

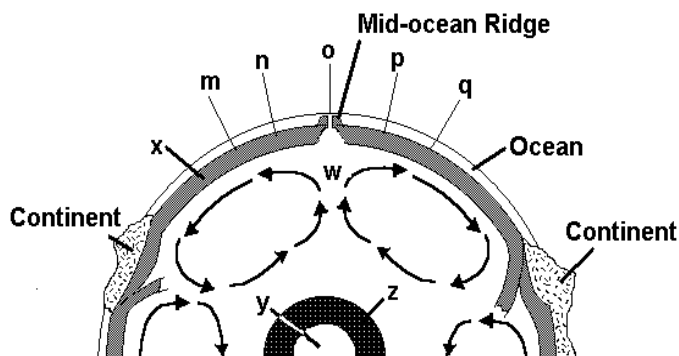
EARTH SCIENCE EXAM

Date January 2012

Directions: Each question is worth 1 point for a total of 72 points. For each statement or question, choose the word or phrase that *best answers* the question or completes the statement. On the Answer Form fill in the corresponding blank *completely*. Take a moment to look over the Reference Tables (last two pages). Refer to them whenever you need them. A ruler is on the reference tables in both cm and inches.

- Which of the following minerals is a common ore for lead?
 A) sphalerite C) chalcopyrite
 B) galena D) pyrite
- Diamonds and native gold are
 A) chemical elements C) mixtures
 B) chemical compounds D) suspensions
- The mass of a sample of galena is determined to be 76 grams. When it is dropped into a graduated cylinder of water, the volume increases by 10 ml. The density of the galena is
 A) 0.14 cm³/g C) 76 g/cm³
 B) 7.6 g/cm³ D) 760 g cm³
- A mineral's streak is most like
 A) a scratch on glass
 B) a reflection from a mirror
 C) a pencil mark
 D) a reflection from rippled water
- Rocks which may have mineral particles or crystals arranged in layers are
 A) igneous and sedimentary
 B) igneous and metamorphic
 C) sedimentary and metamorphic
 D) sedimentary only
- Three species of rock which have the same mineral content, but which cooled at different rates are
 A) basalt, diabase, and gabbro
 B) limestone, marble, and hornfels
 C) granite, sandstone, and quartzite
 D) quartz, granite, and quartzite
- 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.

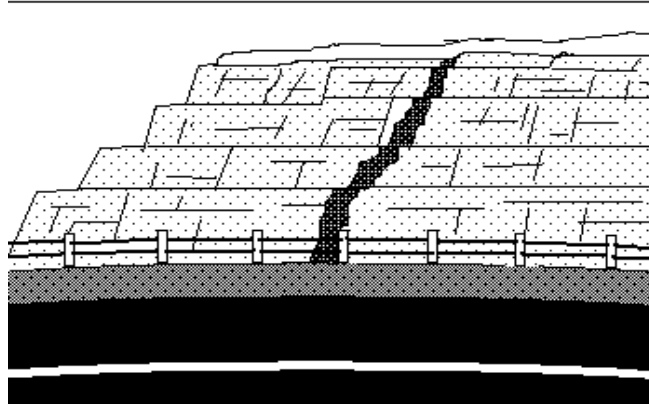
- The central core of the earth is thought to be
 A) solid C) plastic
 B) liquid D) semi-liquid



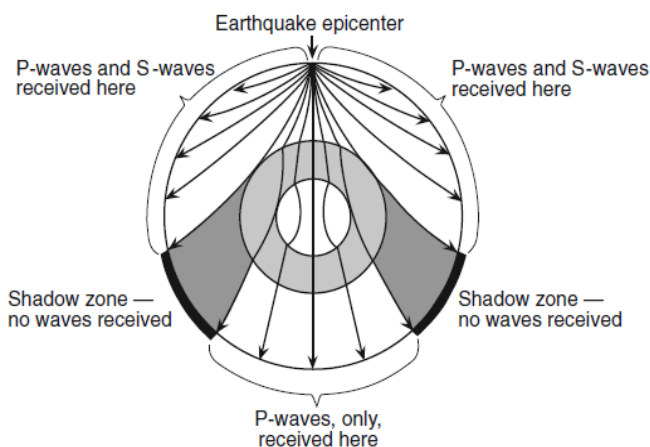
Use the drawing above with questions 9, 10, 11

- 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
- The youngest ocean crust is closest in location to
 A) m C) o
 B) n D) p
- The earth is most likely composed of granite at
 A) the ocean floor C) location w
 B) a continent D) location y
- Each year, on the average, North America moves away from Europe due to seafloor spreading by about
 A) 0.5 centimeters C) 5 meters
 B) 5 centimeters D) 5 kilometers
- The number of seismographic stations necessary to exactly locate an earthquake is
 A) one C) three
 B) two D) five

Base your answer to question # 14 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.



14. 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.



15. A seismograph in Denver records the arrival of earthquake tremors. The p-wave arrives at 08:27:11. The s-wave is recorded at 08:34:41. The seismologists checks the tables, and concludes that the distance to the earthquake is
- A) 6.0 kilometers
 - B) 6,000 kilometers
 - C) 8.5 kilometers
 - D) 8,500 kilometers

16. Molten rock in chambers deep below an active volcano is known as
- A) lava
 - B) magma
 - C) an intrusive formation
 - D) an extrusive formation

17. 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 a (drawing upper right corner)
- A) dike
 - B) laccolith
 - C) sill
 - D) batholith

18. The elevation in mountains above which snow remains all year is called the

- A) ice line
- B) frost line
- C) snow line
- D) melt line

19. Which of the lakes listed below was formed by continental glaciation of North America?

- A) Great Lakes
- B) Lake Meade
- C) Great Salt Lake
- D) Lake Okeechobee

20. When a river, laden with sediments, flows into a lake, bay, gulf, or sea the sediments form a

- A) fan
- B) kame
- C) delta
- D) esker

21. The river which is the western boundary of New Jersey is the

- A) Hudson River
- B) Mullica River
- C) Raritan River
- D) Delaware River

22. At a stream gauging station, the average speed of the water is measured to be 15 feet per second. The width of the stream is 200 feet and its average depth is 10 feet. The discharge (rate of flow) of the river is

- A) 300 ft³/sec
- B) 2,000 ft³/sec
- C) 3,000 ft³/sec
- D) 30,000 ft³/sec

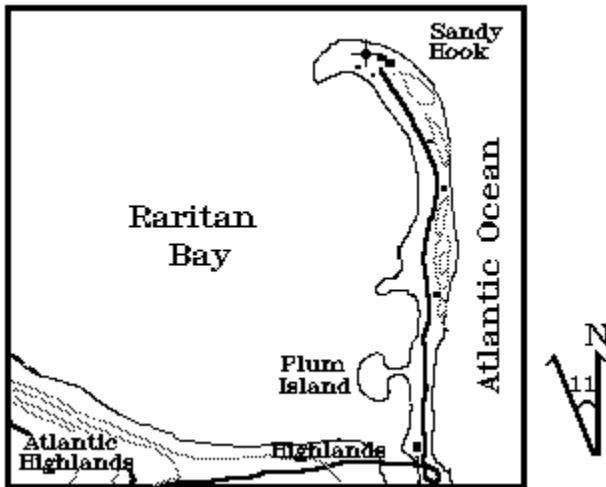
23. A small fissure in the cap rock (or aquitard, or aquaclude) above an aquifer can let water escape to the surface. The flow of water from the ground is

- A) an artesian well
- B) a spring
- C) a lake
- D) a tarn

24. A type of rock which makes a good aquifer because it usually has good porosity and permeability is

- A) granite
- B) sandstone
- C) shale
- D) gneiss

25. Sandy Hook derives its shape primarily from
 A) northeasterly winds washing sand around the end of a spit (drawing below)
 B) waves from southeasterly winds refracting waves around the end of a spit
 C) migration of dunes due to southeasterly winds
 D) convergence of waves from northeasterly and southeasterly winds



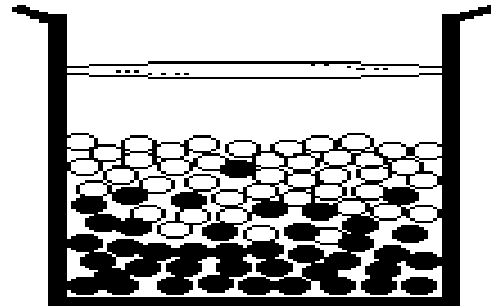
26. Homes and private property on barrier islands, like Long Beach Island, are often destroyed by hurricanes.
 A) They can be protected effectively by constructing sea walls.
 B) They can be protected effectively by constructing jetties.
 C) They can be protected by stabilizing the dunes.
 D) They can not be protected from severe winds and storm surge.

27. The Greenhouse Effect is probably causing sea level to rise. The main direct cause of the rising sea level is
 A) melt water from the melting ice caps
 B) isostatic rise of the sea floor
 C) isostatic sinking of the continents
 D) thermal expansion of sea water

28. Which substance has the greatest effect on the rate of weathering of rock?
 A) oxygen C) water
 B) carbon dioxide D) nitrogen

29. White and black particles of sediment were mixed then allowed to settle in a container of water. The pattern of sedimentation indicates that, compared to the black particles, the white particles of sediment have (drawing below)

- A) a lower density C) a larger surface
 B) a rougher surface D) a greater volume



30. If a dome is eroded until the top surface is relatively flat, the oldest bed will appear to be located
 A) on top C) in the center
 B) on the bottom D) around the outside edge

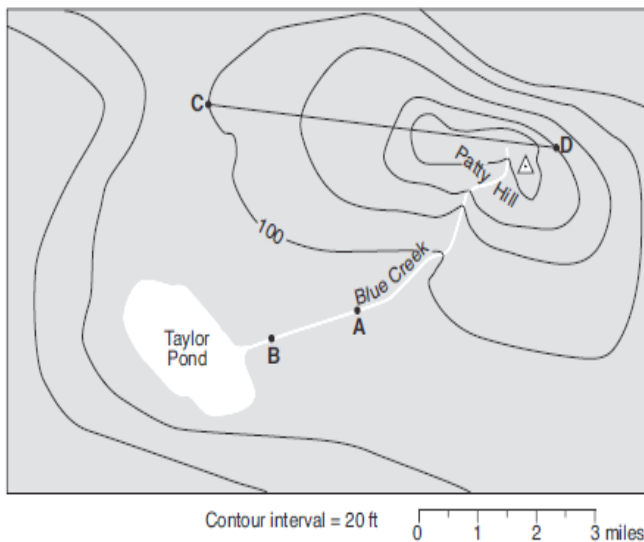
31. Fossils are usually found in which type of rock?
 A) sedimentary C) metamorphic
 B) igneous D) all of these

32. The eruption of the volcano that made Crater Lake in Oregon killed a lot of trees. The wood from many of the trees was preserved by burial and it has been analyzed for radioactive carbon-14. Carbon-14 has a half-life of about 5,730 years and decays to nitrogen-14. About 55% of the carbon-14 has decayed in those trees. Which of the following is the best estimate of the number of years ago that the Crater Lake volcano erupted?
 A) 400 C) 5,000
 B) 4,500 D) 6,500

33. Belemnites are fossils of an extinct marine squid-like animal. They can be found in the banks and beds of streams in Monmouth County. The most reasonable explanation for this is that
- A) the belemnites swam up the streams and died.
 - B) belemnites once lived on land.
 - C) the tides washed dead belemnites up the streams.
 - D) parts of Monmouth County were once covered by the ocean.

Use the map below for questions 34 through 37. Points A, B, C, and D are locations on the map. The top of Patty Hill is marked with a dot in the middle of a triangle.

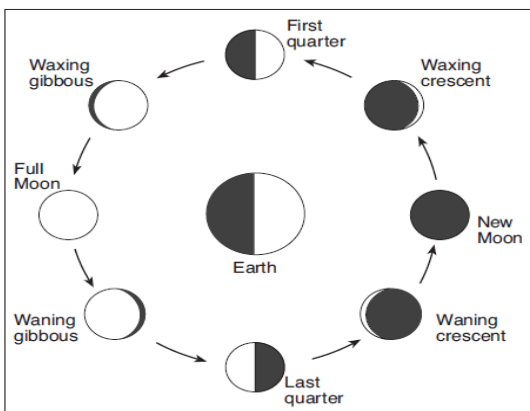
34. What is the direction of Taylor Pond from the top of Patty Hill?
- A) North East
 - B) South East
 - C) North West
 - D) South West
35. Which side of Patty Hill is the steepest?
- A) North East
 - B) South East
 - C) North West
 - D) South West
36. What is the approximate gradient from point C to the top of Patty Hill?
- A) 11 ft/mile
 - B) 5.5 ft/mile
 - C) 60 ft/mile
 - D) 6 ft /mile
37. What is the distance between points A and B on the map?
- A) 2.0 miles
 - B) 1.6 miles
 - C) 4.0 miles
 - D) 1.3 mile



38. Today, global positioning satellites (GPS) are used to locate positions on earth and for navigation of ships, airplanes, and automobiles. Signals from at least how many satellites are necessary to give a position?
- A) one
 - B) two
 - C) three
 - D) more than three
39. The motion of a Foucault pendulum provides evidence that the Earth
- A) varies in distance from the Sun
 - B) spins on its axis
 - C) is tilted on its axis
 - D) travels around the Sun
40. The only map of the earth which does not distort distance, direction, and area is a
- A) globe
 - B) Mercator projection
 - C) polar projection
 - D) polyconic projection
41. In the Northern Hemisphere, during which season does the Earth reach its greatest distance from the sun?
- A) winter
 - B) spring
 - C) summer
 - D) fall
42. The aurora borealis recently was visible in the northern sky. It is rarely seen in New Jersey and when it is seen, usually
- A) the solar wind has died down
 - B) the sunspots are near a maximum
 - C) the earth's magnetic field is at a minimum
 - D) the van Allen belt has collapsed
43. The ratio of the diameter of the Moon to the diameter of the Earth is about (ratio is moon to Earth)
- A) 1:1
 - B) 1:2
 - C) 1:3
 - D) 1:4

44. During which Moon phase might a solar eclipse be viewed on Earth?

- A) new Moon
- B) first quarter
- C) full Moon
- D) last quarter



45. High tides at any shore location, such as Barnegat Inlet or Cape May, occur approximately every

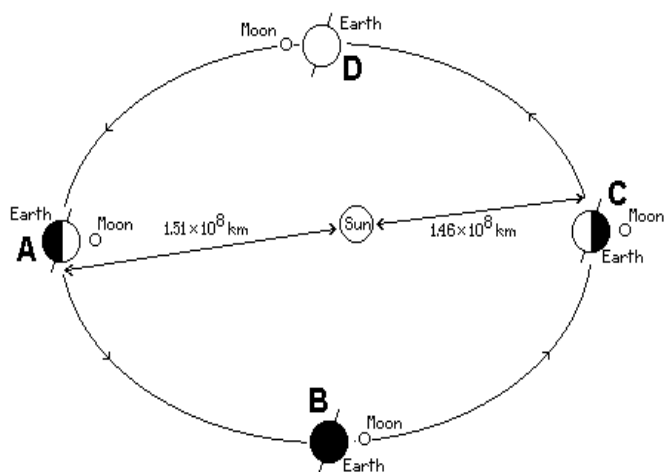
- A) 6 hours
- B) 8 hours
- C) 12 hours
- D) 24 hours

46. The day that has the greatest number of hours of daylight in the year is on or close to

- A) March 21
- B) June 21
- C) September 22
- D) December 22

47. The drawing below is the orbit of the Earth around the Sun. The shape of the earth's orbit around the Sun

- A) a perfect circle
- B) an oblate spheroid
- C) a flattened paraboloid
- D) a slightly eccentric ellipse



48. The "gaseous planets" are

- A) Venus, Mercury, Jupiter, Saturn and Neptune
- B) Venus, Jupiter, Saturn and Uranus
- C) Jupiter, Saturn, Uranus, and Neptune
- D) Mercury, Jupiter, Saturn, Uranus, and Neptune

49. The Great Red Spot on Jupiter is thought to be

- A) storms
- B) oceans
- C) volcanoes
- D) ice caps

50. The Earth is the only body in the solar system known to support life. The characteristic (s) which make this possible are

- A) its distance from the sun
- B) its distance from the sun and its size
- C) its size and composition
- D) its size, composition, and distance from the sun

51. The star, Vega, is blue-white. According to the Hertzsprung-Russell Diagram it is relatively (use reference tables)

- A) hot and bright
- B) hot and not bright
- C) cool and bright
- D) cool and not bright

52. Each night, stars appear to rise in the

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

53. The speed at which a galaxy is moving away from us is determined by measuring

- A) the red shift of its spectra
- B) the blue shift of its spectra
- C) its parallax
- D) its rate of rotation

54. Our Sun revolves around the center of

- A) Polaris
- B) Earth
- C) its axis
- D) Milky Way Galaxy

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

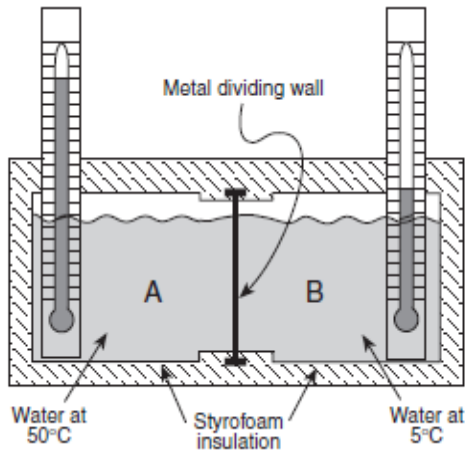
- A) gravitational attraction of dust and rocky meteors
- B) condensation of whirling clouds of gas
- C) explosion of a companion star to the sun
- D) capture as the planets entered the solar system

56. What motion is responsible for the regular seasonal changes of the constellations visible in the night sky?

- A) stars orbit the Earth
- B) The stars orbit the Sun
- C) The Moon orbits the Earth
- D) Earth orbits the Sun

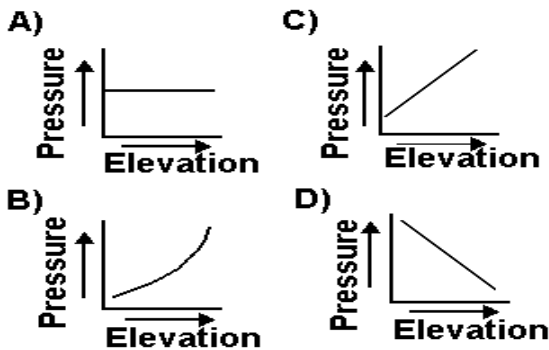
57. Temperature is the
 A) quantity of heat in a cubic centimeter of a substance
 B) average kinetic energy of molecules in a substance
 C) specific heat of a substance
 D) potential energy of molecules in a substance

58. On a cold, blustery January day, the temperature drops to 5°F and the wind is blowing at a steady 25 mph. The wind chill factor for the day is (use the reference tables at the end of the test)
 A) 5°F C) 25°F
 B) -30°F D) -36°F

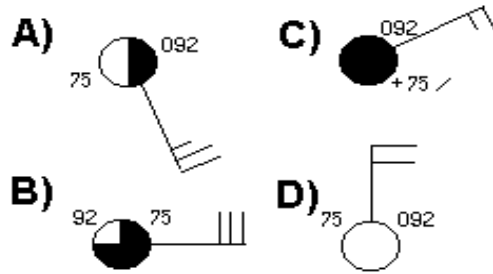


59. In the drawing above are two compartments of equal volumes of water. They are insulated by Styrofoam and separated by sheet of copper metal. The system is closed to the outside. If the temperature in section A were to drop by 20°C then the final temperature in B would
 A) remain the same C) become 15°C
 B) become 20°C D) become 25°C.

60. Which of the graphs, below, best represents the change in atmospheric pressure due to a change in elevation?



61. Which station models shows the wind from the north at a speed of twenty knots?



62. A balloon carrying weather instruments is released at the Earth's surface. As it rises through the troposphere what will the weather instruments of temperature and pressure generally read?
 A) a decrease in both temperature and pressure
 B) an increase in both temperature and pressure
 C) an increase in temperature and a decrease in pressure
 D) a decrease in temperature and an increase in pressure.

63. Winds which blow down from a mountain are usually
 A) warming and drying C) cooling and drying
 B) warming and moist D) cooling and moist

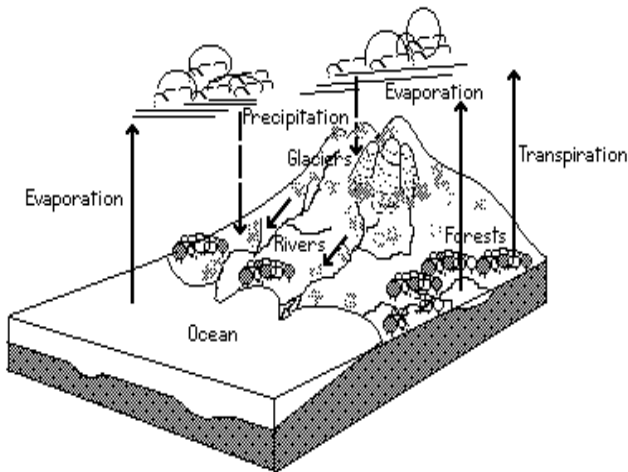
64. The ratio of the amount of water in the air to the amount which it can hold at a given temperature is
 A) the dew point
 B) the relative humidity
 C) the absolute humidity
 D) the vapor pressure

65. The most abundant gas in our atmosphere is
 A) oxygen C) nitrogen
 B) carbon dioxide D) water vapor

The diagram below represents the water cycle. Use it with question # 66

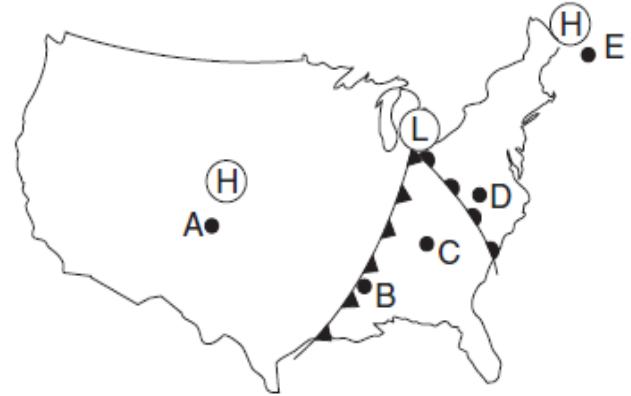
66. By which process does most of the water vapor enter the atmosphere?

- A) evaporation from lakes and rivers
- B) evaporation from ocean surfaces
- C) evapotranspiration from land surfaces
- D) sublimation from ice and snow



69. In the diagram below which two locations are most likely receiving precipitation?

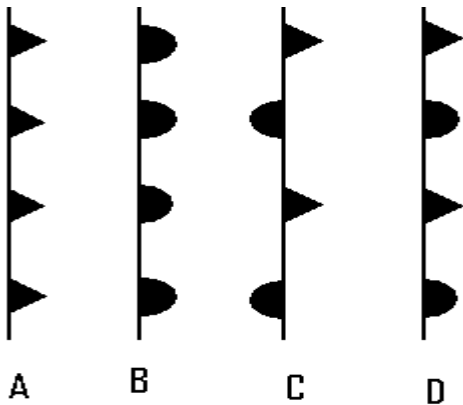
- A) A and C
- B) B and D
- C) C and E
- D) A and E



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

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

68. In the diagram below which symbol represents a warm front?



70. What is the latitude and longitude of the eye of the hurricane? Drawing to the right.

- A) 26.7°N 83.4°W C) 27.3°N 83.4°W
- B) 26.7°N 84.6°W D) 27.3°N 84.6°W

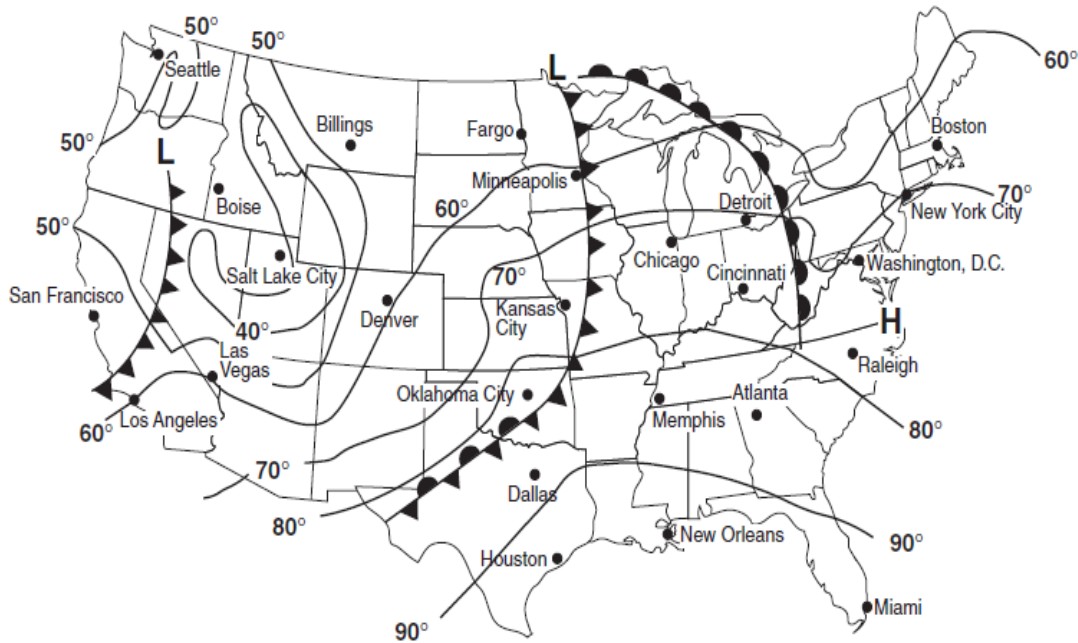
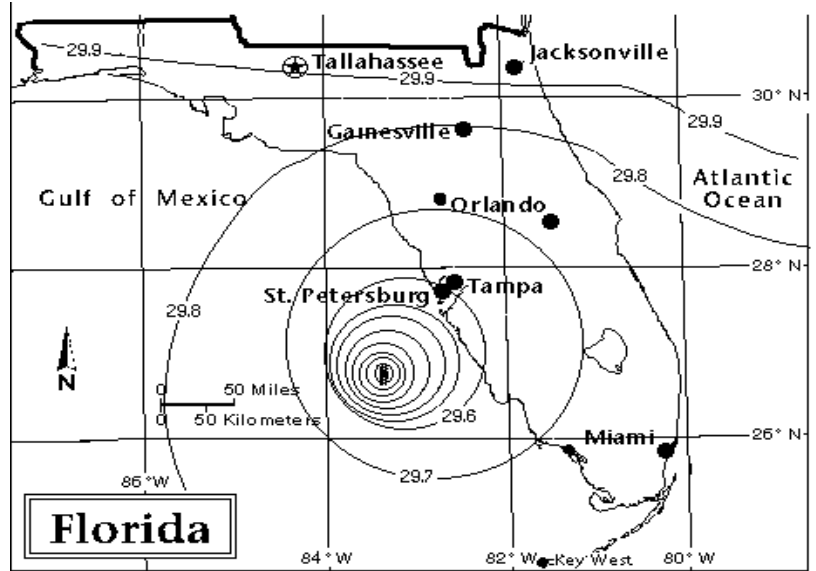
Use the weather map below with questions 71, 72.

71. What type of weather front is located west northwest of Dallas?

- A) cold front C) warm front
- B) occluded front D) stationary front

72. The weather front in California is a

- A) cold front C) Warm front
- B) occluded front D) Stationary front



The End

New Jersey Science League

Earth Science Exam - Answer Key

JANUARY 2012

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

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.

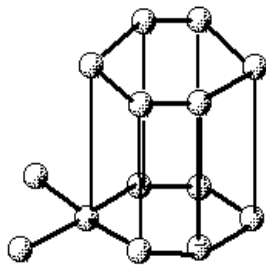
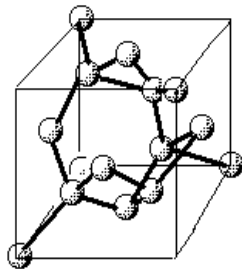
| | |
|---------------------------------------|---------------------------------------|
| Minerals (4) | Sun (2) |
| Rocks (2) | Moon (2) |
| Earth Structure (2) | Sun-Moon-Earth System (3) |
| Plate Tectonics (4) | Solar System (3) |
| Faults/Folds/Seismology (3) | Stars (2) |
| Vulcanism (2) | Galactic 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) | |

EARTH SCIENCE EXAM**February 9, 2012**

Directions: Each question is worth 1 point for a total of 72 points. For each statement or question, choose the word or phrase that *best answers* the question or completes the statement. On the Answer Form fill in the corresponding blank *completely*. Take a moment to look over the Reference Tables (last two pages). Refer to them whenever you need them. There is a metric ruler at the bottom of the reference page.

1. An object has a mass of 80 grams and a volume of 32 cm^3 . If the actual or accepted density is 2.7 g/cm^3 , then what is the %error?
 A) 0.2 % C) 5.0 %
 B) 7.4% D) 92%

2. Minerals form as the result of geologic processes in the earth's crust. They form as the result of
 A) Igneous intrusions or extrusions.
 B) Precipitation or evaporation.
 C) Metamorphism.
 D) Any of the above.

**Graphite****Diamond**

3. The diagrams above 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.

4. 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

5. The rock cycle refers to changes which rocks undergo
 A) at the earth's surface
 B) due to heat and pressure
 C) from depth to surface to burial
 D) deep in the earth's crust

6. Intrusive rocks usually cool slowly, thus their crystals are
 A) small C) perfectly formed
 B) large D) euhedral

7. All of the rocks which make up the continents, taken together, resemble most closely
 A) granite C) limestone
 B) basalt D) shale

8. For any earthquake, there is a shadow zone where no p or s waves are detected. The portion of the solid earth through which the s waves cannot pass and which refracts the p waves away from the shadow zone is the
 A) crust C) inner core
 B) mantle D) outer core

9. The meteorologist who is credited with the concept of continental drift is
 A) George Washington Carver
 B) Robert Deitz
 C) Tuszo Wilson
 D) Alfred Wegener

10. Magma from the mantle wells up to create new edges on crustal plates in
 A) subduction zones C) island arcs
 B) rift valleys D) hot spots

11. The number of large crustal plates that make up the jig-saw puzzle of the earth's crust is closest to

- A) three
- B) eight
- C) twenty-three
- D) fifty-five

12. 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

13. The Appalachian Mountains run through northwestern New Jersey. Structurally, they are

- A) fault block mountains
- B) folded mountains
- C) tilt block mountains
- D) volcanic mountains

14. The distance to an earthquake from a seismographic station can be determined because

- A) S and P waves travel at different speeds
- B) L waves lose intensity over distance
- C) S waves do not travel through the center of the earth
- D) P waves are refracted by the earth.

15. Seismographs are designed to measure

- A) s-waves only
- B) p-waves only
- C) horizontal motion only
- D) vertical motion only

16. Material produced by explosive type volcanoes is usually

- A) silica rich
- B) high temperature
- C) calcium rich
- D) iron rich

17. Mauna Loa on the Big Island of Hawaii is a shield volcano, composed of basaltic lava flows. Which of the profiles below most resembles Mauna Loa?

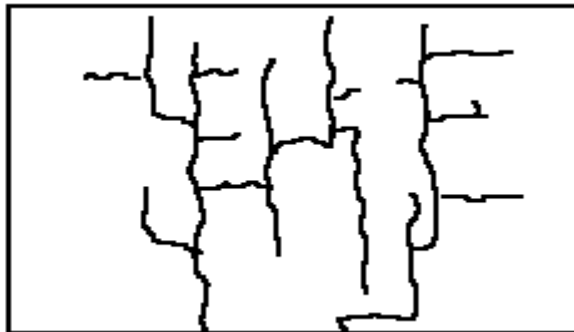


18. The loose, unsorted material deposited by a glacier is called

- A) detritus
- B) talus
- C) till
- D) breccia

19. Northern North America has been covered by continental glaciers at least

- A) once
- B) twice
- C) three times
- D) four times



20. The drainage pattern shown above can result from streams following a set of faults. The pattern is known as

- A) dendritic
- B) arborescent
- C) trellised
- D) radial

21. When an intermittent river or stream flows out of the mountains and onto a desert floor, the sediments form a

- A) delta
- B) cirque
- C) fan
- D) train

22. You would reasonably expect to find meandering rivers and streams in New Jersey, mostly in which geological area of the state?

- A) the Valley and Ridge
- B) the Piedmont
- C) the Highlands
- D) the Coastal Plain

23. When ground water dissolves limestone to form a cavern and the roof of the cavern collapses, the structure formed is a

- A) sink hole
- B) kettle hole
- C) kame
- D) esker

24. 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

25. A sand spit which is modified by waves bending around its end becomes a

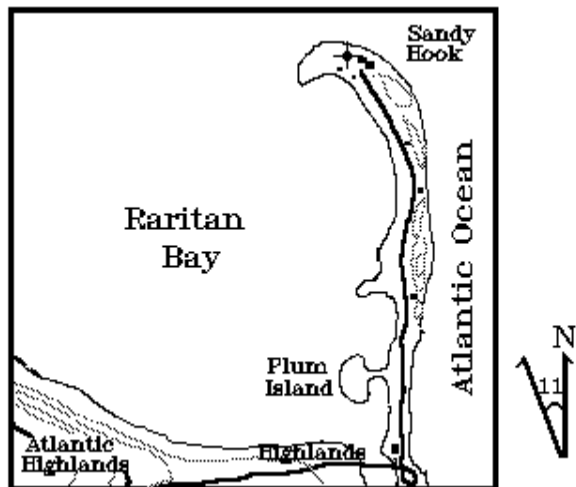
- A) tombolo
- B) bar
- C) terminal moraine
- D) hook

26. Sandy Hook derives its shape primarily from

- A) northeasterly winds washing sand around the end of a spit
- B) waves from southeasterly winds refracting waves around the end of a spit
- C) migration of dunes due to southeasterly winds
- D) convergence of waves from northeasterly and southeasterly winds

27. The Greenhouse Effect is probably causing sea level to rise. The main direct cause of the rising sea level is

- A) melt water from the melting ice caps
- B) isostatic rise of the sea floor
- C) isostatic sinking of the continents
- D) thermal expansion of sea water



28. Freezing and thawing of water in rocks causes them to break apart. A similar process in dry, hot desert climates is the result of

- A) salt formation
- B) blowout
- C) leaching
- D) expansion and contraction

29. Fence posts on a hillside are often tilted with their tops downhill as compared to the bottoms. The cause of this phenomenon is

- A) the farmers installed the fence this way
- B) the soil around the posts moves slowly downhill
- C) frost action pushes the fence posts downhill
- D) gravity pulls the fence until it is perpendicular to the hill

30. The Era known as the "Age of Reptiles" is the

- A) pr-Cambrian
- B) Paleozoic
- C) Mesozoic
- D) Cenozoic

31. The oldest of the Eras is the

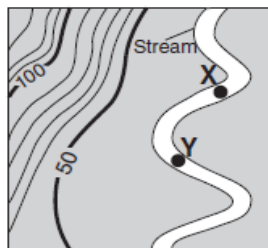
- A) Paleozoic
- B) Precambrian
- C) Cenozoic
- D) Mesozoic

32. What evidence suggests that a mass extinction of the dinosaurs happened at the end of the Cretaceous Period?

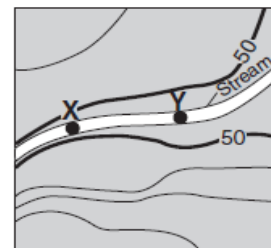
- A) an absence of dinosaur fossils in the Paleocene bedrock
- B) drawings of dinosaurs made by humans in caves during the Paleocene Epoch
- C) an abundance of dinosaur fossils in Early Cretaceous bedrock
- D) evolution of dinosaurs during the Late Cretaceous Epoch.

33. Why are radioactive substances useful for measuring geologic time?

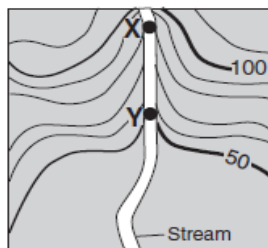
- A) The ratio of decay products to radioactive substances remains constant in rocks
- B) The half-lives of radioactive substances are short
- C) Samples of radioactive substances are easy to collect from rocks
- D) Radioactive substances undergo decay at a predictable rate



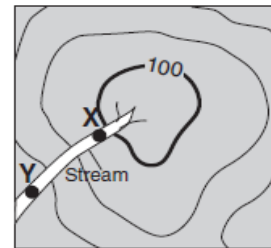
A



B



C

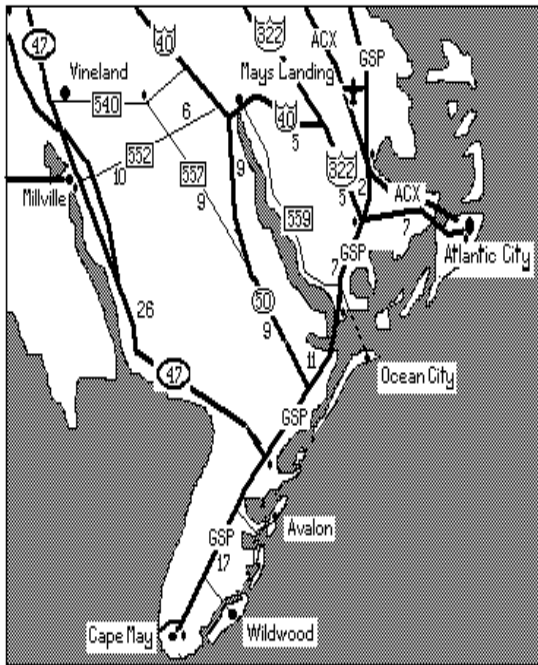


D

34. The four streams on the maps above have the same volume of water between points X and Y, while the distance between X and Y is the same as well. The maps have the same contour interval and are drawn to the same scale. Which map has the greatest stream velocity between points X and Y?

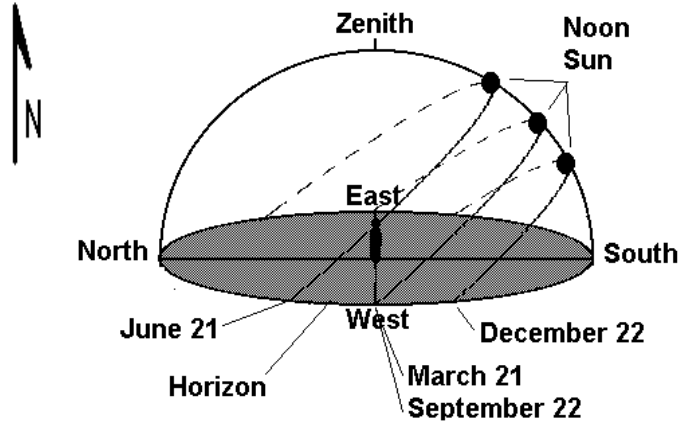
- A) A
- B) B
- C) C
- D) D

The map below represents a road map of southern New Jersey. Use it with questions 35, 36, 37



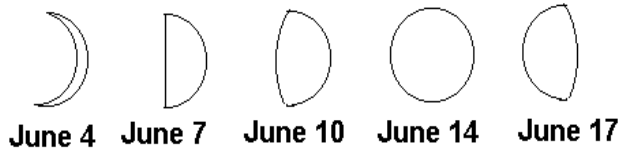
35. Driving on route 47 from Millville toward Avalon, you would be travelling approximately
- A) NW
 - B) S
 - C) SE
 - D) E
36. According to the map, the distance via the Garden State Parkway (GSP) and 322/40 from Cape May to Atlantic City is
- A) 33 miles
 - B) 35 miles
 - C) 28 miles
 - D) 42 miles
37. The body of water which is west of Cape May would be the
- A) Hudson Bay
 - B) Delaware Bay
 - C) Atlantic Ocean
 - D) Chesapeake Bay
38. The meridian for 0° longitude runs through
- A) the Pacific Ocean
 - B) Washington D.C.
 - C) Paris, France
 - D) Greenwich, England
39. On a Mercator projection of a world map, distortion of land areas is greatest near the
- A) equator
 - B) poles
 - C) international date line
 - D) Tropics of Cancer & Capricorn

40. A nautical mile is defined as the distance along one minute of arc on the earth's equator. The circumference of the earth in nautical miles is
- A) 3,600
 - B) 21,600
 - C) 24,800
 - D) 36,000

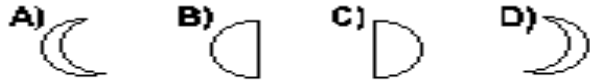


- Use the diagram above with questions #s 41 and 42.
41. The diagram above traces the apparent path of the sun across the sky in the Northern hemisphere on the dates indicated. At noon on which date would an observer at the center cast the shortest shadow?
- A) June 21
 - B) September 22
 - C) December 22
 - D) March 21
42. Which observation about the sun's apparent path at this location on December 22 is best supported by the diagram above?
- A) The sun appears to move across the sky at 5° per hour.
 - B) The sun's total path is longest on this day.
 - C) Sunrise occurs north of east.
 - D) Sunset occurs south of west.

43. The areas of the moon which appear to be dark colored when viewed from the earth are
- A) basaltic plains
 - B) water
 - C) granitic mountains
 - D) sandy deserts



44. The moon was observed in the phases shown above, each on the date given. Which phase below would the observer see on June 21?



45. An eclipse of the moon occurs only when the
 A) the sun passes between the earth and the moon
 B) the moon passes between the earth and the sun
 C) the earth passes between the sun and the moon
 D) the earth, sun, and moon form a right angled line

46. If the moon is on the western horizon just after sunset, its phase is
 A) first crescent C) full
 B) first quarter D) last crescent

47. The tidal motion of water in the ocean basins causes
 A) the moon to move closer to the earth
 B) the moon to slow its rate of revolution
 C) the earth to slow its rate of rotation
 D) the earth to increase its rate of revolution

48. The shape of the orbits of planets is
 A) circular C) parabolic
 B) elliptical D) hyperbolic

49. The orbital motion of a planet around a star is known as
 A) precession C) rotation
 B) declination D) revolution

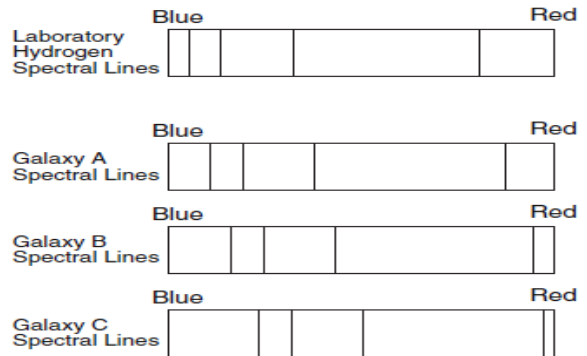
50. Which statement best describes Earth's position in our solar system?
 A. inner planet
 B. Outside of the three smaller planets
 C. Outside of the gas giants
 D. An Outer planet

51. Which statement best explains the apparent daily motion of the stars around Polaris?
 A) The Earth's orbit is an ellipse.
 B) The Earth has the shape of an oblate spheroid.
 C) The Earth rotates on its axis.
 D) The Earth revolves around the sun.

52. Compared to other groups of stars, the group that has relatively low luminosities and relatively low temperatures is the
 A) Red Dwarfs C) Red Giants
 B) White Dwarfs D) Blue supergiants

53. Which sequence lists the relative sizes from smallest to largest?
 A) our solar system, Milky Way Galaxy, the universe
 B) our solar system, the universe, Milky Way Galaxy
 C) Milky Way Galaxy, our solar system, the universe
 D) the universe, Milky Way Galaxy, our solar system

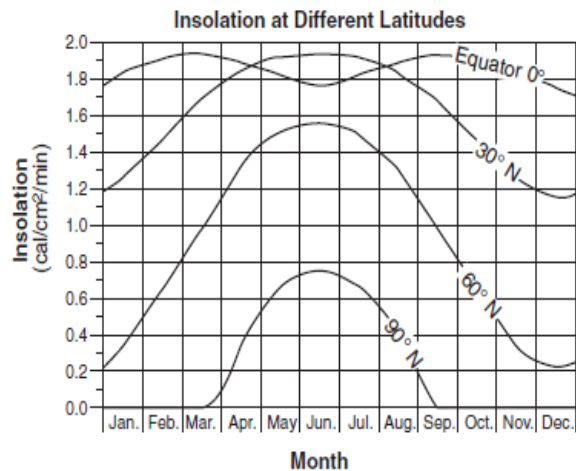
54. The spectra of galaxies A, B, and C are given below. What conclusion can be drawn about the movement of galaxies A, B, and C?
 A) galaxies A and B are moving away from the Earth, but C is moving toward the Earth
 B) Only galaxy C is moving away from the Earth
 C) all three galaxies are moving toward the Earth
 D) all three galaxies are moving away from the Earth



55. The theory for the formation of the universe which is accepted by most astronomers is the
 A) Steady State Theory
 B) Big Bang Theory
 C) Big Crunch Theory
 D) Oscillation Theory

56. According to the big bang theory, the universe began as an explosion and is still expanding. This theory is based on observations of stellar spectra of distance galaxies showing a
- A) a concentration of the yellow portion of the spectrum
 - B) concentration in the green portion of the spectrum
 - C) a shift toward the blue end of the spectrum
 - D) a shift toward the red end of the spectrum
57. The cities listed are all at about the same latitude. Which should have the highest average summer temperatures?
- A) St. Louis, Missouri
 - B) Washington, DC
 - C) San Francisco, California
 - D) Philadelphia, Pennsylvania

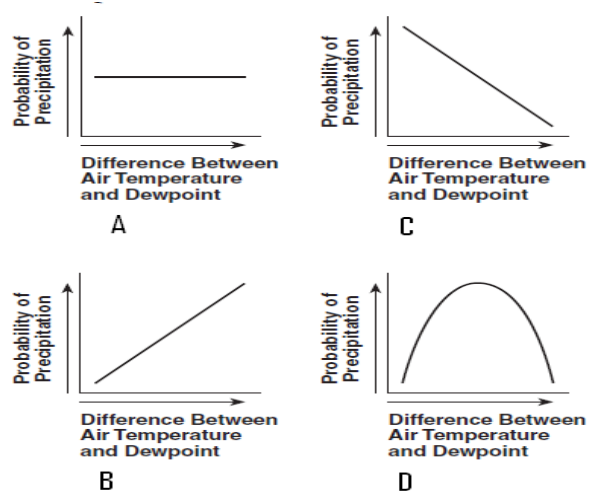
The graph below shows the amount of insolation during one year at four different latitudes on Earth.



58. Which statement describes how insolation varies?
- A) varies with latitude and time of day
 - B) varies with latitude and time of year
 - C) varies with longitude and time of day
 - D) varies with longitude and time of year.
59. Why is insolation 0 cal/cm²/min at the North Pole?
- A) the snow on the ground reflects the sunlight back into the sky.
 - B) during this time of the year the Sun is constantly below the horizon
 - C) the temperature is so cold that insolation cannot be absorbed
 - D) the wind constantly blows the dust and snow into the air reflecting the sunlight away from the ground.

60. Rotation of the earth causes prevailing winds in the northern hemisphere to
- A) blow from the northwest
 - C) turn to the left
 - B) blow from the southeast
 - D) turn to the right
61. Low pressure cells tend to move over the United States along the path of the jet stream in the general direction from
- A) North to South
 - C) South to North
 - B) West to East
 - D) East to West
62. Wind speeds are generally greater
- A) in winter than in summer
 - B) over land than over water
 - C) at the surface than at higher altitudes
63. By increasing the height of smokestacks industries in the Midwest reduced the local concentration of air pollutants. However, the pollution was carried by wind to the Northeast where it contributed significantly to –
- A) solid waste
 - C) rain water runoff
 - B) acid rain
 - D) large amounts of rain

64. As the difference between dew point temperature and the air temperature decreases the probability of precipitation
- A) decreases
 - C) increases
 - B) remains the same
 - D) is not possible.
65. Snowfall at the South Pole is rare. The reason is that the air over the South Pole is usually
- A) rising and moist
 - C) rising and dry
 - B) sinking and moist
 - D) sinking and dry
66. Which graph best represents the probability of precipitation and the difference between air temperature and dew point?

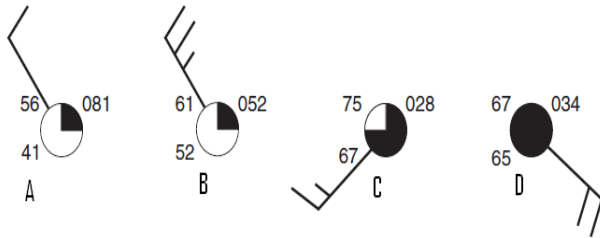


67. Cloud formation is likely to occur in rising air because rising air

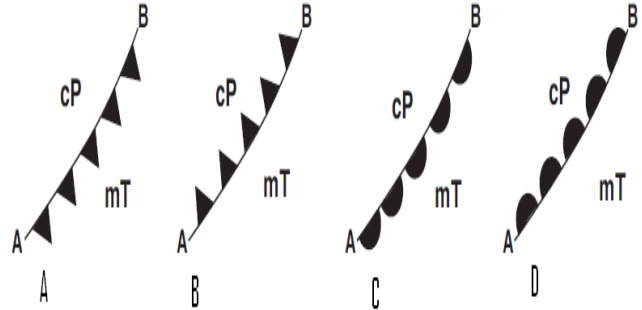
- A) expands and cools
- B) contracts and cools
- C) expands and warms
- D) contracts and warms

68. What is the wind speed at station model letter B?

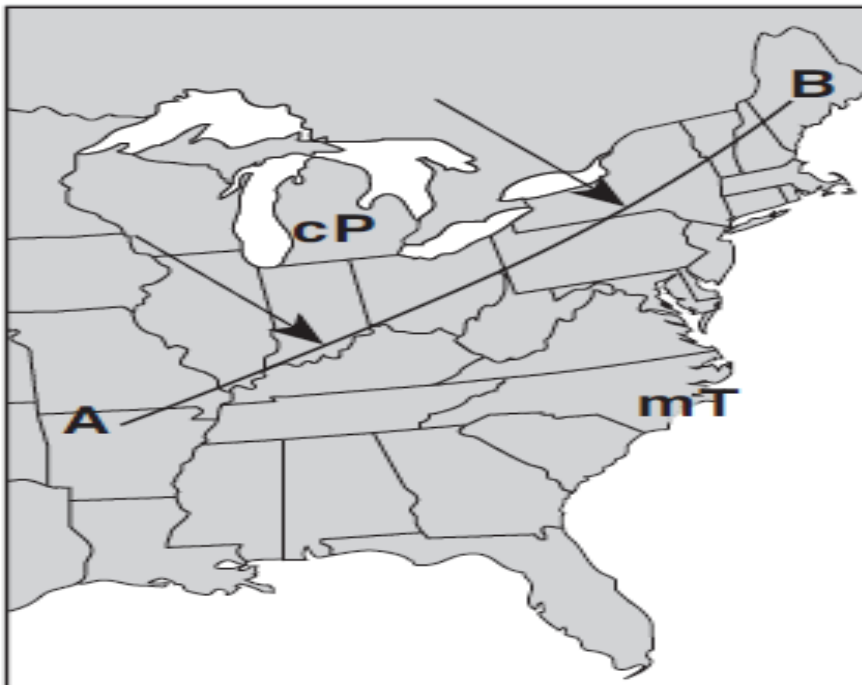
- A) 15 knots
- B) 35 knots
- C) 25 knots
- D) 45 knots



69. Which symbol below represents the frontal boundary for line AB?



The weather map below shows part of the United States. Line AB is a frontal boundary between two air masses. The two large arrows indicate the direction that air mass cP is moving.



Use the weather map below with questions
#s 70, 71, 72

70. Which kind of frontal system is located northwest of Miles City, Montana?

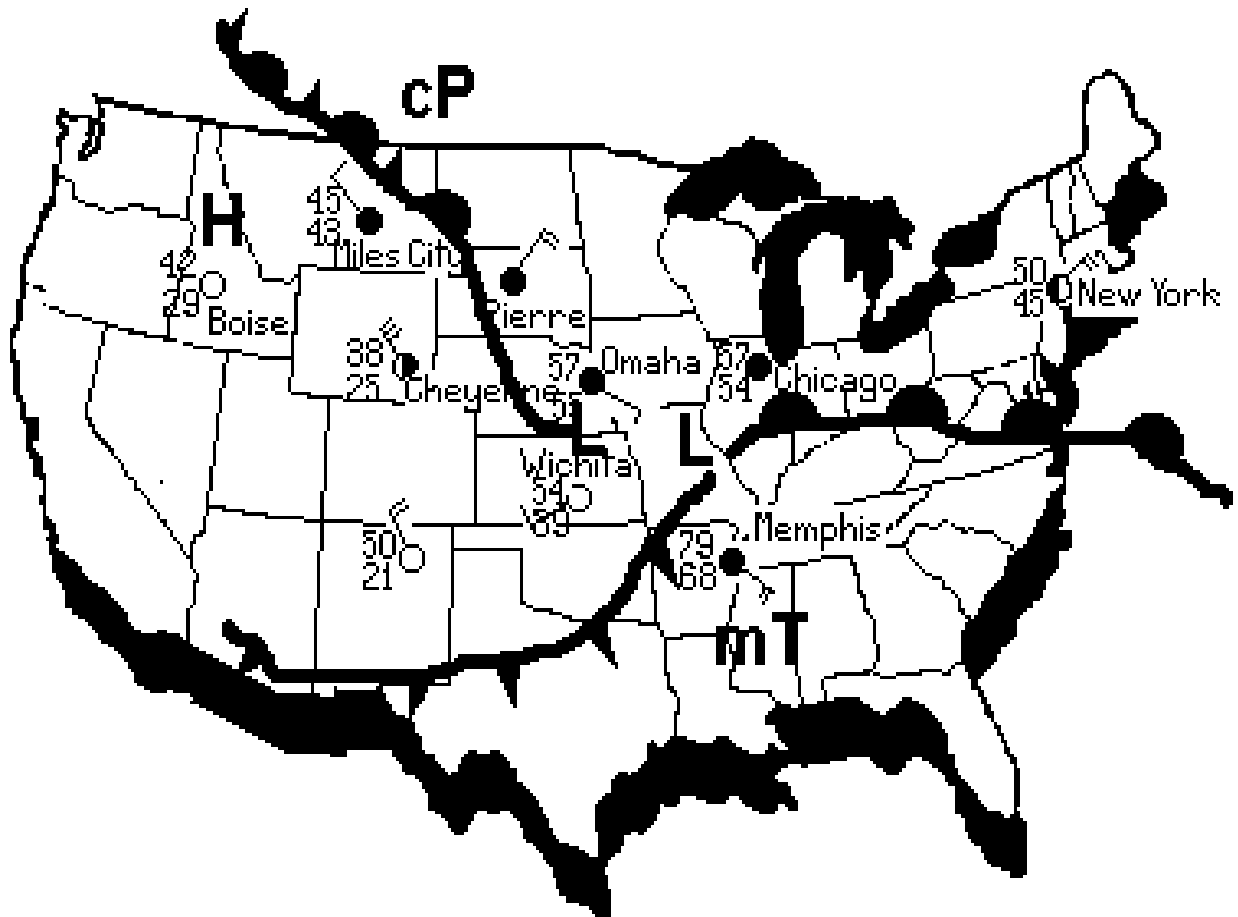
- A) cold front
- B) warm front
- C) stationary front
- D) occluded front

71. The air mass over Memphis, Tennessee, probably originated in

- A) the North Pacific
- B) central Canada
- C) the central United States
- D) The Gulf of Mexico

72. If the low pressure systems follows the path of most weather systems in the United States, in which direction will they move?

- A) northeast
- B) northwest
- C) southeast
- D) southwest



The End

The End

New Jersey Science League

Earth Science Exam - Answer Key

February 9, 2012

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

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) | |

EARTH SCIENCE EXAM

Date March 8, 2012

Directions: Each question is worth 1 point for a total of 72 points. For each statement or question, choose the word or phrase that *best answers* the question or completes the statement. On the Answer Form fill in the corresponding blank *completely*. Take a moment to look over the Reference Tables (last two pages). Refer to them whenever you need them. A ruler is on the reference tables in both cm and inches.

1. Each mineral has a unique crystal shape because of the

- A. hardness being between 1 and 10
- B. streak being constant
- C. arrangement of the atoms
- D. variations in color

2. A sample of the unknown mineral massed in air is 470mg. The same sample massed while suspended in water is 270mg. Its specific gravity is

- A) 200
- B) 2.35
- C) 1.74
- D) 0.57

3. The sample of the unknown mineral in #2 above is colorless and one can see through it. It is

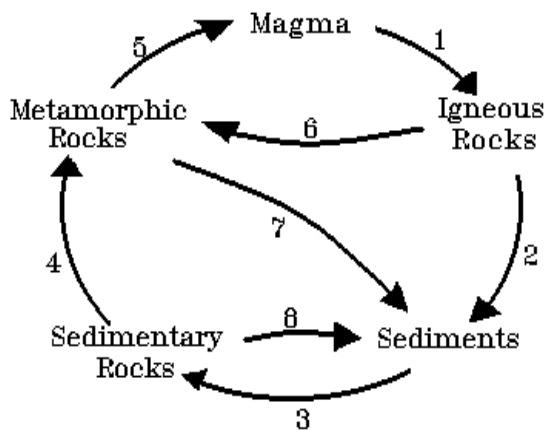
- A) transparent
- B) translucent
- C) diffuse
- D) opaque

4. The chemical element that is most common in minerals of the earth's crust is

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

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. In the diagram of the rock cycle (lower left), the number which represents the process of crystallization is

- A) 1
- B) 2
- C) 5
- D) 7

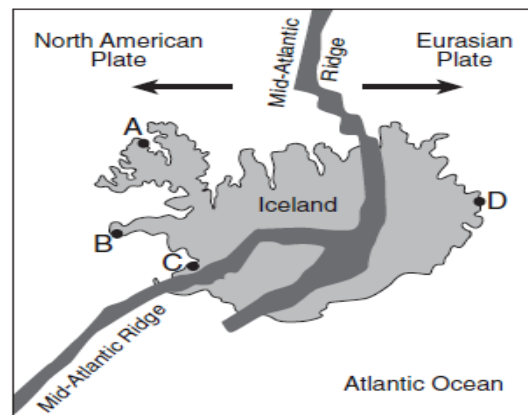
7. The internal structure of the earth is determined from

- A) oil wells
- B) earthquakes
- C) a Siberian mine
- D) the Moho Drilling Project

8. The earth's magnetic field probably results from circulation of fluid material in the

- A) upper mantle
- B) lower mantle
- C) outer core
- D) inner core

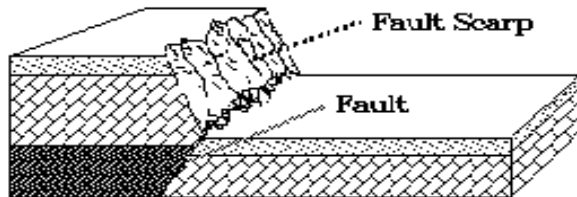
Use the drawing below of a map of Iceland. Iceland is located on the Mid-Atlantic Ridge. There are four locations marked with letters A, B, C, and D. Use with questions #9, 10, 11.



9. Most of the igneous rock has a fine-grained texture. This texture is due to

- A) rapid cooling of the molten rock
- B) high density of the molten rock
- C) the many faults in the bedrock
- D) the high pressure within the molten rock

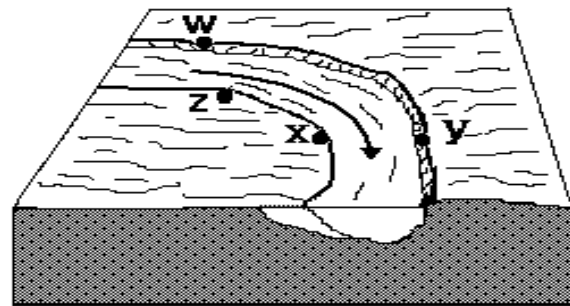
10. Which one of the four labeled sections is the youngest bedrock?
 A) A C) C
 B) B D) D
11. Mid-ocean ridges (rifts) normally form where tectonic plates are
 A) converging C) diverging
 B) stationary D) sliding past each other
12. Plate Tectonic Theory holds that the continents came together to form the super continent, Pangea, in which geologic era?
 A) preCambrian C) Cenozoic
 B) Paleozoic D) Mesozoic
13. Earthquakes occur in California because
 A) earthquakes always accompany volcanoes
 B) California is sinking into the Pacific Ocean
 C) giant underground explosions occur every few years
 D) two blocks of the earth's crust are grinding past each other
14. Folding of rock is caused by compression when two crustal plates push against each other at
 A) rift zones C) transform faults
 B) normal faults D) subduction zones



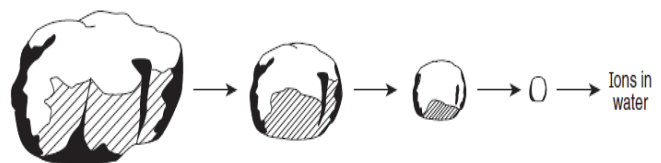
15. The fault in the diagram above was caused by
 A) compression forces (pushing the two blocks together)
 B) tension forces (pulling the two blocks apart)
 C) horizontal shearing forces (sliding the blocks horizontally)
16. Thin layers of volcanic ash act as excellent time markers in correlation of bedrock because volcanic ash
 A) falls to Earth over a large area in a short period of time
 B) is deposited over millions of years
 C) stays in the atmosphere for millions of years
 D) is easily eroded and lasts only a short time on the Earth's surface

17. The type of rock commonly formed by solidification of lava from volcanoes around the Pacific rim is
 A) basalt C) gabbro
 B) diabase D) andesite
18. The Grand Teton Mts. in Wyoming, like the Alps in Switzerland were shaped by mountain glaciers. Peaks formed by the head ward erosion of three or more glaciers are
 A) arêtes C) cols
 B) horns D) tarns
19. Which of the lakes listed below was formed by continental glaciation of North America?
 A) Great Lakes C) Great Salt Lake
 B) Lake Meade D) Lake Okeechobee

The diagram below shows water flowing in a river. Use it with questions 20-21.



20. The arrow shows the direction that water is flowing in a stream. The greatest erosion takes place at point:
 A) w C) y
 B) x D) z
21. The arrow shows the direction that water is flowing in the stream. Of the points indicated, the water velocity is usually greatest at point:
 A) w C) y
 B) x D) z
22. The diagram below shows what happens to a rock within a stream's erosional-depositional system as time passes. Which of the choices of change is best represented by the sequence of diagrams shown?



23. A type of rock which makes a good aquifer because it usually has good porosity and permeability is

- A) granite
- B) sandstone
- C) shale
- D) gneiss

24. Of the sediments listed below which is least permeable?

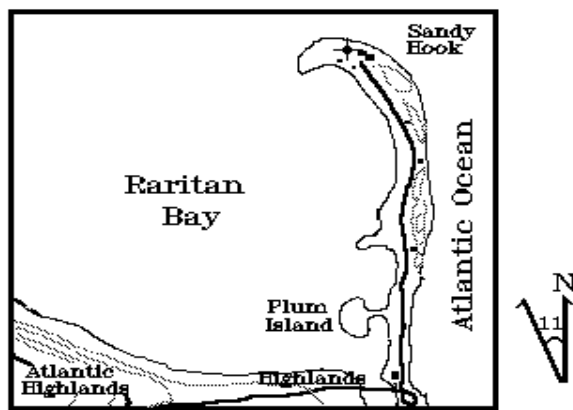
- A) Clay
- B) Silt
- C) Sand
- D) Pebbles

25. In New Jersey an example of an estuary is

- A) Long Beach Island
- B) Barnegat Bay
- C) Raritan Bay
- D) Spruce Run Lake

26. Which landform is produced where the Mississippi River flows into the Gulf of Mexico?

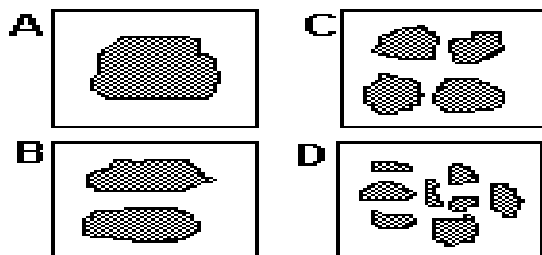
- A) a delta
- B) an outwash
- C) a drumlin
- D) an escarpment



27. Sandy Hook (above) is known as a

- A) spit
- B) a moraine
- C) a barrier beach
- D) a tombolo

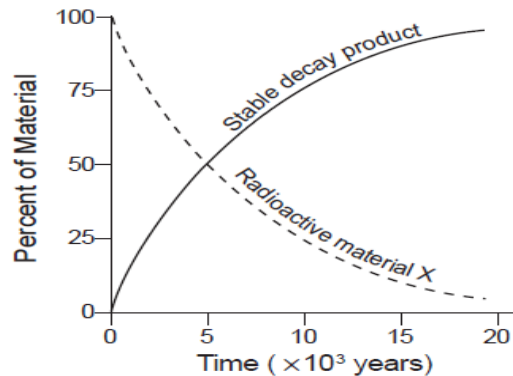
28. The four limestone samples shown below have the same composition, structure, mass, and volume. Under the same climatic conditions, which will weather fastest?



29. Of those listed, the substance that has the greatest effect on the weathering of rocks is

- A) nitrogen
- B) oxygen
- C) water
- D) hydrogen

The graph below represents a radioactive substance, X and the resulting stable decay product. Use with questions #30, 31, 32



30. What is the approximate half-life of radioactive substance X

- A) 5,000 year
- B) 10,000
- C) 50, 000 years
- D) 100,000 years

31. Material X can **only** be used to date young geologic material because X

- A) has relatively short half-life
- B) never existed in older rocks
- C) has only recently become radioactive
- D) has only recently been discovered

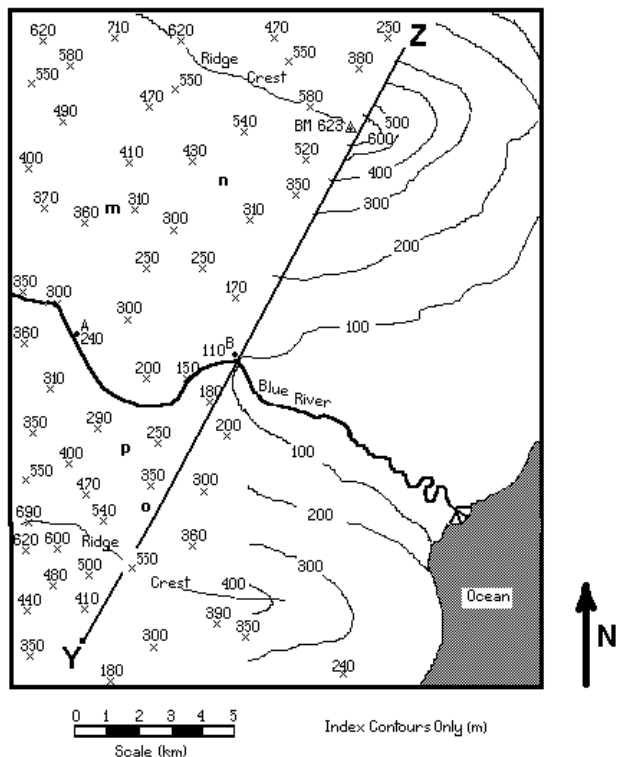
32. If substance X were heated, the length of its half-life would

- A) increase
- B) remain the same
- C) decrease

33. Layers of clay, called varves, show seasonal deposition in the bottoms of some deep lakes. They may be used to determine the age in a manner similar to

- A) uranium-lead age dating
- B) potassium-argon age dating
- C) tree ring age dating
- D) radio carbon age dating

The map below is a topographic map that is only partially completed. Only index contour lines are shown in the right-hand half. Survey points for elevation are shown on the left-hand half of the map. Use the map with questions # 34, 35, 36



34. A benchmark is located at the top of the northernmost hill. When all the contour lines are completed on the map, what will be the elevation represented by the contour line that is then closest to the benchmark? (Note: only index contours are now shown.)

- A) 600 m
- B) 610 m
- C) 620 m
- D) cannot be determined

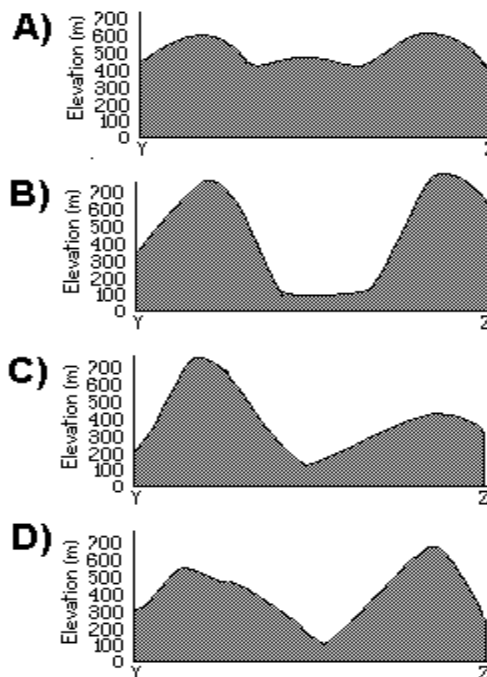
35. In which general direction is Blue River flowing?

- A) east
- B) west
- C) northwest
- D) southeast

36. The gradient of Blue River between points A and B is closest to

- A) 5 m/km
- B) 25 m/km
- C) 45 m/km
- D) 150 m/km

37. Which graph below best represents the position of the 300m contour on the finished map?



38. The meridian for 0° longitude runs through

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

39. On March 21 at noon, Local Time, in the Northern hemisphere, you see the sun to be 50° above the horizon. Therefore, your latitude is

- A) 40° N
- B) 50° N
- C) 90° N
- D) 130° N

40. Measuring the angular height of the star, Polaris, above the horizon will tell you your location's

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

41. This year, 2012 the number of sunspots will be at a maximum. What was the last year that sunspots were at a maximum?

- A) 2001
- B) 1990
- C) 2011
- D) 1979

42. Energy from our Sun reaches the Earth mainly by

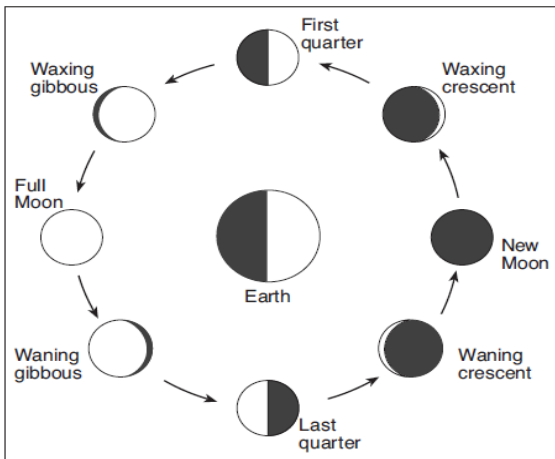
- A) red shifts
- B) density currents
- C) conduction
- D) electromagnetic waves

43. Eclipses do NOT occur every month because the Moon's

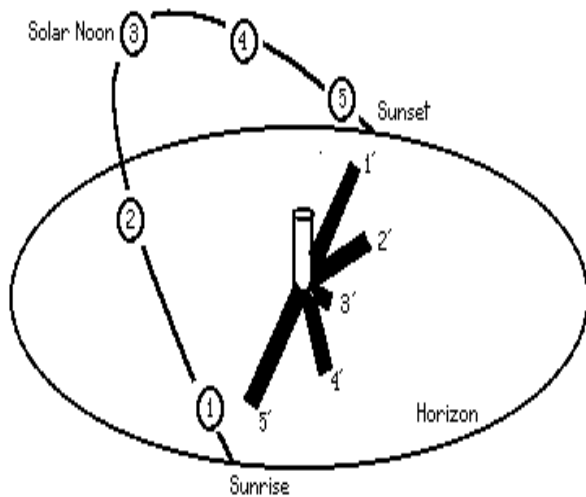
- A) rate of rotation is 15° each hour
- B) orbit is inclined to Earth's orbit
- C) period of revolution is 27.3 days
- D) period of rotation and period of revolution are the same

44. Use the diagram below, which is not drawn to scale. Approximately, how many days occur between the Moon's first quarter phase and its last quarter phase?

- A) 7 days
- B) 15 days
- C) 29.5 days
- D) 365 days



The diagram below shows a post set in the ground in the Northern Hemisphere. Five different shadows (1', 2', 3', 4' and 5') are cast on a given day when the sun is at positions 1, 2, 3, 4, and 5, respectively. Use the diagram with questions 45,46,47



45. Which motion shows the apparent daily path of the sun, as shown in the diagram on lower left side?

- A) the sun's revolution
- B) the earth's revolution
- C) the sun's rotation
- D) the earth's rotation

46. In the Northern Hemisphere, the intensity of insolation during the year is greatest when

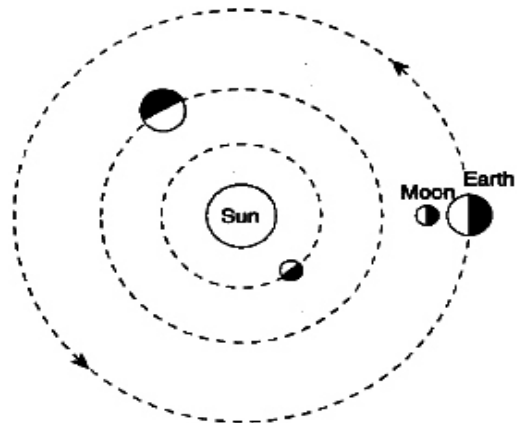
- A) shadow 1' is longest
- B) shadow 4' is longest
- C) shadow 3' is shortest
- D) shadow 5' is shortest

47. How will the length of the shadow change from September 22 to December 22?

- A) decrease
- B) increase
- C) stay the same

48. Besides the Earth what other planets are depicted in the drawing below?

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



49. Which planetary model allows scientists to predict the exact positions of the planets in the night sky over many years?

- A) the motion of the planets are circles in a geocentric model
- B) the motion of the planets are ellipses in a geocentric model
- C) the motion of the planets are circles in a heliocentric model
- D) the motion of the planets are ellipses in a heliocentric model

50. As the Earth comes closer to the Sun, during its orbit around the Sun, the rate of the Earth's rotation

- A) increase
- B) decreases
- C) remains the same
- D) increases

51. As a star exhausts hydrogen in its core, it

- A) becomes hotter and more luminous
- B) becomes cooler and more luminous
- C) becomes hotter and less luminous
- D) becomes cooler and less luminous

52. Main sequence stars usually end their life cycles as

- A) red giants
- B) red dwarfs
- C) blue giants
- D) white dwarfs

53. Galaxies, like our Milky Way, are made of

- A) hundreds of stars
- B) thousands of stars
- C) millions of stars
- D) billions of stars

54. With respect to one another, galaxies have been found to be

- A) moving closer together
- B) moving farther apart
- C) moving in random directions
- D) stationary

55. Cosmic background radiation provides direct evidence for the origin of

- A) the universe
- B) Earth's ozone layer
- C) our solar system
- D) Earth's earliest atmosphere

56. The nearest star is called Proxima Centauri and is 4.2 light years away. If you were travelling at the speed of light, 186,000 miles/second, then how many years would it take to travel to Proxima Centauri?

- A) 4.2 years
- B) 186,000 years
- C) 781200 years
- D) 5.8×10^{12} years

57. In New Jersey the angle of insolation is highest on about

- A) June 1
- B) June 21
- C) July 4
- D) August 3

58. People who live on the first ridge of the Watchung Mts. in Watchung Borough are at an altitude about 500 feet higher than people who live in Scotch Plains. Compared to Scotch Plains, the altitude should make the temperature on the ridge about (lapse rate is $3.5^{\circ}\text{F}/1000\text{ ft}$)

- A) 12°F warmer
- B) 2°F warmer
- C) 12°F cooler
- D) 2°F cooler

59. Lines on a weather map that connect locations with equal temperatures are

- A) isobars
- B) isotherms
- C) isotemps
- D) isopods

60. As compared to warm air, cold air usually has

- A) a lower pressure
- B) a higher pressure
- C) the same pressure
- D) pressure unrelated to temperature

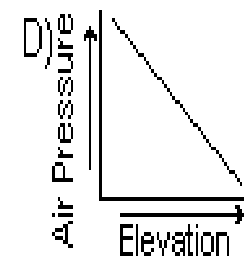
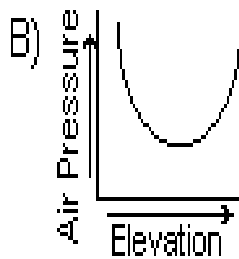
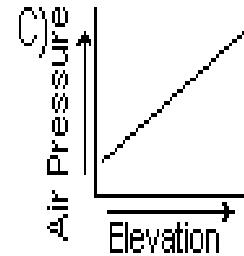
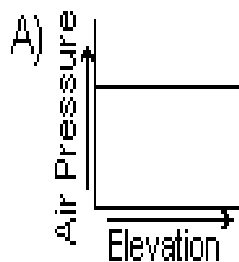
61. The pressures below represent winds blowing from a high pressure system to a low pressure system. Which choice has the greatest wind speed?

- A) 986 mb to 980 mb
- B) 1008 mb to 996 mb
- C) 1008 mb to 1000 mb
- D) 1024 mb to 1020 mb

62. The number of global wind belts, with prevailing winds, around the earth is

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

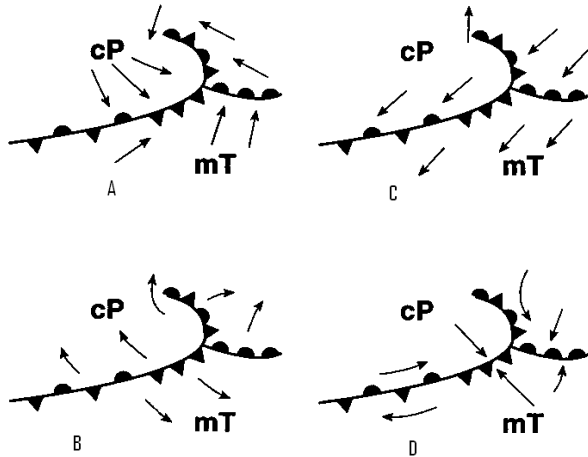
63. A weather balloon is released into the atmosphere on a calm day. Which graph best represents the relationship between pressure and elevation as the balloon rises?



64. Barometric pressure can increase with decreasing
A) density of air C) water vapor in air
B) temperature of the air D) convection in air
65. The mass of water vapor contained in a given volume of air is known as the
A) dew point C) absolute humidity
B) relative humidity D) vapor pressure
66. If you swing a psychrometer for a minute and then read 26°C from the dry bulb thermometer and 24°C from the wet bulb thermometer, the relative humidity is
A) 85% C) about 13%
B) 12% D) 2%
67. Cirrus clouds followed by altostratus and nimbostratus clouds signify the approach of
A) a warm front C) an occluded front
B) a cold front D) any kind of front
68. Warm fronts move over the surface at an average speed of about
A) 5 mph, or 120 miles per day
B) 15 mph, or 360 miles per day
C) 35 mph, or 840 miles per day
D) 55 mph, or 1320 miles per day
69. Occluded fronts usually produce
A) steady precipitation
B) drizzle and intermittent showers
C) fair weather
D) unpredictable weather

Use the weather map with questions # 70, 71, 72

70. Which diagram below shows the surface air movements most likely associated with the low pressure system shown in the weather map?

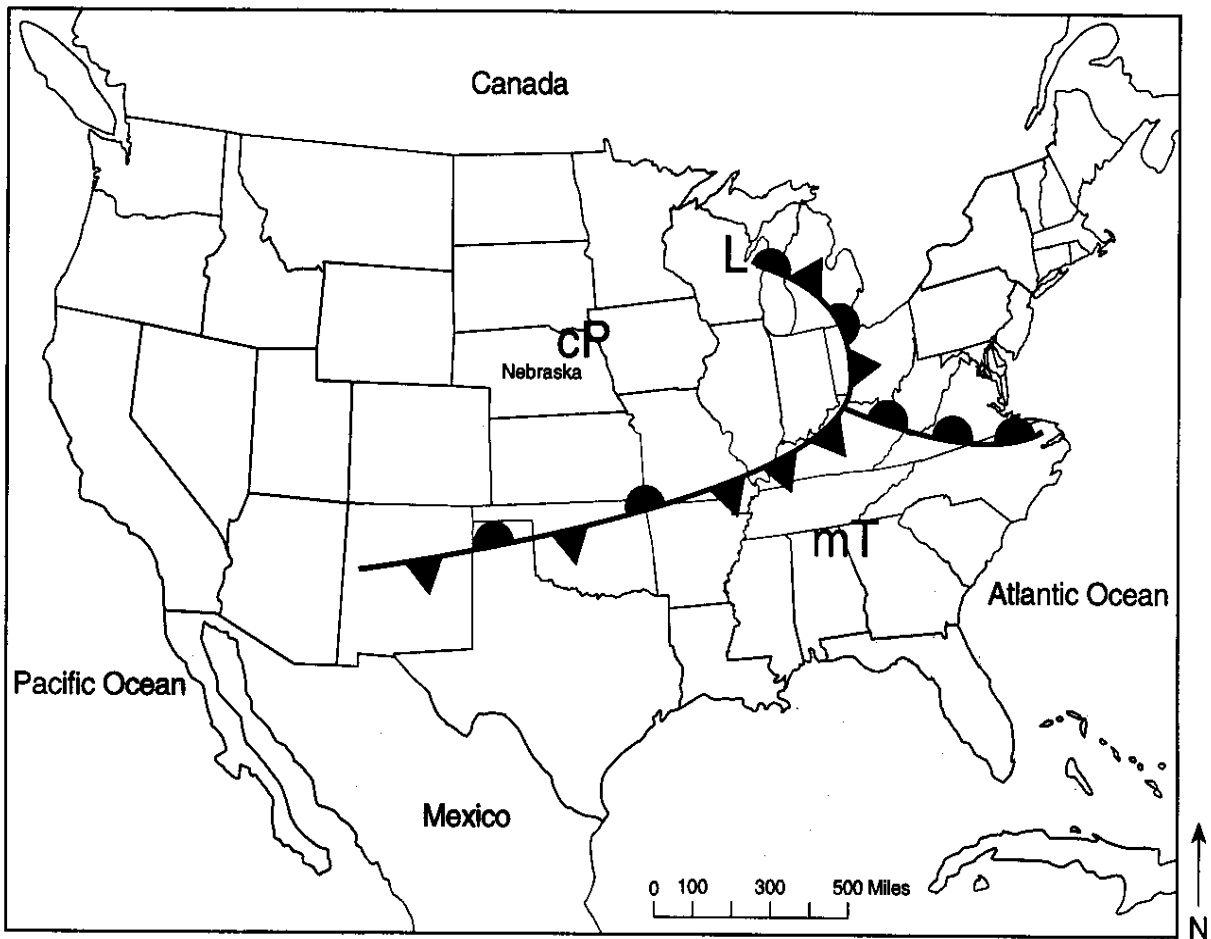


71. The air mass influencing the weather of Nebraska most likely originated in

- A) Northern Pacific Ocean
- B) Northern Atlantic Ocean
- C) Central Canada
- D) central Mexico

72. On the weather map below how many different frontal systems are present?

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



The End

**New Jersey Science League
Earth Science Exam - Answer Key
MARCH 8, 2012**

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

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.

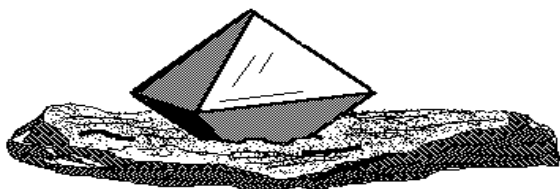
| | |
|---------------------------------------|---------------------------------------|
| Minerals (4) | Sun (2) |
| Rocks (2) | Moon (2) |
| Earth Structure (2) | Sun-Moon-Earth System (3) |
| Plate Tectonics (4) | Solar System (3) |
| Faults/Folds/Seismology (3) | Stars (2) |
| Vulcanism (2) | Galactic 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) | |

EARTH SCIENCE EXAM

April 2012

Directions: Each question is worth 1 point for a total of 72 points. For each statement or question, choose the word or phrase that *best answers* the question or completes the statement. On the Answer Form fill in the corresponding blank *completely*. Take a moment to look over the Reference Tables (last two pages). Refer to them whenever you need them. There is a metric ruler at the bottom of the reference page.

1. Mica cleaves as it does because its silicate tetrahedra are linked to form
- A) single chain C) 3 dimensional frameworks
 B) double chain D) 2 dimensional sheets



2. The crystal of magnetite, shown above, is an octahedron. It has eight sides. The distances between points top and bottom, left and right, and front and back are equal. Magnetite crystals are in the
- A) isometric system C) orthorhombic system
 B) tetragonal system D) monoclinic system

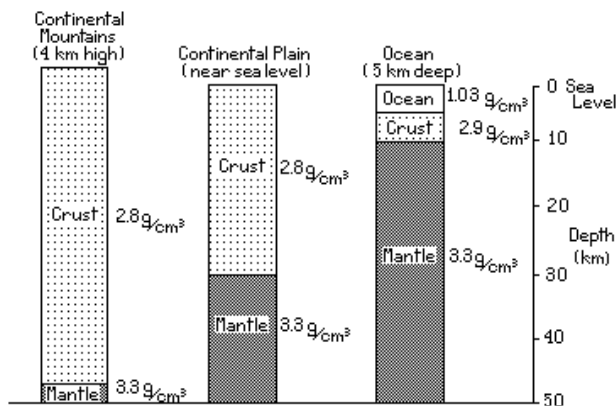
| Hardness | Cleavage | Mineral |
|----------|----------|----------|
| 2 | 1 | selenite |
| 2.5 | 3 | halite |
| 3 | 3 | calcite |
| 4 | 3 | fluorite |
| 7 | none | quartz |

3. You have a mineral which you cannot scratch with either your fingernail or a penny. You can scratch it with a steel knife. It shows cleavage. Using the table above which mineral is it? Moh's hardness scale in reference tables at the back.
- A) selenite C) calcite
 B) halite D) fluorite

4. Hornblende is a silicate that has long thin crystals. It shows two directions of cleavage that are parallel to the length of the crystal. The silicate groups are linked together in the crystal to form
- A) rings C) two dimensional sheets
 B) chains D) three dimensional frameworks

5. The material from which all rock originally formed is
- A) magma C) sediment
 B) lava D) crystals
6. Most rock forming minerals are silicates which are made up of a repeating unit of oxygen and silicon in the geometric form of a
- A) hexoctahedron C) dodecahedron
 B) octahedron D) tetrahedron

The diagram below shows columns of rock to a depth of 50km below sea level at three different positions. Use it with questions 7 & 8.



7. In which group are the layers of the Earth arranged in order of increasing average density?
- A) mantle, crust, ocean water
 B) crust, mantle, ocean water
 C) ocean water, mantle, crust
 D) ocean water, crust, mantle
8. Which statement about the Earth's mantle is confirmed by the diagram
- A) the mantle is liquid
 B) the mantle has the same composition as the crust
 C) the mantle is located at different depths below the Earth's surface
 D) the mantle does not exist under continental mountains

9. What two crustal plates meet at the San Andreas Fault in California?

- A) North American and Nazca plates
- B) Juan de Fuca and Pacific plates
- C) Nazca and Pacific plates
- D) North American and Pacific plates

10. The Aleutian Islands, off Alaska, are a volcanic island arc. Off shore from the islands a geologist would expect to find

- A) a subduction zone
- B) a hot spot
- C) an oceanic ridge
- D) a magnetic reversal

11. The Himalaya Mts., like the Alps and the Ural Mts., were raised by

- A) the convergence of plates carrying continents on their leading edges.
- B) subduction of one continental plate beneath another.
- C) isostatic adjustment of a geosyncline
- D) the formation of a batholith due to intrusion of a granitic magma into the country rock.

12. Tectonic plates are diverging at the

- A) Marianna Trench
- B) San Andreas Fault
- C) Mid Atlantic Ridge
- D) Aleutian Island Arc

13. The mountains in and around the Great Basin (Nevada, Utah, etc) were formed primarily by

- A) folding
- B) faulting
- C) vulcanism
- D) erosion of a plateau

14. There is a fault, named the Alpine Fault, that runs through New Zealand's South Island. It is very much like California's San Andreas Fault, a strike thrust fault. Movement on the Alpine Fault, then, has one block

- A) thrust up and over the other block
- B) moving upward relative to the other block
- C) moving downward relative to the other block
- D) moving sideways along the fault relative to the other block

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
- B) strike-slip fault
- C) thrust fault
- D) reverse fault

16. Shield volcanoes, such as those of the Hawaiian Islands, produce a free flowing fluid type of lava. The rock that results is

- A) andesite
- B) basalt
- C) rhyolite
- D) dacite

17. 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

18. Mountain glaciers over the entire earth are melting. As they do, they leave seasonal deposits of till known as the

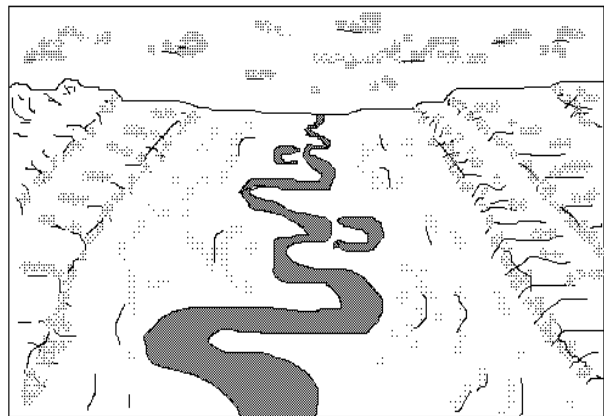
- A) marginal moraine
- B) terminal moraine
- C) lateral moraine
- D) recessional moraine

19. Although only northern New Jersey was covered by Pleistocene glaciers, many of the stream valleys in southern New Jersey contain a continental glacial feature known as

- A) a terminal moraine
- B) a recessional moraine
- C) till
- D) outwash

20. The river in the picture below has cut through a neck of its meander forming two lakes. What are these lakes called?

- A) a tarn
- B) an oxbow
- C) a cirque
- D) a loop

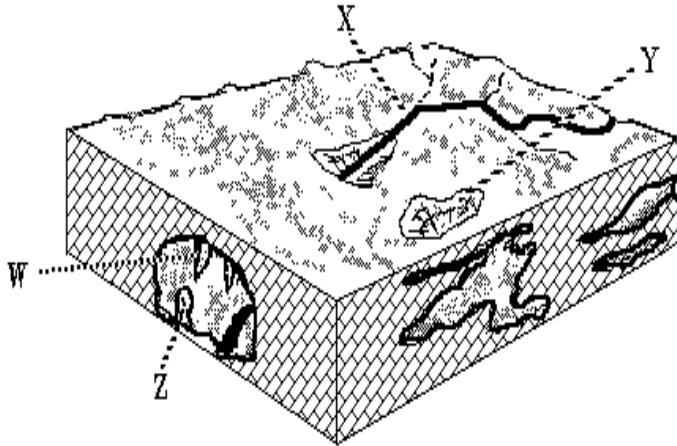


21. Stream valleys are widened by

- A) abrasion
- B) ablation
- C) slumping
- D) saltation

22. The Delaware and Chesapeake bays are estuaries. They were formed when

- A) continental glaciers gouged out the river valleys.
- B) fault blocks dropped downward during the separation of North America and Africa.
- C) river valleys were flooded by a rising sea level at the end of the ice ages.
- D) the crust was down-warped while North America and Africa were converging.



23. The depression in the ground above a limestone formation, shown by Y above, is most likely a

- A) kettle
- B) pothole
- C) cirque
- D) sink

24. The feature in the cavern that is indicated by the pointer, Z, is

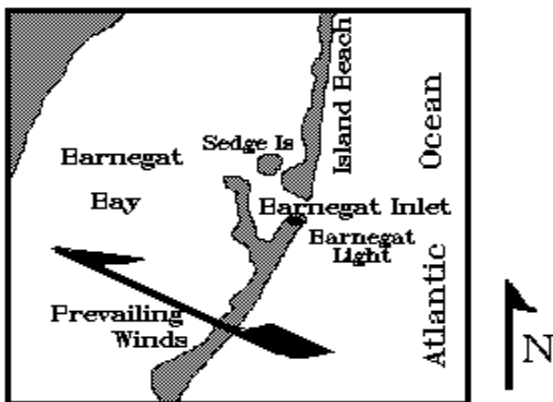
- A) pillar
- B) stalagmite
- C) stalactite
- D) column

25. The stream, indicated by X above, is known as

- A) an intermittent stream
- B) a disappearing stream
- C) a Karst stream
- D) a youthful stream

26. Island Beach at Barnegat Bay is part of an island system that extends from New York down to Mexico. Island Beach is called

- A) a hook
- B) sand spits
- C) barrier island
- D) long shore bars



27. Sand on the ocean water's edge of Island Beach (map above) will move toward the

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

28. Solid bedrock is changed into soil primarily by the process of

- A) erosion
- B) weathering
- C) infiltration
- D) exfoliation

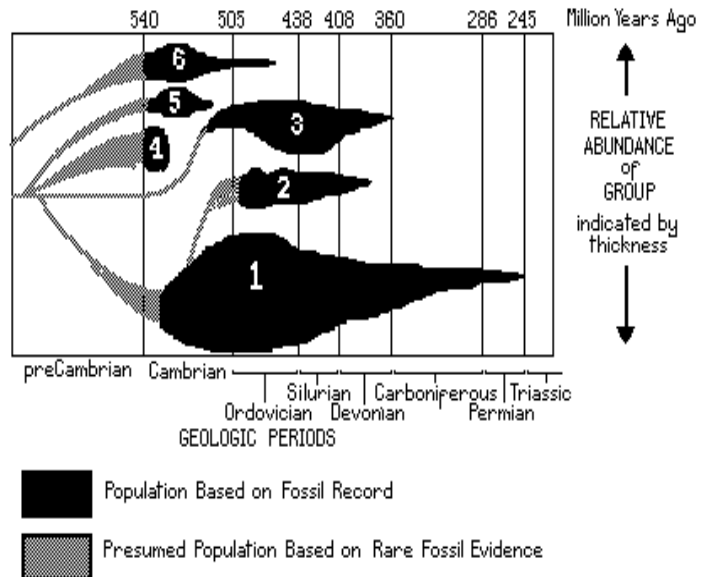
29. As a particle of sediment in a stream breaks into several smaller pieces, the rate of weathering of the sediment will

- A) decrease due to a decrease in surface area
- B) decrease due to an increase in surface area
- C) increase due to a decrease in surface area
- D) increase due to an increase in surface area

30. Evidence from the rock record indicates that humans have existed

- A) for a very short period, compared to geologic time.
- B) since the period of the dinosaurs.
- C) from the beginning of geologic time.
- D) ever since the Big Bang.

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 31 and 32.



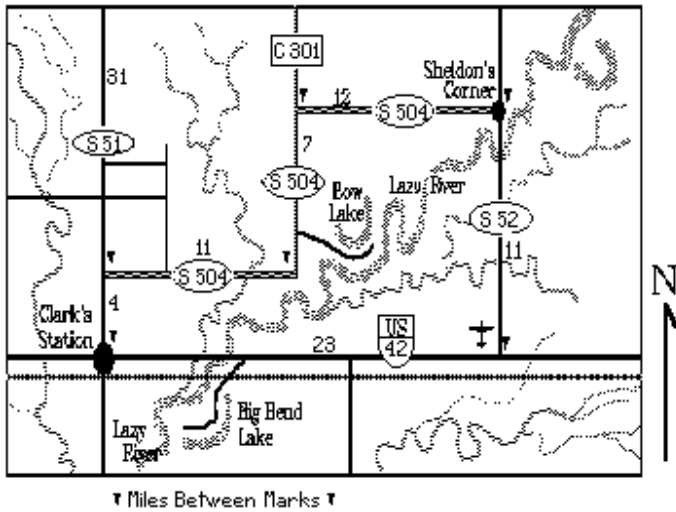
31. If you were to find trilobites from groups 1, 2, and 6 in the same rock formation, the best interpretation would be that the rock was probably formed from

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

32. 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

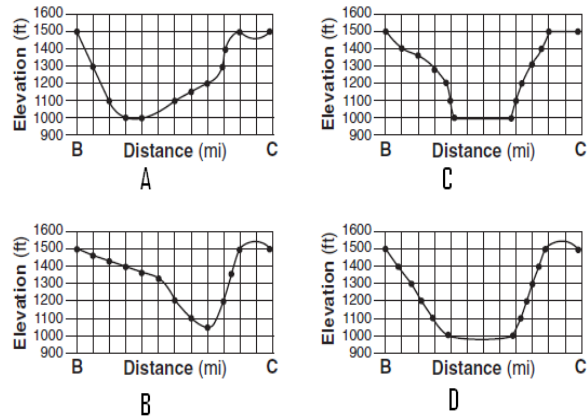
33. In the period before Pangea broke apart, most of the east coast of the United States was joined to
- A) Norway
 - B) England and France
 - C) Spain and Portugal
 - D) Africa



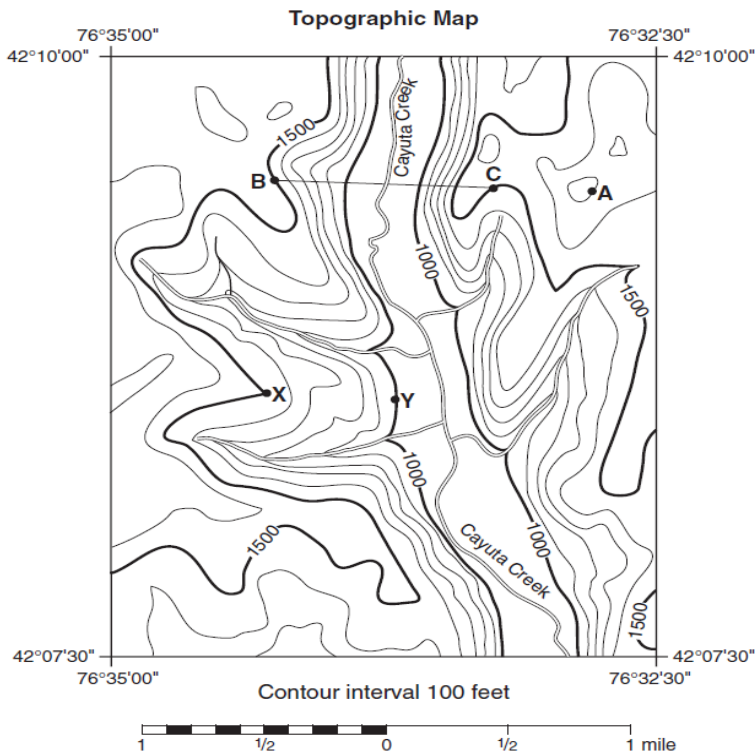
34. The distance from Clark's Station to Sheldon's Corner via State highways 51 and 504 is
- A) 11 miles
 - B) 23 miles
 - C) 34 miles
 - D) 42 miles
35. The map symbol just west of highway S52 and north of US42 indicates the location of
- A) an historical site
 - B) a benchmark
 - C) a railroad
 - D) an airport

Use the map on the lower left for questions # 36 , 37.

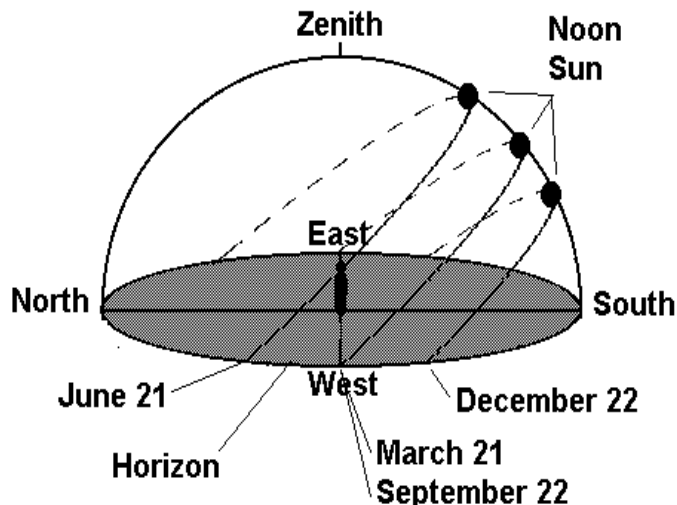
36. Which graph below best represents the profile between points B and C on the map?



37. What is the elevation of point A on the map?
- A) 1700 ft
 - B) 1650 ft
 - C) 1600 ft
 - D) 1550 ft
38. Angular position east or west of Greenwich, England is called
- A) longitude
 - B) latitude
 - C) right ascension
 - D) declination
39. Which of the following cities would be the last to experience the New Year as December 31 turns to January 1?
- A) London, England
 - B) Sidney, Australia
 - C) Honolulu, Hawaii
 - D) San Francisco, California



40. The longitude of Trenton, NJ is about 75° W. The longitude of Honolulu, HI is about 160° W. The Standard Time difference between the two cities should be about
- A) 85 minutes
 - B) 5 hours
 - C) 9 hours 40 minutes
 - D) 11 hours



The diagram above traces the apparent path of the sun across the sky in the Northern hemisphere on the dates indicated.

41. In which general direction did the observer look to see the sunset each day?

- A) North C) East
B) South D) West

42. The daily change in the time of sunrise and sunset primarily is due to the

- A) 23.5° tilt of the earth's axis
B) sun's apparent angular diameter
C) changes in the distance from the earth to the sun
D) changes in the earth's orbital speed

43. The length of one complete lunar cycle (new moon to new moon) is closest to

- A) 8 days C) 27 days
B) 17 days D) 29 days

44. The first person to observe the moon with a telescope was

- A) Newton C) Copernicus
B) Galileo D) Aristotle

45. If the moon rises over the eastern horizon at sunset, the phase of the moon is

- A) new C) full
B) first crescent D) last gibbous

46. The tidal motion of water in the ocean basins causes

- A) the moon to move closer to the earth
B) the moon to slow its rate of revolution
C) the earth to slow its rate of rotation
D) the earth to increase its rate of revolution

47. Summer is hotter than winter because

A) light from the sun travels a straighter line in summer
B) the earth is closer to the sun in summer
C) the earth is tilted on its axis
D) the moon reflects more sunlight in summer

48. The two bright planets in the western sky right after sunset during mid-March 2012 are

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

49. 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 C) Earth
B) Venus D) Mars

50. Three planets that are relatively large, gaseous, and of low density are

- A) Mercury, Jupiter, and Saturn
B) Venus, Jupiter, and Neptune
C) Mars, Jupiter, and Uranus
D) Jupiter, Saturn, and Uranus

51. What method is used to measure distances to stars relatively close within 1000 light years?

- A) Parallax C) Cepheid variable
B) Galileo D) Red Giant

52. According to the Hertzsprung-Russell diagram our sun will end its life as a

- A) red giant C) blue giant
B) red dwarf D) white dwarf

53. Our nearest visible galaxy in the winter southern hemisphere is

- A) Polaris C) Taurus
B) Andromeda D) Ursa Major

54. A galaxy can best be described as a

- A) whirling system or cloud of cosmic dust
B) whirling system or cloud of stars
C) luminous cloud of gas
D) luminous cloud of dust

55. Most estimates for the age of the universe are between 13 and 14 billion years. When astronomers observe a galaxy that is 8.5 billion light years away they are looking

- A) 1/2 to 2/3 of the way back in time to the Big Bang
B) outward and away from the Big Bang
C) at the galaxy as it formed during the Big Bang
D) at the galaxy as it exists today

56. Astronomers have observed galaxies in the

universe are moving away from each other at increasing velocities. This implies a repulsive force which is called:

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

57. Which of the following cities would you expect to have the coldest winter?

- A) Chicago, Ill
- B) San Francisco, California
- C) Washington D.C.
- D) New Orleans, Louisiana

58. A glider pilot looking in the early afternoon for thermals on which to rise would circle over which of the following?

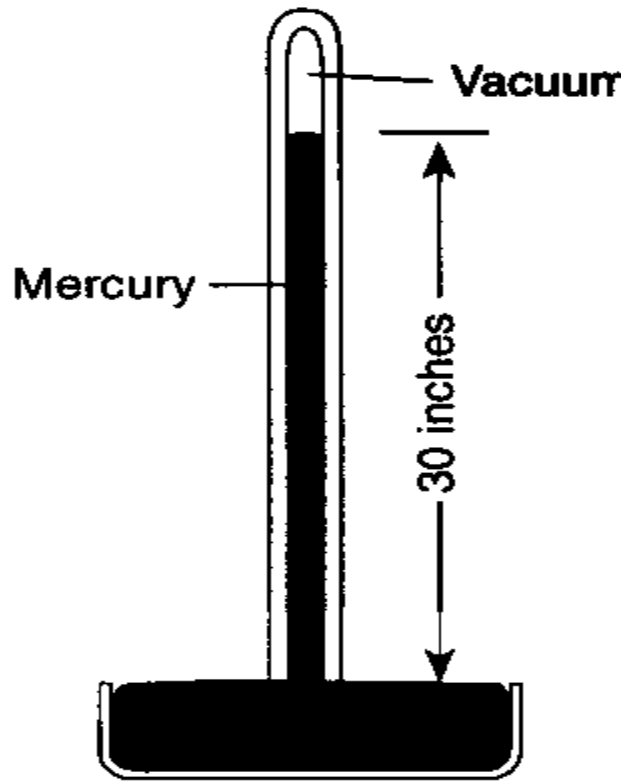
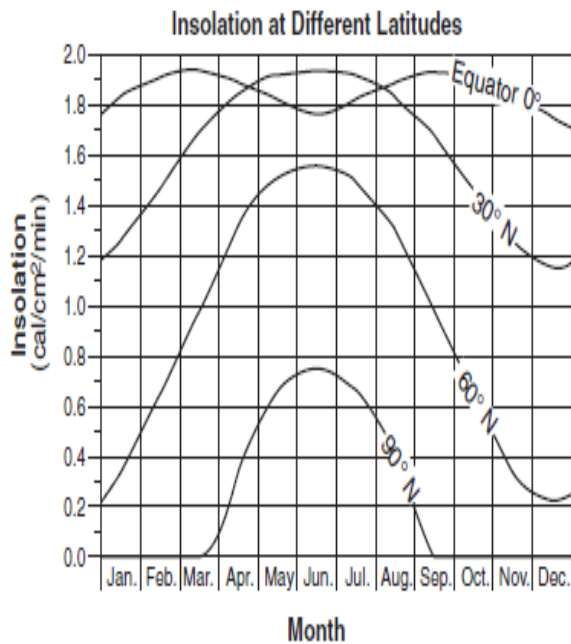
- A) a lake
- B) a forest
- C) a freshly plowed field
- D) a desert

The graph below shows the amount of insolation during one year at four different latitudes on Earth

59. Why is insolation less during June at the equator than during March or September?

- A) the Sun's vertical rays are north of the equator in June.
- B) there are more clouds during June than the other months.
- C) the wind blows the insolation away from the equator during June.
- D) the daylight period is longest in June at the equator.

60. The weather instrument above is designed to



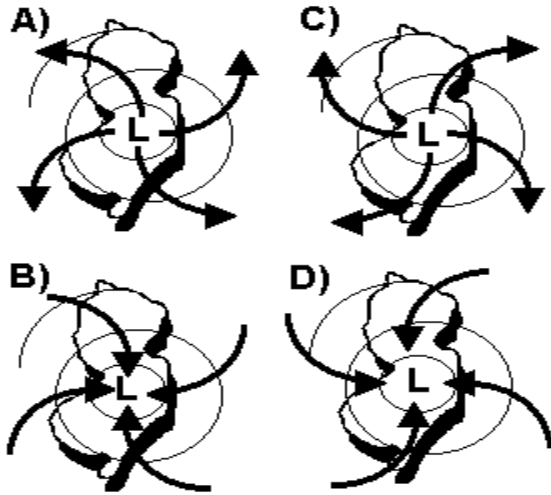
measure what weather variable?

- A) temperature
- B) relative humidity
- C) wind speed
- D) pressure

61. Higher wind velocities are most closely associated with

- A) high temperature differences between high and low pressure centers
- B) low temperature differences between high and low pressure centers
- C) high pressure differences between high and low pressure centers
- D) low pressure differences between high and low pressure centers

62. The figures below show a center of Low pressure over New Jersey. Which diagram indicates the possible circulation of winds around the Low?



63. If you are on the fringe of a hurricane and you note that the wind is in the northeast, the eye of the storm lies to your

- A) northeast
- B) north
- C) southeast
- D) east

64. Warm moist air rises in latitudes that are known as the

- A) westerlies
- B) polar continentals
- C) trade winds
- D) doldrums

65. Most of the water vapor in the atmosphere is found in the

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

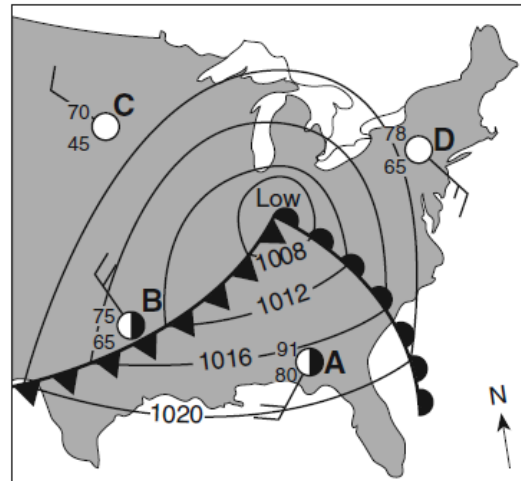
66. Using the reference tables determine the relative humidity from the following data: dry bulb temperature is 24°C while the wet bulb temperature is 18°C.

- A) 6%
- B) 55%
- C) 60%
- D) 100 %

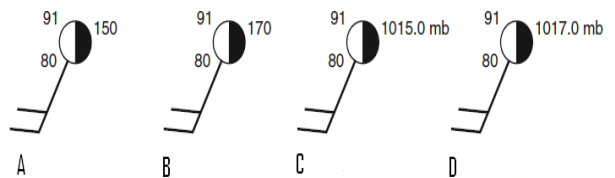
67. Towering clouds, often called thunderheads, have heavy drenching showers indicate the passing of a

- A) warm front
- B) cold front
- C) low pressure cell
- D) high pressure cell

Use the weather map below for questions # 68, 69



68. Which weather station model shows the correct pressure for location letter A in the map above?



69. Which lettered location has the lowest relative humidity?

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

Use the weather map below for questions #70, 71, 72

70. Which city is located in an mT air mass?

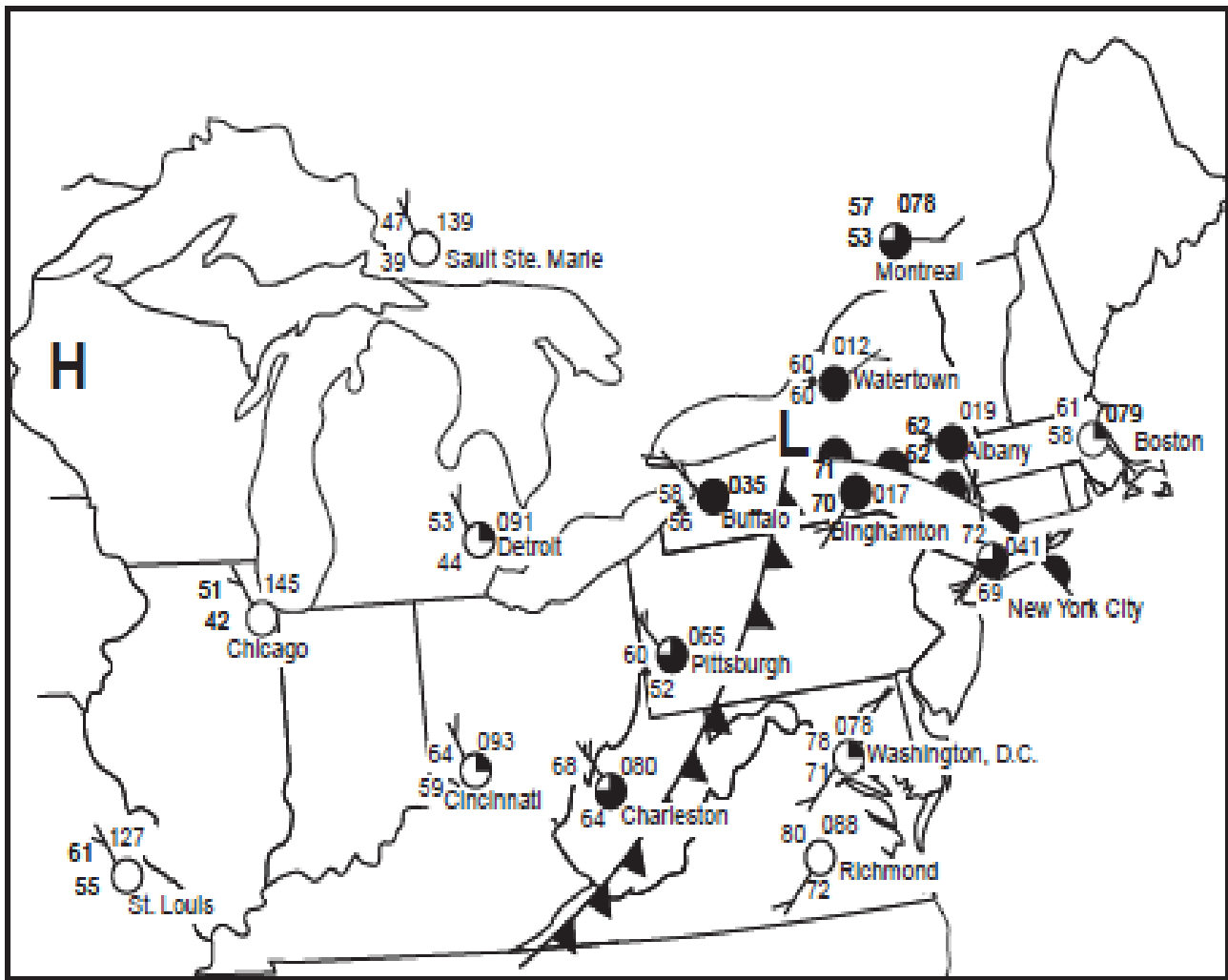
- A) Richmond, Virginia
- B) St. Louis, Missouri
- C) Detroit, Michigan
- D) Buffalo, NY

71. The temperature forecast for Boston over the next 24 hours is expected to

- A) remain the same
- B) fall and then rise
- C) rise and then fall
- D) rise then remain the same

72. What type of frontal system is east of Buffalo, NY Pittsburg, Pa and Charleston, SC?

- A) cold front
- B) stationary
- C) warm front
- D) occluded



The End

New Jersey Science League

Earth Science Exam - Answer Key

APRIL 2012

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

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.

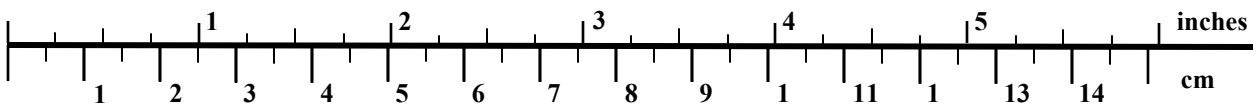
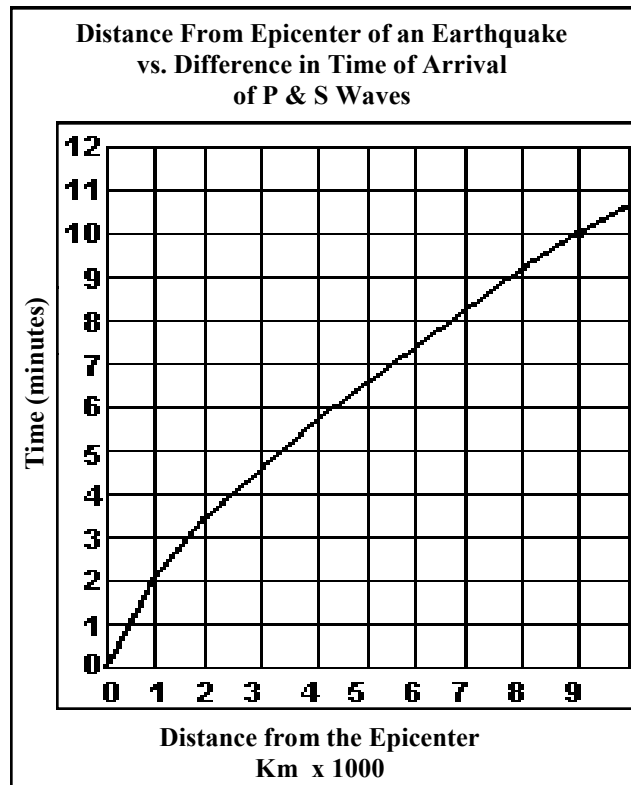
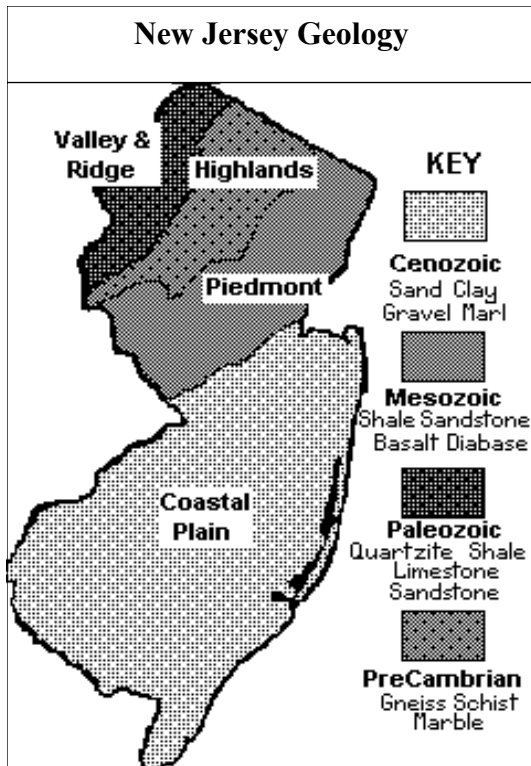
| | |
|---------------------------------------|---------------------------------------|
| Minerals (4) | Sun (2) |
| Rocks (2) | Moon (2) |
| Earth Structure (2) | Sun-Moon-Earth System (3) |
| Plate Tectonics (4) | Solar System (3) |
| Faults/Folds/Seismology (3) | Stars (2) |
| Vulcanism (2) | Galactic 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) | |

REFERENCE TABLES

| Mohs Scale of Hardness | | |
|------------------------|----|-------------------|
| Talc | 1 | |
| Gypsum | 2 | finger nail (2.5) |
| Calcite | 3 | copper (3.5) |
| Fluorite | 4 | |
| Apatite | 5 | knife (5.5) |
| Orthoclase | 6 | glass (<6) |
| Quartz | 7 | |
| Topaz | 8 | |
| Corundum | 9 | |
| Diamond | 10 | |

| GEOLOGIC TIME | | | |
|---------------|---------------|-------------|-------------|
| Eras | Periods | Epochs | Began (ybp) |
| Cenozoic | Quarternary | Holocene | 10 k |
| | | Pleistocene | 1.6 m |
| | Tertiary | Pliocene | 5.3 m |
| | | Miocene | 23.7 m |
| | | Oligocene | 36.6 m |
| Mesozoic | Cretaceous | | 144 m |
| | Jurassic | | 208 m |
| | Triassic | | 245 m |
| Paleozoic | Permian | | 286 m |
| | Pennsylvanian | | 320 m |
| | Mississippian | | 360 m |
| | Devonian | | 408 m |
| | Silurian | | 438 m |
| | Ordovician | | 505 m |
| | Cambrian | | 570 m |
| PreCambrian | | | 4.5 b |

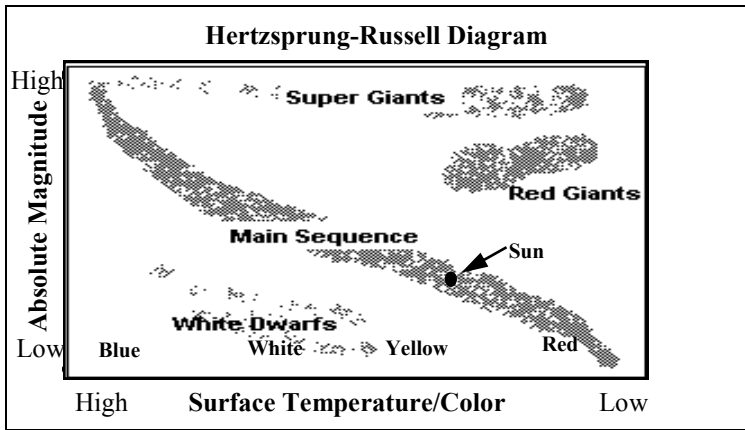
* ybp: years before present



| Planetary Data | | | | |
|----------------|---------------|------------------------|-------------------------|-----------------------|
| Planet | Diameter (km) | Distance from Sun (km) | Revolution (Earth time) | Rotation (Earth time) |
| Mercury | 4,880 | 57.9 million | 88 days | 58.6 days |
| Venus | 12,100 | 108 million | 224.7 days | 247 days |
| Earth | 12,756 | 150 million | 365.26 days | 23h 56m |
| Mars | 6,787 | 228 million | 687 days | 24h 37m |
| Jupiter | 142,000 | 778 million | 11.86 years | 9h 51m |
| Saturn | 120,000 | 1.43 billion | 29.46 years | 10h 14m |
| Uranus | 51,800 | 2.87 billion | 84.01 years | 11h |
| Neptune | 49,500 | 4.50 billion | 164.8 years | 16h |

| Wind Chill Index (°F) | | | | | | | | |
|-----------------------|----|-----|-----|-----|-----|-----|-----|-----|
| Temperature (°F) | | | | | | | | |
| Wind Speed (mph) | 30 | 25 | 20 | 15 | 10 | 5 | 0 | |
| | 15 | 9 | 2 | -5 | -11 | -18 | -25 | -31 |
| | 20 | 4 | -3 | -10 | -17 | -24 | -31 | -39 |
| | 25 | 1 | -7 | -15 | -22 | -29 | -36 | -44 |
| 30 | -2 | -10 | -18 | -25 | -33 | -41 | -49 | |

| Relative Humidity (%) | | | | | | | | |
|-----------------------------------|----|----|----|----|----|----|----|----|
| Difference Between Wet & Dry Bulb | | | | | | | | |
| Dry Bulb Temperature | 2 | 4 | 6 | 8 | 10 | 12 | 14 | |
| | 16 | 80 | 62 | 45 | 29 | 14 | 1 | |
| | 18 | 81 | 64 | 48 | 33 | 19 | 6 | |
| | 20 | 82 | 66 | 51 | 36 | 23 | 11 | 0 |
| | 22 | 83 | 68 | 53 | 40 | 27 | 15 | 4 |
| | 24 | 84 | 69 | 55 | 42 | 30 | 20 | 9 |
| | 26 | 85 | 70 | 57 | 45 | 34 | 23 | 13 |
| | 28 | 86 | 71 | 59 | 47 | 36 | 26 | 17 |



| Heat Index (°F) | | | | | | | | |
|-----------------------|----|-----|-----|-----|-----|-----|-----|-----|
| Relative Humidity (%) | | | | | | | | |
| Temperature (°F) | 70 | 75 | 80 | 85 | 90 | 95 | 100 | |
| | 98 | 134 | | | | | | |
| | 94 | 119 | 124 | 129 | 135 | | | |
| | 90 | 106 | 109 | 113 | 117 | 122 | 127 | 132 |
| 86 | 95 | 97 | 100 | 102 | 105 | 106 | 112 | |

