reference tables.

- A) corundum, apatite, gypsum, feldspar
- B) gypsum, apatite, feldspar, corundum
- C) apatite, gypsum, feldspar, corundum
- D) feldspar, corundum, apatite, gypsum

2. The mineral, epidote, can be scratched by quartz, but not by orthoclase. The hardness of epidote is about (Use reference tables at the end of the test)

- A) 5.5
- B) 6.0
- C) 6.5
- D) 7.0

3. The mineral halite (sodium chloride), breaks easily to form cubes. The number of directions of cleavage that it shows is:

- A) three
- B) four
- C) six
- D) eight

4. Some of the properties of diamond are different than graphite because diamond:

- A) has a different arrangement of atoms
- B) diamond is a poor conductor of electricity
- C) forms larger crystals
- D) has a different chemical composition

Data Table

Mineral	Composition	Depth of Formation	Hardness	Electrical Conductor
graphite	carbon	shallow	1	good
diamond	carbon	very deep	10	poor

5. Using the table to the right which mineral can scratch A, B, and C, but not scratch D? Use reference tables at the end of the test.

- A) talc
- B) selenite gypsum
- C) fluorite
- D) quartz

Data Table

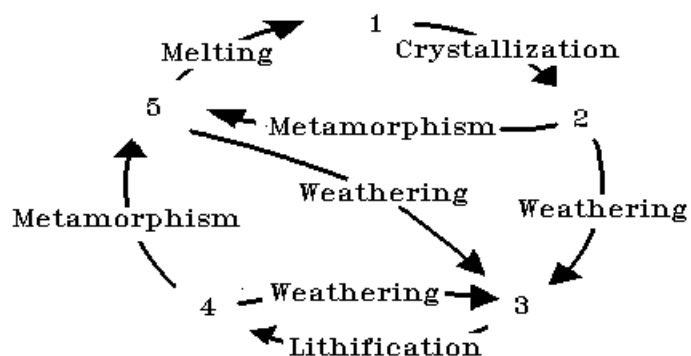
Mineral	Breakage	Hardness	Luster	Color
A	cleavage	2.5	metallic	silver
B	cleavage	2.5	nonmetallic	black
C	cleavage	3	nonmetallic	colorless
D	fracture	6.5	nonmetallic	green

6. The three major groups of rocks are:

- A) igneous, sedimentary and plutonic
- B) sialic, basic and mafic
- C) igneous, sedimentary and metamorphic
- D) plutonic, intrusive, and extrusive

7. In the diagram of the Rock Cycle, igneous rocks are represented by the number

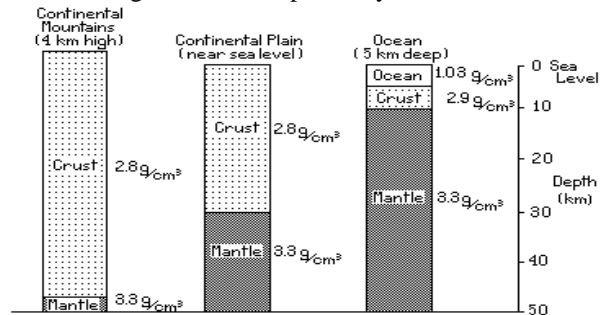
- A) 1
- B) 2
- C) 3
- D) 5



8. The study of how seismic waves change as they travel through Earth has revealed that
- A) *P*-waves travel more slowly than *S*-waves through Earth's crust
 - B) seismic waves travel more slowly through the mantle because it is very dense
 - C) Earth's outer core is solid because *P*-waves are not transmitted through this layer
 - D) Earth's outer core is liquid because *S*-waves are not transmitted through this layer

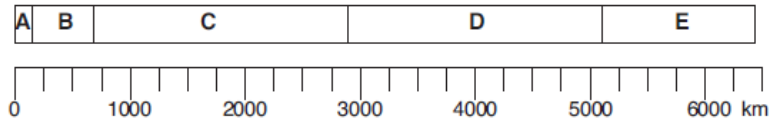
9. The division of the Earth's interior into crust and mantle, as shown in the diagram, is based primarily on the study of

- A) radioactive dating
- B) seismic waves
- C) volcanic eruptions
- D) gravity measurements



The diagram below represents zones of the Earth's interior, identified by letters A through E. The depth is measured in kilometers. Use the diagram with questions 10, 11, and 12.

10. Which zone is characterized by partially melted rock and large-scale convection currents?
- A) A
 - B) B
 - C) C
 - D) E



11. What is the approximate thickness of zone C?

- A) 650 km
- B) 1600 km
- C) 2250 km
- D) 2900 km

12. *S*-waves produced by an earthquake are transmitted through zones

- A) A and B only
- B) A, B, and C only
- C) C, D, and E only
- D) D and E only.

13. Crustal plates that fit together to make the earth's lithosphere are generated at and move away from

- A) transform faults
- B) rift zones
- C) oceanic trenches
- D) subduction zones

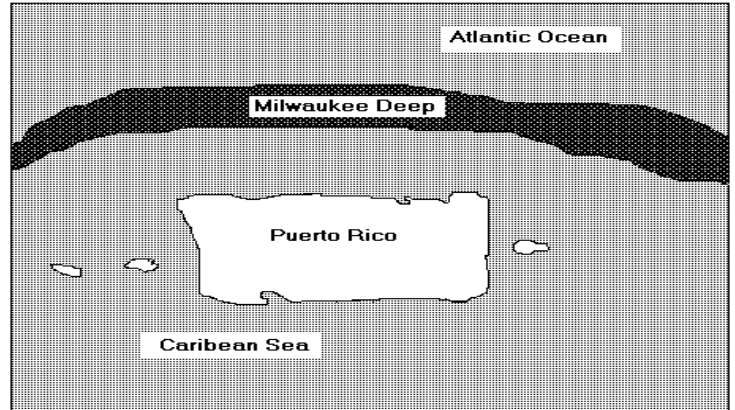
14. Crustal plates seem to move because of

- A) the earth's magnetic field
- B) the earth's curvature
- C) circulation of magma in the mantle
- D) attraction of gravity from the moon

15. Continental volcanoes, like Mt. Rainier and Mt. St. Helens on the Cascade Range in the state of Washington, form above

- A) subduction zones
- B) plate collision zones
- C) spreading rift zones
- D) hot spots

The map below shows the island of Puerto Rico and the Milwaukee Deep (sometimes known as the Puerto Rico Trench). Use it with questions 16 and 17.



16. The map leads to the interpretation that Puerto Rico is located
- | | |
|---------------------------|--------------------------|
| A) over a hot spot | C) on a rift zone |
| B) over a subduction zone | D) on a terminal moraine |
17. A feature which you could reasonably expect to find on the islands south of the Puerto Rican Trench is
- | | |
|---------------------|------------|
| A) volcanoes | C) cirques |
| B) transform faults | D) tarns |
18. When two tectonic plates collide, oceanic crust usually subducts beneath continental crust because oceanic crust is primarily composed of igneous rock that has
- | | |
|------------------------------|-------------------------------|
| A) low density and is mafic | C) high density and is mafic |
| B) low density and is felsic | D) high density and is felsic |
19. When the rock on a fault is displaced vertically and the head wall (hanging wall) moves down during an earthquake, the fault is a
- | | |
|------------------|----------------------|
| A) normal fault | C) thrust fault |
| B) reverse fault | D) strike-slip fault |
20. Volcanoes on island arcs (like Mt. Fujiama in Japan) usually have composite cones. They are likely to have
- | | |
|------------------------|---|
| A) explosive eruptions | C) unpredictable eruptions (quiet or explosive) |
| B) quiet eruptions | D) no more eruptions |
21. The Watchung Mts. in central New Jersey were formed from at least three separate lava flows. Since the rock cooled fairly quickly, it is fine grained and therefore is a
- | | |
|------------|------------|
| A) felsite | C) granite |
| B) gabbro | D) basalt |
22. The Atacama Desert is located in Chile and Peru between the Andes Mts. of South America and the cold Humboldt Current in the Pacific Ocean. The desert climate is caused by
- | | |
|---------------------------------|---|
| A) a wind shadow from the Andes | C) low evaporation from the Humboldt Current |
| B) tropical high temperatures | D) cold air descending from the Andean glaciers |
23. Most of the world's major deserts are located about 30° north or south latitude. They lie beneath the
- | | |
|---------------------------------|-----------------------------------|
| A) equatorial low pressure belt | C) subtropical high pressure belt |
| B) temperate low pressure belt | D) subpolar high pressure belt |

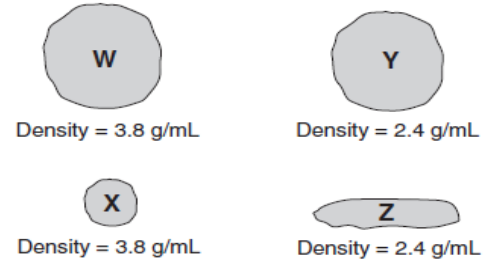
24. The diagram shows what happens to a rock within a stream's erosional-depositional system as time passes. Which process of change is best represented by the sequence of diagrams shown?

- A) deposition
- B) metamorphism
- C) condensation
- D) weathering



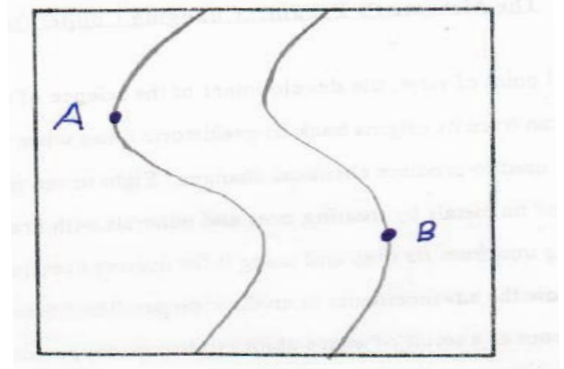
25. A stream is transporting particles W, X, Y, and Z. What would be the order in which these particles settle as the velocity of the stream decreases?

- A) X, W, Y, Z
- B) Z, Y, W, X
- C) W, X, Y, Z
- D) Z, Y, X, W



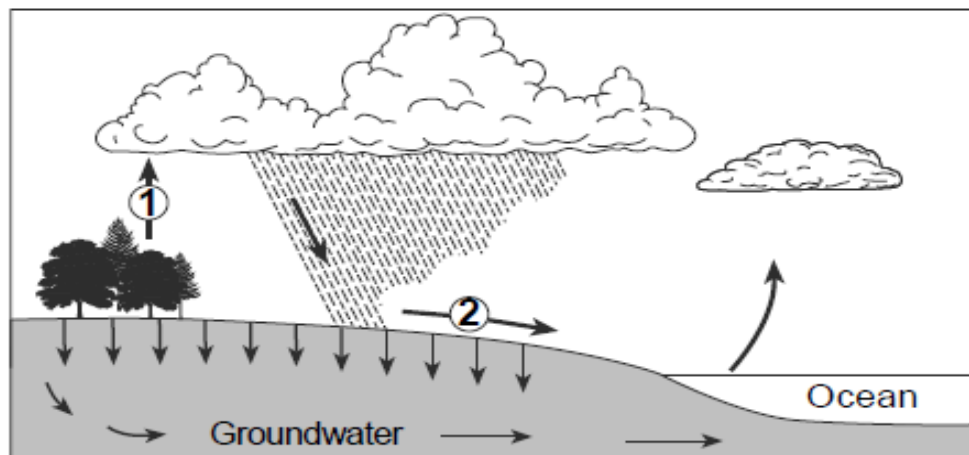
26. The map below shows a meandering river. Points A and B are locations on the bank of the river. What are the major processes taking place at locations A and B?

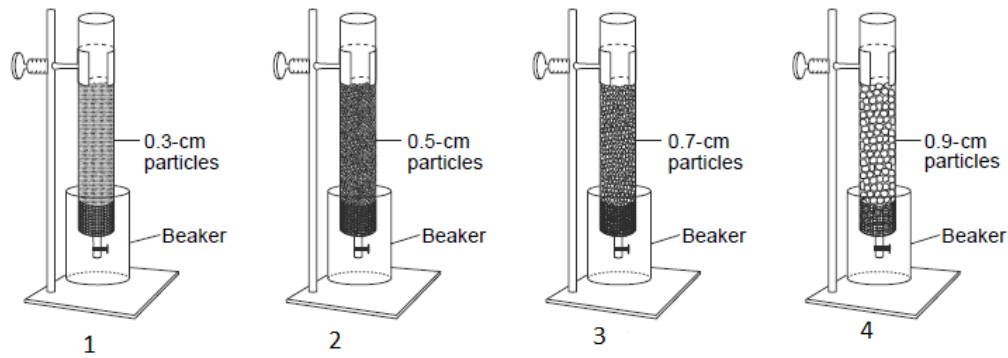
- A) deposition at A; erosion at B
- B) erosion at A; deposition at B
- C) deposition at both A and B
- D) erosion at both A and B.



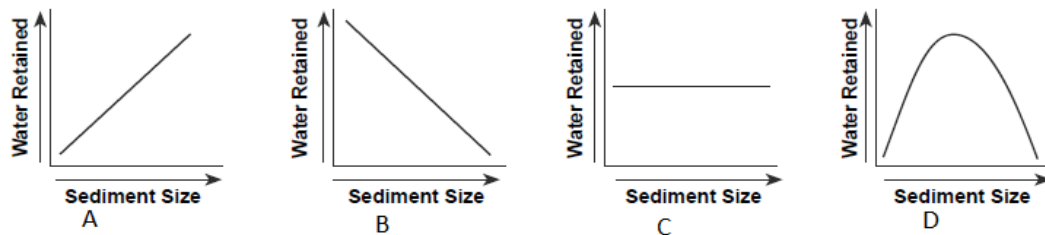
27. The diagram below represent processes in the water cycle. Which processes in the water cycle are identified by the numbered arrows?

- A) process 1 is transpiration; process 2 is runoff
- B) process 1 is precipitation; process 2 is runoff
- C) process 1 is condensation; process 2 is infiltration
- D) process 1 is evaporation; process 2 is infiltration



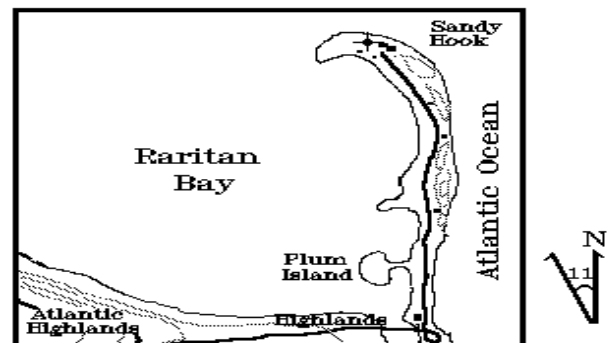


28. The diagrams above represent a setup for studying groundwater. Tubes 1, 2, 3, and 4 contain equal volumes of sediments. Within each tube, the sediments are uniform in size, shape, and packing. A test for ground water retention was conducted by first filling each tube with water, then draining the water into beakers. Which graph represents the general relationship between the sediment size and the amount of water retained by the sediments after the tubes had drained?



29. The greenhouse effect will cause sea level to rise. The result will cause landward migration of
 A) guyots
 B) cuestas
 C) estuaries
 D) aretes

30. Sandy Hook, at the entrance to Raritan Bay and New York Harbor, has been extended to the north and shaped into a hook mostly by
 A) the Gulf Stream and refraction of waves
 B) the wind and discharge from the Hudson River
 C) longshore currents and discharge from the Hudson River
 D) longshore currents and refraction of waves



31. The narrow, sandy, barrier islands in the ocean along the coast of New Jersey were deposited over time by
 A) wind
 B) streams
 C) glacial ice
 D) wave action

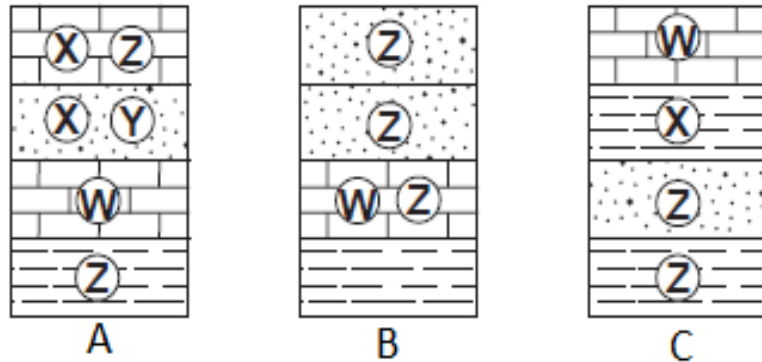
32. The weathered and eroded fragments of rock at the bottom of a slope or cliff are known to geologists as
 A) rubble
 B) talus
 C) detritus
 D) waste

33. Alternate freezing and thawing in cold, moist climates is similar in hot, desert climates to the process of
- A) hydration
 - B) leaching
 - C) exfoliation
 - D) clay formation

34. What percentage of Earth's history represents human existence?
- A) less than 1%
 - B) 1.8 %
 - C) 23.5 %
 - D) more than 50%

35. The cross sections below represent three widely separated bedrock outcrops which are labeled A, B, and C. The letters W, X, Y, and Z represent fossils found in the rock layers. Which fossil would be the best index fossil?

- A) W
- B) X
- C) Y
- D) Z



36. A fossilized species of graptolite was found in an outcrop of black shale near Schenectady, New York. Referring to the table below, which of the following might be an appropriate age for the rock formation?

- A) 294 million years
- B) 339 million years
- C) 417 million years
- D) 500 million years

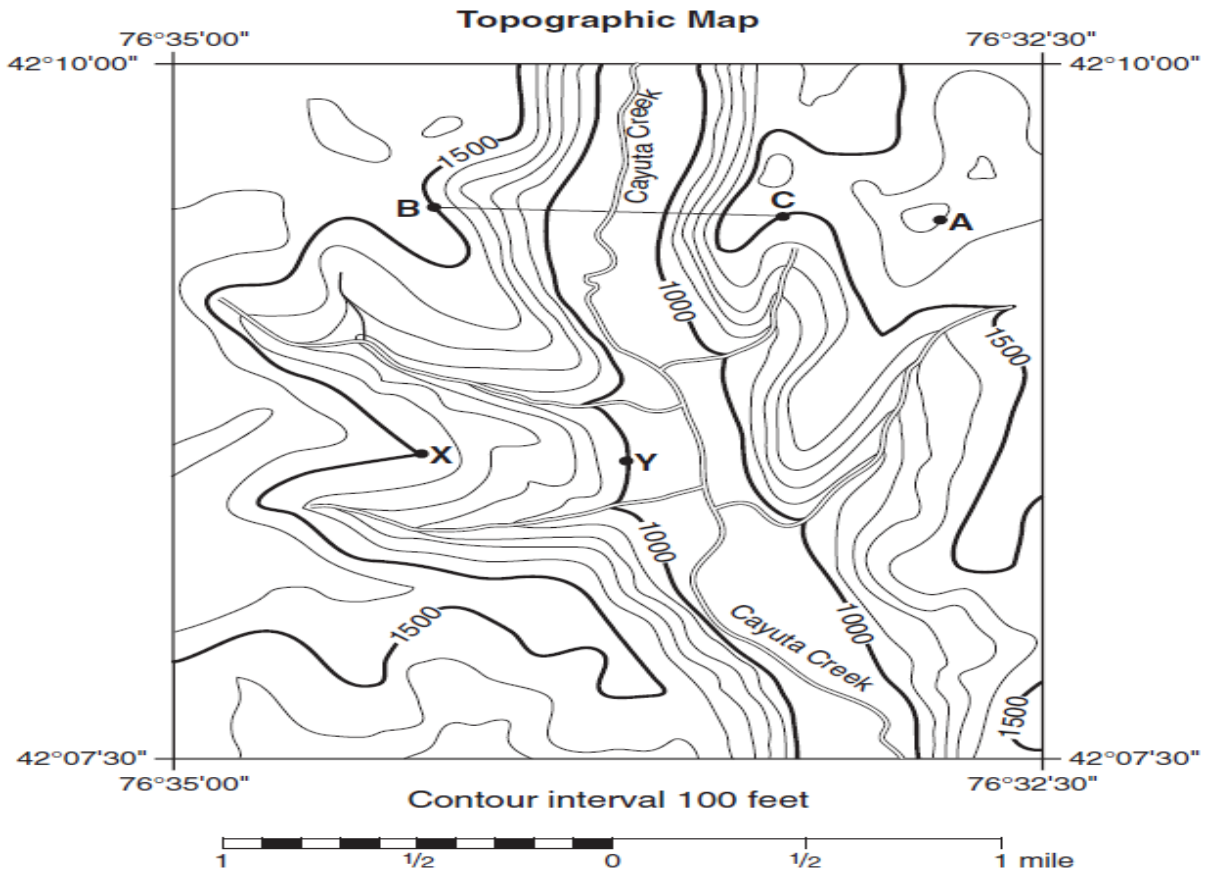
Period	Index Fossil
Permian	Tree fern
Mississippian	Crinoid
Devonian	Brachiopod
Silurian	Trilobite
Ordovician	Graptolite

37. The **epoch** when the last ice sheet advanced into New Jersey is known as the

- A) Pliocene
- B) Paleozoic
- C) Permian
- D) Pleistocene

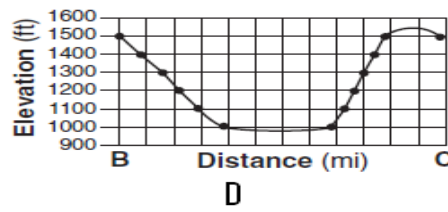
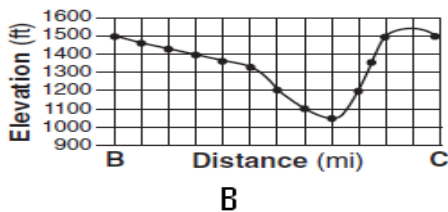
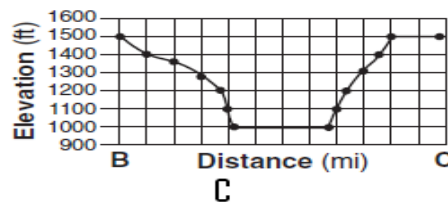
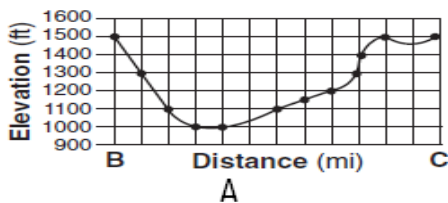
38. In 2004 geologists created the first new geologic period to be named in 113 years. It is the Ediacaran Period, named for a group of hills in Australia. It began about 620 million years ago. Of what era is it a part?

- A) PreCambrian Era
- B) Paleozoic Era
- C) Mesozoic Era
- D) Cenozoic Era



Use the map of Cayuta Creek for questions 39 through 42. On the map are letters A, B, and C. Also are letters X and Y.

39. Which graph below best represents the profile between points B and C?



40. What is the elevation of point A on the map?

- A) 1700 ft B) 1650 ft C) 1600 ft D) 1550 ft

41. What is the approximate gradient between points X and Y?

- A) 100 ft/mile B) 250 ft/mile C) 500 ft/mile D) 1000 ft/mile

42. What evidence supports the inference that the meltwater river that once occupied the Cayuta Creek valley was larger than the modern Cayuta Creek?

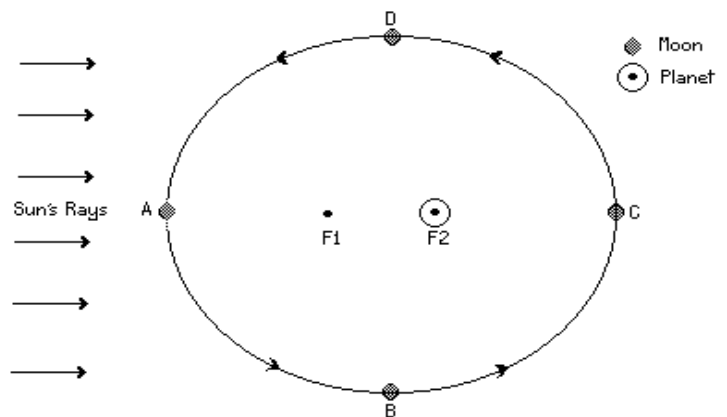
- A) The modern Cayuta Creek occupies a V-shaped valley
 B) The valley floor is wider than the modern Cayuta Creek
 C) The modern Cayuta Creek lacks meanders and a flood plain
 D) The tributary streams meet the modern Cayuta Creek at nearly right angles.

43. The average width of a standard time zone in degrees is
 A) 15° B) 24° C) 180° D) 360°
44. The international dateline runs north/south through
 A) Greenwich, England B) Washington, D.C. C) the Pacific Ocean D) the Atlantic Ocean
45. When crossing the international dateline from west to east, the date is
 A) one day later, only at midnight C) one day earlier only at midnight
 B) one day later at any time D) one day earlier at any time
46. What is the shortest distance between any two points on the surface of the Earth called?
 A) the equator B) longitude C) latitude D) a great circle
47. You wish to use a flat map with minimum distortion of land area and shape. Which of the following should you choose?
 A) cylindrical B) polar C) conic D) polyconic
48. Compared to other stars in the Hertzsprung-Russell main sequence, the sun in size and color is
 A) small and red B) medium and red C) medium and yellow D) large and yellow
49. The Coriolis effect provides evidence that the Earth
 A) has a magnetic field B) has an elliptical orbit C) revolves around the sun D) rotates on its axis
50. Weathering of rock on the surface of the moon is caused by
 A) frost action during the lunar night C) sandblasting from the solar wind
 B) bombardment with micrometeorites D) water running into the lunar seas
51. Eclipses do NOT occur every month because the Moon's
 A) rate of rotation is 15° each hour D) period of rotation and period of revolution are the same
 B) orbit is inclined to Earth's orbit
 C) period of revolution is 27.3 days

The diagram below represents a model of a moon, or satellite, orbiting a planet. Positions A, B, C, & D are positions that can be occupied by the moon or satellite. F1 & F2 are focal points of the orbit. Use the diagram with questions 52, 53, 54

52. If the moon takes 6.8 days to move from point A to point B, the best estimate of the time required for one complete revolution is
 A) 20 days B) 27 days C) 34 days D) 41 days

53. When viewed from the planet, the moon has the greatest apparent diameter at point
 A) A C) C
 B) B D) D



54. If the distance from F1 to F2 is 42,000 km and the straight -line distance from A to C is 768,000 km, the eccentricity of the moon's orbit is about
 A) 0.055 C) 18.3
 B) 0.183 D) 5.2

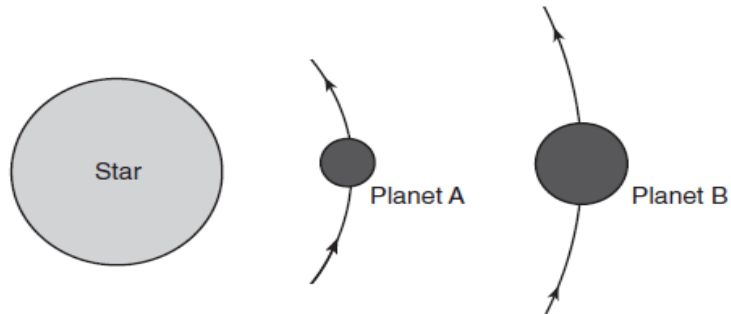
55. Which two characteristics do Jovian planets have in common?

- A) Large diameters and high densities
- B) Large diameters and low densities
- C) Small diameters and high densities
- D) Small diameters and low densities

56. The diagram below represents two planets of equal mass revolving around a star.

Compared to planet A, planet B has

- A) weaker gravitational attraction to the star and a shorter period of revolution
- B) weaker gravitational attraction to the star and a longer period of revolution
- C) stronger gravitational attraction to the star and a shorter period of revolution
- D) stronger gravitational attraction to the star and a longer period of revolution



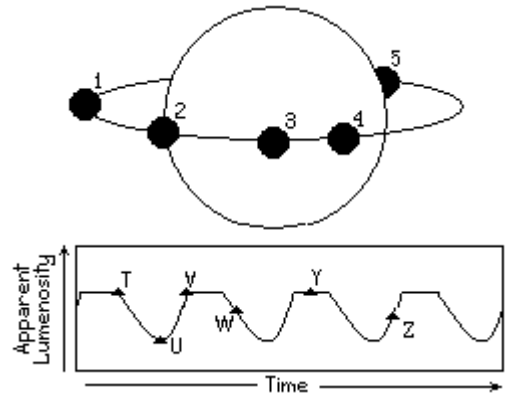
The diagram below represents a distant star with a single planet in different positions in its orbit around the star. The graph below the star is an astronomer's record of the apparent luminosity of the star over a period of time. Use the diagram with questions 57 and 58.

57. The number of orbits of the planet observed by the astronomer was

- A) 2
- B) 4
- C) 4.5
- D) 8

58. The position on the graph which shows that the planet is hidden behind the star is

- A) U
- B) V
- C) W
- D) Y



59. The diagram below represents the spectral lines from the light of an element in a laboratory on Earth.



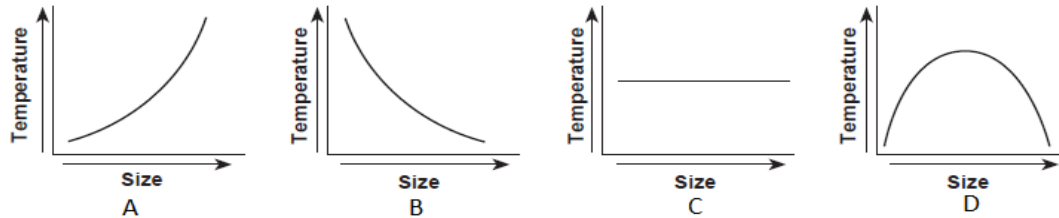
Which diagram below best represents the pattern of spectral lines from the same element when it was observed by Edwin Hubble in the light from a distant galaxy?

- A)
- B)
- C)
- D)

60. Which statement best describes how are galaxies distributed in space?

- A) the galaxies lie on sheets and chains surrounding empty space
- B) the galaxies are distributed uniformly in space
- C) there are a few large clusters of galaxies with nothing in between
- D) there are many clusters of galaxies near us, but nothing beyond.

61. In the 1920s Edwin Hubble discovered the red shift pattern of galaxies which led to the theory of an expanding universe. This expansion suggest an explosion. In the 1940s scientists predicted that the heat left over from the explosion would fill the universe. In the 1960s satellite probes found that this heat, cosmic microwave background radiation uniformly fills the universe. The measured temperature was about 3 Kelvin. This cosmic microwave radiation has been cooling as the universe expands. Which graph best illustrates the relationship between an expanding universe and the temperature indicated by the cosmic microwave background radiation?



62. Astronomers have observed that the galaxies in the universe are moving away from each other at increasing velocities. This implies a repulsive force that they are calling

- A) anti-gravity
- B) negative gravity
- C) dark matter
- D) dark energy

63. A one degree temperature change on the Fahrenheit scale is equal to a _____ degree change on the Celsius scale. $^{\circ}\text{C} \times 9/5 + 32 = ^{\circ}\text{F}$

- A) 0.56°C
- B) 0.90°C
- C) 1.8°C
- D) 3.6°C

64. Which of the following is NOT a primary control of climate?

- A) Altitude
- B) latitude
- C) daily weather
- D) ocean currents

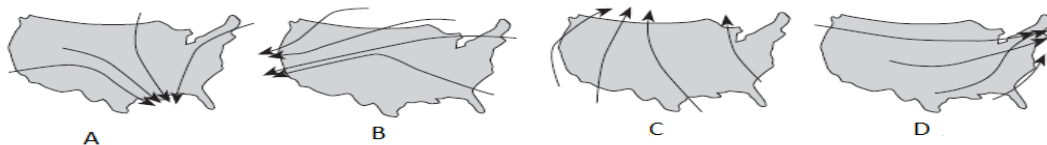
65. Which of the following processes absorbs the most latent heat?

- A) melting
- B) freezing
- C) evaporation
- D) condensation

66. In which direction do surface winds around low pressure centers in the Northern Hemisphere generally move?

- A) clockwise away from the center of the low.
- B) clockwise toward the center of the low.
- C) counterclockwise away from the center of the low
- D) counterclockwise toward the center of the low.

67. Which map shows normal paths followed by low-pressure storm centers as they cross the United States?



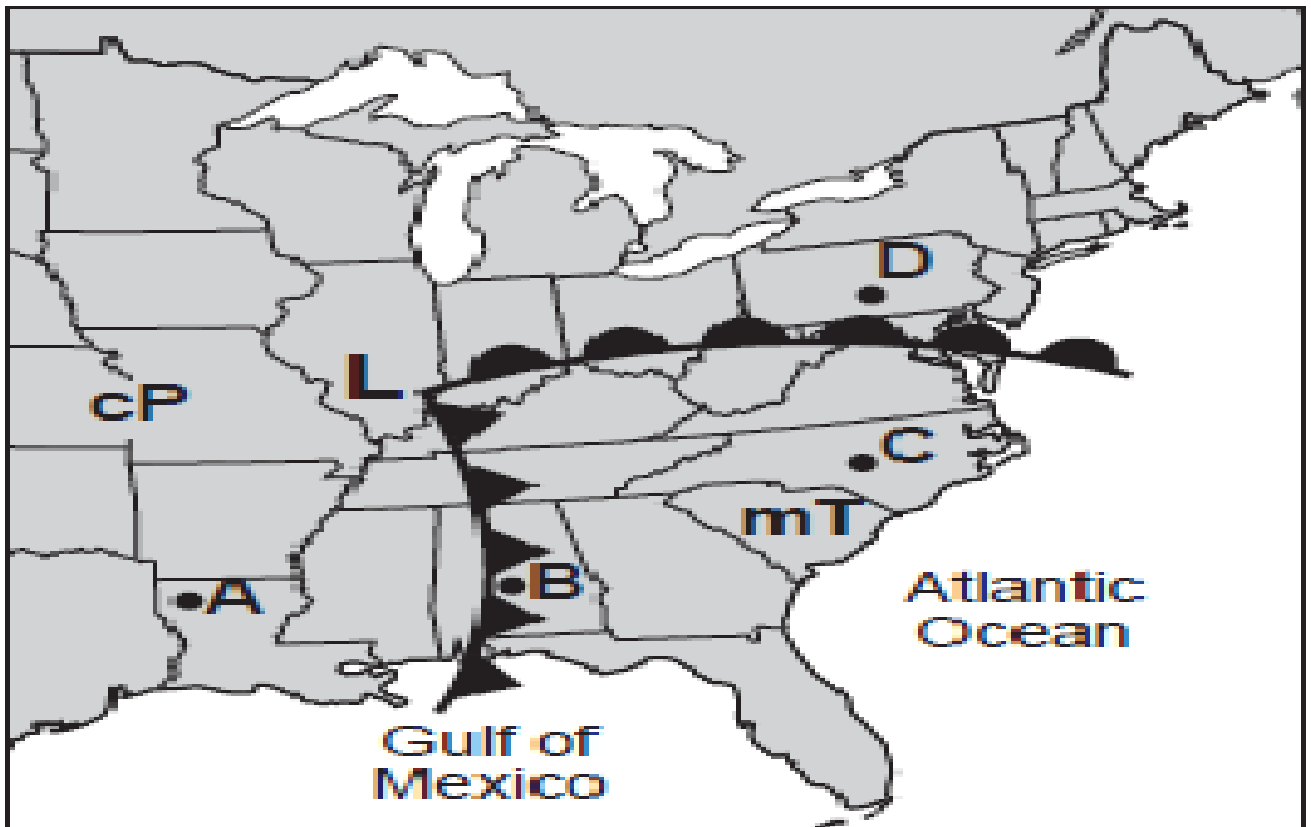
68. Clouds that cover the sky in flat sheets are

- A) cirrus
- B) cumulus
- C) stratus
- D) nimbus

69. A student reads the dry bulb of a sling psychrometer as 28°C and the wet bulb as 20°C . The relative humidity is closest to (relative humidity charts found in reference tables)

- A) 7%
- B) 21%
- C) 40%
- D) 47%

The weather map below shows a low-pressure system with two fronts extending from its center (L). There are surface points lettered A, B, C, and D. There are two different labeled air masses. Use the map with questions 70, 71, and 72.



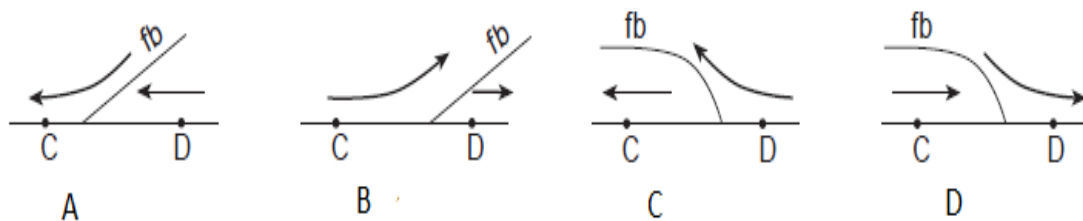
70. Which atmospheric conditions describe the air mass that is influencing weather conditions at location C?

- A) cool and dry B) cool and moist C) warm and dry D) warm and moist

71. Which locations are most likely experience precipitation?

- A) A and B B) B and C C) C and D D) D and B

72. Which cross section best represents the frontal boundary (fb) and general pattern of air movements between points C and D?



New Jersey Science League

Earth Science Exam - Answer Key

January 2014 (corrections in ())

1. B	19. A	37. D	55. B
2. C	20. C	38. A	56. B
3. C(A)	21. D	39. A(D)	57. B
4. A	22. C	40. A	58. D
5. C	23. C	41. D	59. C
6. C	24. D	42. B	60. A
7. B	25. A	43. A	61. B
8. D	26. C(D)	44. C	62. D
9. B	27. A	45. D	63. A
10. B	28. B	46. D	64. C
11. C	29. C	47. D	65. C
12. B	30. D	48. C	66. D
13. B	31. D	49. D	67. D
14. C	32. B	50. B	68. C
15. A	33. C	51. C(B)	69. D
16. B	34. A	52. B	70. D
17. A	35. A	53. C	71. D
18. C	36. D	54. A	72. B

Test Specifications

Since some earth science courses in New Jersey start with geology, others with astronomy, and still others with meteorology, each of the four tests will include the following topics. Over time, this provides an equal opportunity to everyone. The number in parentheses indicates the number of questions for that topic. The number per topic occasionally varies by one or two, but usually does not.

Minerals (4)	Sun (2)
Rocks (2)	Moon (2)
Earth Structure (2)	Sun-Moon-Earth System (3)
Plate Tectonics (4)	Solar System (3)
Faults/Folds/Seismology (3)	Stars (2)
Vulcanism (2)	Galactic Systems (2)
Glaciation/Deserts (2)	Cosmology (2)
Rivers:Erosion & Deposition (3)	Insolation/Temperature/Air Masses (3)
Ground Water/Caves (2)	Atmospheric Pressure/Highs/Lows (4)
Ocean Shore Line/Currents/Salinity(3)	Moisture in the Atmosphere (3)
Weathering/Mass Wasting (2)	Frontal Systems (3)
Historical Geology (4)	Interpreting Weather Maps (3)
Map Reading: Road/Topo/Geologic (4)	
Geodesics/Time/Map Projections (3)	

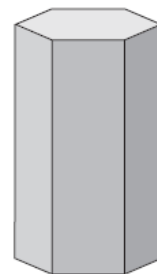
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1. The hardness of minerals is most closely related to the
- A) mineral's color
 - B) mineral's abundance in nature
 - C) the iron content of the minerals
 - D) internal arrangement of the atoms in the mineral.

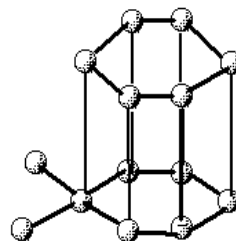
2. Which mineral precipitates from oceans and forms rock salt?
- A) quartz
 - B) fluorite
 - C) olivine
 - D) halite

3. The hexagon shaped cylinder to the right has a mass of 80 grams and a volume of 32 cm^3 . What is the percentage error, if the actual density of the object is 2.7 g/cm^3 ?
- A) 0.2 %
 - B) 7.4%
 - C) 5.0 %
 - D) 8.0%

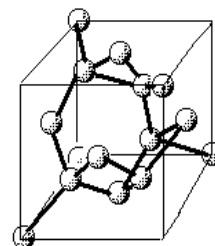


4. The diagrams to the right represent the arrangement of carbon atoms in graphite and diamond. Which conclusion about the two minerals is best supported by these diagrams?

- A) They have similar color because of their similar composition.
- B) They have similar crystal shapes because of their similar composition.
- C) They have different chemical composition due to the difference in their atomic arrangements.
- D) They have different physical properties due to their different atomic arrangements.



Graphite



Diamond

5. When subjected to heat and pressure by deep burial, limestone becomes
- A) marble
 - B) phyllite
 - C) schist
 - D) gneiss

6. Sand beaches near the mouths of rivers are usually made up of grains of
- A) hornblende
 - B) calcite
 - C) quartz
 - D) feldspar

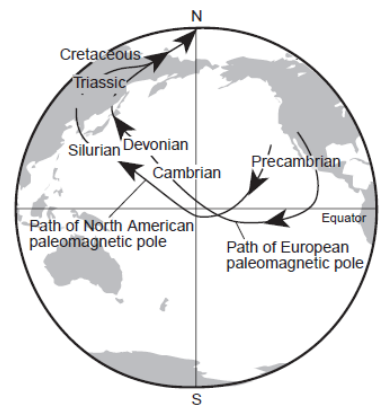
7. Sediment found at a certain point along the shores of the Delaware River in Cape May County is composed of mixed sand and pebbles. If the sediments are buried, compressed, and cemented, the rock that will form is

- A) conglomerate
 - B) breccia
 - C) shale
 - D) sandstone
8. All of the rocks which make up the continents, taken together, resemble most closely
- A) granite
 - B) basalt
 - C) limestone
 - D) shale
9. Except for water on the surface, the only part of the earth that is thought to be liquid is the
- A) upper mantle
 - B) lower mantle
 - C) outer core
 - D) inner core

10. The supercontinent which existed when all the present continents were last joined is known as
 A) Gondwanaland C) Laurasia
 B) Eurasia D) Pangaea
11. The Aleutian Islands extend westward from southern Alaska to form the northern boundary of the Pacific Ocean. These volcanic islands were formed by the nearby
 A) subduction of a continental plate
 B) subduction of an oceanic plate
 C) divergence of a continental plate
 D) divergence of an oceanic plate
12. In 1986 the Baseball World Series in San Francisco was delayed by a major earthquake on a branch of the San Andreas fault. The tectonic cause was
 A) the subduction of a plate carrying ocean floor.
 B) collision of two plates carrying continents on their leading edges.
 C) one plate sliding laterally along the edge of another.
 D) two plates moving away from each other.

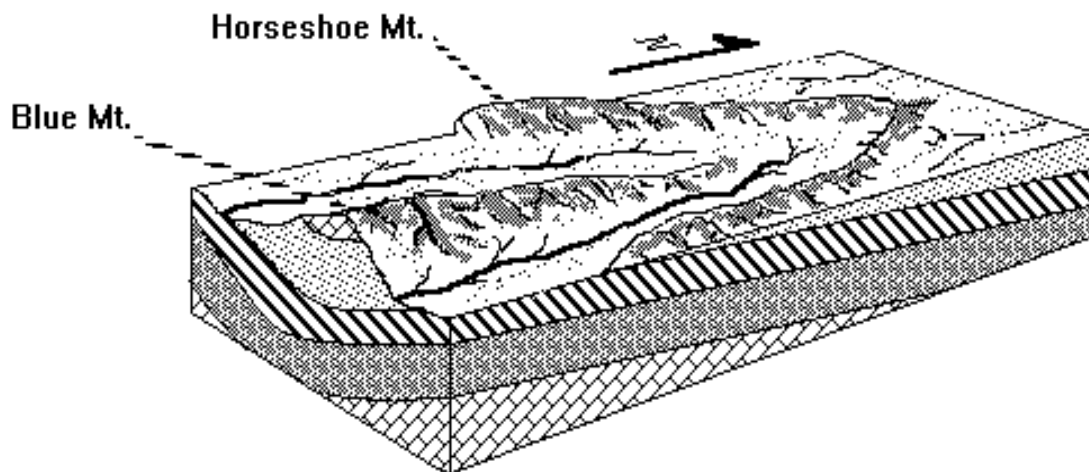
The arrows on the map below show the apparent changes in the position of the Earth's magnetic North Pole throughout geologic time, as recorded in the igneous rocks of Europe and North America.

13. This evidence best supports the concept of
 A) the heliocentric solar system
 B) The Coriolis effect
 C) planet orbit eccentricity
 D) plate tectonics



14. The largest earthquake known to have struck the United States occurred near
 A) San Francisco, California
 B) Los Angeles, California
 C) Charleston, South Carolina
 D) St. Louis, Missouri

15. In an Alaskan earthquake several years ago, the coastline of some Aleutian Islands rose straight up more than 40 feet above sea level. The fault that produced the earthquake is a
 A) normal fault C) thrust fault
 B) strike-slip fault D) reverse fault

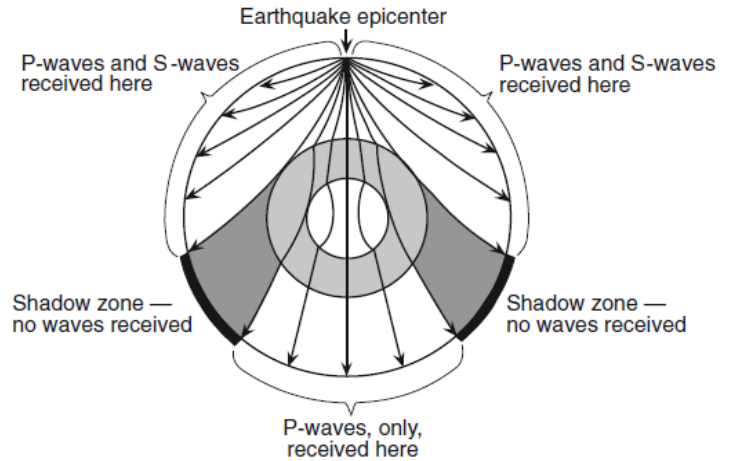


16. Use the diagram above for question # 16. Structurally, Blue Mt. and Horseshoe Mt. are
 A) anticlinal mountains C) fault block mountains
 B) synclinal mountains D) monoclinal mountains

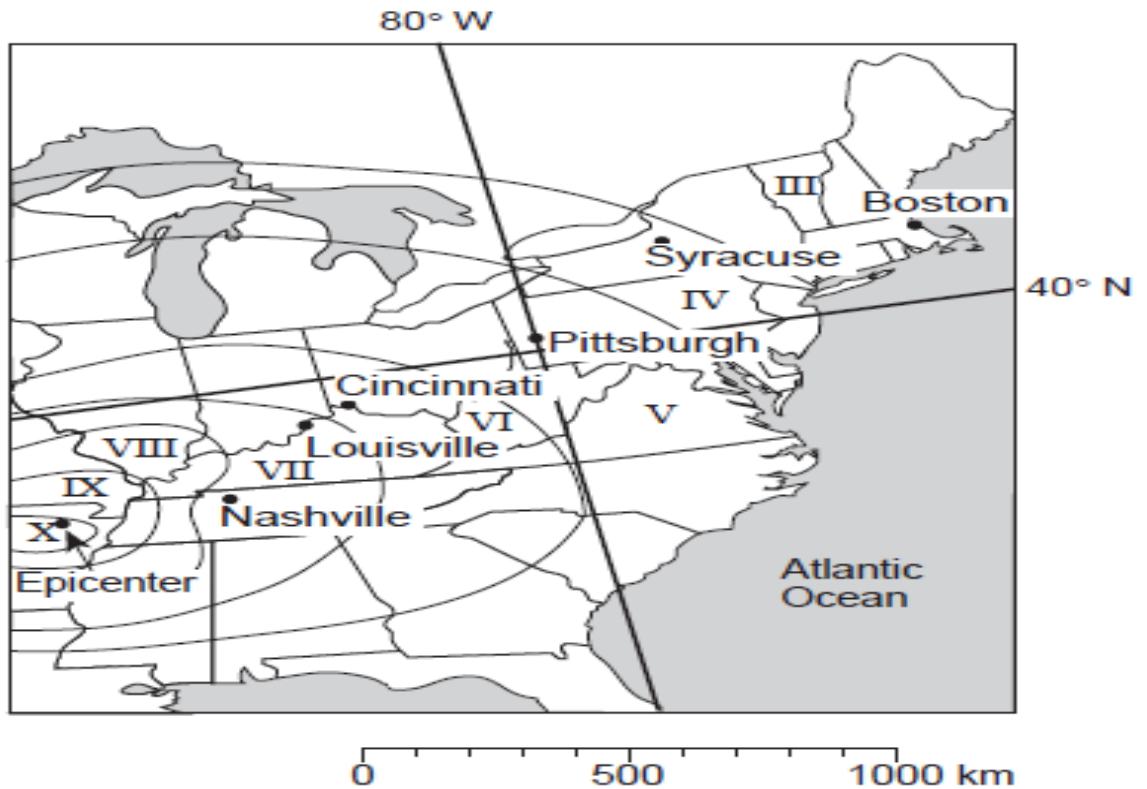
Base your answer to question # 17 on the cross section below. The cross section shows the paths of seismic waves traveling from an earthquake epicenter through different layers of the Earth's interior.

17. No P-waves or S-waves are received in the shadow zone because

- A) P-waves are absorbed and S-waves are refracted by the Earth's outer core.
- B) P-waves are refracted and S-waves are absorbed by the Earth's outer core.
- C) Both P-waves and S-waves are refracted by the Earth's outer core.
- D) both P-waves and S-waves are absorbed by the Earth's outer core.



The map shows an earthquake that occurred slightly southwest of New Madrid, Missouri on December 16, 1811. The Roman Numerals on the map were determined from the Modified Mercalli Scale, which is based on the observed effects of the earthquake. This map will be on the Mar and April exams.



18. The distance from New York City to the epicenter is 1666 km. Approximately, how much longer did it take for the S-wave to arrive at New York City than the P-wave? P waves travel at 8 Km/sec, while S waves travel at 60% of the speed of P waves.

- A) 3 min 28 sec
- B) 2 min and 19 sec
- C) 5 min and 47 sec
- D) 7 min and 47 seconds

The map below shows the locations of volcanic islands and seamounts that erupted on the seafloor of the Pacific Plate as it moved northwest over the stationary mantle hotspot beneath the lithosphere. The hotspot is currently under Kilauea. Use the map and data table for questions 19 and 20.

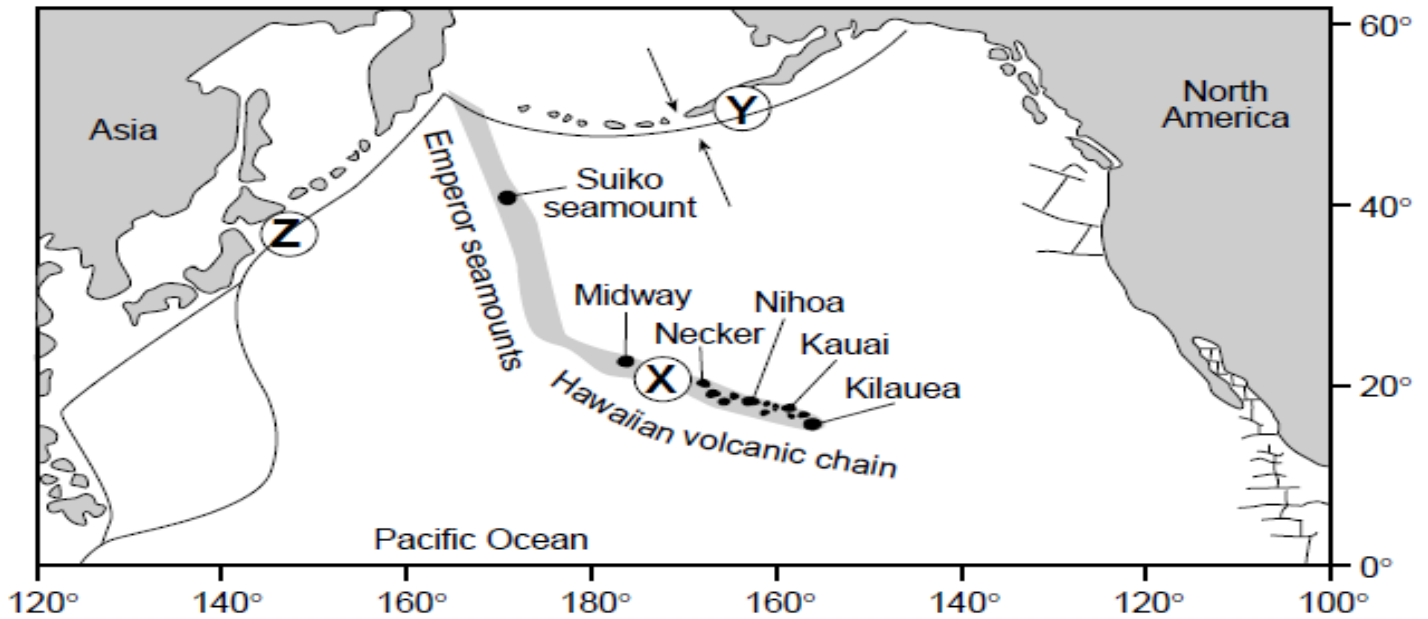
19. Location X was originally over the hotspot. Approximately, how many km has X moved from its original position over the hotspot?

- A) 3600 km B) 2500 km C) 1800 km D) 690 km

20. According to the data table what is the approximate speed at which Kauai has been moving away from the hotspot in **kilometers per millions of years**?

- A) 1 B) 10 C) 100 D) 1,000

Map of Volcanic Features

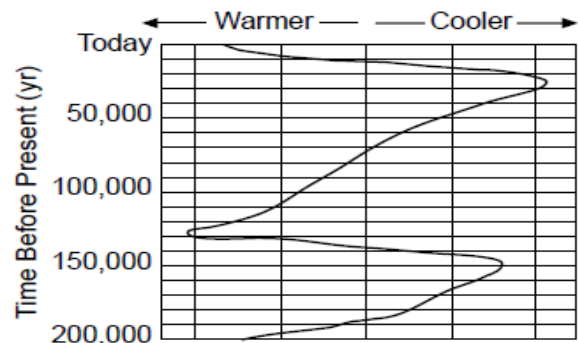


Data Table
Age of Volcanic Features

Volcanic Feature	Distance from Kilauea (km)	Age (millions of years)
Kauai	545	5.6
Nihoa	800	6.9
Necker	1,070	10.4
Midway	2,450	16.2
Suiko seamount	4,950	41.0

21. The graph below shows the changes in temperature in North America over the last 200,000 years. What is the total number of major glacial periods represented by the graph?

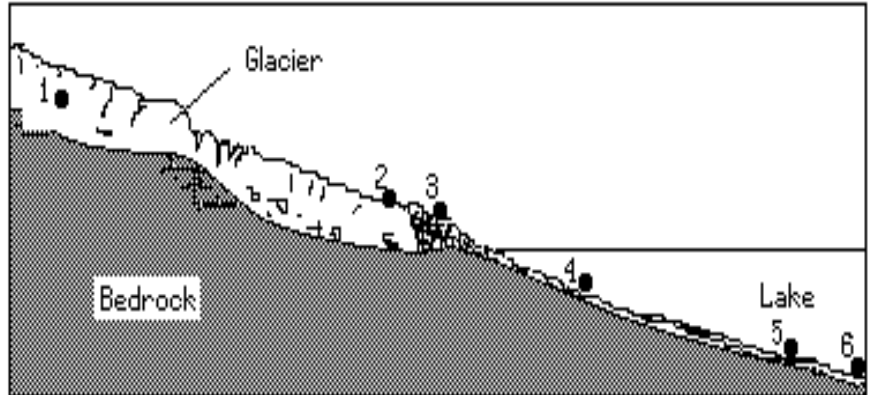
- A) 2
B) 3
C) 4
D) 5



22. Glaciers often form parallel scratches and grooves in bedrock because glaciers
- A) deposit sediment in unsorted piles
 - B) deposit rounded sand in V-shaped valleys
 - C) continually melt and refreeze
 - D) drag loose rocks over Earth's surface

The diagram below represents a glacier moving out of a mountain valley. Use it with questions 23 and 24.

23. Which characteristic would form as the glacier advances from point 2 to point 1?
- A) a V-shaped valley.
 - B) a thick, well sorted soil.
 - C) layers of salt and other evaporites.
 - D) scratched and polished bedrock.



24. Colloidal-sized particles carried by water are most probably being deposited at
- A) position 2
 - B) position 3
 - C) position 4
 - D) position 6

The figure below represents a river valley with the river flowing toward you. Use it with questions 25, 26, 27.

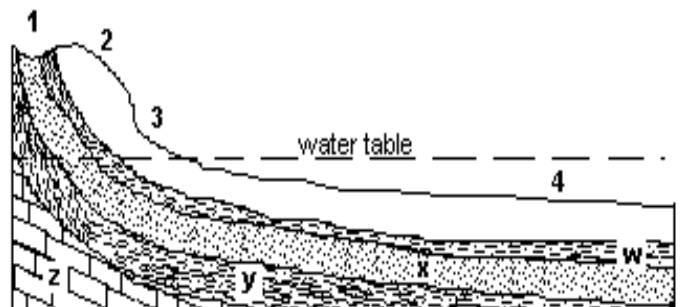
25. The looping curves in the river are called
- A) cols
 - B) cirques
 - C) oxbows
 - D) meanders
26. The two lakes found near the river are
- A) tarns
 - B) cirques
 - C) oxbows
 - D) meanders
27. In its development, the river valley illustrated is
- A) old
 - B) mature
 - C) young
 - D) senile



28. The surface level of a lake during periods of normal rainfall is usually
- A) below the water table
 - B) above the water table
 - C) at the water table
 - D) unrelated to the water table

The diagram below is a cross section through a mountain, rising above a plain, and the underlying rocks. Use it with questions 29 and 30.

29. The best place to drill a well in order to obtain an artesian flow (natural flow without pumping) would be at position
- A) 1
 - B) 2
 - C) 3
 - D) 4



30. The rock layer which is the aquifer is
- A) w
 - C) y



- B) x D) z

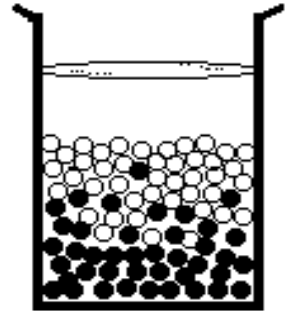
31. Winter storms tend to change ocean beaches by
 A) building beach and dunes
 B) building beach and eroding off-shore bars
 C) eroding beach and building off-shore bars
 D) eroding beach and bars

32. A current, dangerous to swimmers, that flows seaward from an ocean beach is
 A) an undertow C) a rip
 B) an eddy D) a drift

33. Large caves are formed when carbon dioxide in water etches out the joints and cracks in limestone. Carbon dioxide dissolves in water to produce
 A) hydrates C) oxides
 B) carbide D) carbonic acid

34. The soil layer which contains animal and plant matter is called
 A) silt C) humus
 B) subsoil D) talus

35. In the diagram to the right the particles were poured into the beaker and stirred. The most probable explanation for the distribution of the white and black grains is that the white grains have a
 A) smaller volume C) greater solubility
 B) smaller density D) rougher texture

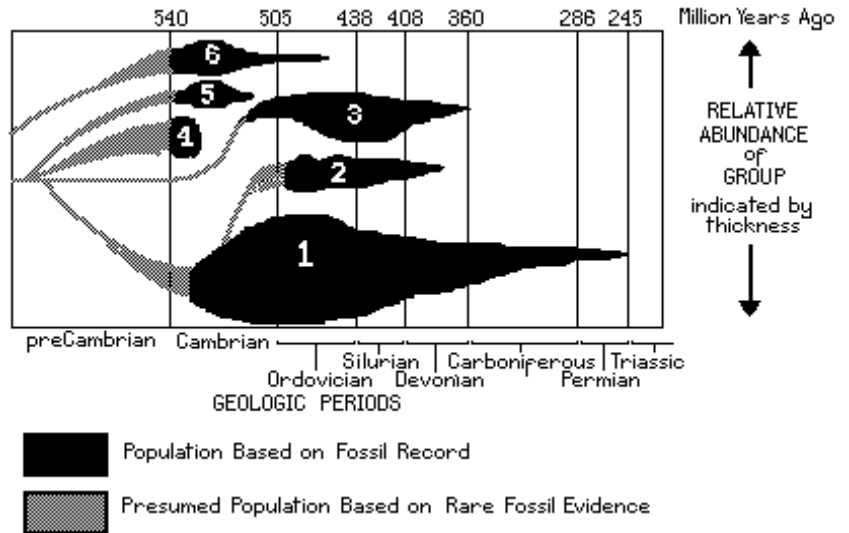


The graph shows the growth in population and extinction of the six major groups of trilobites, labeled 1 through 6.

Use it with questions: 36, 37, 38

36. The group of trilobites that became the most abundant was
 A) group 1 C) group 4
 B) group 3 D) group 6

37. During which period did the last of these trilobite groups become extinct?
 A) Cambrian C) Permian
 B) Triassic D) Ordovician



38. Which inference is best supported by the graph?
 A) All trilobites evolved from group 1 trilobites.
 B) The trilobites were most abundant during the Devonian Period.
 C) PreCambrian trilobite fossils are very rare.
 D) Trilobites may exist in present-day marine climates.

39. Of the methods listed below, the only one that can date an event to the exact year is

- A) radioactive carbon dating
- B) uranium/lead ratio
- C) index (or guide) fossils
- D) tree ring analysis

40. From most general to most specific, in order, geologic time intervals are

- A) eras, epochs, periods
- B) periods, eras, epochs
- C) eras, periods, epochs

Use the topographic map for questions: 41, 42, 43, 44.

41. The contour interval shown on the map of Moana Pele is

- A) 10 feet
- B) 100 feet
- C) 20 feet
- D) 200 feet

42. Moana Pele is a

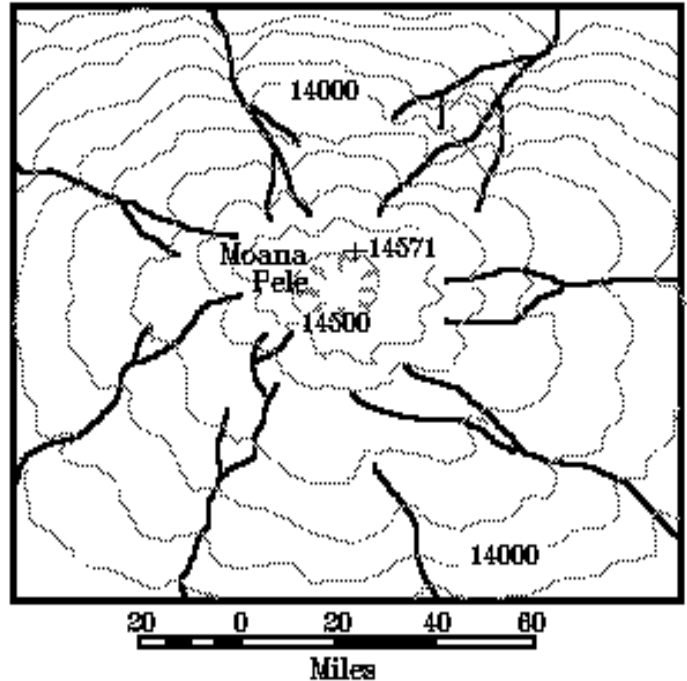
- A) volcano
- B) glaciated mountain
- C) sink hole
- D) plateau

43. The side of Moana Pele which has the steepest slope is the

- A) northern
- B) eastern
- C) southern
- D) western

44. Using the ruler in the reference section determine the approximate area shown by the map. The area is close to:

- A) 4,400 sq. mi.
- B) 10,200 sq. mi.
- C) 16,800 sq. mi.
- D) 21,600 sq. mi.



45. The international dateline runs north/south through

- A) Greenwich, England
- B) Washington, D.C.
- C) the Pacific Ocean
- D) Atlantic Ocean

46. A map which is a Mercator projection (rectangular of the whole Earth) accurately shows only

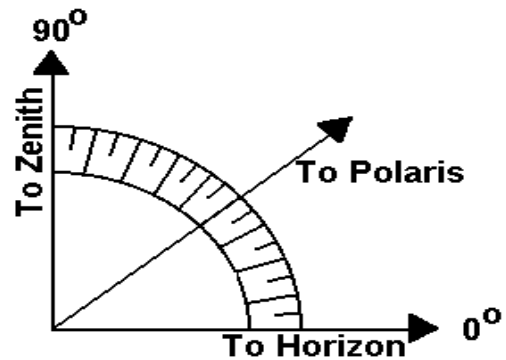
- A) area
- B) size of land masses
- C) direction
- D) distance

47. The number of full-hour standard time zones around the earth is

- A) 12
- B) 24
- C) 75
- D) 360

48. The diagram at the right shows the altitude above the horizon of Polaris as measured by a student. What does this measurement indicate in terms of latitude or longitude?

- A) 40°N latitude
- B) 50° N latitude
- C) 40° W longitude
- D) 50° W longitude



49. The energy producing reaction in the sun is the

- A) combustion of hydrogen
- B) fission of uranium
- C) fission of hydrogen
- D) fusion of hydrogen

50. Of the total energy that the sun emits toward the earth, the amount which reaches the surface is about

- A) one tenth
- B) one quarter
- C) one half
- D) two thirds

51. The ratio of the diameter of the Moon to the diameter of the Earth is about (ratio is moon to Earth)

- A) 4:1
- B) 1:2
- C) 1:3
- D) 1:4

52. As the moon revolves around the earth, the point where it is **closest** to the Earth is called

- A) perigee
- B) apogee
- C) vernal equinox
- D) summer solstice

The diagram to the right represents a model of a moon or satellite, orbiting a planet. Positions A, B, C, & D are positions that can be occupied by the moon or satellite. F1 & F2 are focal points of the orbit.

Use the diagram with questions: 53, 54, 55, 56.

53. When observed from the planet, the full phase of the moon appears at point

- A) A
- B) B
- C) C
- D) D

54. As the moon moves in its orbit from point D to point B, the gravitational attraction between the moon and the planet

- A) increases, only
- B) decreases, only
- C) increases, then decreases
- D) decreases, then increases

55. The time interval is **shortest** when the moon moves between points

- A) A and B
- B) B and C
- C) C and A
- D) D and A

56. The phases of the moon are caused by

- A) rotation of the earth on its axis
- B) rotation of the moon on its axis
- C) revolution of the moon around the earth
- D) revolution of the earth around the sun

57. According to Kepler's Laws, the radius from the sun to a planet

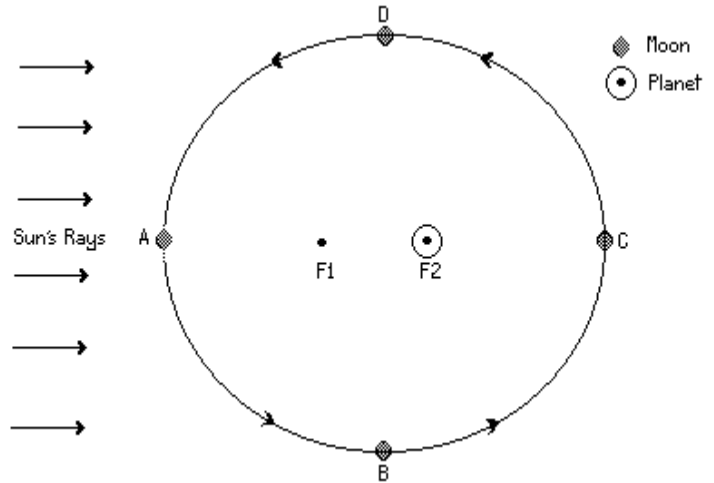
- A) is longer in winter than in summer
- B) sweeps through equal areas in equal times
- C) is inversely proportional to the mass of the planet
- D) is directly proportional to the speed of the planet

58. According to Kepler's Law of Harmonic Planetary Motion, the farther a planet is from the sun, the

- A) shorter its period of rotation
- B) shorter its period of revolution
- C) longer its period of rotation
- D) longer its period of revolution

59. The planet, Venus, has an astonishingly high surface temperature of about 500°C. The high temperature is due to:

- A) Venus being closer to the sun
- B) Venus having a carbon dioxide, "greenhouse" atmosphere
- C) Both A & B
- D) Neither A nor B



The diagram below represents a distant star with a single planet in different positions in its orbit around the star. The graph below the star is an astronomer's record of the apparent luminosity of the star over a period of time.

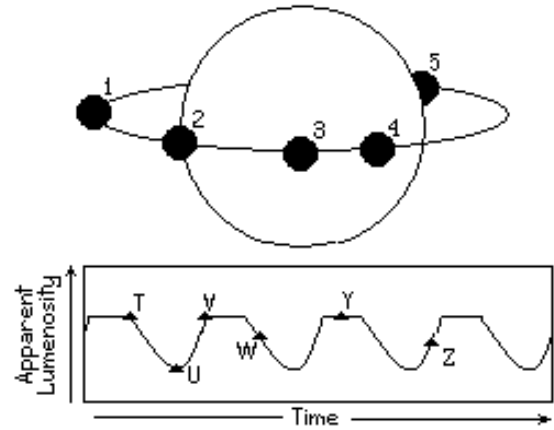
Use with questions: 60 and 61.

60. The apparent luminosity of the star shown by point U on the graph occurs when the planet is at which point in its orbit

- A) 1
- B) 2
- C) 3
- D) 5

61. The planet is orbiting in the direction of positions 1 through 5. While the planet moves from position 1 to 3, the light from the star will appear to be

- A) more red in color
- B) more blue in color
- C) unchanged in color



62. The galaxy in Andromeda is the classical example of

- A) an oval galaxy
- B) a spherical galaxy
- C) an elliptical galaxy
- D) a spiral galaxy

63. According to the laws of physics, the arms of a spiral galaxy should wrap around and fall inward toward the center of the galaxy. That they do not, led to the hypothesis of

- A) black holes
- B) dark matter
- C) an expanding universe
- D) dark energy

64. According to Newton's Law of Gravitation, the force of attraction between two objects, is proportional to

- A) the distance between them times the product of their masses.
- B) the distance between them and the squared product of their masses.
- C) the inverse of the distance between them and the squared product of their masses.
- D) the product of their masses and the inverse square of the distance between them.

65. Light travels at 186,000 miles per second. The distance represented by one light year is approximately

- A) 93 million miles
- B) 6 trillion miles
- C) 8.6 billion miles
- D) 3 trillion miles

66. If the winter air temperature is -5°F and the wind is blowing at a constant 20 mph, the wind chill factor is probably about (use the reference tables at the end of the test)

- A) -25°F
- B) -44°F
- C) -47°F
- D) -55°F

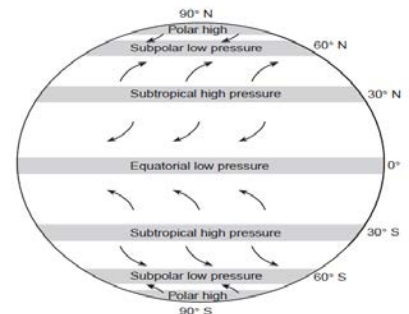
67. Changing the color of the roof of a house from light to dark would probably increase the amount of solar energy that is

- A) reflected
- B) created
- C) insulated
- D) absorbed

68. Earth's atmosphere is warmed when

A) ultraviolet radiation emitted by Earth is absorbed by nitrogen and carbon dioxide in the atmosphere

- B) x-ray radiation emitted by Earth is absorbed by nitrogen and carbon dioxide in the atmosphere
- C) infrared radiation emitted by Earth is absorbed by carbon dioxide and water vapor in the atmosphere
- D) gamma radiation emitted by Earth is absorbed by carbon dioxide and water vapor in the atmosphere



69. Prevailing winds blowing away from the north polar high are known as

- A) northerlies
- B) north easterlies
- C) north westerlies
- D) south easterlies

Use the weather map with questions 70, 71 and 72.

70. The Great Lakes are dominated by what type of air mass?

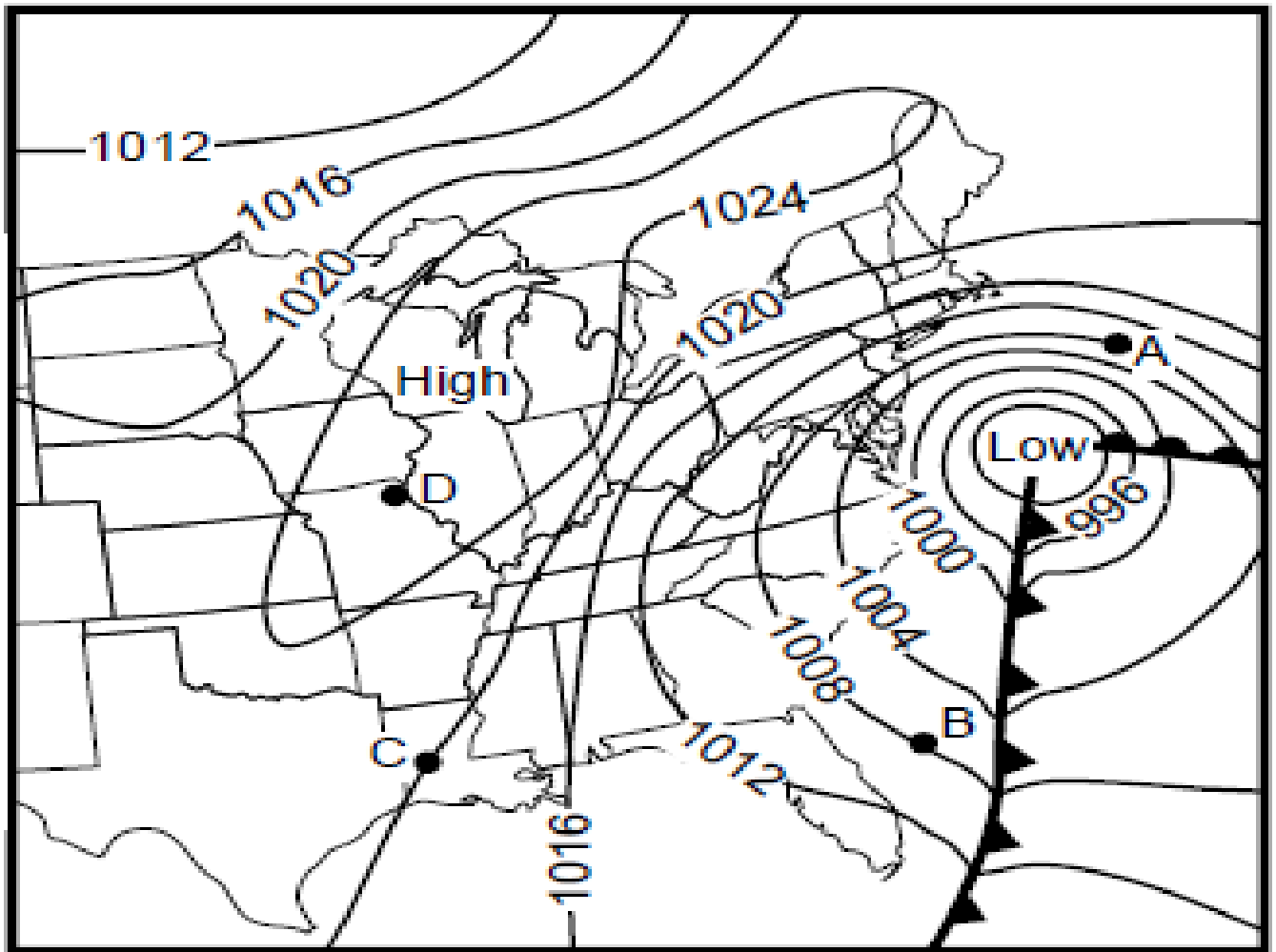
- A) tropical maritime C) polar maritime
- B) tropical continental D) polar continental

71. What type of weather would be predicted in the region of the Great Lakes?

- A) raining with cold air C) hot humid and clear weather
- B) clear fair weather D) overcast warm air

72. The isolines on this weather map represent?

- A) density C) pressure
- B) humidity D) temperature



New Jersey Science League

Earth Science Exam - Answer Key

February 2014

1. D	19. C	37. C	55. B
2. D	20. C	38. C	56. C
3. B	21. A	39. D	57. B
4. D	22. D	40. C	58. D
5. A	23. D	41. B	59. C
6. C	24. D	42. A	60. C
7. A	25. D	43. A	61. C
8. A	26. C	44. C	62. D
9. C	27. A	45. C	63. B
10. D	28. C	46. C	64. D
11. B	29. D	47. B	65. B
12. C	30. B	48. A	66. C
13. D	31. C	49. D	67. D
14. D	32. C	50. C	68. C
15. A	33. D	51. D	69. B
16. B	34. C	52. A	70. D
17. B	35. B	53. C	71. B
18. B	36. A	54. D	72. C

Test Specifications

Since some earth science courses in New Jersey start with geology, others with astronomy, and still others with meteorology, each of the four tests will include the following topics. Over time, this provides an equal opportunity to everyone. The number in parentheses indicates the number of questions for that topic. The number per topic occasionally varies by one or two, but usually does not.

Minerals (4)	Sun (2)
Rocks (2)	Moon (2)
Earth Structure (2)	Sun-Moon-Earth System (3)
Plate Tectonics (4)	Solar System (3)
Faults/Folds/Seismology (3)	Stars (2)
Vulcanism (2)	Galactic Systems (2)
Glaciation/Deserts (2)	Cosmology (2)
Rivers:Erosion & Deposition (3)	Insolation/Temperature/Air Masses (3)
Ground Water/Caves (2)	Atmospheric Pressure/Highs/Lows (4)
Ocean Shore Line/Currents/Salinity(3)	Moisture in the Atmosphere (3)
Weathering/Mass Wasting (2)	Frontal Systems (3)
Historical Geology (4)	Interpreting Weather Maps (3)
Map Reading: Road/Topo/Geologic (4)	
Geodesics/Time/Map Projections (3)	

ES March Exam 2014

Please PRINT your name, school, area, and which test you are taking onto the scan-tron.

Choose the answer that best completes the statements or questions below and fill in the appropriate response on the form. If you change an answer, be sure to completely erase your first choice. Reference tables are located at the end of the test. A ruler is also on the reference sheets.

1. Which of the following would give the **best** indication of the relative hardness of a mineral?

- A) breaking the mineral with a hammer
- B) squeezing the mineral with pliers
- C) weighing the mineral in air and in water
- D) scratching the mineral across a glass plate

2. The most abundant element found in rocks and minerals on the earth's surface is

- A) silicon C) magnesium
- B) iron D) oxygen

Use the data table below for questions #3 and 4.

3. What two mineral samples would be most difficult to distinguish from each other based upon their color, luster, and streak?

- A) halite & quartz
- B) halite & gold
- C) galena & quartz
- D) galena & gold

Mineral Sample	Color	Luster	Streak	Breakage pattern
Galena	Gray	Metallic	Gray	Breaks into cubes
Halite	Colorless	Nonmetallic	Colorless	Breaks into cubes
Quartz	Colorless	Nonmetallic	Colorless	Irregular breakage
Gold	Yellow	Metallic	Yellow	Irregular breakage

4. Which two mineral samples most likely have a similar internal arrangement of atoms?

- A) galena & quartz
- B) galena & halite
- C) gold and halite
- D) gold & galena

5. Rocks can be classified as sedimentary, igneous, or metamorphic based primarily upon differences in their

- A) color
- B) density
- C) origin
- D) age

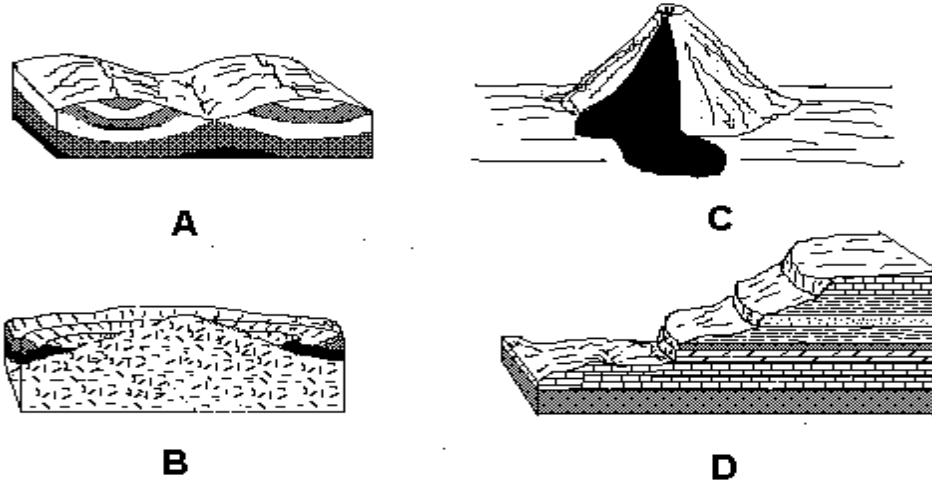
6. Which statement is an accurate conclusion based upon the information in the table below?

- A) Most rocks are monomineralic
- B) All rocks are polymineralic
- C) Many rocks have a number of minerals in common.
- D) Only igneous rocks contain quartz.

A check in a box means the mineral is present.

Rock Sample	Mineral Composition								
	Quartz	Potassium feldspar	Plagioclase feldspar	Biotite	Hornblende	Pyroxene	Olivine	Calcite	Others
Granite	✓	✓	✓	✓	✓				
Rhyolite	✓	✓	✓	✓	✓				
Pumice	✓	✓	✓	✓	✓				
Conglomerate	✓	✓	✓	✓	✓	✓	✓	✓	✓
Slate				✓					✓
Marble								✓	
Limestone								✓	
Basalt			✓		✓	✓	✓		
Gabbro			✓	✓	✓	✓			

Use the diagram below with questions # 7 and 8.



7. Which diagram above shows an area in which fine-grained igneous rocks are most likely to be found?
 8. Which structure above most resembles the structure you would expect to see in the Grand Canyon?

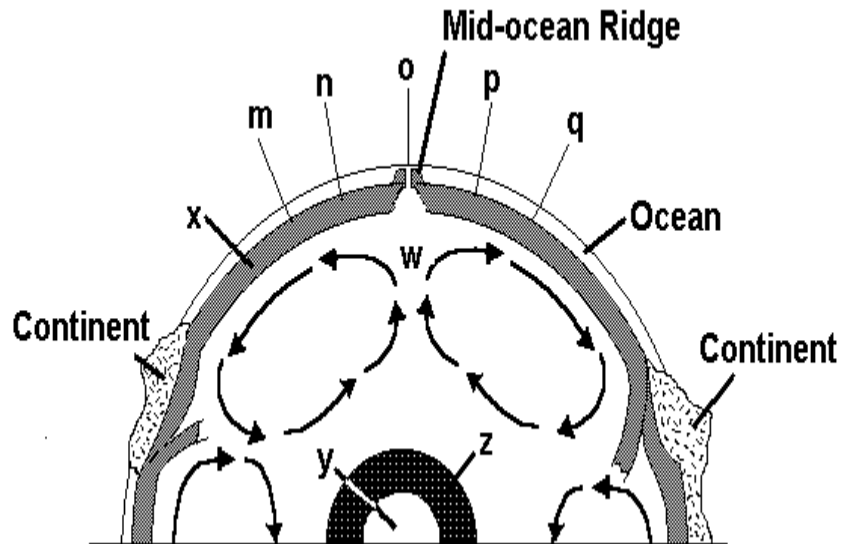
The diagram below represents a tectonic cross-section through the earth. Use it with questions #9, 10, 11, 12, 13, 14.

9. The driving force for the motion of tectonic plates is thought to be convection at

- A) w C) o
 B) z D) y

10. Zone z within the earth is believed to be

- A) a solid rock called peridotite
 B) solid metal, probably iron and nickel
 C) semi-liquid or plastic rock, rich in olivine
 D) liquid metal, probably iron and nickel



11. The youngest ocean crust is closest in location to

- A) m C) o
 B) n D) p

12. The earth is most likely composed of granite at

- A) the ocean floor C) location w
 B) a continent D) location y

13. The ocean floor at location m would most likely have the same magnetic orientation as at location

- A) n C) p
 B) o D) q

14. Basalt in the ocean floor gives the rate at which crustal plates spread from rifts. The ocean floor rock at point o was age dated by measuring

- A) radioactivity C) fossilized plankton
 B) superposition D) magnetic reversals

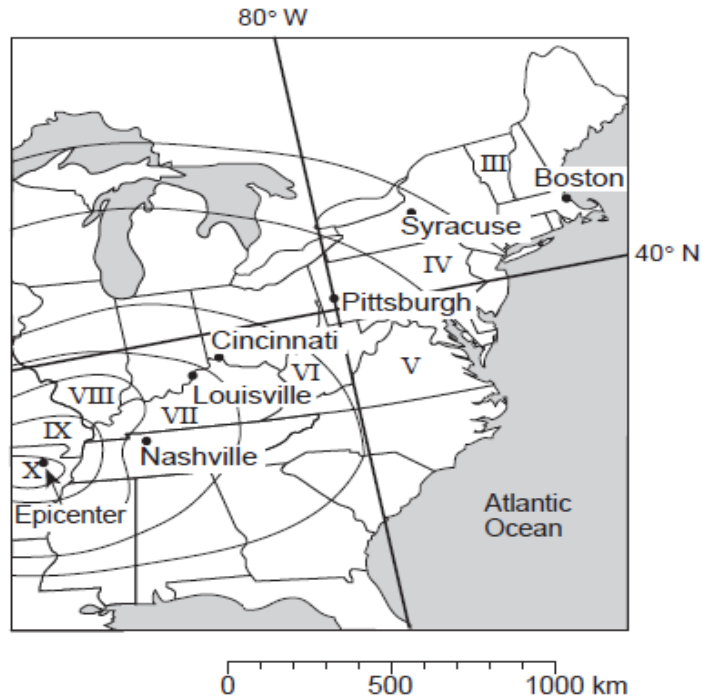
The map shows an earthquake that occurred slightly southwest of New Madrid, Missouri on December 16, 1811. The Roman Numerals on the map were determined from the Modified Mercalli Scale which is based on the observed effects of the earthquake. Use the map with questions 15 and 16. The same map will be on the April exam.

15. What is the approximate location of the earthquake's epicenter?

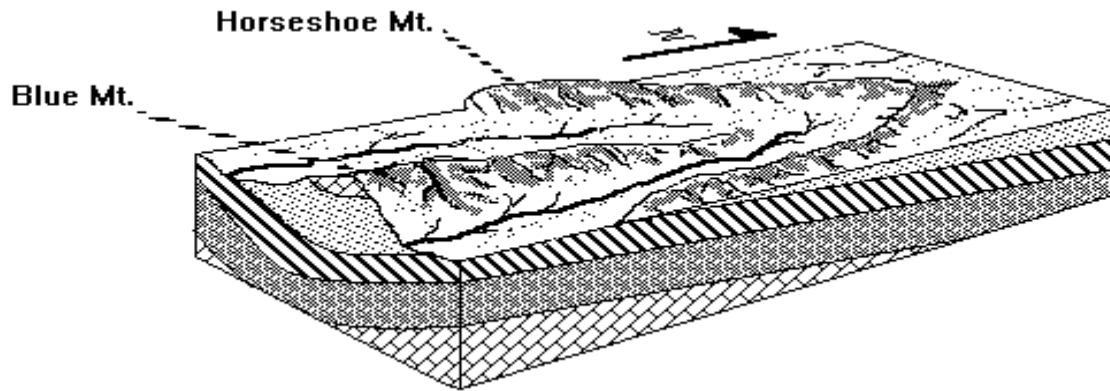
- A) 36°N, 90°W C) 36°N, 90°E
 B) 90°N, 36°W D) 90°N, 36°E

16. The P-waves travel at approximately 8 km/sec. Approximately how many **minutes** did it take the P-waves to travel from the epicenter to Boston?

- A) 4 min C) 5 min
 B) 8 min D) 10 min



Use the diagram of Blue Mountain and Horseshoe Mountain, which are synclinal mountains with questions #17 and 18.



17. The youngest bed of rock is located

- A) at the top of Blue Mountain C) at the top of Horseshoe Mt.
 B) in the valleys between the mountains D) north of Horseshoe Mt.

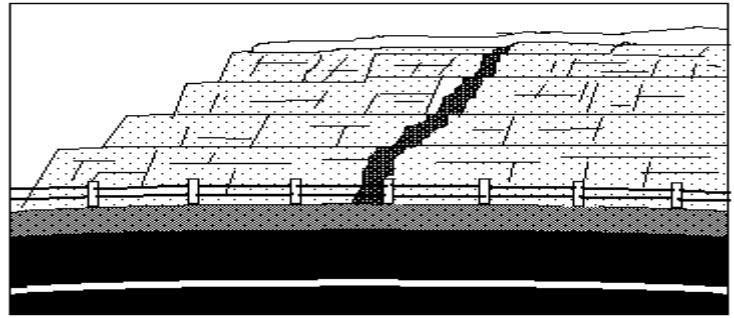
18. The structural axis of Horseshoe Mt. plunges toward the

- A) east C) south
 B) west D) north

19. Crater Lake, in Oregon, is in a caldera. A caldera forms

- A) as a crater in a shield volcano
 B) when a volcano collapses into the magma chamber
 C) when a volcano explodes
 D) as a crater in a cinder cone

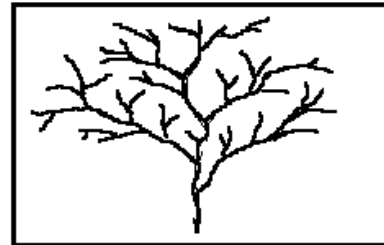
20. While riding along a highway and passing through a rock-cut, you see flat lying layers of sandstone with a vertical band of basalt cutting through them. The band of basalt is called a
- A) dike C) sill
 B) laccolith D) batholiths



21. The desert conditions of the American Southwest are caused mostly by
- A) the circulation of ocean currents C) the subpolar jet stream
 B) the surrounding mountains D) the usual high temperatures

22. The defining characteristic of a desert is
- A) high temperature C) precipitation exceeds evaporation
 B) low rainfall D) shifting sand dunes

23. The drainage pattern shown below right is most likely that of streams eroding
- A) along a fault zone C) a volcanic cone
 B) a plateau D) a syncline

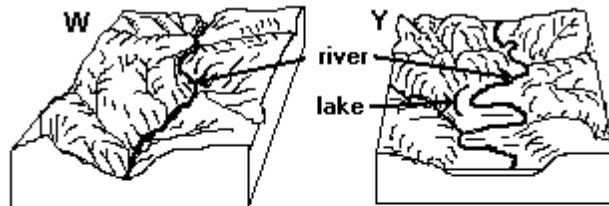


24. The drainage pattern shown in the illustration below right is most likely on
- A) a fault zone C) a volcano
 B) a plateau D) a syncline

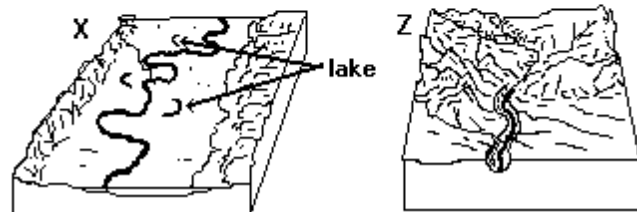


The four diagrams, below, show different stages in the development of river erosion and landforms. Use them with questions 25, 26, 27

25. In which order should the diagrams be placed to show the most likely sequence of river and landscape development?
- A) W, Z, X, Y C) Y, X, W, Z
 B) X, Z, Y, W D) Z, W, Y, X



26. In which block diagram, is the river cutting downward most rapidly?
- A) W C) Y
 B) X D) Z



27. The lakes shown in diagrams X & Y are known as
- A) tarns C) paternoster lakes
 B) oxbow lakes D) finger lakes

28. During a heavy rainfall, runoff will be greatest on a soil that has an infiltration (permeability) rate of
 A) 0.1 cm/sec C) 0.3 cm/sec
 B) 0.2 cm/sec D) 1.2 cm/sec

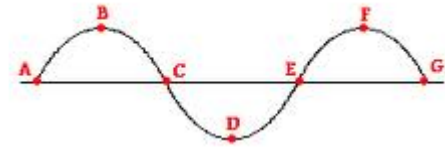
29. A student performed a laboratory activity in which water was poured slowly into four cups containing equal volumes of loosely packed sediment samples. The contents of the cups are below. All particles were spherical in shape and uniform in size within a container. After the water level reached the surface of each sample, the student determined the amount of water that had been added.

I. Contained sand II. Silt III. Pebbles IV. Mixture of sand, clay, and pebbles.
 The results of the activity should have indicated that approximately equal amounts of water were added to the cups of

- A) silt and pebbles, only C) pebbles and the mixture, only
 B) sand, silt, and pebbles, only D) sand, pebbles, and the mixture, only

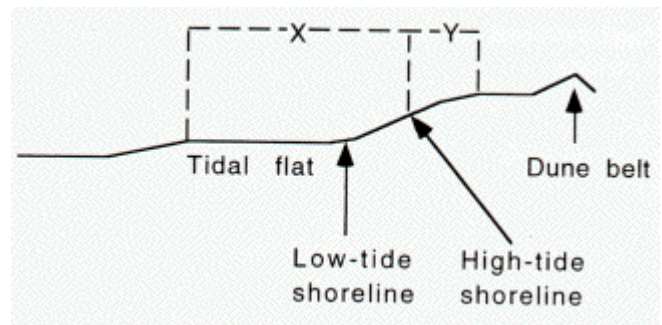
30. A simple sine wave drawing is illustrated below.
 Which letter segments represent the wavelength of the wave?

- I. A to B II. A to C III. B to C
 IV. A to E V. C to G
 A) I only B) IV only C) II and III D) IV and V



31. The picture to the lower right is of a sea shore area. The area labeled X in the diagram below is called ____?

- A) foreshore C) swash zone
 B) surf zone D) backshore



32. A list of three observed relationships is shown.

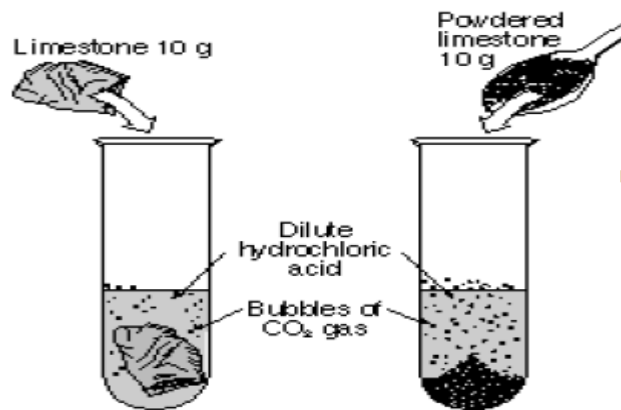
- Erosional rate = depositional rate.
- Amount of insolation = amount of terrestrial radiation
- Rate of condensation = rate of evaporation

In which situation would each relationship exist?

- A) when a cyclic change occurs
 B) when a change of state occurs
 C) when dynamic equilibrium is reached
 D) when global warming ceases and global cooling begins

33. The demonstration below shows that powdered limestone reacts faster than a single large piece of limestone of equal mass when both are placed in the same acid. What is the reason for the faster reaction?

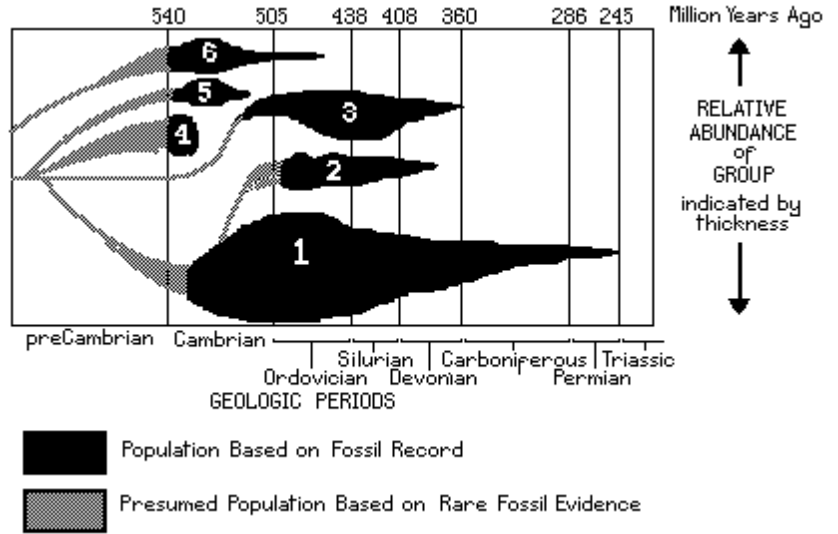
- A) less total volume
 B) more chemical bonds
 C) more total surface area
 D) lower density



The graph below shows the growth in population and extinction of the six major groups of trilobites, labeled 1 through 6. Use it with questions 34, 35, 36.

34. Which fossil group would be the best index fossil for the entire Paleozoic Era?

- A) group 1
- B) group 2
- C) group 4
- D) group 6



35. If you were to find trilobites from groups 1, 2, and 6 in the same rock formation, the best interpretation would be that the rock was probably formed from

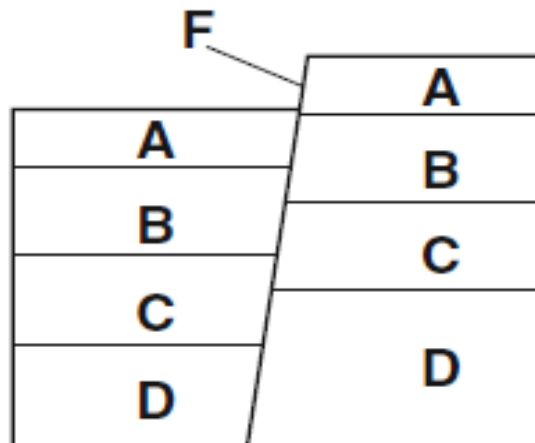
- A) Cambrian sediments
- B) Ordovician sediments
- C) Triassic sediments
- D) Silurian Sediments

36. The fossil evidence that forms the basis for this graph was most likely found in

- A) lava flows of ancient volcanoes
- B) sedimentary rock from old ocean sediments
- C) granite that formed from former sedimentary rocks
- D) metamorphic rock that formed from volcanic rocks

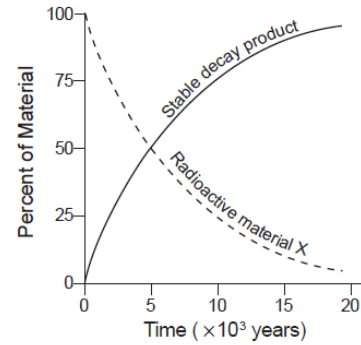
37. The cross section below shows rock layers A, B, C, and D with fault F. The rock layers have not been overturned. Which sequence places the rock layers and fault from the **oldest** to the **youngest**?

- A) D → C → B → A → F
- B) F → A → B → C → D
- C) F → D → C → B → A
- D) A → B → C → D → F



The graph below represents a radioactive substance, X and the resulting stable decay product. This graph will be on the April exam.

38. What is the approximate half-life of radioactive substance X
 A) 5,000 year C) 50,000 years
 B) 10,000 D) 100,000 years



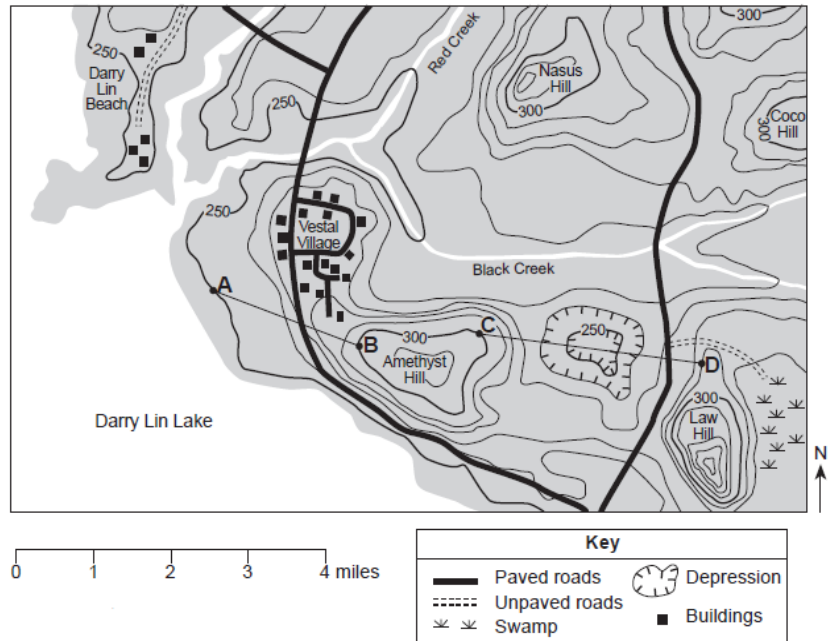
39. Material X can only be used to date young geologic material because X
 A) has a short relatively short half-life
 B) never existed in older rocks
 C) has only recently become radioactive
 D) has only recently been discovered

Use the topographic map below for questions # 40, 41, 42, 43, 44.
 Elevations are measured in feet.

40. In which general direction does Red Creek flow?
 A) Northeast
 B) southeast
 C) southwest
 D) northwest

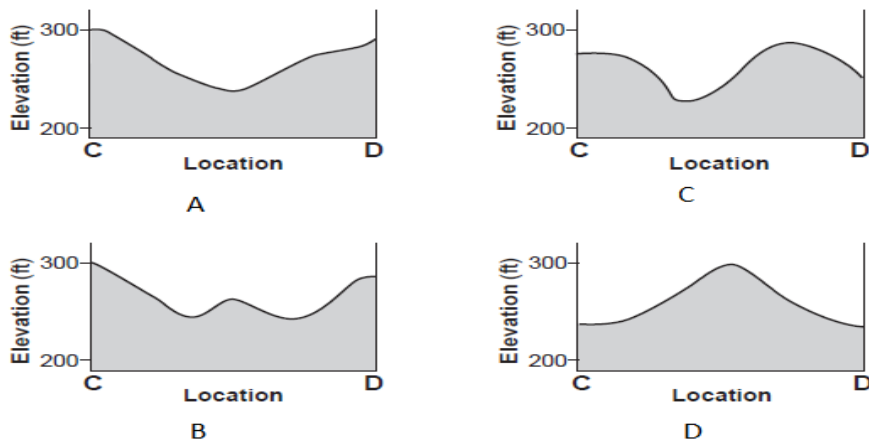
41. What is the contour interval of this map?
 A) 10 ft
 B) 20 ft
 C) 100 ft
 D) 200 ft

42. What is the approximate gradient from point A to point B on this map?
 A) 25 ft/mile
 B) 50 ft/mile
 C) 75 ft/mile
 D) 100 ft/mile



43. What is the **possible** elevation of the surface of Darry Lin Lake?
 A) 228 ft C) 255 ft
 B) 242 ft D) 268 ft

44. Which cross section represents an accurate profile of the landscape between points C and D?

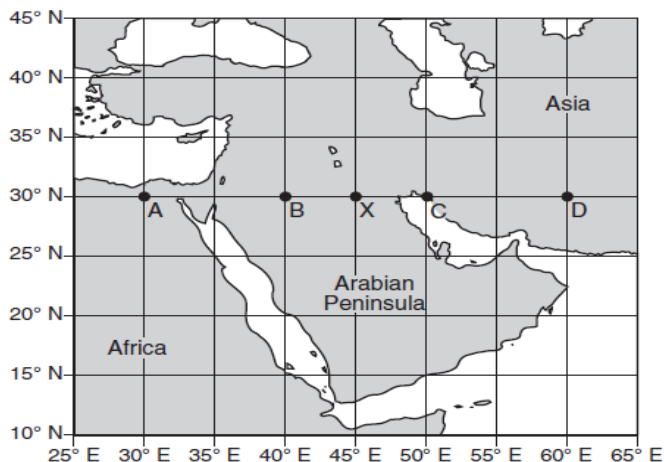


45. Angular position east or west of Greenwich, England is

- A) longitude
- B) latitude
- C) right ascension
- D) declination

46. The map below shows portions of the Middle East. Points A, B, C, D, and X are locations on the map. At which location is the time 11 am when it is 10 am at position X?

- A) A
- B) B
- C) C
- D) D



47. The rate at which the sun rotates can be determined by observing its

- A) corona
- B) sunspots
- C) granules
- D) flares

48. Particles streaming away from the sun are known as

- A) plasma
- B) the aurora australis
- C) the aurora borealis
- D) the solar wind

49. The Maria, or "seas", on the moon are the large areas which appear to be dark. The material of which they are composed is

- A) frozen water
- B) liquid water
- C) granite
- D) basalt

50. The areas of the moon which appear to be light colored are

- A) mountains
- B) lava flows
- C) sand plains
- D) impact craters

The diagram below shows the position of the moon in the sky. East is to your left and you are looking south. Use the diagram with questions 51,52,53

51. The time indicated by the position and phase of the moon is about

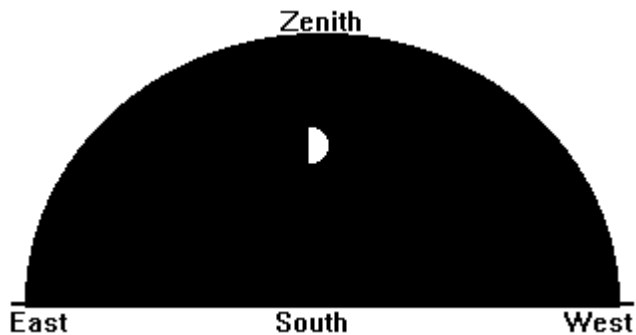
- A) sunrise
- B) noon
- C) sunset
- D) midnight

52. If you are at the shore, the tide is

- A) high
- B) low
- C) full ebb
- D) full flood

53. With the moon in this phase

- A) a lunar eclipse is possible
- B) a solar eclipse is possible
- C) both solar and lunar eclipses are possible
- D) neither solar nor lunar eclipses are possible

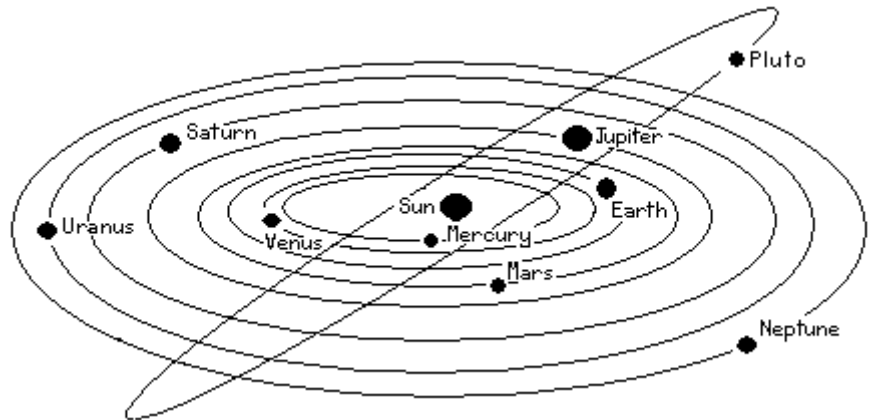


54. If the Earth's distance from the sun were doubled, the gravitational attraction between the sun and Earth would be

- A) twice as great
- B) one fourth as great
- C) half as great
- D) four times as great

55. The planets which are never visible at midnight from the Earth

- A) Mars and Jupiter
- B) Mercury and Mars
- C) Venus and Mars
- D) Mercury and Venus



56. Mercury has almost no atmosphere mostly because it is

- A) too hot
- B) too close to the sun
- C) too small
- D) too large

57. Using the planetary data in the reference tables determine which planet would have the longest time from sunrise to sunset, when measured from the equator?

- A) Mercury
- B) Venus
- C) Earth
- D) Mars

58. The apparent magnitude of a star is its

- A) size
- B) visual brightness
- C) absolute brightness
- D) temperature

59. The type of star which is the key to determining absolute brightness is the

- A) Cepheid variable
- B) quasar
- C) pulsar
- D) brown dwarf

60. A new nebula formed in 1987 in the southern celestial hemisphere. It, like the nebula in Orion and others, was formed by

- A) the collapse of a galaxy
- B) the explosion of a galaxy
- C) the collapse of a star
- D) the explosion of a star

61. The constellations of the zodiac are located along the

- A) celestial equator
- B) meridian
- C) ecliptic
- D) 0 hour circle

62. The planitesimal theory holds that the inner planets, including the earth, were formed by

- A) gravitational attraction of dust and rocky meteors
- B) condensation of whirling clouds of gas
- C) explosion of a companion star to the sun
- D) capture as the planets entered the solar system

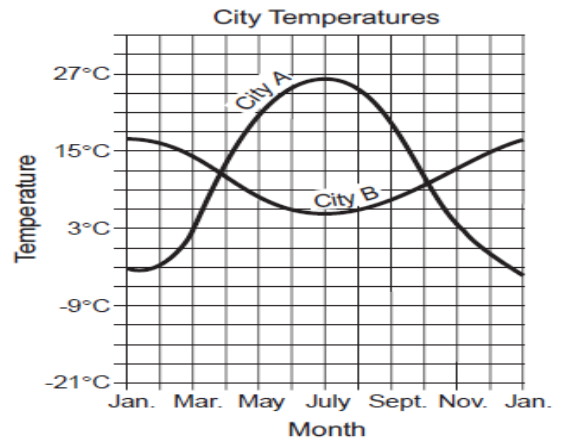
63. Astronomers have observed the light from most galaxies have a red shift. This observation has led to the conclusion that
- A) there is interstellar dust in all directions.
 - B) stars in all galaxies are consuming hydrogen.
 - C) the galaxies are moving away from us.
 - D) the galaxies have a black hole at their centers.

64. The "Alberta Clipper" causes our frigid winter weather, and usually snow. Which type of air mass is it?
- A) Polar Pacific C) Polar Atlantic
 - B) Polar Canadian D) Tropical Continental

65. The plains states over the last few years have had extreme drought. Which air mass usually causes these long periods of drought?
- A) Tropical Pacific C) Tropical Atlantic
 - B) Tropical Continental D) Tropical Gulf

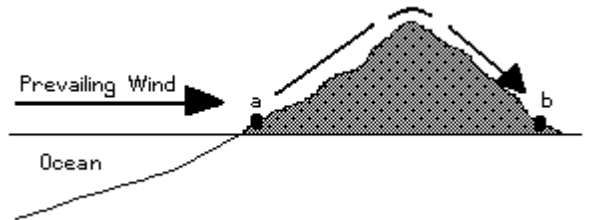
66. Both cities have an average yearly temperature of 11°C, but city A has a much greater temperature range than city B has because city A most likely

- A) is closer to the Equator
- B) is farther from a large body of water
- C) has more rainfall
- D) has stronger prevailing winds.



67. In the diagram of a mountain below, locations a and b are at the same elevation. Compared to the climate at a, the climate at b will be

- A) warmer and drier
- B) cooler and drier
- C) warmer and wetter
- D) cooler and wetter



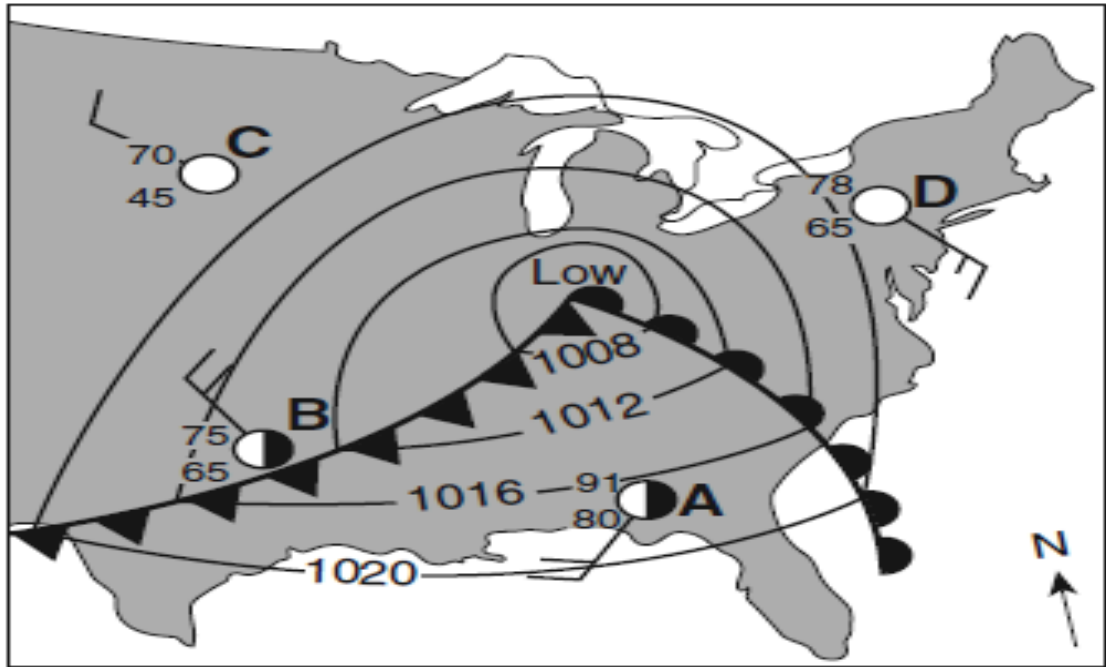
68. A wind that blows down the eastern slope of the Rocky Mountains is called a Chinook. The Chinook would be

- A) warming and drying C) cooling and drying
- B) warming and moist D) cooling and moist

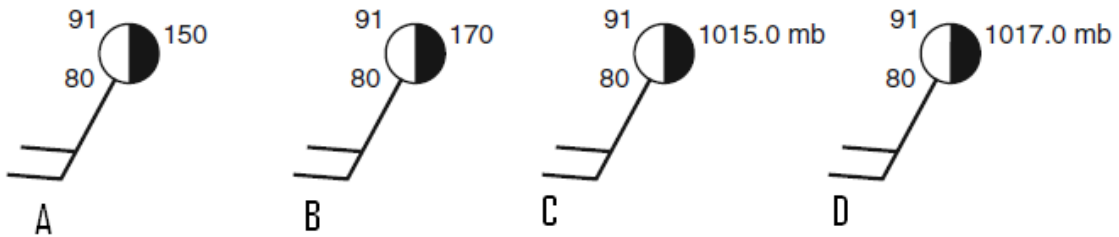
69. Dew forms on a cold surface when the relative humidity at that surface is

- A) 0% C) 67%
- B) 50% D) 100%

Use the weather map for questions 70, 71, 72.



70. Which station model correctly represents the barometric pressure at station A?



71. Which weather instrument was used to measure wind speed at station D?

- A) thermometer
- B) barometer
- C) anemometer
- D) psychrometer

72. Surface winds within this low-pressure system are flowing

- A) away from the center in a counterclockwise pattern
- B) away from the center in a clockwise pattern
- C) around the center in a counterclockwise pattern
- D) around the center in a clockwise pattern

NEW JERSEY SCIENCE LEAGUE
EARTH SCIENCE EXAM ANSWER KEY TAN TEST
MARCH 2014

1	D	19	B	37	A	55	D
2	D	20	A	38	A	56	C
3	A	21	B	39	A	57	B
4	B	22	B	40	C	58	B
5	C	23	B	41	A	59	A
6	C	24	A	42	A	60	D
7	C	25	D	43	B	61	C
8	D	26	D	44	A	62	A
9	A	27	B	45	A	63	C
10	D	28	A	46	D	64	B
11	C	29	B	47	B	65	B
12	B	30	D	48	D	66	B
13	D	31	B	49	D	67	A
14	A	32	C	50	A	68	A
15	A	33	C	51	C	69	D
16	A	34	A	52	A	70	B
17	A	35	B	53	D	71	C
18	D	36	B	54	B	72	C

Test Specifications

Since some earth science courses in New Jersey start with geology, others with astronomy, and still others with meteorology, each of the four tests will include the following topics. Over time, this provides an equal opportunity to everyone. The number in parentheses indicates the number of questions for that topic. The number per topic occasionally varies by one or two, but usually does not.

Minerals (4)	Sun (2)
Rocks (2)	Moon (2)
Earth Structure (2)	Sun-Moon-Earth System (3)
Plate Tectonics (4)	Solar System (3)
Faults/Folds/Seismology (3)	Stars (2)
Vulcanism (2)	Galactic Systems (2)
Glaciation/Deserts (2)	Cosmology (2)
Rivers:Erosion & Deposition (3)	Insolation/Temperature/Air Masses (3)
Ground Water/Caves (2)	Atmospheric Pressure/Highs/Lows (4)
Ocean Shore Line/Currents/Salinity(3)	Moisture in the Atmosphere (3)
Weathering/Mass Wasting (2)	Frontal Systems (3)
Historical Geology (4)	Interpreting Weather Maps (3)
Map Reading: Road/Topo/Geologic (4)	
Geodesics/Time/Map Projections (3)	

Testing Dates for 2014

Thursday March 13, 2014 Thursday April 10, 2014

***The April 2014 exam can be changed based upon the Schools spring break.**

The April exam must be completed by **April 25th**. No area may take the April exam during the first week of April or during the first week of May.

New Jersey Science League

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Web address <http://entnet.com/~personal/njscil/html/>

PLEASE RETURN THE AREA RECORD AND ALL TEAM MEMBER SCANTRONS(ALL STUDENTS PLACING 1ST, 2ND, 3RD, AND 4TH).

If you return scantrons of alternates, then label them as ALTERNATES.

Dates for 2015 Season

Thursday January 8, 2015 Thursday February 12, 2015

Thursday March 12, 2015 Thursday April 9, 2015

ES April Exam 2014

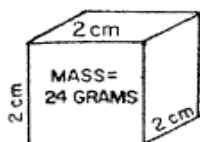
Please PRINT your name, school, area, and which test you are taking onto the scan-tron.

Choose the answer that best completes the statements or questions below and fill in the appropriate response on the form. If you change an answer, be sure to completely erase your first choice. Reference tables are located at the end of the test. A ruler is also on the reference sheets.

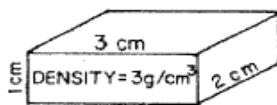
1. The diagrams below represent samples of the same substance. Each has a different size and shape.

What order of letters ranks the substance by volume from the smallest to the largest?

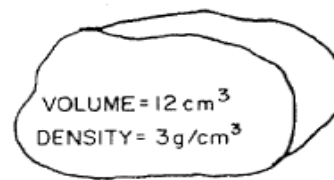
- A) C, A, B B) B, A, C C) A, B, C D) B, C, A



A



B



C

2. Using the diagram for #1 determine the mass of sample B.

- A) 2 g B) 4 g C) 6 g D) 18 g

3. Which mineral is most frequently found in both granitic continental crust and basaltic oceanic crust?

- A) olivine B) quartz C) potassium feldspar D) plagioclase feldspar

4. Clay sediments when lithified become

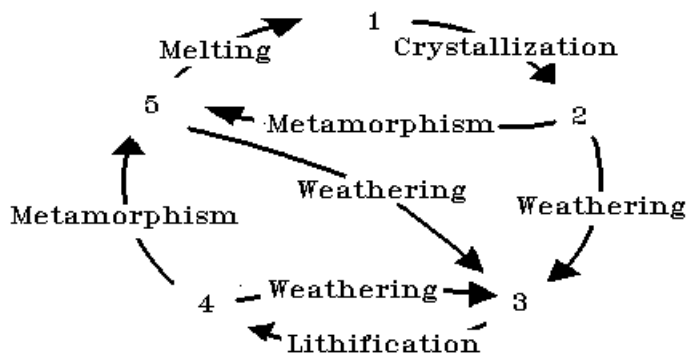
- A) marble B) limestone C) slate D) shale

5. The material from which all rock originally formed is

- A) magma B) lava C) sediment D) crystals

6. In the diagram of the Rock Cycle below, magma is represented by the number

- A) 1 B) 2 C) 3 D) 5



7. In the diagram of the Rock Cycle (above), unconsolidated sediments are represented by the number

- A) 2 B) 3 C) 4 D) 5

8. In the diagram of the Rock Cycle (above), sedimentary rocks are indicated by the number

- A) 2 B) 3 C) 4 D) 5

9. About one-third of the earth's diameter is the distance through the

- A) mantle B) crust C) core D) lithosphere

10. The evidence that the outer core of the earth is liquid comes from

- A) deep oil wells B) deep mines C) earthquakes D) geysers

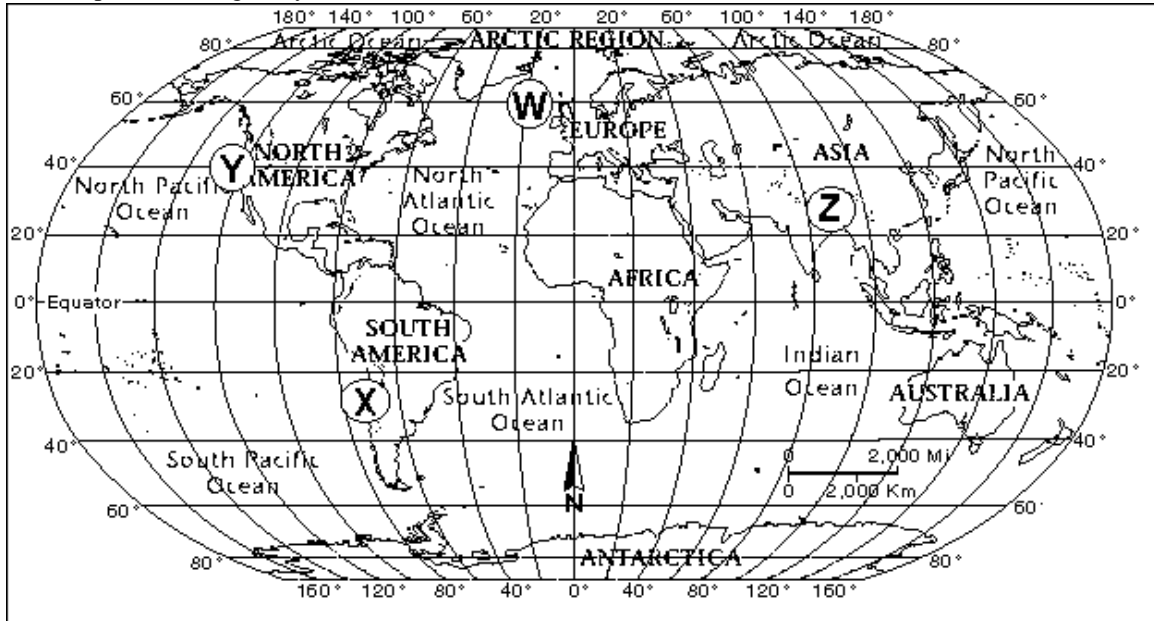
11. Which observation about the Mid-Atlantic Ridge region provides the best evidence that the seafloor has been spreading for millions of years?

- A) The bedrock of the ridge and nearby seafloor is igneous rock.
- B) The ridge is the location of irregular volcanic eruptions
- C) Several faults cut across the ridge and nearby seafloor.
- D) Seafloor bedrock is younger near the ridge and older farther away.

The world map, below, has four locations identified as W, X, Y, Z. Use the map with questions # 12-13.

12. There is a volcanic eruption at W, a small island near Iceland. The eruption is caused by

- A) the subduction of a plate carrying ocean floor.
- B) collision of two plates carrying continents on their leading edges.
- C) one plate sliding laterally along the edge of another.
- D) two plates moving away from each other.



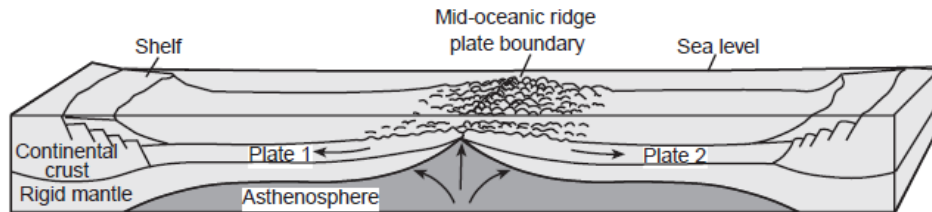
13. A volcano in the Chilean Andes Mountains(X) erupts. The tectonic cause is

- A) the subduction of a plate carrying ocean floor.
- B) collision of two plates carrying continents on their leading edges.
- C) one plate sliding laterally along the edge of another.
- D) two plates moving away from each other.

Base your answers to the questions 14 and 15 below on the cross section of two crustal plates and the boundary between them shown below. The arrows indicate the direction of rock movement.

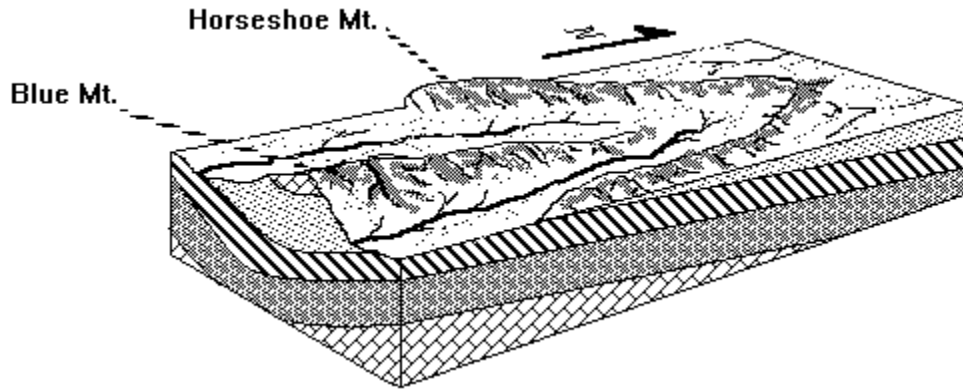
14. The mid-oceanic ridge portion best represents

- A) convergence of the Nazca Plate and the South American Plate
- B) divergence of the African Plate and the South American Plate
- C) subduction of the Philippine Plate by the China Plate
- D) transform faulting between the Pacific Plate and the North American Plate



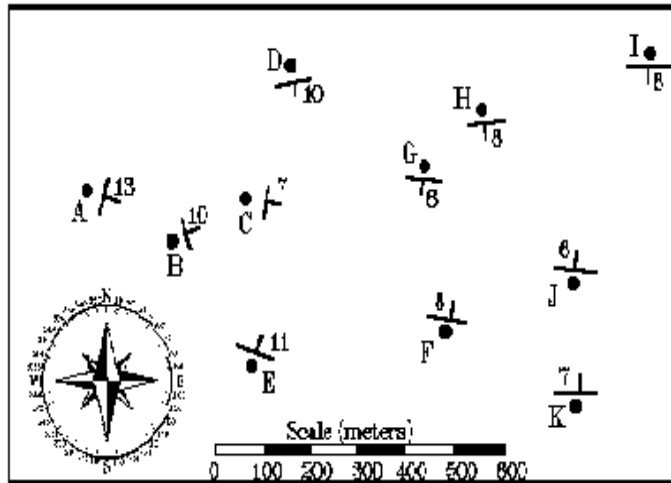
15. What geologic events would most likely occur at the mid-oceanic ridge plate boundary?
- A) magnetic pole reversals and cooling of ocean water.
 - B) meteorite impacts and tilting of shorelines
 - C) hydrospheric pollution and adiabatic heating
 - D) earthquakes and volcanic eruptions

The map below is of Horseshoe Mt and Blue Mt located in the Appalachian Mountains. Use the map to answer questions # 16, 17, 18.



16. The dip of the bedding plane on Horseshoe Mt. west of Blue Mt. is toward the
- A) southeast
 - B) northeast
 - C) southwest
 - D) northwest

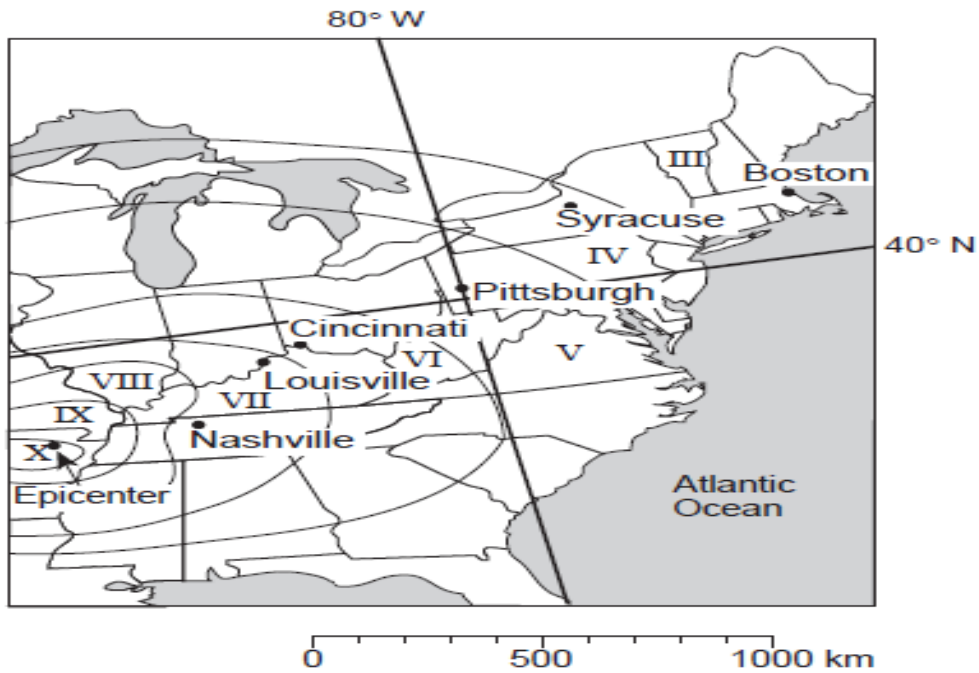
17. A geologist's field notes and map are shown below. The structure the geologist was surveying is
- A) a dome
 - B) a syncline
 - C) an anticline
 - D) a thrust fault



STRIKE & DIP DATA TABLE			
Station	Strike	Dip	Rock Type
A	20°	13°	Marble
B	345°	10°	Mica Schist
C	10°	7°	Gneiss
D	80°	10°	Marble
E	285°	11°	Marble
F	280°	6°	Mica Schist
G	95°	6°	Gneiss
H	85°	8°	Mica Schist
I	90°	6°	Marble
J	277°	6°	Gneiss
K	270°	7°	Marble

18. The geologist who did the survey above would tell you that the oldest rock found in a surface outcrop is the
- A) marble
 - B) mica schist
 - C) gneiss

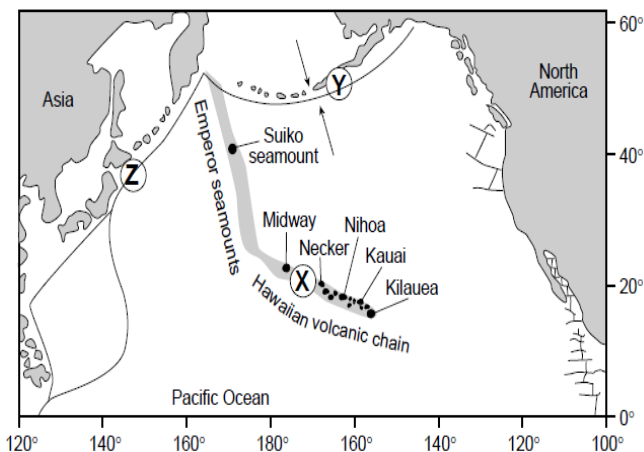
The map below shows an earthquake that occurred slightly southwest of New Madrid, Missouri on December 16, 1811. The Roman Numerals on the map were determined from the Modified Mercalli Scale, which is based on the observed effects of the earthquake.



19. Which statement best describes the earthquake waves recorded at Boston?
- A) P and S waves arrived the same time
 - B) S-waves arrived before the P-waves
 - C) P-waves arrived before the S-waves
 - D) S-waves arrived, but the P-waves did not arrive
20. For which city was the difference in arrival times between the P-waves and S-waves the smallest?
- A) Nashville
 - B) Pittsburgh
 - C) Syracuse
 - D) Boston

The map below shows the locations of volcanic islands and seamounts that erupted on the seafloor of the Pacific Plate as it moved northwest over the stationary mantle hotspot beneath the lithosphere. The hotspot is currently under Kilauea. Use the map and data table with questions # 21 and 22.

Map of Volcanic Features



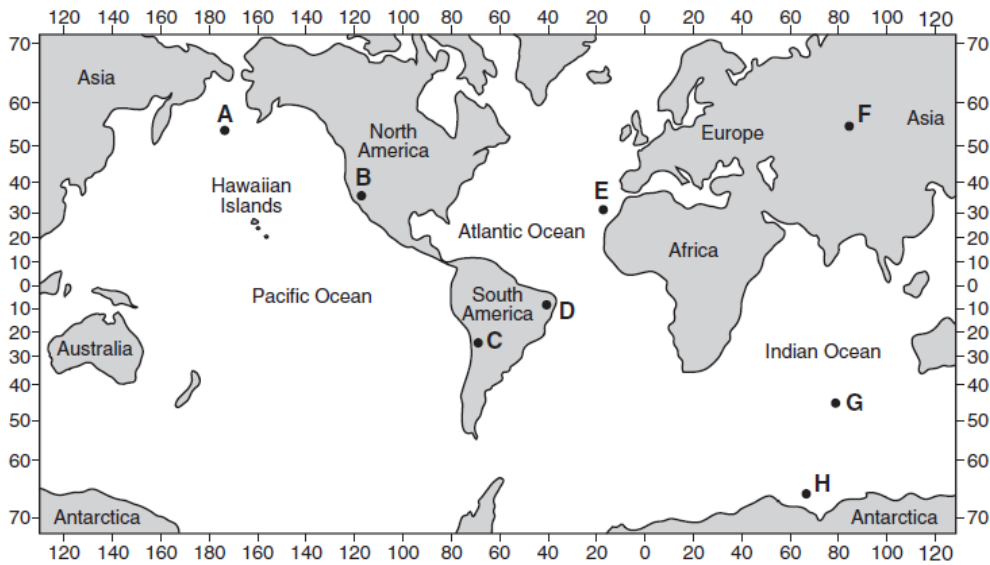
Data Table
Age of Volcanic Features

Volcanic Feature	Distance from Kilauea (km)	Age (millions of years)
Kauai	545	5.6
Nihoa	800	6.9
Necker	1,070	10.4
Midway	2,450	16.2
Suiiko seamount	4,950	41.0

21. Location X was originally over the hotspot. Approximately, how many km has X moved from its original position over the hotspot?
 A) 3600 km B) 2500 km C) 1800 km D) 690 km

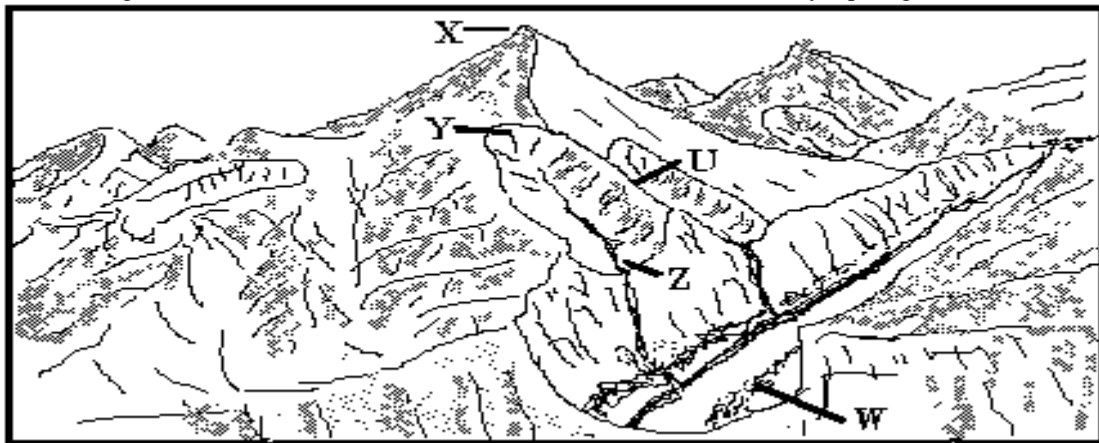
22. Which lithospheric plate boundary features are located at Y and Z?
 A) trenches created by the subduction of the Pacific Plate
 B) rift valleys created by seafloor spreading of the Pacific Plate
 C) secondary plates created by volcanic activity within the Pacific Plate
 D) mid-ocean ridges created by the faulting below the Pacific Plate.

Use the world map for the following question. Note the 8 places marked with letters on the map.



23. Which lettered location is most likely **not** going to experience a volcano?
 A) D B) E C) F D) G

24. The diagram below shows a number of features carved out of the rock by alpine glaciers.



The horn, lateral moraine, arête, cirque and hanging valley are indicated, in order by
 A) X, W, Y, U and Z B) U, Z, X, Y, and W C) X, U, Z, W and Y D) X, W, U, Y and Z

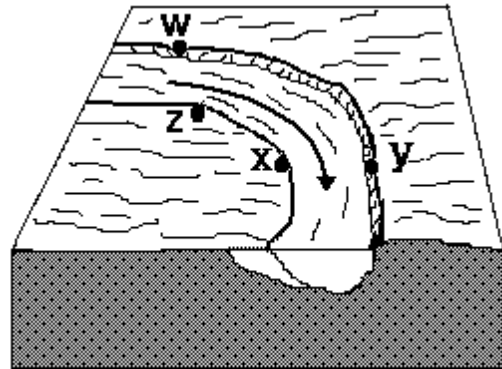
25. Ice sheets still exist on Antarctica and Greenland. Increased atmospheric temperature could cause them to melt and sea levels to rise by several feet. The primary human contribution to the greenhouse effect is
- A) cutting tropical forests C) releasing chlorofluorocarbons
 B) methane from solid waste D) burning fossil fuels

26. The transformation of semi-arid regions into deserts is called:
- A) deflation B) deforestation C) detoxification D) desertification

27. What minerals are responsible for the orange-brown colors of weathered surfaces in the desert?
- A) quartz B) alkali feldspar C) iron oxides D) halite, NaCl

The diagram below shows water flowing in a river. Use it with question #28.

28. The arrow shows the direction that water is flowing in the stream. The greatest deposition of sediments takes place at point:
- A) w B) x C) y D) z

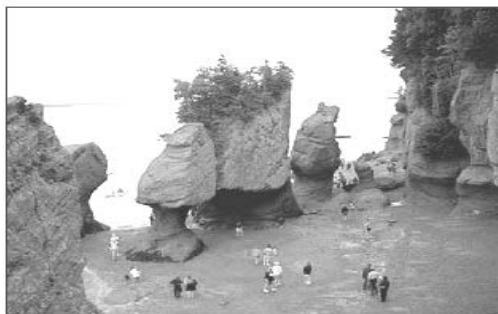


29. Trees growing on the edge of a river's meander are most likely to fall into the river due to
- A) deposition on the inside of the meander
 B) deposition on the outside of the meander
 C) erosion on the inside of the meander
 D) erosion on the outside of the meander

30. Long points of rock which hang in caves and look like rocky icicles are called
- A) pendants B) rockcicles C) stalagmites D) stalactites

31. The level to which water will rise due to pressure in an aquifer is known as the
- A) artesian level B) water table C) cap level D) aquifer table

32. The photographs below show the same coastal location at two different times during the same day.



People on Beach
12:40 p.m.



People Boating
6:52 p.m.

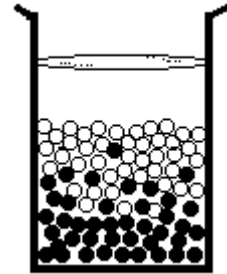
Source: thehopewellrocks.ca (adapted)

- Which statement best explains the cause for the higher water level at 6.52 pm?
- A) Earth's rotation causes a deflection of surface ocean currents
 B) Earth's tilted axis causes different amount of insolation during the day.
 C) The Moon exerts a gravitational pull on the rotating Earth
 D) The Moon rotates on its axis as the same rate that it revolves around the Earth..

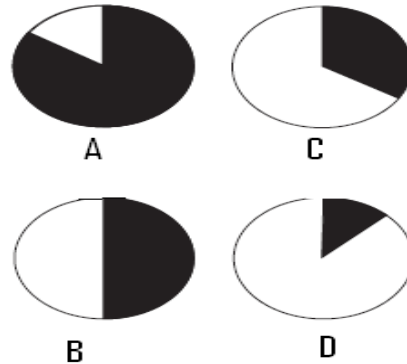
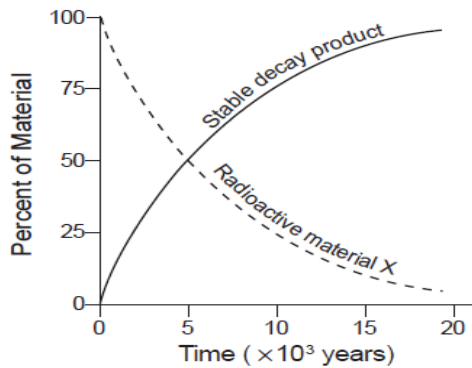
33. As waves approach a beach, the rows of waves gradually bend to a direction more parallel to the shore. This change in direction is called
 A) long shore drift B) tidal surge C) wave refraction D) wave reflection
34. Underground limestone is chemically eroded mostly by
 A) water B) sand in water C) oxygen in water D) carbon dioxide in water
35. Alternate freezing and thawing in cold, moist climates is similar in hot, desert climates to the process of
 A) hydration B) leaching C) exfoliation D) clay formation
36. In the diagram below the particles were poured into the beaker of water and stirred.

The most probable explanation for the distribution of the white and black grains is that the white grains have a

- A) smaller volume
 B) smaller density
 C) greater solubility
 D) rougher texture



The graph below and pie charts represents a radioactive substance, X and the resulting stable decay product. The half-life of substance X is about 5,000 years. Use the graphs and pie graphs with questions # 37, 38, and 39.



37. Four substances below have a certain amount of radioactive material X remaining. Which substance is the oldest?
 A. A rock 10% X B. Wood 33% X C. Shell 42% X D. Bone 52% X
38. If substance X were heated, the length of its half-life would
 A) increase B) remain the same C) decrease
39. Using the pie charts above which choice best represents the amounts of X and its decay product remaining after 15,000 years? The dark sections represent X remaining, while the light sections represents the decay product.
 A) A B) B C) C D) D
40. The discovery of coal in the Antarctica indicates
 A) forests can grow on continental glaciers
 B) coal can form in cold climates
 C) Antarctica's climate was once warmer
 D) Antarctica currently has area of tropical forest.

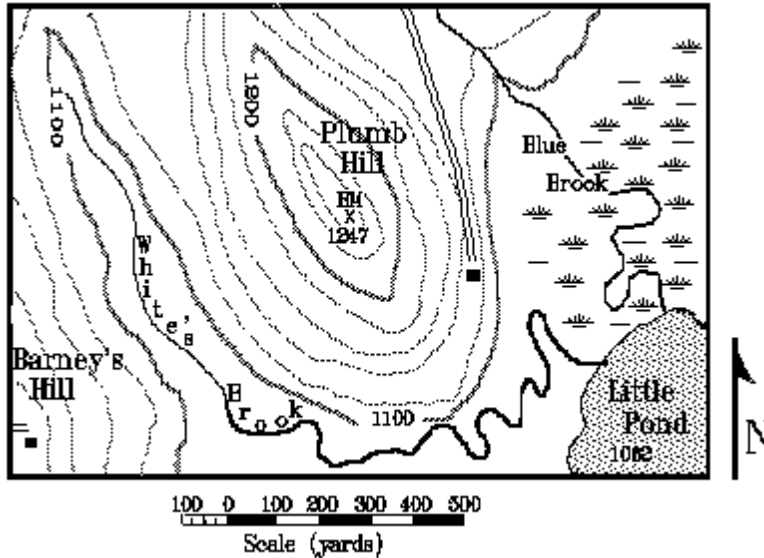
41. The last dinosaurs became extinct about how many years ago?
 A) 10 thousand B) 1 million C) 65 million D) 4.5 billion

Use the contour map for questions # 42 through # 46.

42. The contour interval for the map above is
 A) 10 feet B) 20 feet
 C) 50 feet D) 100 feet

43. Plumb Hill is a glacial feature. It is a
 A) drumlin B) kame
 C) kettle D) esker

44. In the area of the map, the continental glacier moved on an azimuth of
 A) 40° B) 150°
 C) 190° D) 280°



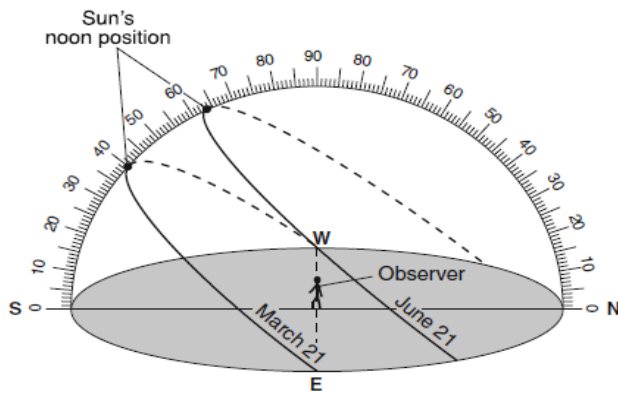
45. Can the cabin on the southeast flank of Plumb Hill be seen from the cabin on Barney's Hill?
 A) No B) Yes C) It is impossible to determine?

46. The drainage of Blue Brook is
 A) into Little Pond B) from Little Pond C) impossible to determine

47. You are a geologist and you need to compare land areas of different counties in New Jersey. The following map projections are available. Which is the best one to use?
 A) cylindrical B) sinusoidal C) polar D) polyconic

48. To measure longitude, the two instruments needed are
 A) sextant and compass C) sextant and chronometer
 B) quadrant and compass D) compass and chronometer

The diagram below shows the apparent path of the sun as viewed by an observer at 50° N latitude on June 21 and March 21. The data in the table records the Sun's maximum altitude on the same two days. The blank in the table is to be filled in for question #49. Use the diagram with questions 49, 50, 51, and 52.

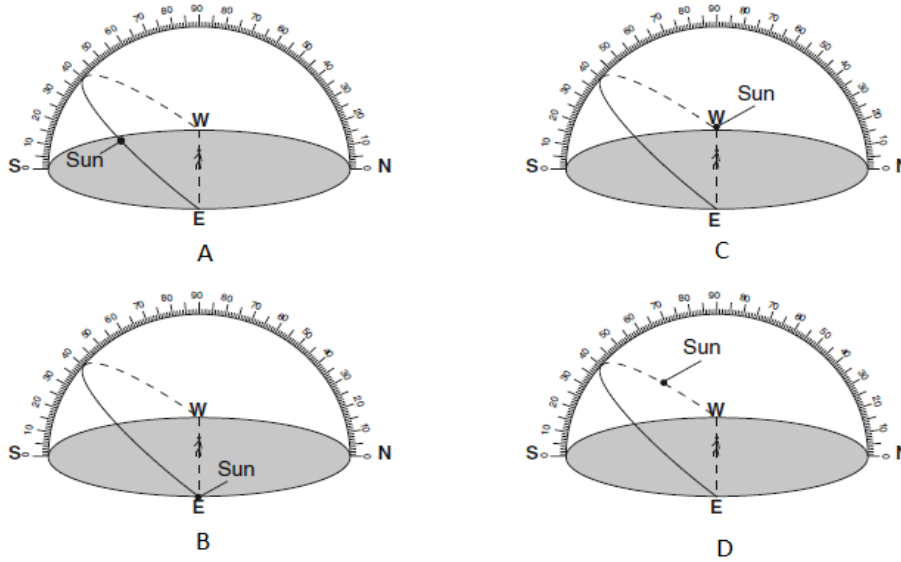


Date	Sun's Maximum Altitude
June 21	63.5°
March 21	40°
December 21	

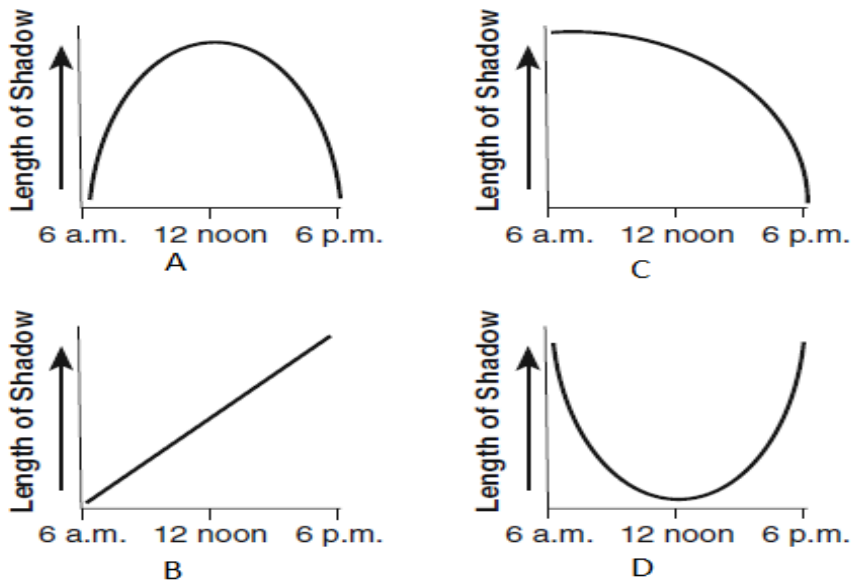
49. Which value should be placed in the data table for the Sun's maximum altitude on December 21?
 A) 16.5° B) 23.5° C) 40° D) 90°

50. Which statement best compares the intensity and angle of insolation at noon on March 21 and June 21?
- A) The intensity and angle of insolation are greatest on March 21.
 - B) The intensity and angle of insolation are greatest on June 21.
 - C) The intensity of insolation is greatest on June 21 and the angle of insolation is greatest on March 21.
 - D) The intensity of insolation is greatest on March 21 and the angle of insolation is greatest on June 21.

51. Which diagram represents the approximate location of the Sun at 3 pm on March 21?

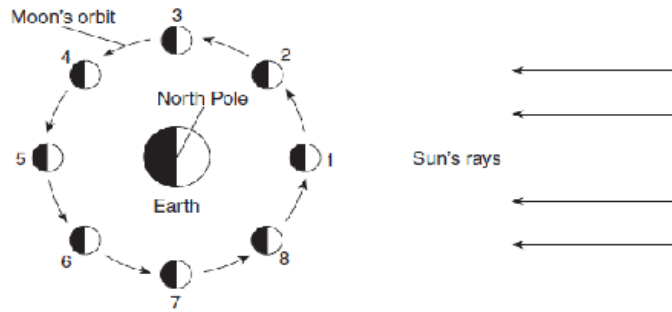


52. Which graph below best represents the relationship between the time of day and the length of a shadow cast by the observer on March 21?



The diagram below shows the Moon in eight different positions in its orbit around the Earth as viewed from the North Pole. The light side of the Moon is on the right. Use with questions # 53 and 54.

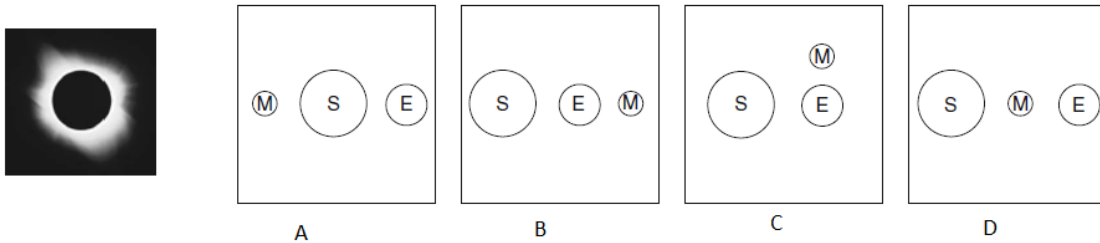
53. The approximate time for the Moon to move from position 3 to 5 is
 A) 2 weeks B) 6 hours
 C) 3 months D) 4 days



54. As the Moon moves from position #1 to #6 the visible portion of the Moon as observed from the Earth
 A) decreases only C) increases only
 B) decreases, then increases D) increases, then decreases

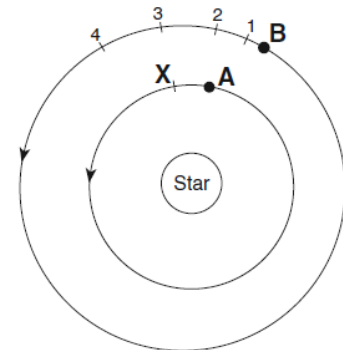
55. An eclipse of the moon can occur only when the moon is
 A) full B) crescent C) gibbous D) new

56. The left diagram below represents a total eclipse of the Sun as seen from Earth. Which diagram (A, B, C, and D) represents the relative positions of the Sun(S), Earth (E) and the Moon (M) in space during the total solar eclipse?



The diagram below represents the positions of two planets as they orbit around a star. X indicates a position in the orbit of planet A. The numbers 1 through 4 indicate positions in the orbit of planet B.

57. As planet A moves in orbit from its present location to X, planet B most likely moves in orbit to which position.
 A) 1 B) 2 C) 3 D) 4



58. If planet B was Venus in our solar system, then A would be which planet?
 A) Mercury B) Jupiter C) Earth D) Mars

59. The main characteristic which determines whether a planet can have an atmosphere is its
 A) mass B) distance from the sun C) temperature D) rate of spin

60. Astronomers determine the composition of stars from their
 A) light B) gravity C) magnetic fields D) rate of spin

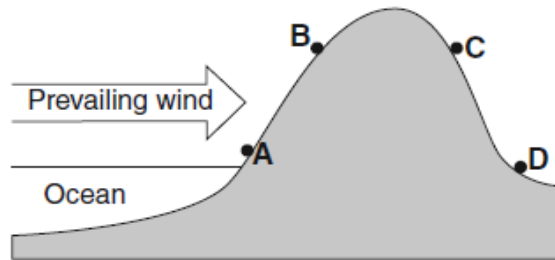
61. To an observer on Earth, the Sun appears brighter than the star Rigel (the brightest star in the constellation Orion, a blue white supergiant). The reason for this is that the Sun is
 A) Hotter than Rigel B) more luminous than Rigel C) closer than Rigel D) larger than Rigel

62. The position of the vernal equinox in space is a point where the
 A) celestial equator crosses the meridian
 B) celestial equator crosses the 0 hour circle
 C) ecliptic crosses the meridian
 D) ecliptic crosses the celestial equator

63. If the Big Bang Theory is correct, the Universe will
 A) continue to expand
 B) expand to a maximum size and maintain it
 C) stay the same size as it is now
 D) expand to a maximum size and then shrink to another Big Bang

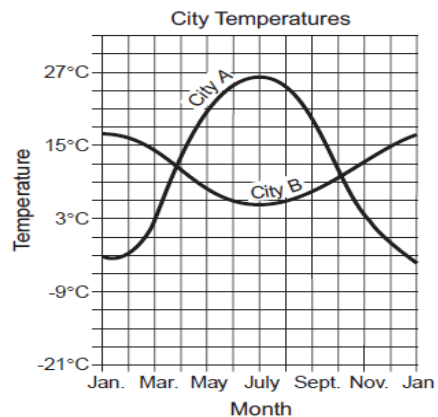
64. According to Newton's Law of Gravitation, the attraction between two bodies is proportional to the product of their masses and inversely proportional to the square of the distance between them. At closest approach to each other is the same then which of the following pairs of planets will be most strongly attracted to each other?
 A) Earth and Venus B) Earth and Mars C) Mercury and Venus D) Venus and Mars

65. The cross section below represents four locations on a mountain. The prevailing wind is given in the diagram. Of the four lettered locations which will be the warmest and most arid? Use the letters on the mountain for the choices.



The graph below shows the average monthly temperature of two cities, A and B

66. The temperature in city B is highest in January and lowest in July because city B is located
 A) on the western side of a mountain
 B) in the Southern Hemisphere
 C) On one of the Florida Keys
 D) at the North Pole



67. Both cities have an average yearly temperature of 11°C, but city A has a much greater temperature range than city B has. The reason city A has a much greater range is
 A) is closer to the Equator C) has more rainfall
 B) is farther from a large body of water D) has stronger prevailing winds.

68. Which weather variable generally decreases when wind speed is increasing, clouds are thickening, and visibility drops?

- A) relative humidity B) dew point C) precipitation D) air pressure

69. Which processes of the water cycle returns water vapor directly to the atmosphere?

- A) evaporation and transpiration C) freezing and precipitation
B) infiltration and capillarity D) water retention and run off

The weather map below shows the position of the jet stream relative to two air masses and a low-pressure center (L) over the United States. Use the map with questions 70, 71, and 72.



70. In which layer of the atmosphere is this jet stream located?

- A) thermosphere B) mesosphere C) stratosphere D) troposphere

71. What is the difference in air temperature and humidity between the cP and mT air masses?

- A) The cP air mass is warmer and less humid
B) The cP air mass is colder and more humid
C) The mT air mass is warmer and more humid
D) The mT air mass is colder and less humid

72. What is the general movement of the surface winds around the center of the low pressure area?

- A) counterclockwise and outward
B) counterclockwise and inward
C) clockwise and outward
D) clockwise and inward

NEW JERSEY SCIENCE LEAGUE
EARTH SCIENCE EXAM ANSWER KEY **TAN TEST**

DATE: April Exam 2014

Record the # correct onto the area record

1	B	19	C	37	A	55	A
2	D	20	A	38	B	56	D
3	D	21	C	39	D	57	A
4	D	22	A	40	C	58	A
5	A	23	C	41	C	59	A
6	A	24	D	42	B	60	A
7	B	25	D	43	A	61	C
8	C	26	D	44	B	62	D
9	C	27	C	45	A	63	A
10	C	28	B	46	A	64	A
11	D	29	D	47	D	65	D
12	D	30	D	48	C	66	B
13	A	31	B	49	A	67	B
14	B	32	C	50	B	68	D
15	D	33	C	51	D	69	A
16	A	34	D	52	D	70	D
17	B	35	C	53	A	71	C
18	A	36	B	54	D	72	B

Test Specifications

Since some earth science courses in New Jersey start with geology, others with astronomy, and still others with meteorology, each of the four tests will include the following topics. Over time, this provides an equal opportunity to everyone. The number in parentheses indicates the number of questions for that topic. The number per topic occasionally varies by one or two, but usually does not.

Minerals (4)	Sun (2)
Rocks (2)	Moon (2)
Earth Structure (2)	Sun-Moon-Earth System (3)
Plate Tectonics (4)	Solar System (3)
Faults/Folds/Seismology (3)	Stars (2)
Vulcanism (2)	Galactic Systems (2)
Glaciation/Deserts (2)	Cosmology (2)
Rivers:Erosion & Deposition (3)	
Ground Water/Caves (2)	Insolation/Temperature/Air Masses (3)
Ocean Shore Line/Currents/Salinity(3)	Atmospheric Pressure/Highs/Lows (4)
Weathering/Mass Wasting (2)	Moisture in the Atmosphere (3)
Historical Geology (4)	Frontal Systems (3)
Map Reading: Road/Topo/Geologic (4)	Interpreting Weather Maps (3)
Geodesics/Time/Map Projections (3)	

Testing Dates for 2014

Thursday April 10, 2014

***The April 2014 exam can be changed based upon the Schools spring break.**

The April exam must be completed by **April 25th**. No area may take the April exam during the first week of April or during the first week of May.

New Jersey Science League

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Web address <http://entnet.com/~personal/njscil/html/>

PLEASE RETURN THE AREA RECORD AND ALL TEAM MEMBER SCANTRONS(ALL STUDENTS PLACING 1ST, 2ND, 3RD, AND 4TH).

If you return scantrons of alternates, then label them as **ALTERNATES**.

Dates for 2015 Season

Thursday January 8, 2015 Thursday February 12, 2015

Thursday March 12, 2015 Thursday April 9, 2015