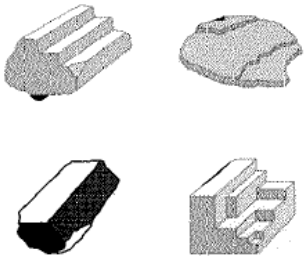
ES January Exam 2016 **TAN EXAM** (No Corrections)

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.

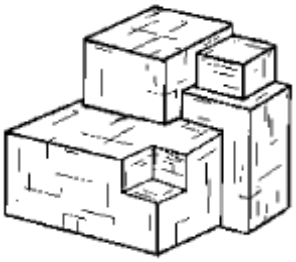
1. The diagrams below represent fractured samples of four minerals. Which mineral property is illustrated by these diagrams?



A) hardness B) streak
C) cleavage D)density

The table below provides information about four minerals labeled A through D.

2. The diagram below represents a sample of mineral letter A.



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

Using the data table above identify the mineral letter A.
A) garnet B) galena C) olivine D) halite

3. Which mineral can scratch A, B, and C, but not scratch D? Use the data table above as well as the hardness scale in the reference tables at the end of the exam
A) talc B) gypsum C) fluorite D) quartz

4. The hardest mineral known is
A) corundum B) diamond C) emery D) sapphire

5. Which of the following rocks is composed of more than one mineral ?
A) marble B) shale C) granite D) obsidian

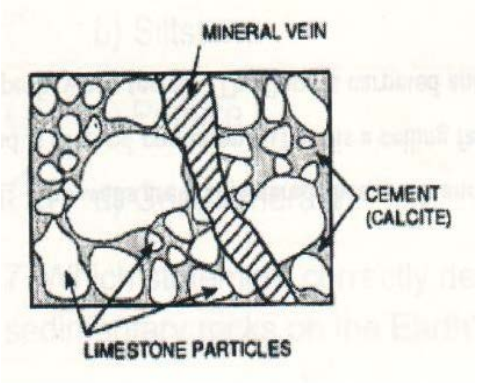
6. Which property best describes a rock which formed from sediments?
A) crystalline structure
B) distorted structure
C) fragmental particles arranged in layers
D) banding or zoning of minerals

7. Which observation about an igneous rock would support the inference that the rock cooled slowly underground?
A) the rock has well-define layers
B) The rock has large crystals
C) the rock is about 50% plagioclase feldspar
D) the rock is light in color and low in density.

8. Why do calcite and dolomite both bubble when placed in a solution of hydrochloric acid?
A) both are silicate minerals
B) both are metamorphic rocks
C) both are carbonates(CO_3^{-2})
D) both are colorless and of similar hardness

9. The texture of an igneous rock gives information regarding
A) the rate at which the rock formed B) the chemical composition of the rock
C) the age of the rock D) the number of erosional-depositional cycles the rock has gone through

10. The diagram below is of a conglomerate rock. Which of the labeled parts is the oldest?



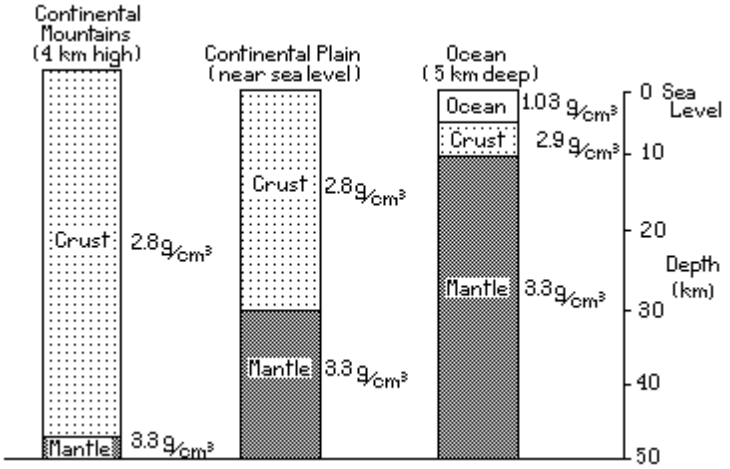
A) the limestone particles
B) the mineral vein
C) the calcite cement
D) the conglomerate rock itself

11. About two-thirds of the earth's diameter is the distance through the
A) crust B) mantle C) core D) lithosphere

12. The ocean floor is made mostly of
A) granite B) basalt C) sand D) coral

13. For the last 200 million years the continents on opposite of the Atlantic Ocean have
A) been drifting closer together B) been drifting apart C) remained the same distance apart.

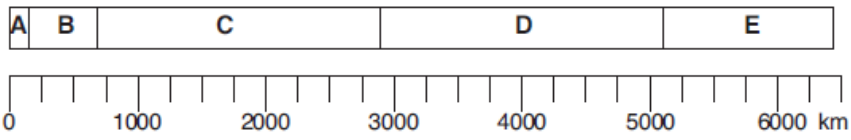
The diagram below shows a column of rock to a depth of 50 km below sea level at three different locations. Use it with questions 14 and 15.



14. 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

15. Which statement about the Earth's mantle is confirmed by the diagram above?
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

The diagram below represents zones of the Earth's interior, identified by letters A through E. Use the diagram with questions 16, 17, and 18. The depth is measured in kilometers.



16. The Moho is a boundary located between which two zones of the Earth's interior?
A) A and B B) B and C C) C and D D) D and E

17. Which number is closest to the approximate thickness of zone C?
A) 650 km B) 1600 km C) 2200 km D) 2900 km

18. Which zones contain the lithosphere?
A) A and B B) B and C C) C and D D) D and E

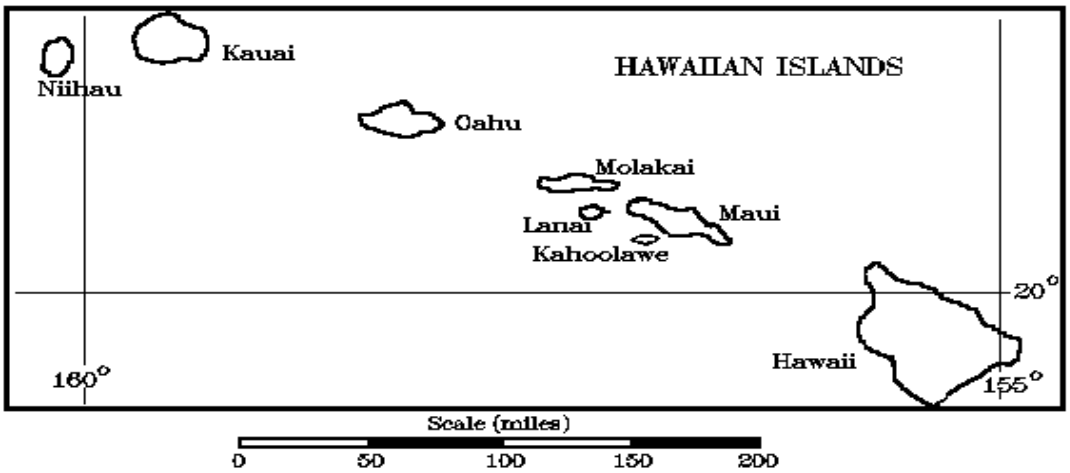
19. The feature produced when two crustal plates carrying continents on the converging edges collide is a
A) mountain range B) trench C) mid-oceanic ridge D) island arc

20. Crustal plates separate and new crust is produced at
A) continental mountain ranges C) mid-oceanic ridges
B) oceanic trenches D) island arcs

21. Basalt in the ocean floor gives the rate at which crustal plates spread from rifts. The ocean floor rock was age dated by measuring
A) radioactivity B) superposition C) fossilized plankton D) magnetic reversals

22. The direction and distance that oceanic plates have moved over millions of years can be inferred from chains of volcanic islands that result from plate movement over
A) subduction zones B) hot spots C) rift valleys D) midoceanic ridges

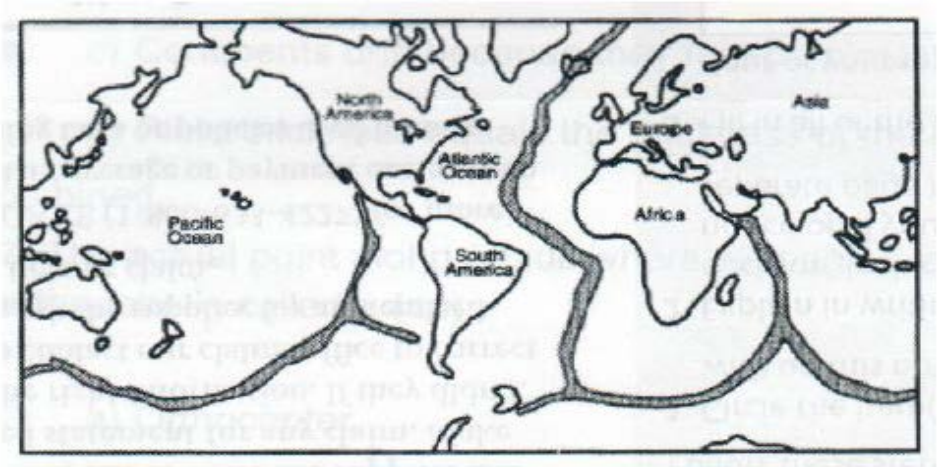
23. Use the map below of the Hawaiian Islands. The island of Hawaii has active volcanoes on it and is still being built. Kauai is about 5 million years old. A ruler is located in the reference section at the end of the exam. Which of the following is true?



A) The Pacific Plate is moving NW at about 4 inches/year
B) The Pacific Plate is moving SW at about 4inches/year
C) The Pacific Plate is moving NW but the rate cannot be determined.
D) Neither the rate nor the direction of motion can be determined from the information given.

24. 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

25. What Earth features are represented by the gray areas in the diagram? For example the grey area between South America and Africa.

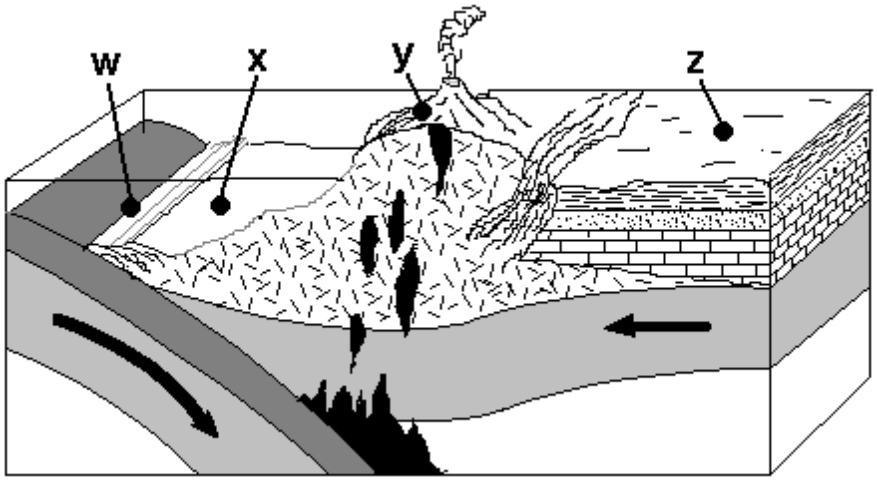


A) Mid-ocean ridges
B) Subduction zones
C) Hot spots
D) convergent plate boundaries.

26. Why do earthquakes provide valuable information about the composition of the Earth's interior?
A) earthquake waves have a constant amplitude.
B) earthquake waves travel at different rates through different materials.
C) earthquake waves release materials from within the Earth.
D) earthquake waves travel through the Earth at a constant velocity.

27. The actual point along a fault where slippage occurs and causes an earthquake is called
A) orthocenter B) epicenter C) circumcenter D) focus

28. In the diagram below there are two arrows showing the movement of two plates. What is the boundary called where the two plates meet?



A) Convergent plate boundary
B) a divergent plate boundary
C) A transformation plate boundary
D) a fault plate boundary

29. Why are seismologist interested in the time difference between the arrival of P-waves and S-waves from an earthquake?
A) The time difference is used in the Richter scale to measure the magnitude of the earthquake.
B) The time difference is used to determine the location of the epicenter of the earthquake
C) The time difference is used to determine the depth of the earthquake
D) The time difference is used to determine the distance to the epicenter.

30. Molten rock which is in the **Earth's crust** is known as
A) intrusive B) extrusive C) lava D) magma

31. Volcanoes on island arcs (like Mt. Fujiama in Japan) usually have composite cones. They are likely to have
A) explosive eruptions
B) quiet eruptions
C) unpredictable eruptions (quiet or explosive)
D) no more eruptions

32. 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

33. A good example in the United States of mountains shaped by mountain glaciers are the
A) Grand Teton Mts. in Wyoming
B) Appalachian Mts.
C) Adirondack Mts. in New York
D) Blue Ridge Mts. in Virginia

34. In the last Ice Age, the Wisconsin Ice sheet covered most of Canada and the Northern United States. It melted about
A) 1,000 years ago C) 100,000 years ago
B) 10,000 years ago D) 1 million years ago

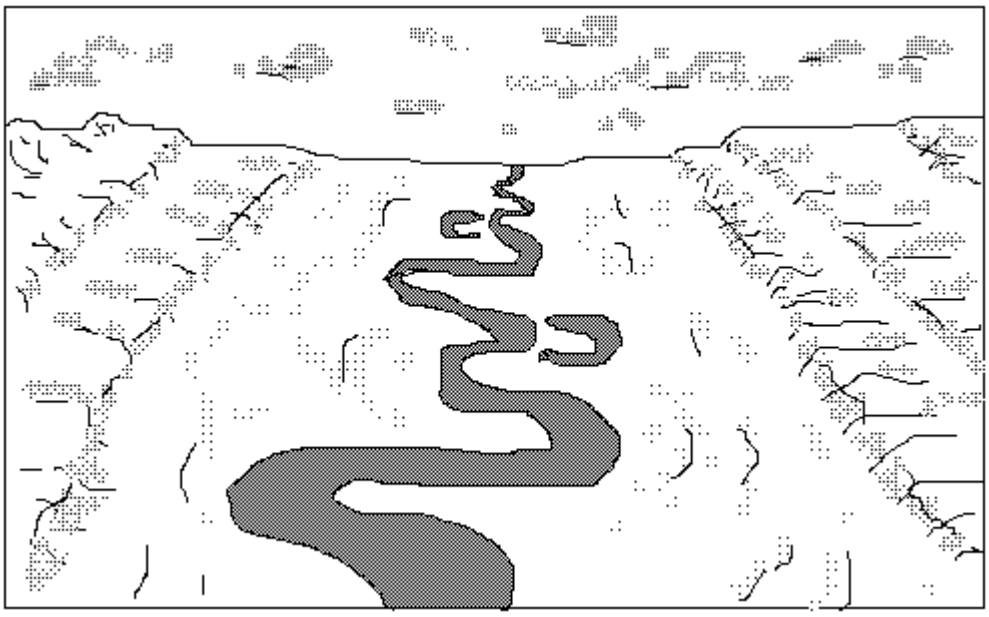
35. Ice sheets still exist on Antarctica and Greenland. Increased atmospheric temperature could cause them to melt and sea levels to rise by several feet. The primary human contribution to the greenhouse effect is

A) cutting tropical forests
B) methane from solid waste
C) releasing chlorofluorocarbons
D) burning fossil fuels

36. Continental glaciers covered New Jersey only as far south as Phillipsburg, Flemington, Bound Brook, and Perth Amboy. However, there are glacial sediments over much of the southern half of the state. They are found mostly in stream valleys and are
A) terminal moraine B) till C) recessional moraine D) outwash

37. Through the Grand Canyon, the Colorado River is
A) young B) mature C) old D) senile

The figure below represents a river valley with the river flowing toward you. Use it with questions 38, 39, and 40.



38. The looping curves in the river are called
A) cols B) cirques C) oxbows D) meanders

39. The two lakes found near the river are
A) tarns B) cirques C) oxbows D) meanders

40. In its development, the river valley illustrated is
A) old B) mature C) young D) senile

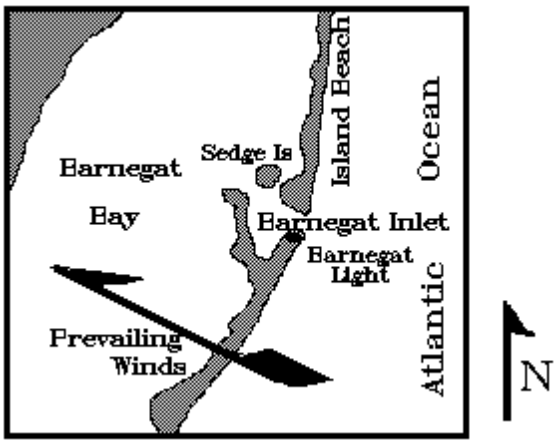
41. The substance which is dissolved in water and is mostly responsible for dissolving limestone to form caverns is
A) tannic acid B) nitrogen C) carbon dioxide D) oxygen

42. Which sediment listed below is the least permeable?
A) Clay B) Silt C) Sand D) Pebbles

43. About what % of the water on Earth is fresh liquid water?
A) 1% B) 2% C) 3% D) 97%

44. 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

The map below shows Island Beach at Barnegat Bay and the direction of the prevailing winds. Use it with questions 45 and 46.



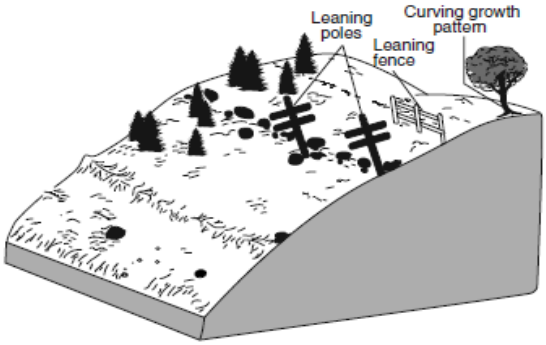
45. The prevailing onshore winds at Barnegat Bay are from the
A) south
B) southeast
C) north
D) northwest

46. Sand on the ocean water's edge of Island Beach will move toward the
A) north B) east C) south D) west

47. Weathering of rock is most important to living things because it
A) releases oxygen B) makes soil C) leaches salts D) releases ground water

48. Of the substances listed below, which has the greatest effect on the weathering of rocks is
A) nitrogen B) oxygen C) water D) hydrogen

49. The diagram below shows the surface features of a landscape. Which erosional agent had the greatest effect on tree growth, the fence, and the poles?
A) running water
B) moving ice
C) prevailing winds
D) mass movement

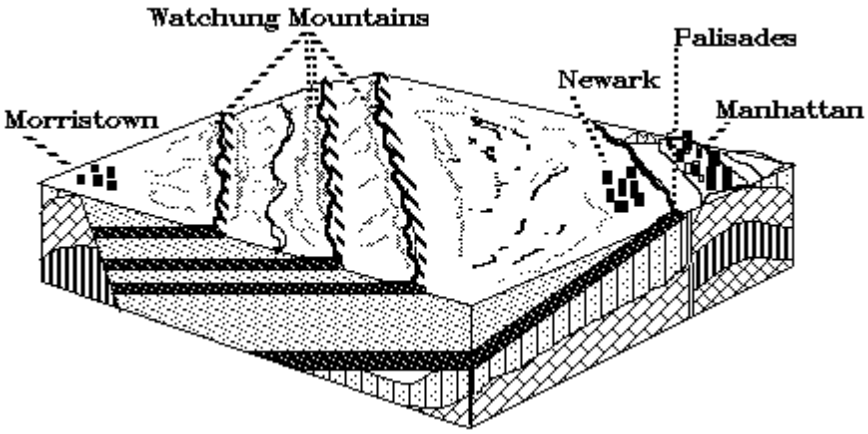


50. The Era known as the "Age of Fish" is the
A) preCambrian B) Cenozoic C) Mesozoic D) Paleozoic

51. The **epoch** when the last ice sheet advanced into New Jersey is known as the
A) Pliocene B) Paleozoic C) Permian D) Pleistocene

52. In the block diagram below, the three ridges of the Watchung Mts. are old lava flows. The Palisades is an intrusive sill. The formations below and between the lava flows are red sandstone and shale. The lava flow which is the oldest is

A) the ridge nearest Morristown
B) the ridge nearest Newark
C) the middle ridge
D) there is no way to tell

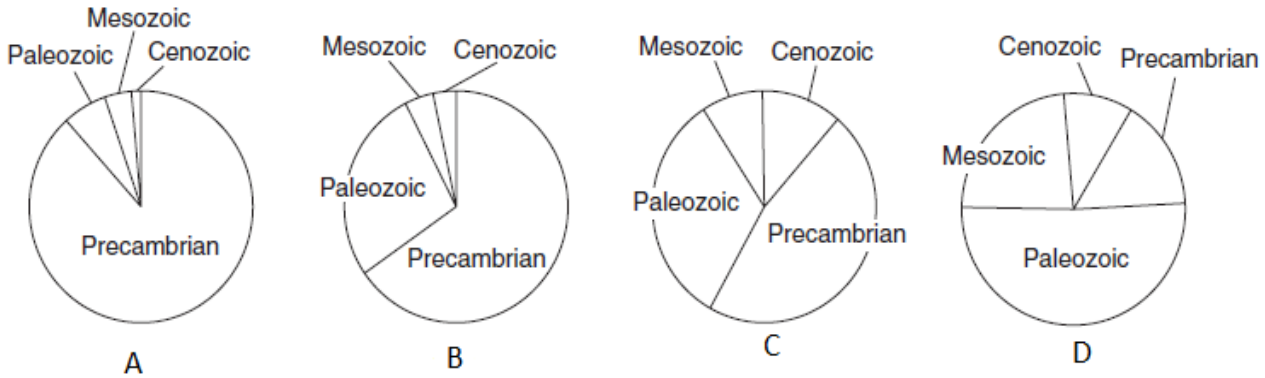


53. Based upon the reference tables at the end of the exam which Era is the oldest?
A) Paleozoic B) Precambrian C) Cenozoic D) Mesozoic

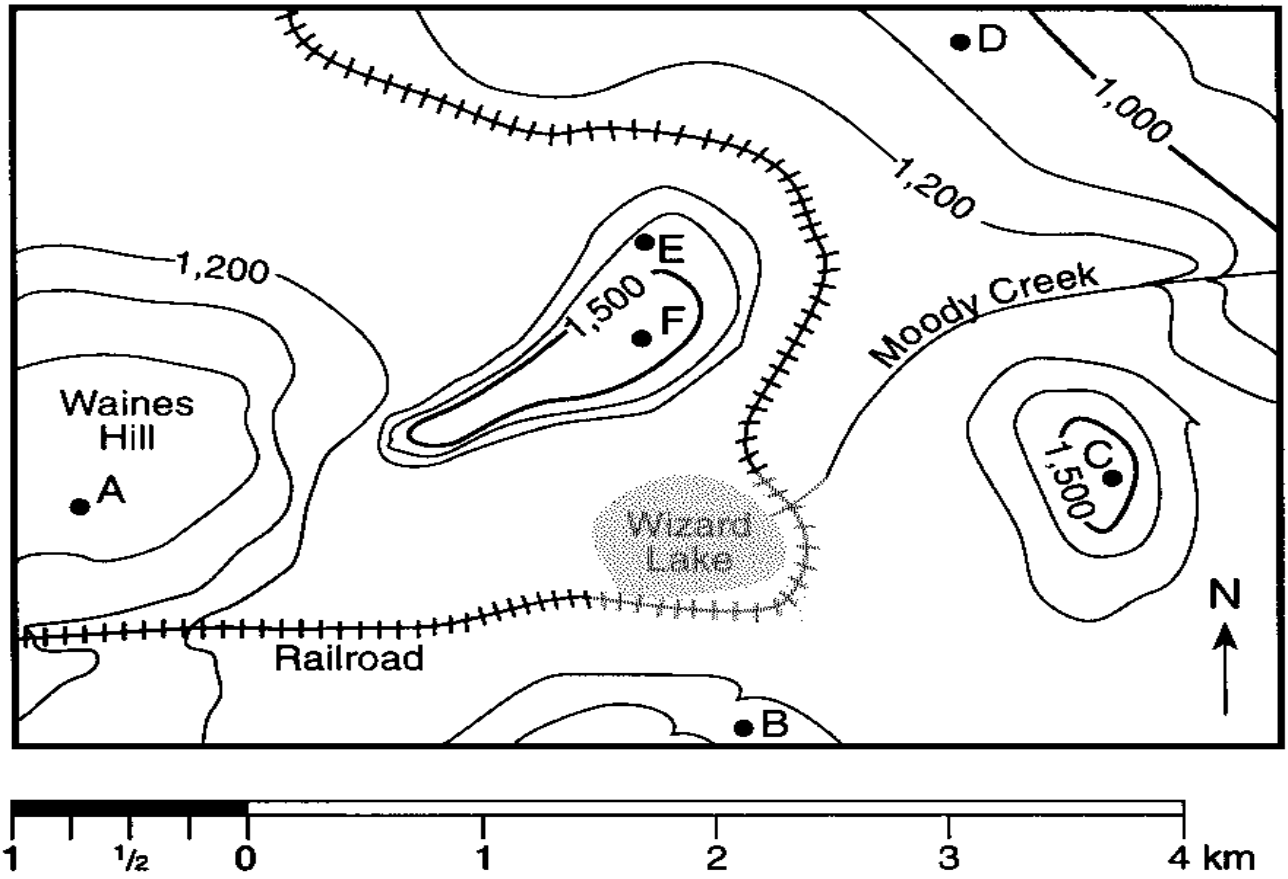
54. Of the methods listed below, the only one that can date an event to the exact year is
A) radioactive carbon dating
B) uranium/lead ratio
C) index (or guide) fossils
D) tree ring analysis

55. 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. The wood 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 B) 4,500 C) 5,000 D) 6,500

56. Which graph best represents the relative length of time of the major intervals of Earth's geologic history?



Use the map below with questions # 57, 58, 59, and 60.



57. What is the contour interval of this map?
A) 10 m B) 50 m C) 100 m D) 150 m

58. Toward what direction does Moody Creek flow?
A) southwest B) northwest C) northeast D) southeast

59. Of the lettered locations which is the lowest elevation?
A) A B) B C) C D) D

60. What is the approximate length of the railroad tracks?
A) 15 km B) 12 km C) 8 km D) 4 km

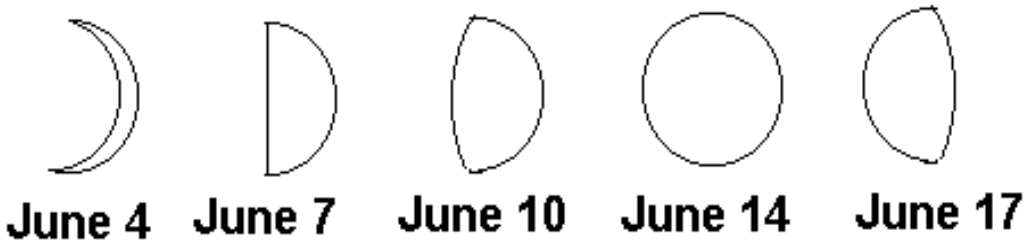
61. On the Hertzsprung-Russell chart (reference tables end of exam) of the stars, the sun is among the
A) red giant stars C) white dwarf stars
B) main sequence stars D) yellow dwarf stars

62. The Coriolis effect provides evidence that the Earth
A) has a magnetic field C) revolves around the sun
B) has an elliptical orbit D) rotates on its axis

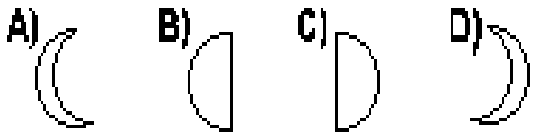
63. The apparent daily movement of the Sun across the sky is caused by
A) Earth's rotation on its axis
B) Earth's revolution around the Sun
C) The Sun's revolution around the Earth
D) The Sun's rotation during a 24 hour period

64. The light colored rays which radiate from the large craters on the moon are
A) pressure ridges B) impact ejecta C) transform faults D) radial drainage

The moon was observed in the phases shown below, each on the date given.

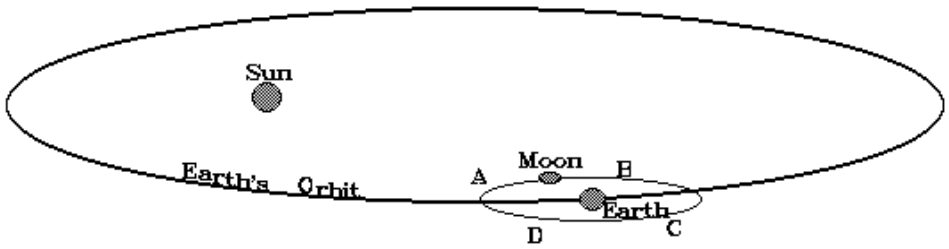


65. Which of the phases below would the observer see on June 21?



66. The highest tides will occur when the moon is at either of which two positions as shown by the diagram below?

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

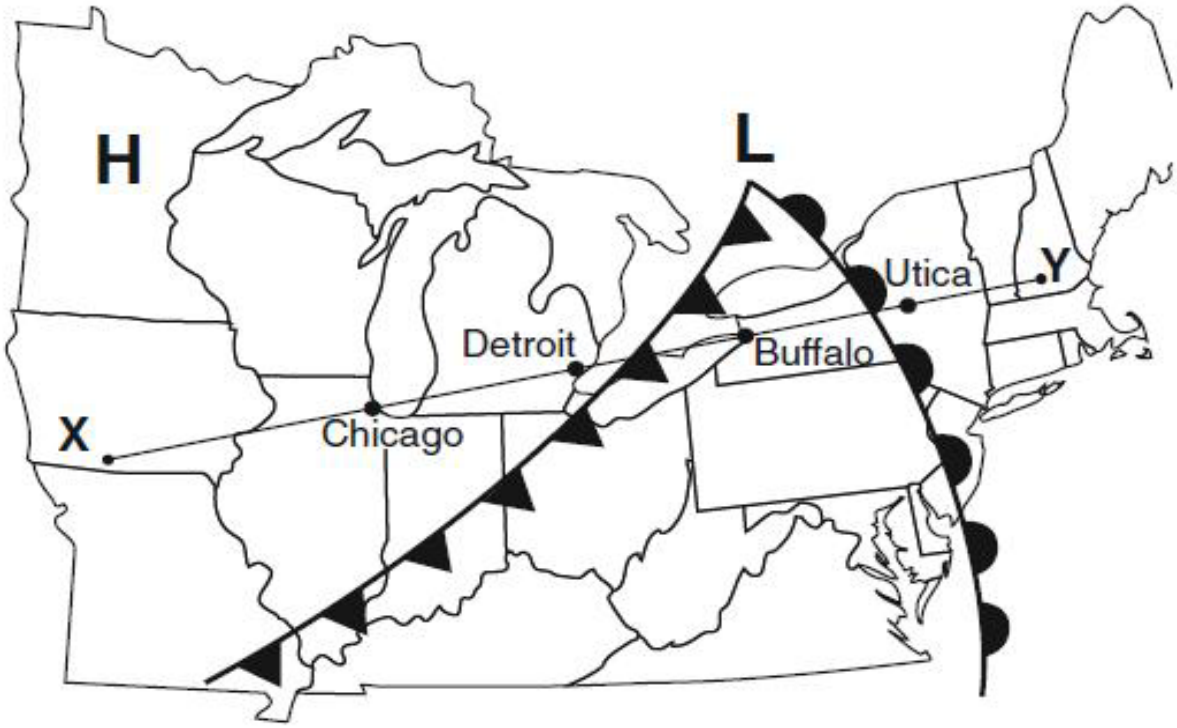


67. Summer is hotter than winter because
A) light from the sun travels a straighter line in summer
B) the earth is closer to the sun in summer
C) the earth is tilted on its axis
D) the moon reflects more sunlight in summer

68. The asteroid belt is located between the orbits of
A) Mars and Jupiter B) Earth and Mars C) Jupiter and Saturn D) Earth and Venus

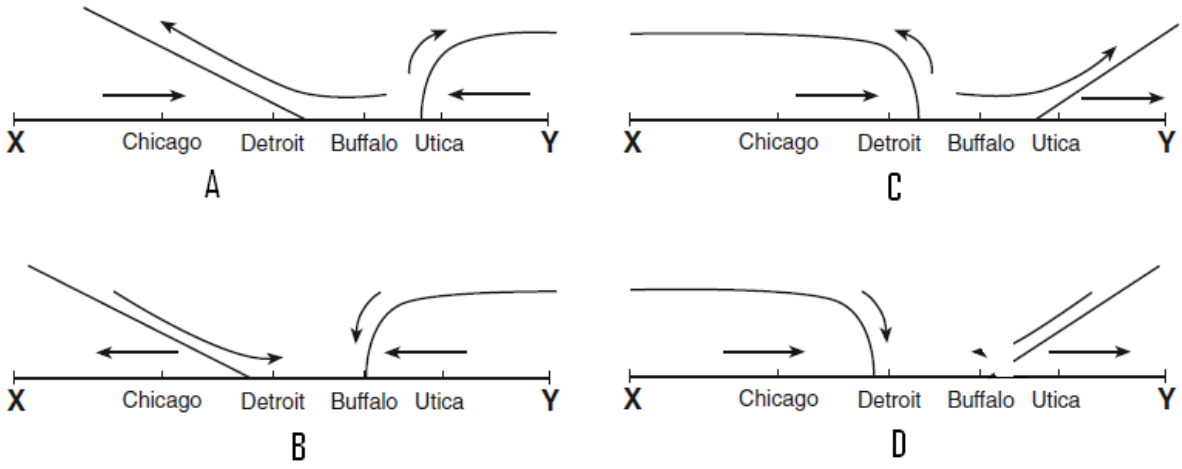
69. Which motion causes some constellations to be visible in New Jersey during the summer nights and other constellations to be visible only during winter nights?
A) stars in constellations revolve around the Earth
B) stars in constellations revolve around the Sun
C) The Earth revolves around the Sun
D) The Earth rotates on its axis.

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



70. What type of weather front is between Buffalo and Utica on the weather map?
A) cold front B) warm front C) stationary front D) occluded front

71. Which cross section below best represents the fronts and air movements in the lower atmosphere along line XY?



72. The weather forecast for Utica is
A) rain and warmer B) fair and warmer C) colder with showers likely D) fair and colder

NEW JERSEY SCIENCE LEAGUE

EARTH SCIENCE EXAM ANSWER KEY TAN TEST (No Corrections)

DATE: Jan 14, 2016

1	C	19	A	37	A	55	D
2	B	20	C	38	D	56	A
3	C	21	A	39	C	57	C
4	B	22	B	40	A	58	C
5	C	23	A	41	C	59	D
6	C	24	C	42	A	60	C
7	B	25	A	43	A	61	B
8	C	26	B	44	C	62	D
9	A	27	D	45	B	63	A
10	A	28	A	46	A	64	B
11	B	29	D	47	B	65	B
12	B	30	D	48	C	66	A
13	B	31	C	49	D	67	C
14	D	32	B	50	D	68	A
15	C	33	A	51	D	69	C
16	A	34	B	52	B	70	B
17	C	35	D	53	B	71	C
18	A	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)
Rocks (2)
Earth Structure (2)
Plate Tectonics (4)
Faults/Folds/Seismology (3)
Vulcanism (2)
Glaciation/Deserts (2)
Rivers: Erosion & Deposition (3)
Ground Water/Caves (2)
Ocean Shore Line/Currents/Salinity(3)
Weathering/Mass Wasting (2)
Historical Geology (4)
Map Reading: Road/Topo/Geologic (4)
Geodesics/Time/Map Projections (3)

Sun (2)
Moon (2)
Sun-Moon-Earth System (3)
Solar System (3)
Stars (2)
Galactic Systems (2)
Cosmology (2)

Insolation/Temperature/Air Masses (3)
Atmospheric Pressure/Highs/Lows (4)
Moisture in the Atmosphere (3)
Frontal Systems (3)
Interpreting Weather Maps (3)

Testing Dates for 2016

Thursday, January 14, 2016 Thursday, February 11, 2016
Thursday, March 10, 2016 Thursday, April 14, 2016*

All areas and schools must complete the April exam and mail in the results by April 28th, 2016.

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

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

Dates for 2017 Season

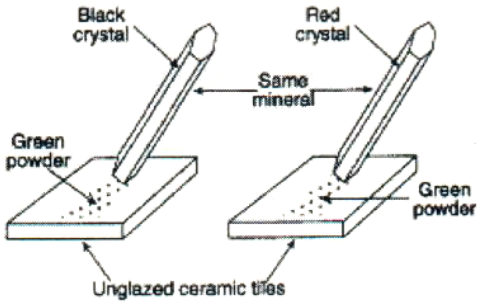
Thursday, January 12, 2017 Thursday, February 9, 2017
Thursday, March 9, 2017 Thursday, April 13, 2017

Earth Science Exam February 11, 2016 **TAN EXAM** (Corrections)

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.

1. Which statement is best supported by Moh's scale of hardness?
A) A fingernail will scratch calcite, but not quartz.
B) A fingernail will scratch quartz, but not calcite
C) A piece of glass can be scratched by quartz, but not by calcite.
D) A piece of glass can be scratched by calcite, but not by quartz.

Mohs Scale of Hardness		
Talc	1	graphite
Gypsum	2	fingernail (2.5) halite 2.5
Calcite	3	copper (3.5)
Fluorite	4	iron nail 4.5
Apatite	5	knife (5.5)
Orthoclase	6	glass (<6) pyrite 6.5
Quartz	7	streak plate 7
Topaz	8	
Corundum	9	
Diamond	10	



2. Which property of a mineral is being tested in the diagram directly above?
A) luster B) hardness C) cleavage D) Streak

3. Based on Moh's scale (#1) which one of the following minerals would be able to scratch the other three? B not D
A) Gypsum B) Quartz C) Calcite D) pyrite

4. 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

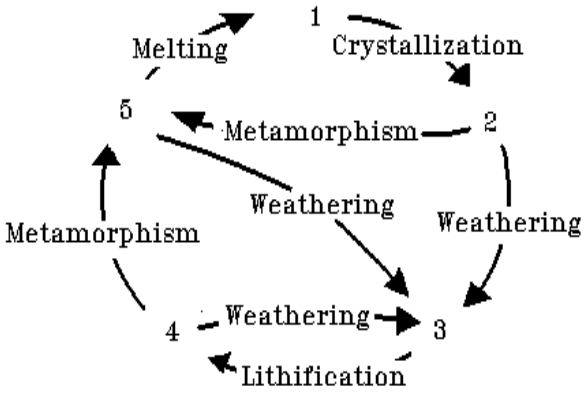
5. The three major groups of rocks are:
A) igneous, sedimentary and plutonic
B) sialic, basic and mafic
C) igneous, sedimentary and metamorphic
D) plutonic, intrusive, and extrusive

6. Grains of sand on beaches of tropical atolls are usually
A) hornblende B) calcite C) quartz D) feldspar

7. The Watchung Mountains in New Jersey are old lava flows. The predominant type of rock, therefore, is most likely to be which of the following
A) granite B) basalt C) gneiss D) gabbro

8. 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

9. In the diagram of the Rock Cycle below, magma is represented by the number
A) 1
B) 2
C) 3
D) 5



10. The internal structure of the earth is determined from
A) oil wells B) earthquakes C) a Siberian mine D) the Moho Drilling Project

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.

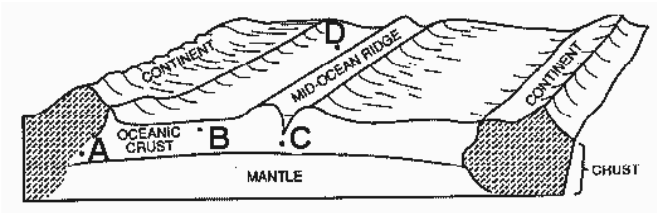
12. The supercontinent which existed when all the present continents were last joined is known as
A) Gondwanaland B) Eurasia C) Laurasia D) Pangaea

13. 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

14. 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

15. Iceland is a portion of the Mid-Atlantic Ridge which extends above the surface of the ocean. Volcanoes on Iceland result from a
A) rift zone B) hot spot C) subduction zone D) laccolith

16. Which lettered location in the sea-floor diagram below is the oldest?
A) A
B) B
C) C
D) D



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

18. 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

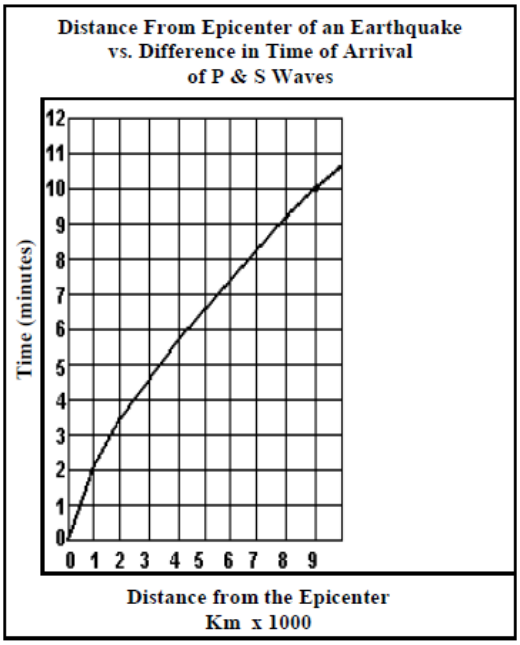
19. There is a fault, named the Alpine Fault, that runs through New Zealand's South Island. It is very much like California's San Andreas Fault, a strike thrust fault. Movement on the Alpine Fault, then, has one block
A) thrust up and over the other block
B) moving upward relative to the other block
C) moving downward relative to the other block
D) moving sideways along the fault relative to the other block

20. Folding of rock is caused by compression when two crustal plates push against each other at
A) rift zones B) normal faults C) transform faults D) subduction zones

21. The greatest danger to people in an earthquake is from
A) burial from landslides
B) collapsing buildings
C) floods due to collapsed dams
D) fire due to ruptured gas lines

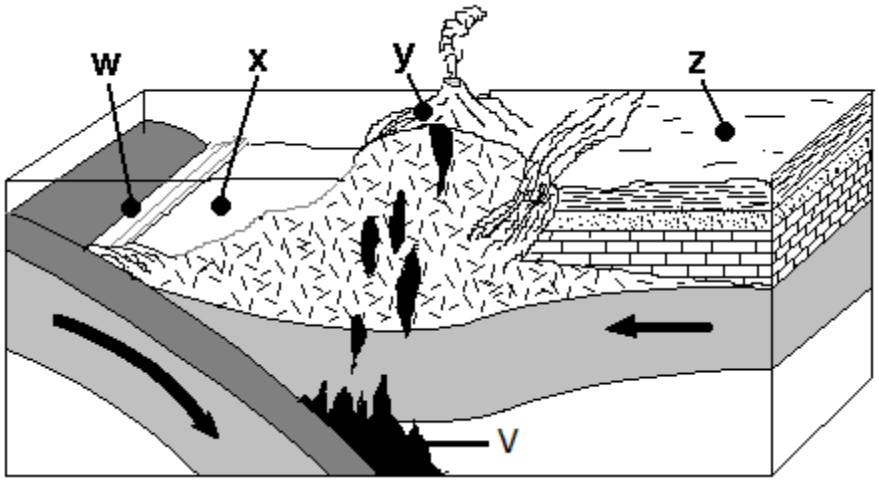
22. A seismographic station records a travel time difference of 3 minutes between P-waves and S-waves of an earthquake. Approximately how far is the seismic station from the epicenter of the earthquake?

A) 1000 km
B) 1500 km
C) 3200 km
D) 4800 km



23. Letter v in the diagram below points to chambers of molten rock deep below an active volcano. The molten rock is known as

A) lava
B) magma
C) an intrusive formation
D) an extrusive formation



24. Crater lake is an example of
A) a shield volcano B) a caldera C) a cinder cone D) a volcanic bomb

25. Most of the world's major deserts are located about 30° north or south latitude. They lie beneath the

A) equatorial low pressure belt
B) temperate low pressure belt
C) subtropical high pressure belt
D) subpolar high pressure belt

26. Which statement (s) is(are) always true about deserts?

I. Deserts are hot
II. Deserts are hot and have small amounts of precipitation
III. Deserts have small amounts of precipitation.

A) I only B) II only C) III only D) None of these.

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

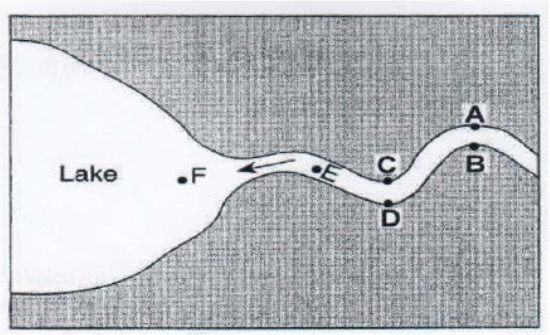
A) Hudson River B) Mullica River C) Raritan River D) Delaware River

28. 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

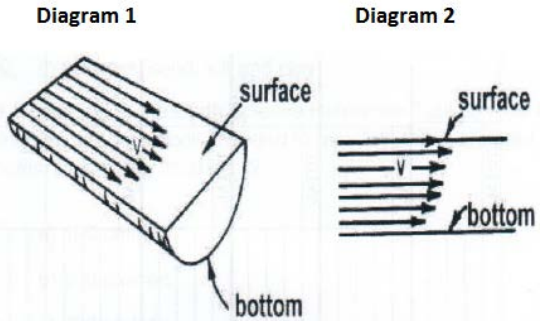
29. Below is a diagram of a river flowing into a lake. Places along the river and lake are marked with letters: A, B, C, D, E, and F. At which locations will the rate of erosion be greatest?

A) A and C
B) B and C
C) A and D
D) E and F

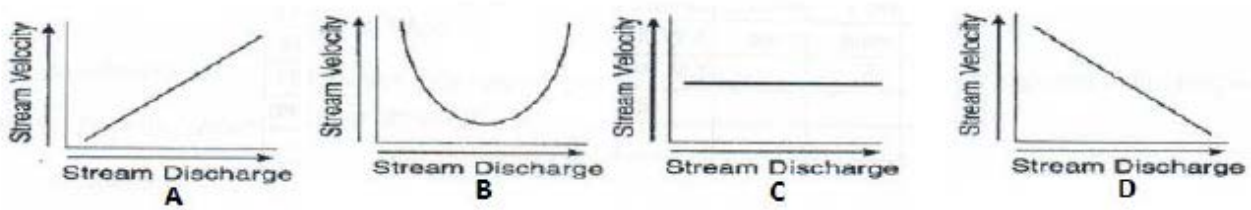


30. The diagrams below shows the water speed at various points in a river. Both diagrams are of the same river at the same place. Taken together what do these two diagrams state about the speed of water in the river?

A) The speed of the water is greatest in the middle of the river and at the surface.
B) The speed of the river is greatest in the middle of the river and close to the bottom.
C) The speed of the river is greatest at the surface of the river and near the edge
D) The speed of the river is greatest near the sides of the river and at the bottom.



31. Which graph correctly shows the relationship between stream discharge and stream velocity?

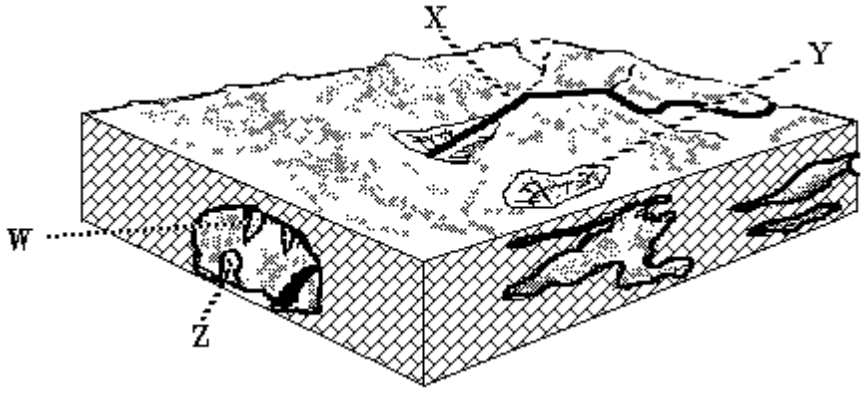


32. The water table in aquifers is dropping across the United States because the rate of
A) recharge exceeds pumping
B) pumping exceeds recharge
C) rainfall exceeds pumping
D) pumping exceeds rainfall

33. The rate at which deep aquifers are filled with water is usually measured in
A) days B) months C) years D) centuries

The diagram below shows caverns, surface depressions, and a river. Use the diagram with questions 34 and 35.

34. 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



35. The feature in the cavern that is indicated by the pointer, Z, is a
A) pillar
C) stalactite
B) stalagmite
D) column

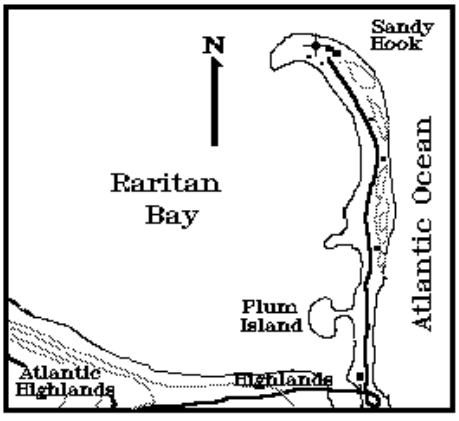
36. Immediately after a moderate rainfall, stream discharge is greater from a stream that drains on clay soil than from one that drains on sandy area. The discharge differs because clay soil is
A) less porous and allows less runoff.
B) more porous and allows more runoff.
C) less permeable and allows more runoff.
D) more permeable and allows less runoff.

37. When sand transported along a coastline reaches a point or the end of an island it usually forms
A) a barrier beach B) a tombolo C) a spit D) a moraine

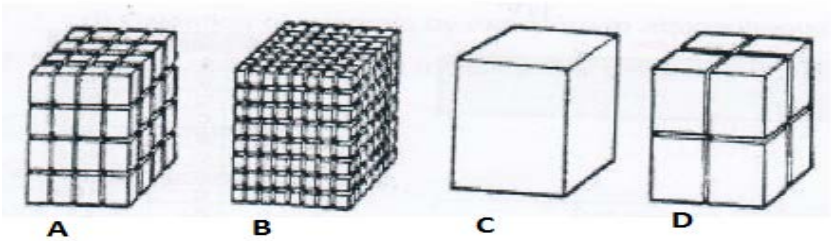
38. Long Beach Island on the New Jersey shore is a
A) spit B) tombolo C) hook D) barrier beach

39. 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



40. The diagrams below represent blocks of limestone. Each breaks into the segments indicated in each drawing. Which choice will then weather at the fastest rate?



41. What is the most common type of physical weathering above the frost line in mountains?
A) abrasion of rocks by the wind B) dissolving of minerals into solution
C) alternate freezing and melting of water D) oxidation of minerals by exposure to O_2 (gas) in the air.

42. 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

43. For bedded rock formations, unless they have been overturned, the youngest is always
A) on the bottom B) on the top C) near the bottom D) near the top

44. 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 approximate age for the rock formation?

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

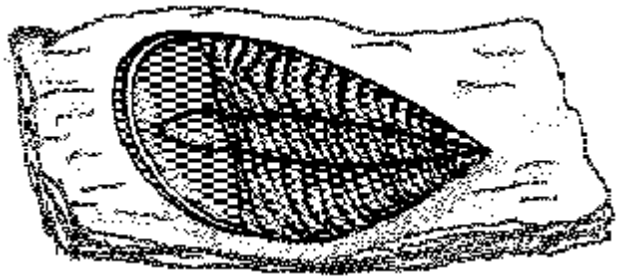
A) 294 million years
B) 339 million years
C) 417 million years
D) 500 million years

GEOLOGIC TIME			
Eras	Periods	Epochs	Began (ybp)
Cenozoic	Quarternary	Holocene	10t
		Pleistocene	1.6m
	Tertiary	Pliocene	5.3m
		Miocene	23.7m
		Oligocene	36.6m
		Eocene	57.8m
		Paleocene	66.4m
Mesozoic	Cretaceous		144m
	Jurassic		208m
	Triassic		245m
Paleozoic	Permian		286m
	Pennsylvanian		320m
	Mississippian		360m
	Devonian		408m
	Silurian		438m
	Ordovician		505m
	Cambrian		570m
preCambrian			4.5b

45. Exogira, belemnites, and many other shell fish fossils from the Cretaceous Period are found in New Jersey from Sandy Hook to Cape May. Using the geologic time table (#44 above) determine which Era these fossils are from.
A) Mesozoic Era B) Cenozoic Era C) preCambrian Era D) Paleozoic Era

46. The fossil illustrated below was a dominant form of animal life on earth in the ancient seas during which Era?

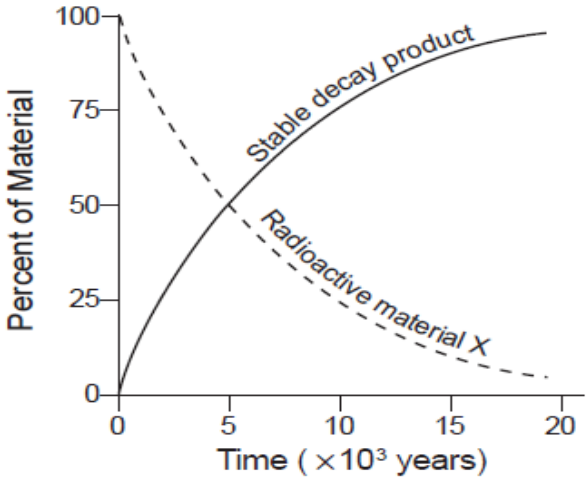
A) pre-Cambrian Era
B) Paleozoic Era
C) Mesozoic Era
D) Cenozoic Era



47. 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

The graph below represents a radioactive substance, X and the resulting stable decay product.
48. 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

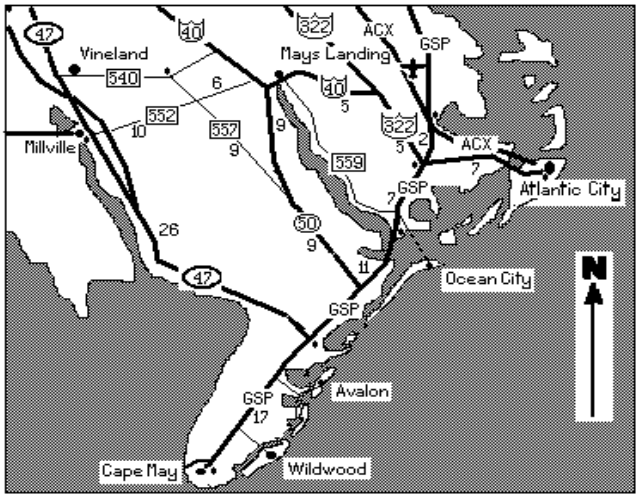


49. Material X can only be used to date young geologic material because X
A) has a relatively short half-life
B) never existed in older rocks
C) has only recently become radioactive
D) has only recently been discovered

50. 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

51. If substance X were heated, the length of its half-life would
A) increase B) remain the same C) decrease

The map below represents a roadmap of southern New Jersey use it with questions 52 and 53.

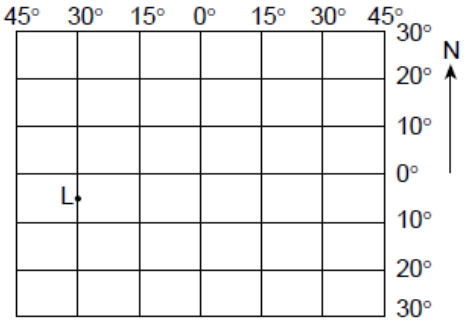


52. According to the map, the distance via the Garden State Parkway (GSP) and 322/40 from Cape May to Atlantic City is
A) 33 miles B) 35 miles
C) 38 miles D) 42 miles

53. Driving on route 47 from Millville toward Avalon, you would be travelling approximately
A) NW B) S
C) SE D) E

54. Angular position east or west of Greenwich, England is
A) longitude B) latitude C) right ascension D) declination

55. The diagram below represents the Earth's latitude and longitude system. What is the latitude and longitude of point L?



A) 5^{o} E 30^{o} N
B) 5^{o} W 30^{o} S
C) 5^{o} N 30^{o} E
D) 5^{o} S 30^{o} W

56. The energy producing reaction in the sun is the
A) combustion of hydrogen B) fusion of uranium C) fission of hydrogen D) fusion of hydrogen

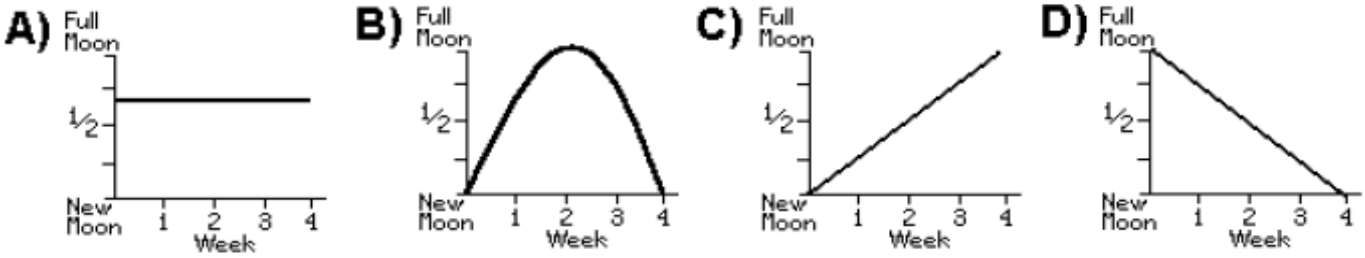
57. In the Northern Hemisphere, during which season does the Earth reach its greatest distance from the sun?
A) winter B) spring C) summer D) fall

58. When you observe a full moon, the brightest areas are
A) maria B) plains C) seas D) mountains

59. Eclipses do NOT occur every month because the Moon's
A) rate of rotation is 15^{o} 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

60. The cause of the change of seasons is
A) the tilt of the earth's orbit B) the shape of the earth's orbit
C) regular changes in the temperature of the sun D) the tilt of the earth's axis

61. Which graph best shows the amount of the moon's surface that an observer on the earth would see during one month, beginning with the new moon phase?



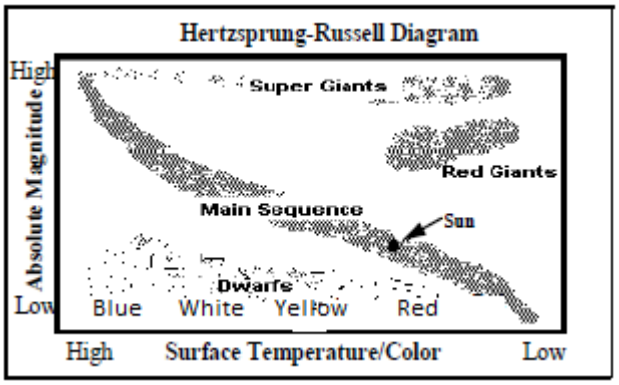
62. The Earth is the only body in the solar system known to support life. The characteristic(s) which make this possible are

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

63. The shape of the orbits of planets is

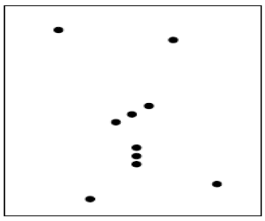
A) circular B) elliptical C) parabolic D) hyperbolic

64. Which group of stars has relatively low luminosities and relatively low temperatures according to the Hertzsprung-Russell Diagram?



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

65. The diagram represents the major stars in the constellation Orion as viewed from NJ on December 21. What is the reason this constellation **cannot** be seen on June 21 in NJ?



A) Earth rotates on its axis.
B) Earth revolves around the Sun
C) Orion has an eccentric orbit around the Sun
D) Orion has an eccentric orbit around the Earth.

66. The center of our galaxy appears to be in the constellation, Sagittarius, and is hidden from us by dust clouds. The center of our galaxy is thought to be a

A) black hole B) red giant C) cosmic string D) brown dwarf

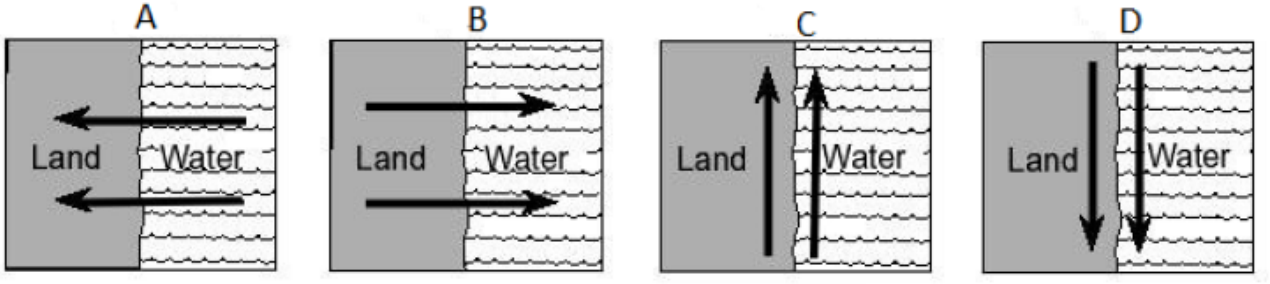
67. The speed at which a galaxy is moving away from us is determined by measuring

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

68. **Most** astronomers estimate the age of the Universe to be closest to

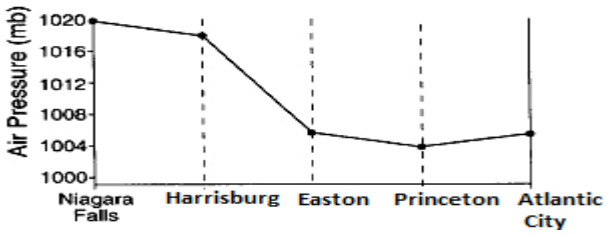
A) 7,000 years C) 4.6 billion years
B) 360 million years D) 13.5 billion years

69. Which diagram correctly shows the wind direction at 2 pm on a sunny afternoon in July at the Jersey shore?



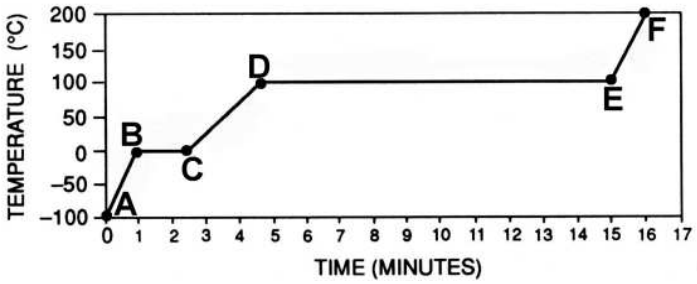
70. The graph below shows air pressure readings at several locations between Niagara Falls, NY and Atlantic City NJ. Between which two locations is the wind speed the greatest?

A) Niagara Falls and Harrisburg
B) Harrisburg and Easton
C) Easton and Princeton
D) Princeton and Atlantic City



71. You are given 100 grams of water at 0°C. It is heated. Between which two points on the graph below does **most** of the water evaporate?

A) B and C
B) C and D
C) D and E
D) E and F



72. The weather map below, diagram #1,shows part of the United States. Line AB is a frontal boundary between two air masses. The two large arrows indicate the direction that cP air mass is moving. Which symbol below in diagram #2 represents the frontal boundary for line AB?

Weather Map Diagram #1 ↓

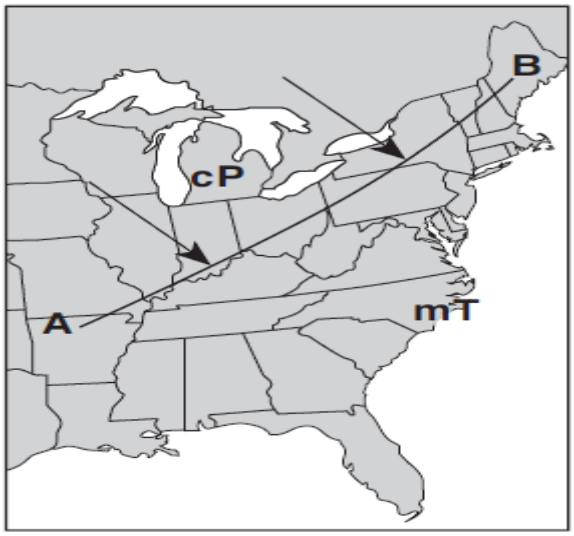
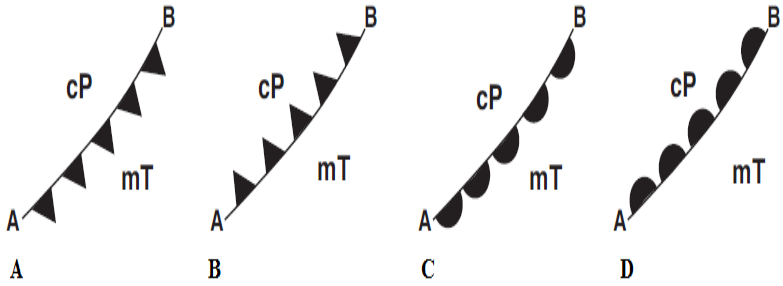


Diagram #2 ↓



A is correct not C.

NEW JERSEY SCIENCE LEAGUE

EARTH SCIENCE EXAM ANSWER KEY TAN TEST

DATE: Feb 11 , 2016 (Corrections)

1	C	19	D	37	C	55	D
2	D	20	D	38	D	56	D
3	B correct not D	21	B	39	B	57	C
4	C	22	B	40	B	58	D
5	C	23	B	41	C	59	B
6	B	24	B	42	B	60	D
7	B	25	C	43	B	61	B
8	A	26	C	44	D	62	D
9	A	27	D	45	A	63	B
10	B	28	C	46	B	64	A
11	D	29	C	47	D	65	B
12	D	30	A	48	A	66	A
13	B	31	A	49	A	67	A
14	A	32	B	50	A	68	D
15	A	33	D	51	B	69	A
16	A	34	D	52	D	70	B
17	A	35	B	53	C	71	C
18	B	36	C	54	A	72	A not 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)
Rocks (2)
Earth Structure (2)
Plate Tectonics (4)
Faults/Folds/Seismology (3)
Vulcanism (2)
Glaciation/Deserts (2)
Rivers: Erosion & Deposition (3)
Ground Water/Caves (2)
Ocean Shore Line/Currents/Salinity(3)
Weathering/Mass Wasting (2)
Historical Geology (4)
Map Reading: Road/Topo/Geologic (4)
Geodesics/Time/Map Projections (3)

Sun (2)
Moon (2)
Sun-Moon-Earth System (3)
Solar System (3)
Stars (2)
Galactic Systems (2)
Cosmology (2)

Insolation/Temperature/Air Masses (3)
Atmospheric Pressure/Highs/Lows (4)
Moisture in the Atmosphere (3)
Frontal Systems (3)
Interpreting Weather Maps (3)

Testing Dates for 2016

Thursday, February 11, 2016

Thursday, March 10, 2016 Thursday, April 14, 2016*

All areas and schools must complete the April exam and mail in the results by April 28th, 2016.

New Jersey Science League
PO Box 65 Stewartsville, NJ 08886-0065
Phone #: 908-213-8923 **Fax #:** 908-213-9391 **email:** newjsl@ptd.net
Web address: entnet.com/~personal/njscil/html

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

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

Dates for 2017 Season

Thursday, January 12, 2017 Thursday, February 9, 2017

Thursday, March 9, 2017 Thursday, April 13, 2017

Earth Science Exam **TAN EXAM**

March 10, 2016

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.

1. The general name for a mineral or group of minerals mined for their economic value is
A) gangue B) burden C) wad D) ore

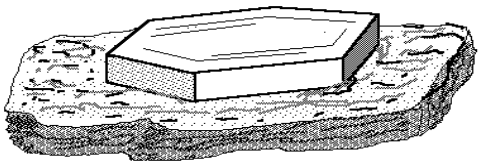
2. The hardness of minerals is most closely related to the
A) mineral's color
B) mineral's abundance in nature
C) the iron content of the minerals
D) internal arrangement of the atoms in the mineral.

3. Which of the following is an important rock-forming mineral?
A) pyrite B) galena C) quartz D) magnetite

4. Pencils use what mineral with which to write?
A) lead B) molybdenite C) graphite D) silicon

5. The piece of corundum at the lower right, belongs to which crystal system?

A) isometric
B) orthorhombic
C) monoclinic
D) hexagonal



6. Grains of sand on beaches of **tropical atolls** are usually
A) hornblende B) calcite C) quartz D) feldspar

7. Metamorphosed sandstone is called
A) schist B) slate C) marble D) quartzite

8. Rocks can be classified as sedimentary, igneous, or metamorphic based primarily upon differences in their
A) color B) density C) origin D) age

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

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

✓ means mineral is present

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 quarts.

10. Which process is necessary for the formation of igneous rocks?
A) erosion B) deposition C) solidification D) metamorphism

11. The internal structure of the earth is determined from
A) oil wells B) earthquakes C) a Siberian mine D) the Moho Drilling Project

12. The study of how seismic waves change as they travel through the 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

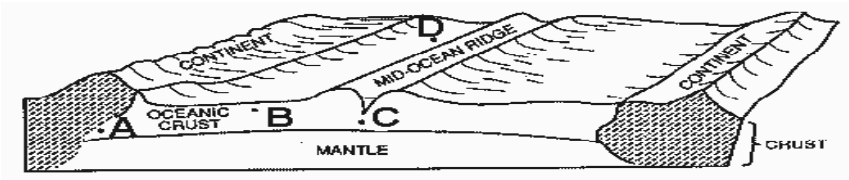
13. Which observation about the Mid-Atlantic Ridge region provides the best evidence that the seafloor has been spreading for millions of years?
A) The bedrock of the ridge and nearby seafloor is igneous rock.
B) The ridge is the location of irregular volcanic eruptions
C) Several faults cut across the ridge and nearby seafloor.
D) Seafloor bedrock is younger near the ridge and older farther away.

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. For the last 200 million years the continents on opposite of the Atlantic Ocean have
A) been drifting closer together B) been drifting apart C) remained the same distance apart.

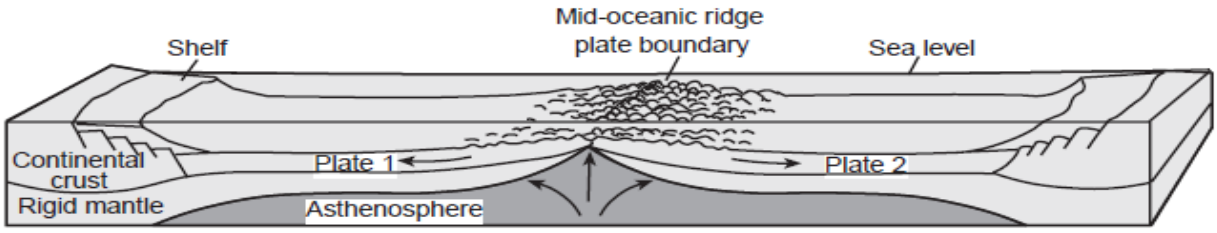
16. The diagram below of the sea-floor has several marked locations. Which lettered location is the <u>oldest</u>?

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



17. According to plate tectonics, the Peru-Chile Trench and the Andes Mountains formed along the west coast of South America because the South American Plate
A) Collided with the Nazca Plate C) Slid away from the Nazca Plate
B) Collided with the North America Plate D) Slid away from the North American Plate

Base your answers to the questions 18 and 19 below on the cross section of two crustal plates and the boundary between them shown below. The arrows indicate the direction of rock movement.



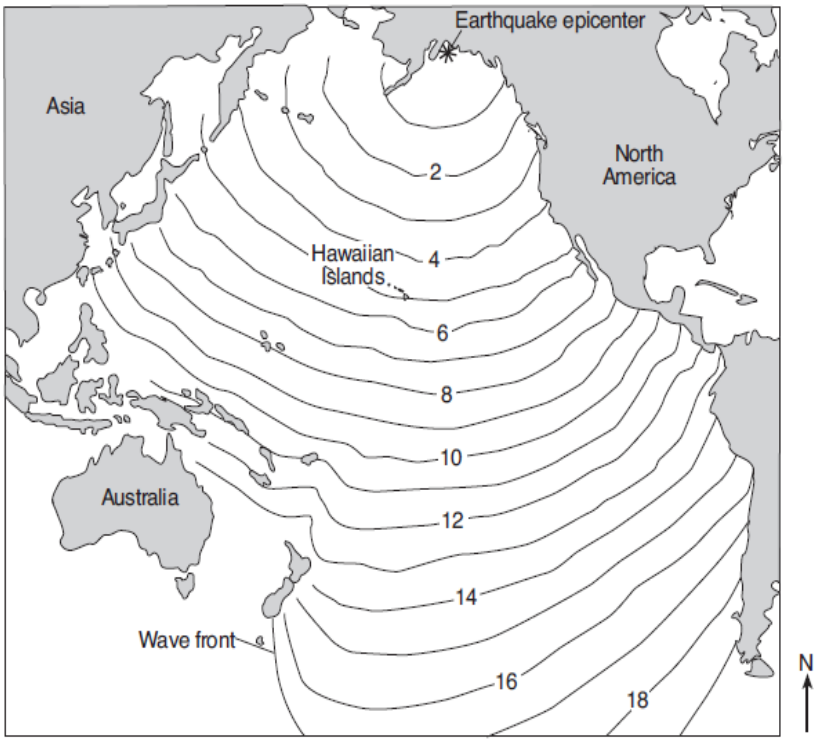
18. The mid-oceanic ridge portion best represents
A) convergence of the Nazca Plate and the South American Plate
B) divergence of the African Plate and the South American Plate
C) subduction of the Philippine Plate by the China Plate
D) transform faulting between the Pacific Plate and the North American Plate

19. Use the drawing in #18. 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

20. In 1964 an Alaskan earthquake lifted some Aleutian Islands straight up more than 40 feet above sea level.. The fault that produced the earthquake was a
A) normal fault B) strike-slip fault C) thrust fault D) reverse fault

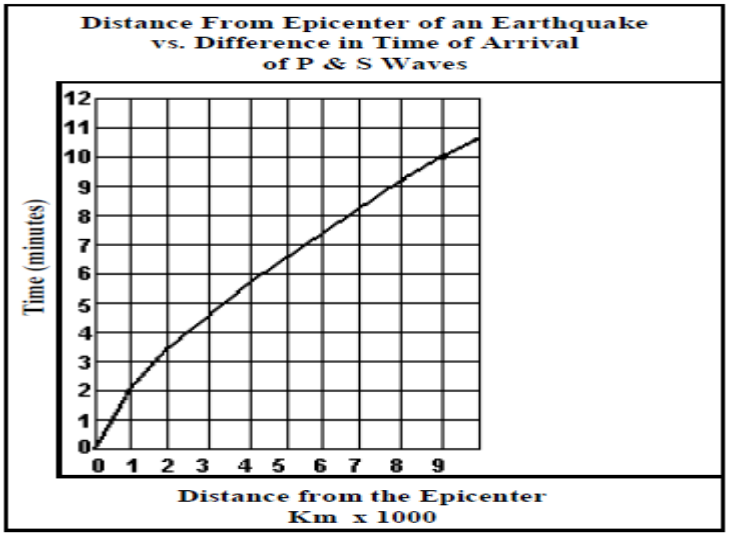
21. The map below shows the changes in the position of the tsunami wave front that was produced by the Alaskan earthquake in 1964. The numbers on the map indicate the time in hours for the wave front to reach the positions indicated by the isolines. If the wave front reached the Hawaiian Islands at 10:30 pm, then what time did the earthquake occur?

A) 1:30 pm
B) 5:30 pm
C) 3:30 pm
D) 4:30 pm



22. A seismograph at the Lamont-Dougharty Geophysical Observatory in Alpine, NJ records the arrival of earthquake tremors. The p-wave arrives at 07:31:53. The s-wave is recorded at 07:35:23. The seismologists checks the tables , and concludes that the distance to the epicenter of the earthquake is _____ kilometers?

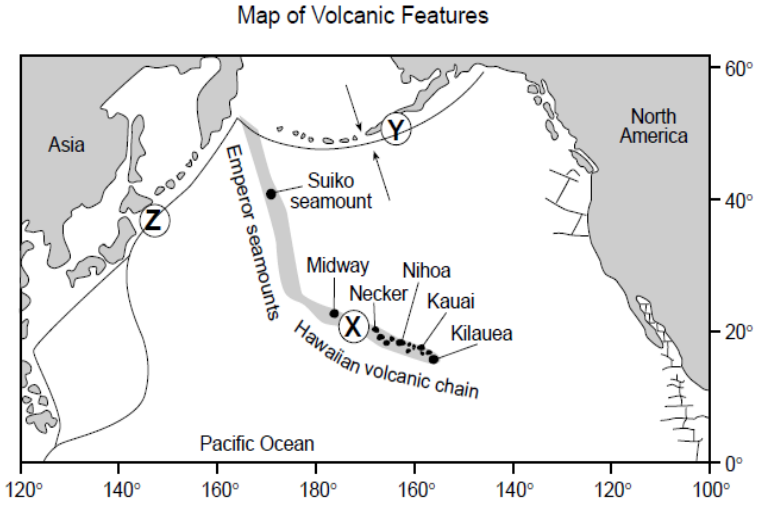
A) 2 kilometers
B) 2000 kilometers
C) 1000 kilometers
D) 3,300 kilometers



23. The Appalachian Mountains are folded mountains. Many of them are the upturned edges of eroded troughs. Therefore, they are
A) horsts B) grabens C) anticlines D) synclines

24. 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

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.



Data Table
Age of Volcanic Features

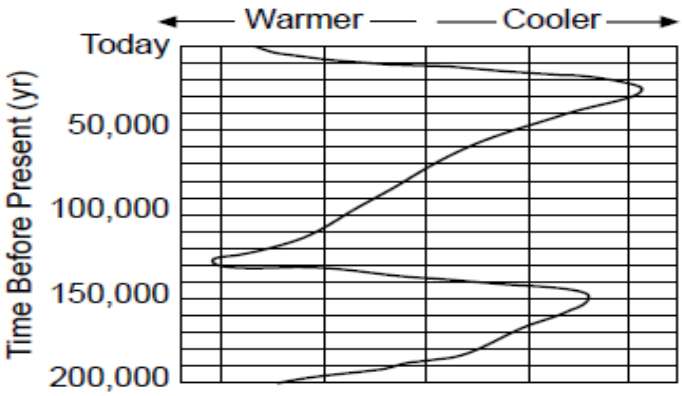
Volcanic Feature	Distance from Kilauea (km)	Age (millions of years)
Kauai	545	5.6
Nihoa	800	6.9
Necker	1,070	10.4
Midway	2,450	16.2
Suiko seamount	4,950	41.0

25. 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

26. 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

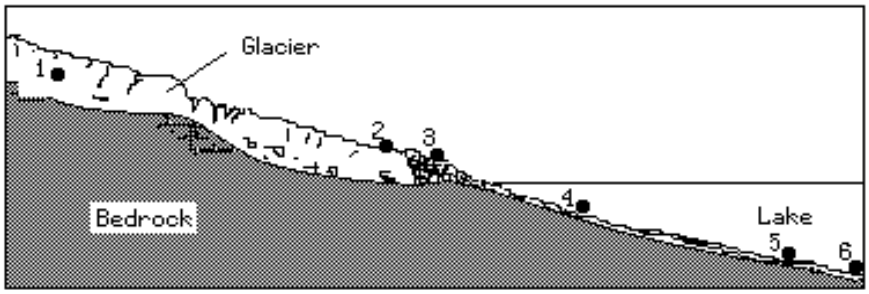
27. The graph below shows the changes in temperature in North America over the last 200, 000 years. What is the total number of major glacial periods represented by the graph?

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



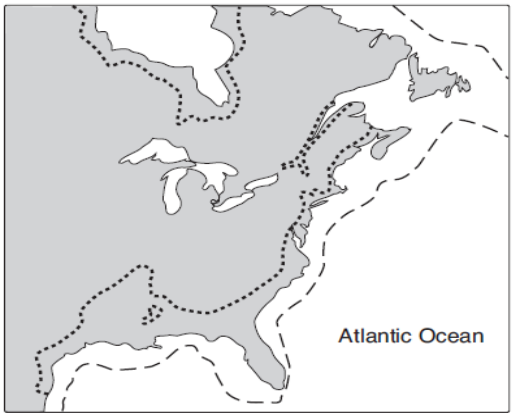
The diagram below represents a glacier moving out of a mountain valley. Use it with questions # 28, 29, 30.
28. Deposits of unsorted sediments most probably would be found at

A) position 5
B) position 6
C) position 3
D) position 4



29. An ice interface between deposition and erosion by the ice is most likely located at
A) positions 1 and 2
B) positions 2 and 3
C) positions 3 and 4
D) positions 4 and 5

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



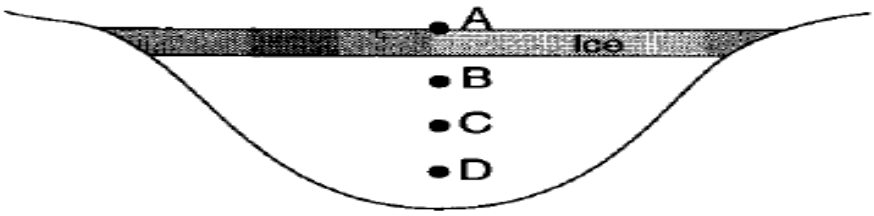
The side map shows part of the coastline of North America. Use the map with questions # 31 and 32. The solid line represents the present coastline. The key with a – – – – represents the coast line 18, 000 years ago. The future coast line being represented by - - - - - - - - .

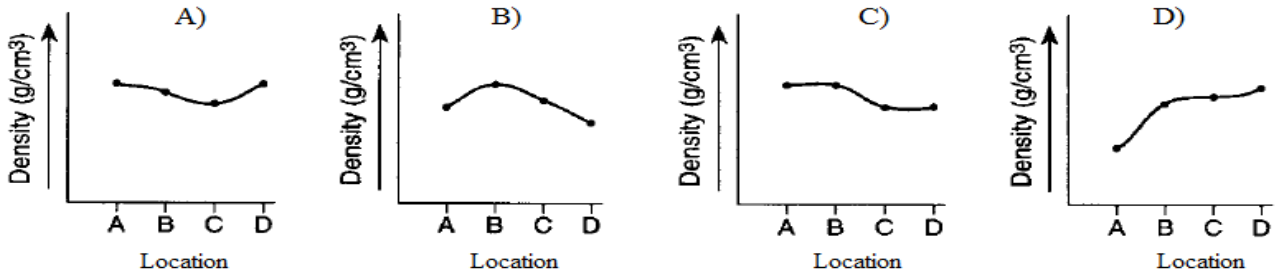
31. Which statement below best explains why 18,000 years ago the coastline was at a different location than it is today?
A) The climate of the Earth was extremely hot and dry.
B) A large amount of the Earth's water was stored in large continental sheets of ice.
C) The east coast of North America was being subducted under the Euriasian Plate.
D) North America had just separated from Africa, and the Atlantic Ocean was forming.

32. What assumption is being made about the future position of the coastline?
A) the total amount of global precipitation will decrease
B) the thickness of the ozone layer will decrease
C) the concentration of carbon dioxide in the Earth's atmosphere will increase
D) The rate of uplift of North American continent will increase.

33. When placed in water, ice rises to the top of the liquid water. Unlike most solids that sink when placed in their liquid, ice floats because
A) ice is less dense than water
B) the pressure of the water holds it up
C) gases inside the ice make it buoyant
D) it is colder than water.

34. The diagram below is of a deep lake in Canada during the month of January. Ice has formed on the lake. Point A is at the surface. Point D is at the bottom of the lake where the temperature is 4°C. Which graph **best** represents the relationship between location points A, B, C, and D and the density of the water and ice?





35. The Delaware River has lower stream discharge in August and September than in the spring during April and May. What is the reason for the lower discharge?
A) Potential evapotranspiration is less in late summer than in the spring.
B) Plants carry on more transpiration in spring than in later summer.
C) The river rainfall shows a surplus in late summer.
D) The river rainfall shows a deficit in later summer.

The diagrams below represent four different rocks or minerals samples. Each has a different shape and mass. Use the diagram with questions # 36, 37, 38, 39, 40

A) Mass = 12.0 g, Volume = 4.0 cm³
B) Mass 16.0 g, Volume = 4.0 cm³
C) Mass = 20.0 g, Volume = 4.0 cm³
D) Mass = 24.0 g, Volume = 4.0 cm³

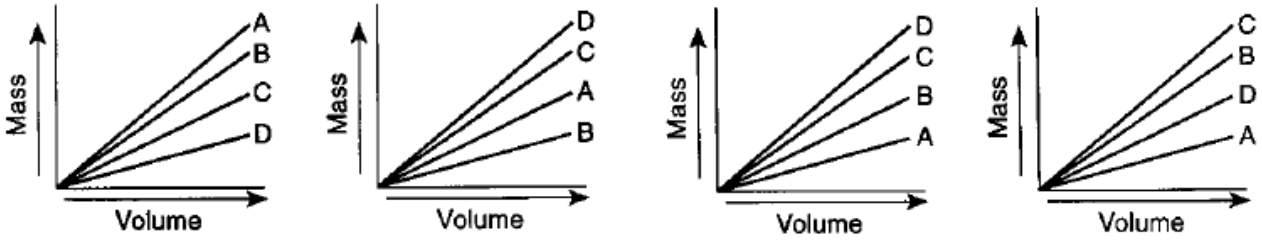
36. What instrument was most likely used to **measure** the volume?
A) Graduated cylinder B) Balance C) Thermometer D) Psychrometer

37. Another sample of A has a mass of 48 grams. What is the **volume** of this sample?
A) 24cm^3 B) 16.0 cm^3 C) 12.0 cm^3 D) 4.0 cm^3

38. A student determined the mass of sample B to be 17.5 grams. The accepted mass was 16.0 grams. What is the percentage error?
A) 1.5% B) 6.7% C) 8.6 % D) 9.4 %

39. Which sample would most likely settle the **slowest** in a calm body of water? Choices are in the diagram above.
A) B) C) D)

40. Which graph best represents the density of the samples?

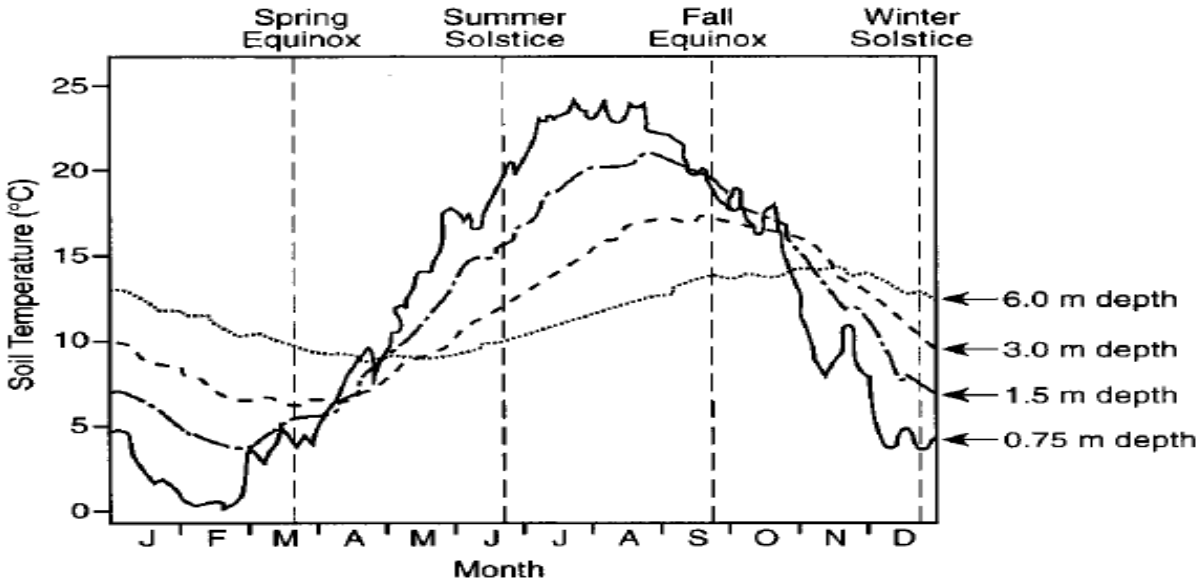


41. A type of rock which makes a good aquifer because it usually has good porosity and permeability is
A) granite B) sandstone C) shale D) gneiss

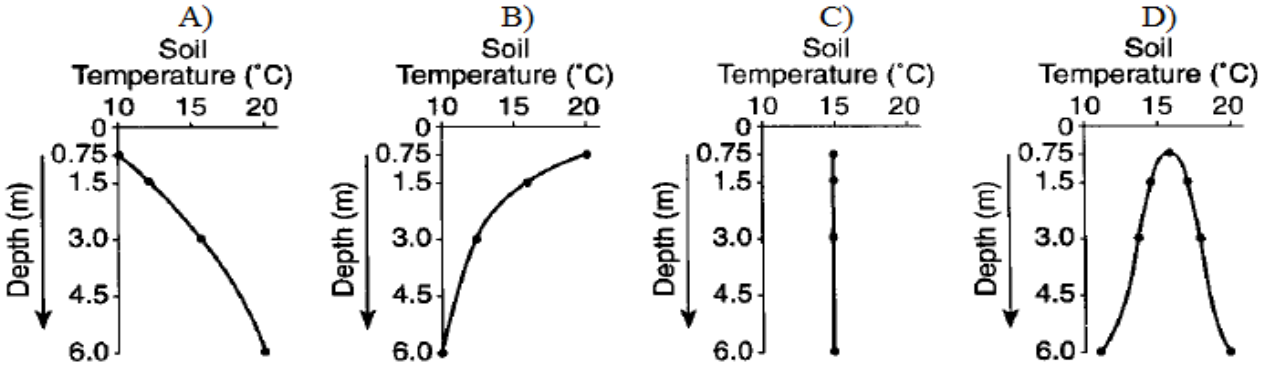
42. Soil with the lowest porosity is composed of particles that are all
A) small and flat.
B) large and angular.
C) small and rounded.
D) large and rounded.

43. Which material covering the surface of a landfill would permit the least amount of rain water to infiltrate the surface?
A) silt B) clay C) sand D) gravel

The graph below shows temperature data taken at four different depths in the soil at a field around Clinton NJ for one year.



44. Which graph below best represents the relationship between the soil temperature and depth in the soil on June 21?



45. The graph of temperature vs soil depth shows that as depth increases, the annual temperature range
A) decreases B) increases C) remains the same

46. Over one year which depth of soil had the **<u>least change</u>** in temperature?
A) 0.75 m B) 1.5 m C) 3.0 m D) 6 m

47. Jetties, groins and sea walls have been built along New Jersey beaches. They
A) prevent the long-shore transport of sand
B) prevent the erosion of the beaches
C) stabilize the dunes
D) are largely ineffective in preventing erosion

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

49. Ocean tides are best described as
A) unpredictable and cyclic B) unpredictable and noncyclic C) predictable and cyclic D) predictable and noncyclic

50. A warming atmosphere is causing glaciers and ice caps to melt. This is causing
A) shorelines to migrate landward
B) shorelines to migrate seaward
C) estuaries to sink below sea level
D) barrier islands to migrate landward

51. Granite is eroded by processes that include
A) physical weathering
B) chemical weathering
C) both physical and chemical weathering
D) neither physical nor chemical weathering

52. The weathering of granite produces particles of
A) quartz and obsidian B) clay and obsidian C) clay and dunite D) quartz and clay

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

54. A good index (or guide) fossil for use in identifying the sequence or age of rock formations has the following characteristics:
A) lived for a short period of time over a small area.
B) lived for a long period of time over a small area.
C) lived for a short period of time over a wide area.
D) lived for a long period of time over a wide area.

55. 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.

56. Geologists have divided geologic time into periods that are based on
A) carbon dating B) rock types C) fossil evidence D) mountain building

57. 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.

58. The time line below represents the entire geologic history of the Earth. Which lettered position represents the first appearance of humans?

59. The data table below shows information on six major extinctions that occurred many millions of year ago (mya). Use the data table and the geologic time chart to answer the following question.
More than half of brachiopod species became extinct at the end of which geologic period ?

Some Major Mass Extinctions in Earth's History

Approximate Time (mya)	Certain Life-Forms That Became Extinct
65.5	all dinosaurs and all ammonoids
200	many species of nautiloids, ammonoids, mammal-like reptiles, and early dinosaurs
251	all trilobites and 90% of other marine species and 70% of land species
376	many species of corals, brachiopods, and trilobites
444	more than half of brachiopod species, many trilobite species, and some coral species
520	small shelly fossil species and some early trilobite species

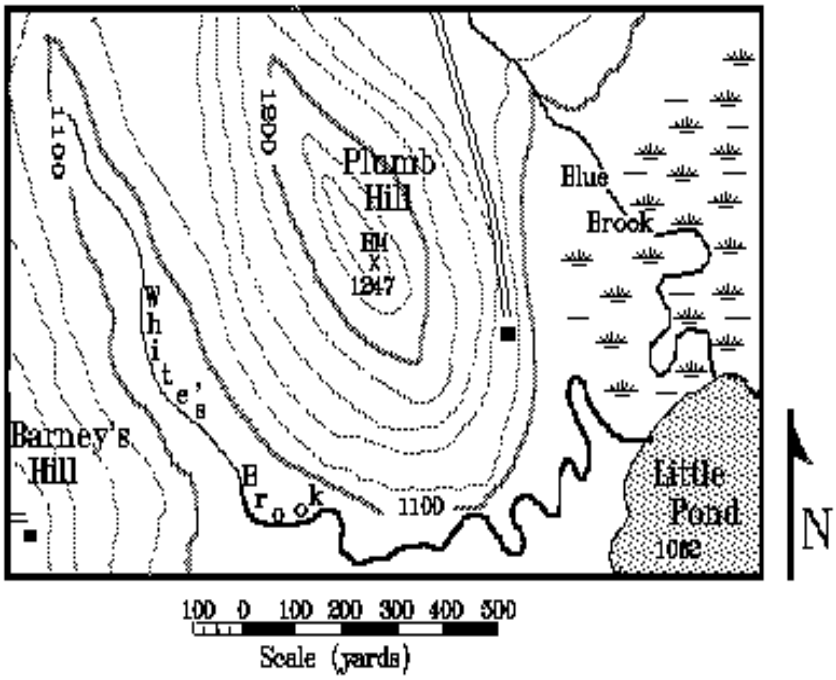
GEOLOGIC TIME

Eras	Periods	Epochs	Began (ybp)
Cenozoic	Quarternary	Holocene	10t
		Pleistocene	1.6m
	Tertiary	Pliocene	5.3m
		Miocene	23.7m
		Oligocene	36.6m
		Eocene	57.8m
		Paleocene	66.4m
Mesozoic	Cretaceous		144m
	Jurassic		208m
	Triassic		245m
Paleozoic	Permian		286m
	Pennsylvanian		320m
	Mississippian		360m
	Devonian		408m
	Silurian		438m
	Ordovician		505m
	Cambrian		570m
preCambrian			4.5b

A) Devonian Period B) Siurian Period C) Ordovician Period D) Cambrian Period

60. Using the table in #59 what event is generally accepted as the cause of the mass extinction that occurred 65.5 million years ago?
A) volcanic eruption B) continental collision C) asteroid impact D) sea-level change.

Use the map below for questions # 61, 62, and 63.



61. The contour interval for the map below is

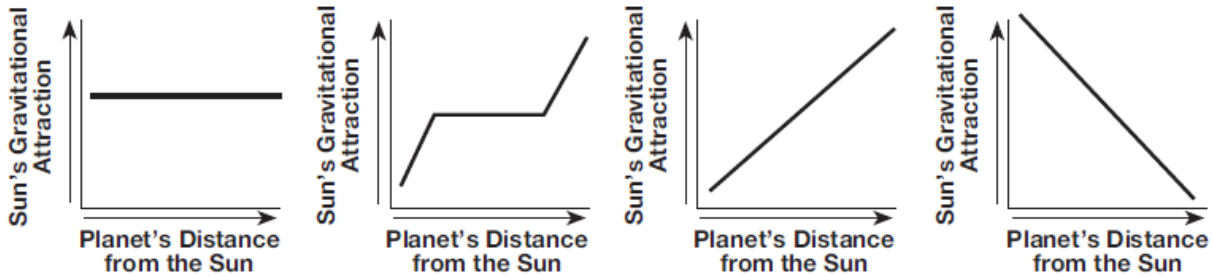
A) 10 feet
B) 20 feet
C) 50 feet
D) 100 feet

62. The feature north of Little Pond is a
A) meadow
B) woodland
C) swamp
D) swale

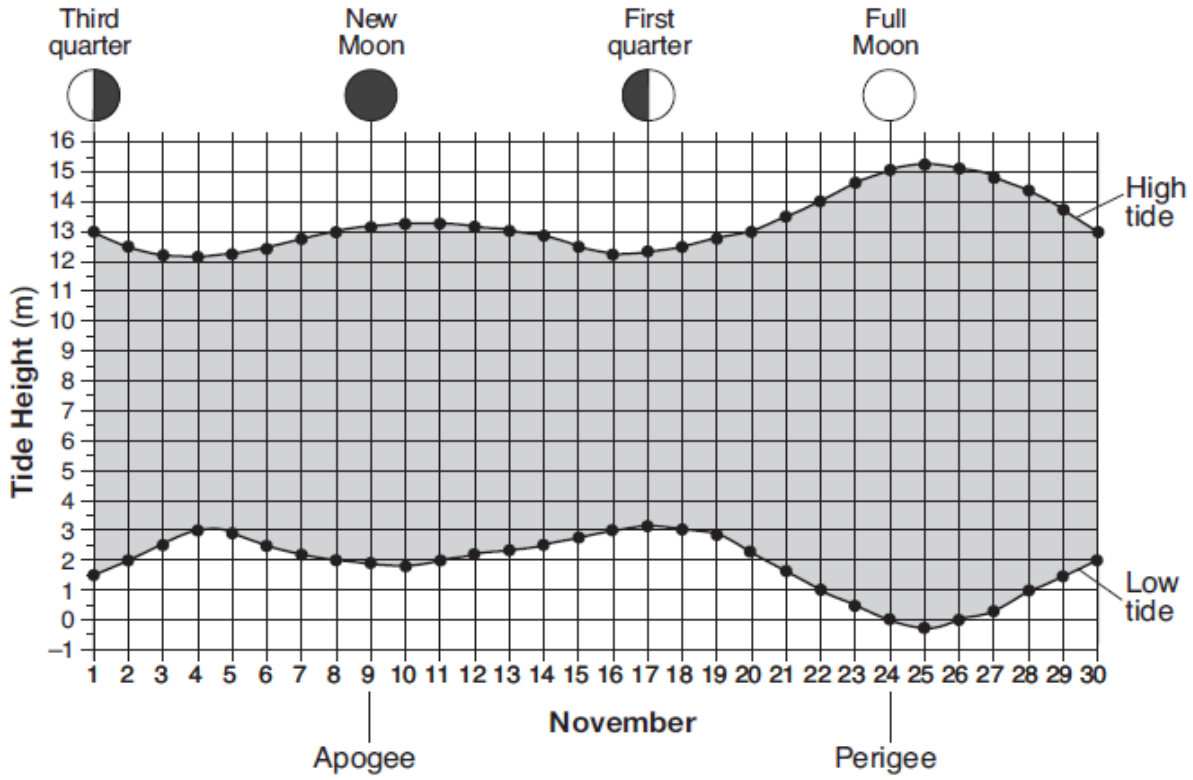
63.The road east of Plumb Hill
A) runs up hill to the cabin
B) runs down hill to the cabin
C) is approximately level

64. Energy produced by the sun results from the nuclear fusion of
A) hydrogen B) helium C) carbon D) uranium

65. Which graph below shows the general relationship between a planet's distance from the Sun and the Sun's gravitational attraction to the planet?



The graph below shows the tidal range (the difference between high tide and low tide) recorded in Minas Basin, Nova November 2007. The phase of the Moon on selected days is shown above the graph. The apogee (farthest from Earth) and perigee (closest to Earth) are indicated under the graph.



66. On November 8 the tidal range was approximately how many meters?
A) 11 meters B) 2 meters C) 13 meters D) 15 meters

67. The highest high tides and lowest low tides occurred when the Moon was near
A) apogee and a new-Moon phase B) apogee and a full-Moon phase
C) perigee and a new-Moon phase D) perigee and a full-Moon phase

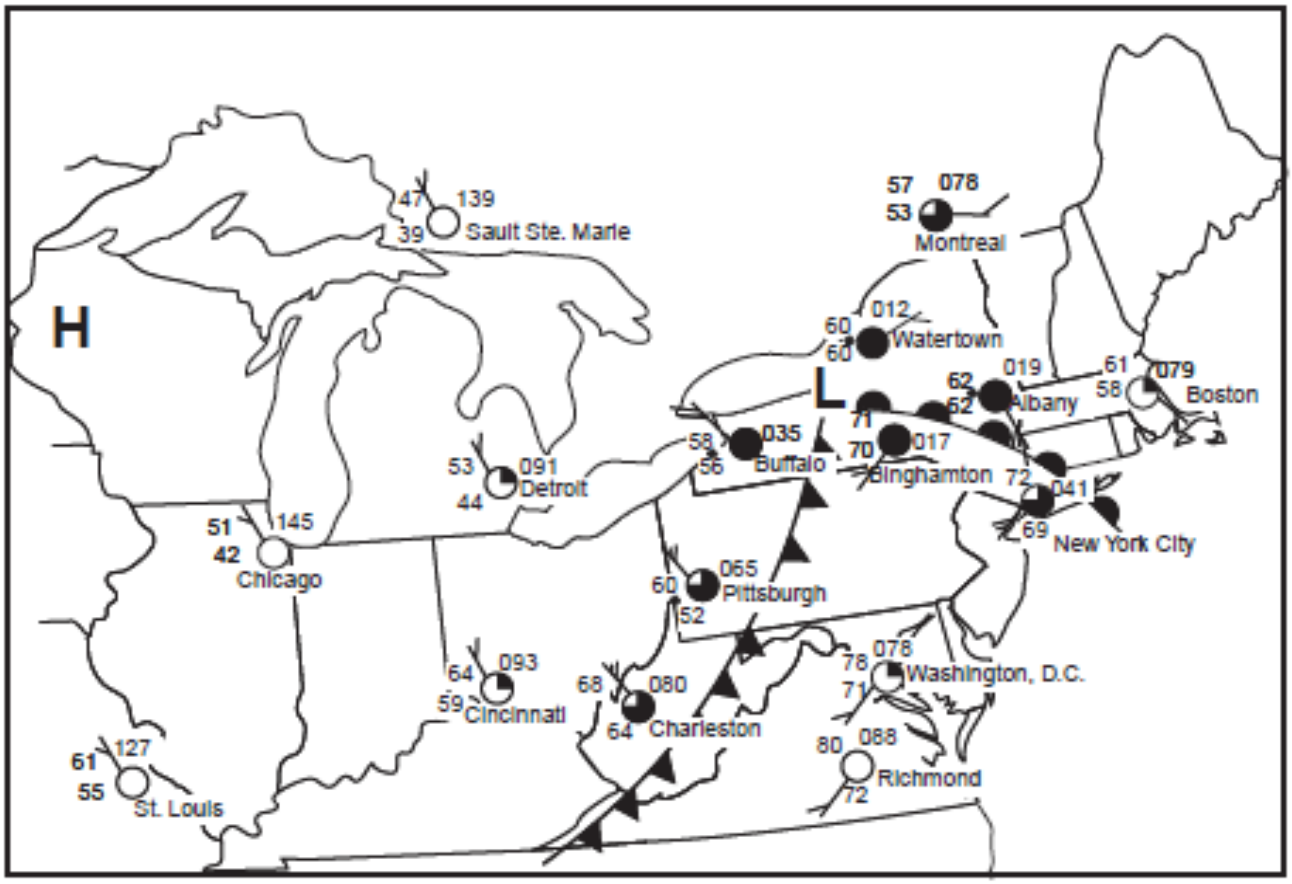
68. The next first-quarter Moon after November 17 occurred closest to what date?
A) December 9 B) December 14 C) December 17 D) December 24

69. Two 400 ml beakers are placed on a hot plate in an open room at constant pressure. Beaker A has 150 ml of boiling water, while beaker B contains 350 ml of boiling water. A thermometer is placed into each beaker. How will the temperature in beaker B compare with the temperature in beaker A?
A) lower B) higher C) the same D) Cannot be determined

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

70. Which city is located in an mT air mass?
A) Richmond, Virginia B) St. Louis, Missouri C) Detroit, Michigan D) Buffalo, NY

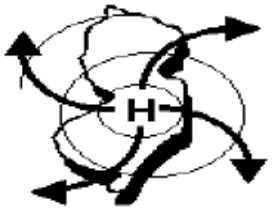
71. Which city has the highest relative humidity?
A) Chicago B) Watertown, NY C) Washington DC D) Pittsburg



72. There is a high pressure system in the northwest section of the map just above Chicago?
Looking down on a high pressure system which map shows the direction of the surface winds?

A)


B)


C)


D)


NEW JERSEY SCIENCE LEAGUE

EARTH SCIENCE EXAM ANSWER KEY TAN TEST (No Corrections)

DATE: March 10, 2016

Record onto the area record the # correct

1	D	19	D	37	B	55	D
2	D	20	A	38	D	56	C
3	C	21	B	39	A	57	A
4	C	22	B	40	C	58	D
5	D	23	D	41	B	59	C
6	B	24	B	42	A	60	C
7	D	25	C	43	B	61	B
8	C	26	C	44	B	62	C
9	C	27	A	45	A	63	C
10	C	28	C	46	D	64	A
11	B	29	B	47	D	65	D
12	D	30	D	48	C	66	A
13	D	31	B	49	C	67	D
14	A	32	C	50	A	68	C
15	B	33	A	51	C	69	C
16	A	34	D	52	D	70	A
17	A	35	D	53	C	71	B
18	B	36	A	54	C	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)
Rocks (2)
Earth Structure (2)
Plate Tectonics (4)
Faults/Folds/Seismology (3)
Vulcanism (2)
Glaciation/Deserts (2)
Rivers: Erosion & Deposition (3)
Ground Water/Caves (2)
Ocean Shore Line/Currents/Salinity(3)
Weathering/Mass Wasting (2)
Historical Geology (4)
Map Reading: Road/Topo/Geologic (4)
Geodesics/Time/Map Projections (3)

Sun (2)
Moon (2)
Sun-Moon-Earth System (3)
Solar System (3)
Stars (2)
Galactic Systems (2)
Cosmology (2)

Insolation/Temperature/Air Masses (3)
Atmospheric Pressure/Highs/Lows (4)
Moisture in the Atmosphere (3)
Frontal Systems (3)
Interpreting Weather Maps (3)

Testing Dates for 2016

Thursday, March 10, 2016 Thursday, April 14, 2016*

All areas and schools must complete the April exam and mail in the results by April 28th, 2016.

New Jersey Science League
PO Box 65 Stewartsville, NJ 08886-0065
Phone #: 908-213-8923 **Fax #:** 908-213-9391 **email:** newjsl@ptd.net
Web address: entnet.com/~personal/njscil/html

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

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

Dates for 2017 Season

Thursday, January 12, 2017 Thursday, February 9, 2017
Thursday, March 9, 2017 Thursday, April 13, 2017

ES April Exam 2016 **TAN EXAM** (No Corrections)

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.

1. You have a mineral specimen that has a yellow color and a metallic luster. Weighing it. you find its mass is 50.5g. Displacement of water shows its volume is 12cm^3. Using the table below, what is the name of the mineral?

A) Arsenopyrite
B) Gold
C) Chalcopyrite
D) Pyrite

DENSITY OF YELLOW METALLIC MINERALS	
Mineral	Density
Arsenopyrite	6.1
Chalcopyrite	4.2
Gold	19.3
Marcasite	4.9
Pyrite	5.0

2. The softest mineral in Mohs scale of hardness is
A) muscovite B) talc C) gypsum D) fluorite

3. You are looking at a yellow mineral which shows three directions of cleavage. You cannot scratch it with your fingernail, but you can scratch it with a copper penny. Of the minerals in the table below, it is

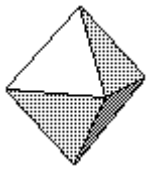
Hardness	Cleavage	Mineral
2	1	selenite
2.5	3	halite
3	3	calcite
4	3	fluorite
7	none	quartz

Mohs Scale of Hardness		
Talc	1	graphite
Gypsum	2	fingernail (2.5)
Calcite	3	halite 2.5 copper (3.5)
Fluorite	4	iron nail 4.5
Apatite	5	knife (5.5)
Orthoclase	6	glass (<6)
Quartz	7	pyrite 6.5 streak plate 7
Topaz	8	
Corundum	9	
Diamond	10	

A) selenite B) halite
C) calcite D) fluorite

4. Which of the following minerals is a common ore for lead?
A) sphalerite B) galena C) chalcopyrite D) pyrite

5. Diamond and fluorite cleave to form octahedrons, as shown below. Both minerals show how many directions of cleavage?



A) Two B) Four C) Six D) Eight

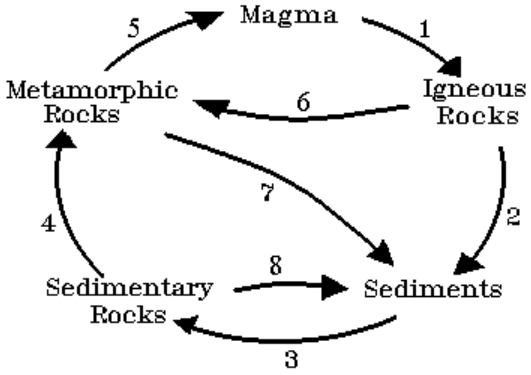
6. The chemical element that is most common in minerals of the earth's crust is
A) aluminum B) iron C) oxygen D) silicon

7. 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

8. The material from which all rock originally formed is
A) magma B) lava C) sediment D) crystals

9. In the diagram of the rock cycle below, which number represents the process of crystallization?

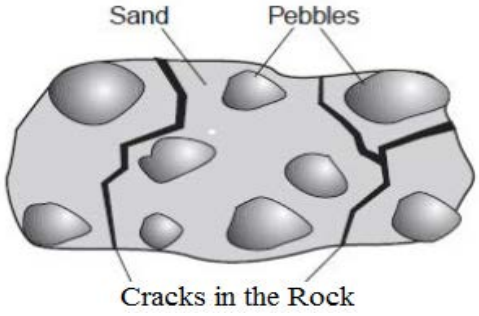
A) 1
B) 2
C) 5
D) 7



10. In the diagram of the rock cycle (above), the process of weathering is represented by
A) 2, only B) 7, only C) 2 and 7, only D) 2, 7, and 8

11. 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

12. Which statement most accurately compares the ages of the cracks and pebbles to the age of the sedimentary rock in which they are found?



A) The cracks and pebbles are both younger than the sedimentary rock
B) The cracks and pebbles are both older than the sedimentary rock
C) The cracks are younger and the pebbles are older than the sedimentary rock.
D) The cracks are older and the pebbles are younger than the sedimentary rock.

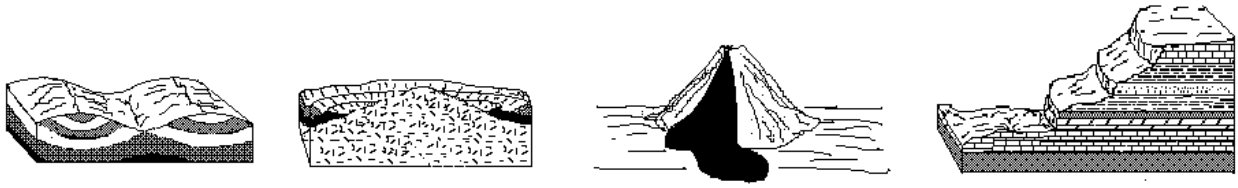
13. Except for water on the surface, the only part of the earth that is thought to be liquid is the
A) upper mantle B) lower mantle C) outer core D) inner core

14. The asthenosphere is the rather soft, plastic part of the earth that includes parts of the
A) crust and mantle B) outer core and mantle C) inner core and mantle D) inner core and outer core

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

16. 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

17. Which diagram below shows an area in which fine-grained igneous rocks are most likely to be found?



A) B) C) D)

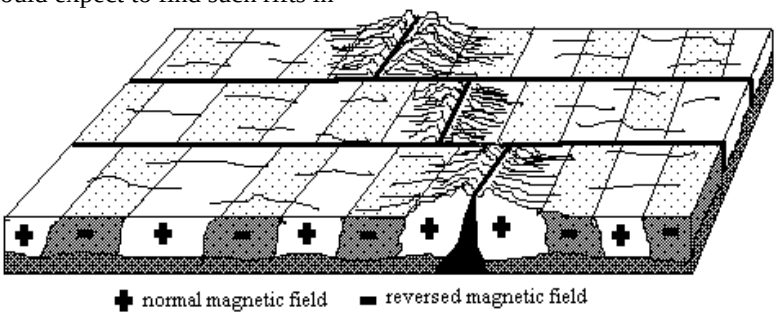
18. Which diagram above shows an intrusive igneous body?

19. 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

20. 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

21. The heavy broken lines show a rift zone. You should expect to find such rifts in

A) a subduction zone
B) a syncline
C) an oceanic trench
D) a mountain range

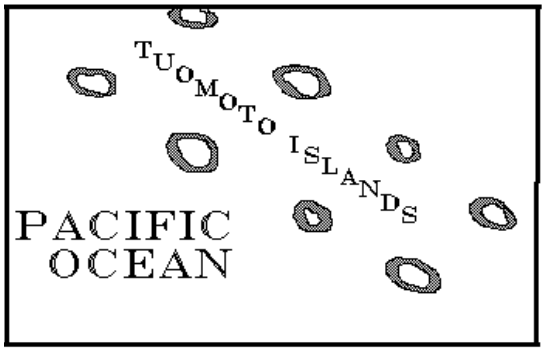


22. The magnetic reversals in the bands of rock indicated
A) subduction B) an anticline C) a syncline D) sea floor spreading

23. The spreading of the Mid Atlantic Ridge is forcing North America and South America to move toward the
A) north B) south C) east D) west

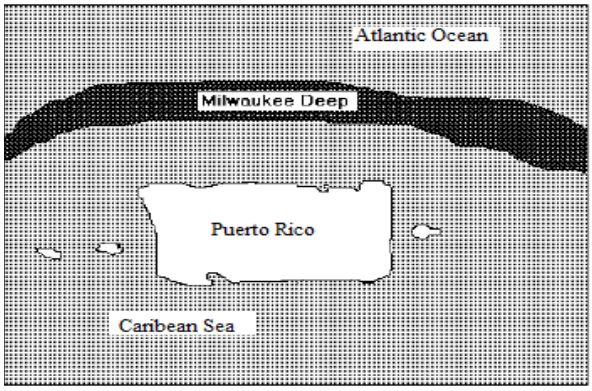
24. The Tuomoto Islands in the South Pacific Ocean are two parallel chains of coral atolls [See map below]. Most likely, the two chains are each side of

A) a subduction zone
B) a line of hot spots
C) an oceanic ridge
D) a transform fault



25. Volcanoes associated with subduction zones are usually found
A) on the edge of plates bordering a continent
B) on the edge of plates underlying an ocean
C) in the center of plates carrying a continent
D) in the center of plates underlying an ocean

The map below shows the island of Puerto Rico and the Milwaukee Deep (sometimes known as the Puerto Rico Trench). Use it with questions 26 and 27.

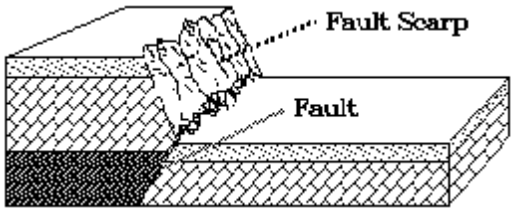


26. The map leads to the interpretation that Puerto Rico is located
A) over a hot spot
B) over a subduction zone
C) on a rift zone
D) on a terminal moraine

27. A feature which you could reasonably expect to find on the islands south of the Puerto Rican Trench is
A) volcanoes B) transform faults C) cirques D) tarns

28. The Earth's internal heat is the primary source of energy that
A) warms the lower troposphere
B) melts glacial ice at lower altitudes
C) moves the lithospheric plates
D) pollutes deep groundwater with radioactivity

29. The cliff, or scarp, shown below was created by



A) wave action
B) an earthquake
C) a meandering river
D) differential erosion

30. The fault shown in the diagram above(#29) is a
A) normal fault B) reverse fault C) thrust fault D) strike-slip fault

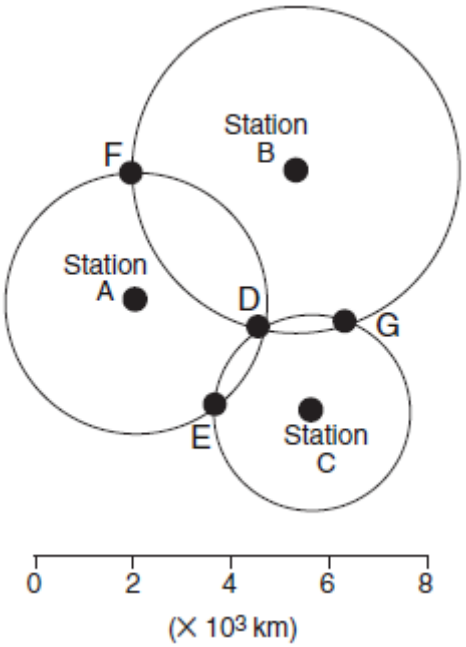
31. When the rock on a fault is displaced vertically and the head wall (hanging wall) moves down during an earthquake, the fault is a
A) normal fault B) reverse fault C) thrust fault D) strike-slip fault

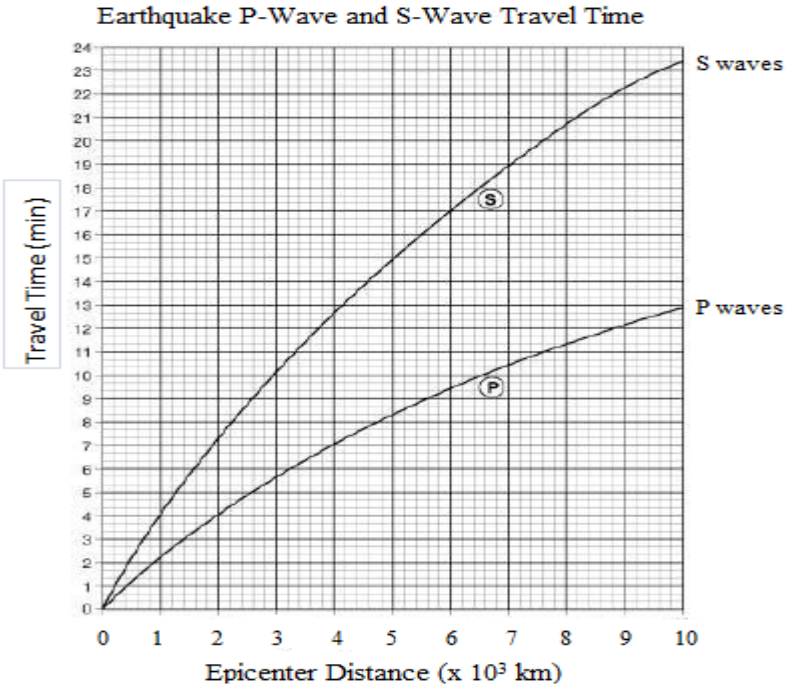
32. The data table below shows the origin and depths of all large-magnitude earthquakes over a 20 year period
According to these data most of these earthquakes occurred within the Earth's _____

A) Lithosphere
B) Asthenosphere
C) stiffer mantle
D) outer core

Depth Below Surface in Km	Number of Earthquakes
0-33	27788
34-100	17585
101-300	7329
301-700	3167

Seismic stations A, B, and C are in the diagram below. The distance from each station to an earthquake's epicenter is plotted. Use the graph of P and S wave travel time for questions # 33 and 34





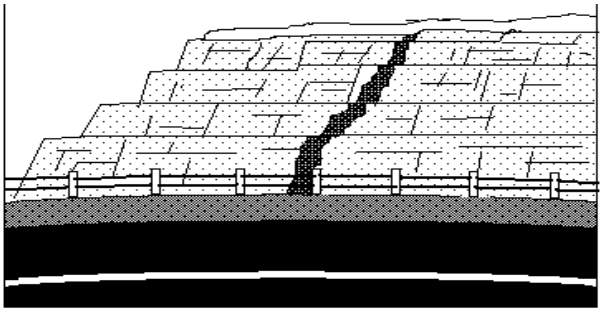
33. Seismic station A is 2600 km from the epicenter. The P-wave arrived at 5:24:45 am. Based upon the graph what time did the S-wave arrive.
A) 5:33:45 am B) 5:21:05 am C) 5:28:45 am D) 9:24:05 am

34. The epicenter is closest to which lettered point?
A) D B) E C) F D) G

35. Basalt which has formed from the eruption of a volcano is
A) intrusive B) extrusive C) nui nui D) talus

36. 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

A) dike
B) laccolith
C) sill
D) batholith

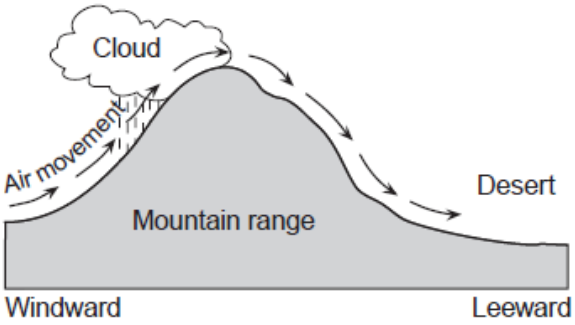


37. Which process could lead directly to the formation of pumice rock?
A) precipitation of minerals from evaporating seawater.
B) metamorphism of unmelted rock material
C) deposition of quartz sand
D) explosive eruption of lava from a volcano

38. Snowfall at the South Pole or North Pole is rare. The reason is that the air over the South Pole is usually
A) rising and moist B) sinking and moist C) rising and dry D) sinking and dry

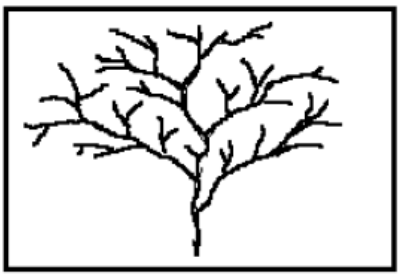
39. A desert often forms on the leeward side of a mountain range, as shown in the diagram below.
After most of the moisture is removed from the air on the windward side, deserts from on the leeward side because the sinking air

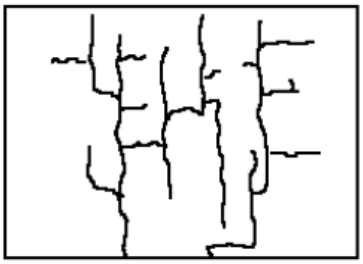
A) compresses and warms
B) compresses and cools
C) expands and warms
D) expands and cools

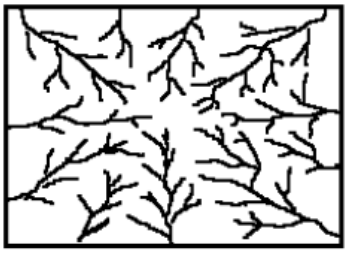


40. You would reasonably expect to find meandering rivers and streams in New Jersey, mostly in which geological area of the state?
A) the Valley and Ridge B) the Piedmont C) the Highlands D) the Coastal Plain

41. If a group of rivers or streams is flowing across a set of parallel faults, you would expect it to show which of the following patterns?


A)

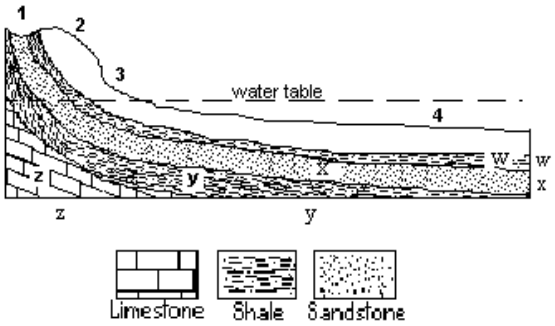

B)


C)

42. 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.

The diagram below is a cross section through a mountain, rising above a plain, and the underlying rocks. Use it with questions #43 and 44.

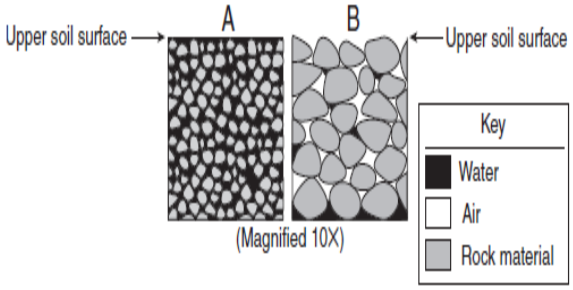
43. The best place to drill a well in order to obtain an artesian flow (natural flow without pumping) would be at position
A) 1
B) 2
C) 3
D) 4



44. In which rock layer is the aquifer found?
A) w B) x C) y D) z

45. The diagram below shows two soil samples A and B. Both became saturated with water after a rainstorm. After 10 minutes after the storm the soils appeared as in the diagram below. Which statement best explains the observed change in the water content of the two soil samples?

A) the permeability of B is greater than the permeability of A
B) the surface runoff of B is greater than the surface runoff of A
C) the capillarity of B is greater than the capillarity of A
D) the porosity of B is greater than the porosity of A



46. Most of Earth's surface ocean current patterns are primarily caused by
A) the force of gravity B) the impact of precipitation C) prevailing winds D) river currents

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

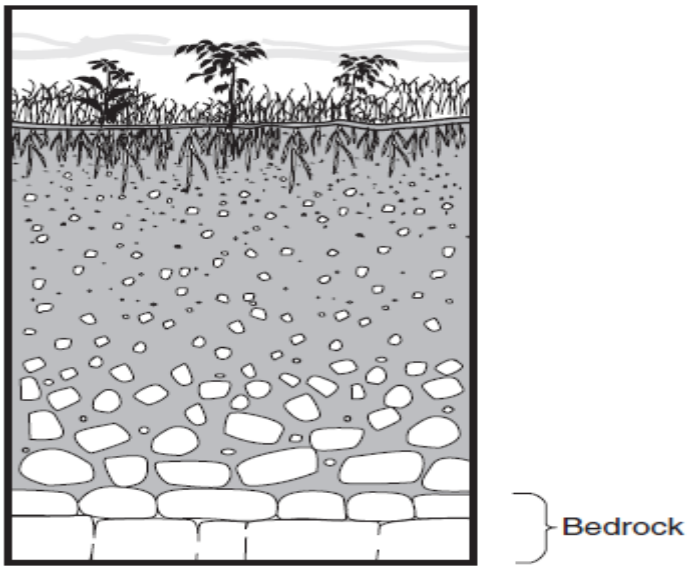
48. Barrier beach islands are vulnerable to hurricanes because
A) the storm surge is often higher than the islands
B) they are always on the side of the storm which has the highest wind speed
C) hurricanes usually hit the island during high tides
D) all of the above

49. Friction occurring at an interface always produces a
I. transformation of energy II. form of pollution III. chemical change IV. phase change

A) I and II B) III and IV C) I only D) III only

50. The cross section below shows a soil profile. This soil was formed primarily by

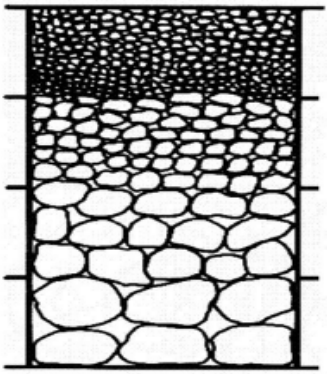
A) erosion by glaciers
B) erosion by running water
C) capillarity and human activity
D) weathering and biological activity



51. Which is the best example of physical weathering?
A) The transportation of sediment by a stream or river B) The cracking of rock by freezing and thawing of water
C) The effect of acid rain on limestone D) The formation of a sandbar along the side of a stream

52. The diagram below represents a section of sediment ranging from large pebbles on the bottom to fine sand on top. The sediment was most likely deposited by

A) a glacier
B) a stream
C) wind
D) particles falling directly from a cliff

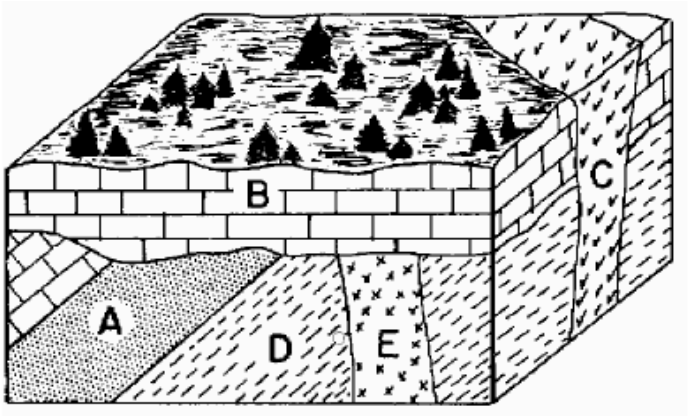


53. The following is a table of radioactive elements, formed at the time of the Earth's origin. Which one has just about reached one half-life?

54. Which of the rock formations in the diagram below is the youngest?

Lettered Choices	Radioactive Isotope	Disintegration Reactant →product	Half-Life in years
A)	Carbon-14	$^{14}C \rightarrow {}^{14}N$	5.7×10^{3}
B)	Potassium-40	$^{40}K \rightarrow {}^{40}Ar$	1.3×10^{9}
C)	Uranium -238	$^{238}U \rightarrow {}^{206}Pb$	4.5×10^{9}
D)	Rubidium-87	$^{87}Rb \rightarrow {}^{87}Sr$	4.9×10^{10}

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



55. The Era known as the "Age of Mammals" is the
A) pre-Cambrian B) Mesozoic C) Cenozoic D) Paleozoic

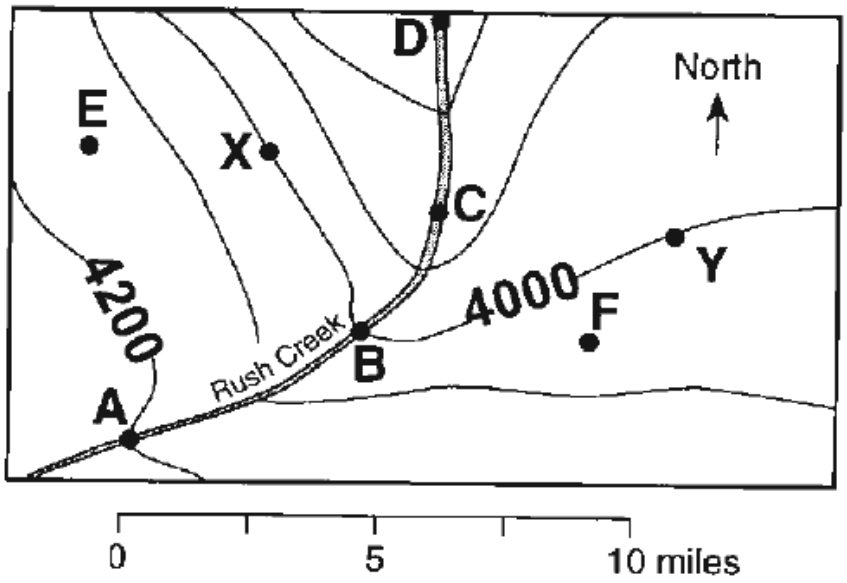
56. A timeline is made on a strip of paper to illustrate the Earth's history. A length of 1.0 cm is used to represent 10 million years. According to the geology time reference chart below, what length should be used to represent the length of the Mesozoic Era which starts with the Triassic Period and extends to the beginning of the Paleocence Epoch?

A) 1.0 cm
B) 5.0 cm
C) 13.0 cm
D) 18.0 cm

GEOLOGIC TIME			
Eras	Periods	Epochs	Began (ybp)
Cenozoic	Quarternary	Holocene	10t
		Pleistocene	1.6m
	Tertiary	Pliocene	5.3m
		Miocene	23.7m
		Oligocene	36.6m
		Eocene	57.8m
		Paleocene	66.4m
Mesozoic	Cretaceous		144m
	Jurassic		208m
	Triassic		245m
Paleozoic	Permian		286m
	Pennsylvanian		320m
	Mississippian		360m
	Devonian		408m
	Silurian		438m
	Ordovician		505m
	Cambrian		570m
preCambrian			4.5b

57. What is the contour interval of this map?

A) 50 ft
B) 100 ft
C) 200 ft
D) 400 ft



58. What direction is the flow of Rush Creek between the points D and C?
A) North B) South C) Southwest D) Northwest

59. If you are standing at point letter C, what is your approximate elevation above sea level?
A) 3800 ft B) 3880 ft C) 3850 ft D) 3940 ft

60. What is the gradient between points A and B?
A) 10 ft/mile B) 20 ft/mile C) 30 ft/mile D) 40 ft/mile

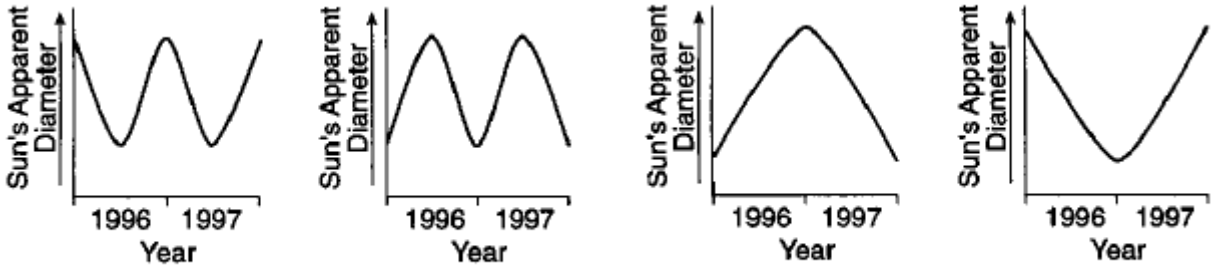
61. Two ships are sailing along the equator. The difference in local solar time between them is 2 hours. What is their difference in longitude?
A) 0^o
B) 15^o
C) 30^o
D) 45^o

62. Two people are located 800 kilometers apart on the same meridian of longitude. They measure the altitude of Sun at noon on the same day. How can their measurements be used?
A) Calculate the circumference of the Earth
B) Calculate the mass of the Earth
C) Calculate the density of the Earth
D) Calculate the diameter of the Sun.

63. The model below shows the Earth's latitude and longitude system. Points A and B are marked on the model. On Earth the solar time difference between points A and B is

A) 1 hour
B) 5 hours
C) 12 hours
D) 24 hours

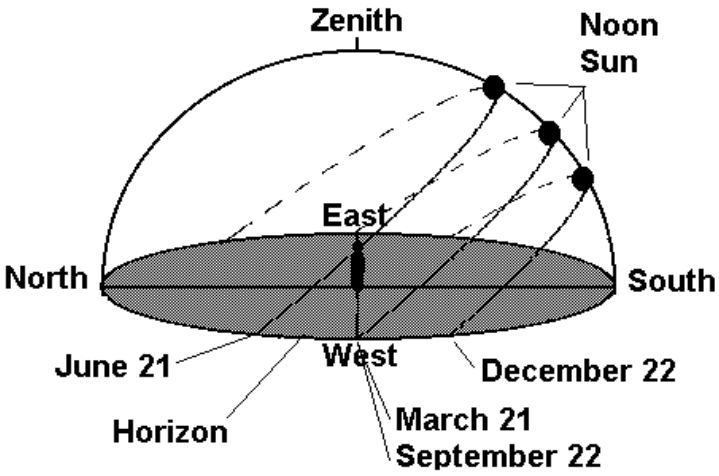
64. An observe on Earth measured the apparent diameter of the Sun over a 2 year time period. Which graph below best represents the Sun's apparent changing diameter during the 2 years?



Use the diagram below with questions 65 and 66.

65. The diagram below 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

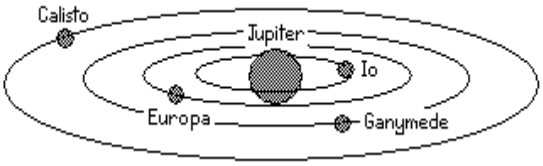


66. Which observation about the sun's apparent path at this location on December 22 is best supported by the diagram?
A) The sun appears to move across the sky at 5^{o} per hour.
B) The sun's total path is longest on this day.
C) Sunrise occurs north of east.
D) Sunset occurs south of west.

67. Which statement best explains why the same side of the Moon is viewed from Earth as the Moon goes through its phases?
A) The Moon does not rotate as it revolves around Earth
B) The Moon's period of rotation equals Earth's period of rotation.
C) The Moon's period of rotation equals Earth's period of revolution around the Sun
D) The Moon's period of rotation equals the Moon's period of revolution around Earth.

68. 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

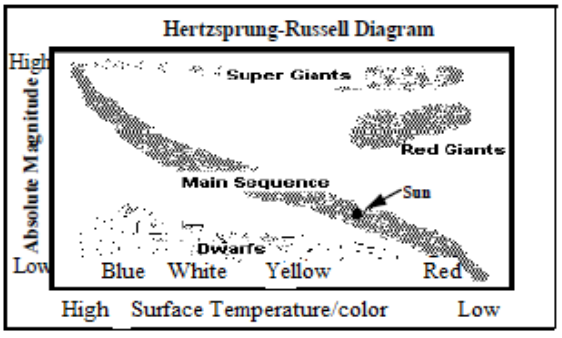
The diagram below shows Jupiter and its four major moons. Use it for question # 69.



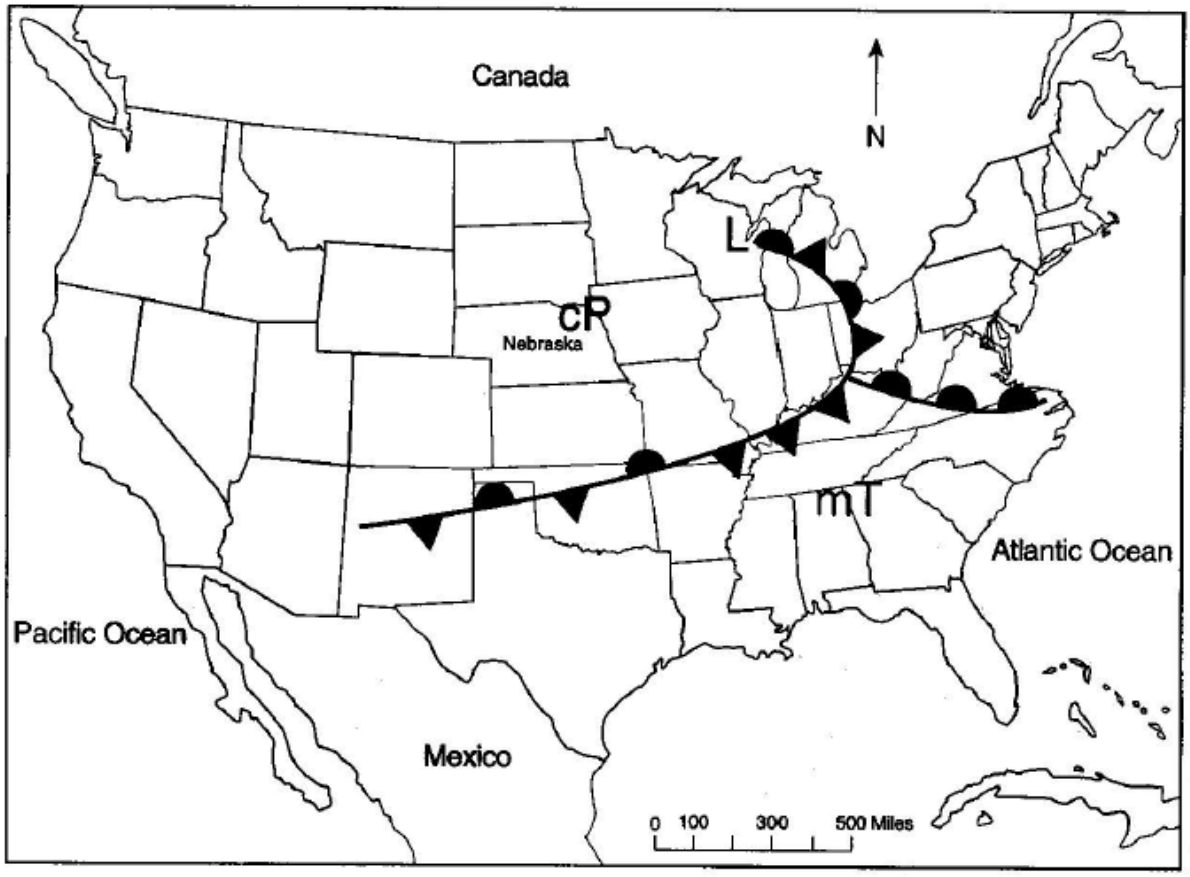
69. The shape of the orbits for the moons is most likely
A) circular
B) elliptical
C) hyperbolic
D) parabolic

70. The star, Vega, is blue-white main sequence star. According to the Hertzsprung-Russell Diagram below Vega is relatively

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

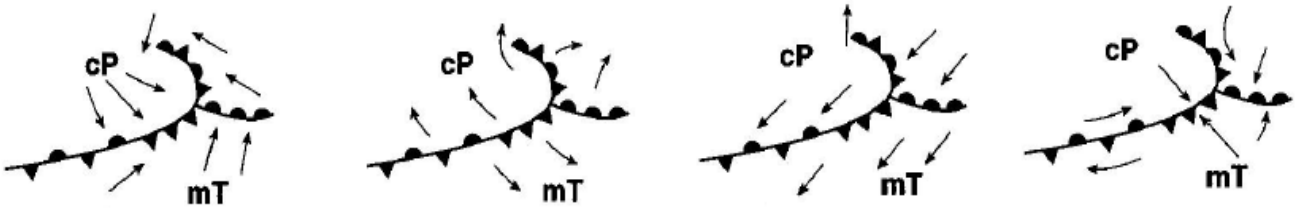


Use the weather map below for questions 71 and 72.



71. On the weather map above how many different frontal systems are present?
A) 1
B) 2
C) 3
D) 4

72. Which diagram below shows the surface air movements most likely associated with the low pressure system depicted in the diagram above?



NEW JERSEY SCIENCE LEAGUE

EARTH SCIENCE EXAM ANSWER KEY TAN TEST

DATE: April 14, 2016 (No Corrections)

1	C	19	D	37	D	55	C
2	B	20	B	38	D	56	D
3	C	21	D	39	A	57	B
4	B	22	D	40	D	58	A
5	B	23	D	41	B	59	B
6	C	24	C	42	C	60	D
7	C	25	A	43	D	61	C
8	A	26	B	44	B	62	A
9	A	27	A	45	A	63	B
10	D	28	C	46	C	64	A
11	A	29	B	47	C	65	A
12	C	30	B	48	A	66	D
13	C	31	A	49	C	67	D
14	A	32	A	50	D	68	A
15	A	33	C	51	B	69	B
16	C	34	A	52	B	70	A
17	C	35	B	53	C	71	D
18	B	36	A	54	C	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)
Rocks (2)
Earth Structure (2)
Plate Tectonics (4)
Faults/Folds/Seismology (3)
Vulcanism (2)
Glaciation/Deserts (2)
Rivers: Erosion & Deposition (3)
Ground Water/Caves (2)
Ocean Shore Line/Currents/Salinity(3)
Weathering/Mass Wasting (2)
Historical Geology (4)
Map Reading: Road/Topo/Geologic (4)
Geodesics/Time/Map Projections (3)

Sun (2)
Moon (2)
Sun-Moon-Earth System (3)
Solar System (3)
Stars (2)
Galactic Systems (2)
Cosmology (2)

Insolation/Temperature/Air Masses (3)
Atmospheric Pressure/Highs/Lows (4)
Moisture in the Atmosphere (3)
Frontal Systems (3)
Interpreting Weather Maps (3)

Dates for 2017 Season

Thursday, April 13, 2017

All areas and schools must complete the April exam and mail in the results by April 28th, 2016.

New Jersey Science League
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Web address: entnet.com/~personal/njscil/html

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

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

Dates for 2017 Season

Thursday, January 12, 2017 **Thursday, February 9, 2017**
Thursday, March 9, 2017 **Thursday, April 13, 2017**