

Earth Science: 3rd MP Quarterly Review

Key

1. Ocean crust is / high density, young age, thin, and made of basalt (ESRT pg. 10)
2. Continental crust is / low density, old age, thick, and made of granite (think Mt. Everest)
3. Inferences about the Earth's layers and interior come from / studying seismic data
Example: Mohorovicic found the asthenosphere due speed changes (density differences)
4. Earthquake is / the sudden movement of earth's crust along a fault
5. Most earthquakes and volcanoes are located / at or near plate tectonic boundaries
6. Prepare for an earthquake by / creating a plan, learn first aid, make buildings stronger
7. P-waves / faster than S-waves, travels through solids and liquids
8. S-waves / slower, S-motion, solids only (all start with S)
9. Use the difference in time of P and S waves to get / the distance to Epicenter (P-wave slide)
10. One seismograph can give you / epicenter distance (Big circles = Big distance)
11. To get the exact location of an epicenter you need / three seismographs
12. We know the outer core is liquid because / S-waves can't go through it
13. Proof of continental drift / continents fit together, fossils/rocks/mts. all match up along coasts, climate evidence (Palm tree fossil and Alfred Wegner)
14. Plate tectonics says / the earth's lithosphere is divided into pieces called plates that move
15. Plate tectonics is caused by / convection currents in the asthenosphere (upper mantle)
16. Divergent boundary / plates move away, forms a mid-ocean ridge or rift valley where magma rises (less dense) forming new rock (basalt)
17. The farther you go from the center of a ridge / the older the rocks get
18. Proof of sea floor spreading / (1) the age of the ocean floor is younger at the mid ocean ridges and gets older as you move away (2) Matching pattern of earth's magnetic polarity on either side of the ridge (Earth's poles have flipped in the past)
19. Convergent boundary / two plates come together forming a trench (volcanoes)
20. Subduction occurs at convergent plates because / ocean crust is more dense than continental
21. Transform boundary / plates slide past each other ex. San Andreas Fault
22. Hot spot / magma burns through middle of plate and forms a series of islands like Hawaii
23. Marine (shell) fossils in mountains prove / crustal uplift occurred (an uplifted sea floor)
24. In undisturbed strata, the bottom layer is / older (law of superposition)
25. Sedimentary rocks are ALWAYS deposited in / horizontal layers and underwater (original horizontality)
26. Any event that crosses another layer is / younger than it (faults, folds, intrusions)
27. Contact metamorphism occurs when / molten rock partially melts the rock around it
28. If an intrusion has no contact meta. (bald) on top it is / older and was an extrusion
29. If an intrusion has contact meta. (hairs) on top it is / younger than the rock layer above it
30. An unconformity was caused by / erosion and weathering (seen as the line that separates crazy layers from straight layers)

31. Unconformities represent a / gap in the geologic record
32. Volcanic ash good time marker because / it spreads out quickly over a large area
33. Index fossils are / found over a wide area and existed for a short period of time (found only in one geologic layer on a diagram)
34. Radioactive (absolute) dating / compares percentage of unstable atoms to stable atoms to get age of rock
35. Half life means / the time it takes for ½ the unstable atoms to decay into stable atoms (think hour glass, sand grains)
36. The half life of a radioactive isotope cannot / be changed No Matter What! Radioactive elements decay forever!
37. When calculating half using a T or T.O.M. chart remember to / add half life on the time (left) side and divide (÷) by 2 on the mass (right) side.
38. Carbon 14 is used to date / RECENT organic remains (thousands of years ago)
39. Uranium 235 is used date / old rocks (billions of years ago)
40. Earth is / 4.6 billion years old (that is about when the sun and solar system formed)
41. Precambrian time period is / 4 billion years long (most of earth's time, only simplest life forms existed)
42. The geologic timescale is based on / fossil evidence
43. Most life forms (99%) from the geologic past have / become extinct
44. The atmosphere formed from / outgassing of volcanoes (CO₂, N₂, H₂O)
45. Asteroid impacts are thought to cause / mass extinctions (dinosaurs died 65 mya)

Earth Interior Worksheet

1. _____ Earth's inner core is inferred to be solid based on the analysis of:
 - (1) seismic waves
 - (2) crustal rocks
 - (3) radioactive decay rates
 - (4) magnetic pole reversals

2. _____ Which combination of pressure and temperature is inferred to occur with Earth's stiffer mantle?
 - (1) 3500°C and 0.4 million atmospheres
 - (2) 3500°C and 2.0 million atmospheres
 - (3) 5500°C and 0.4 million atmospheres
 - (4) 5500°C and 2.0 million atmospheres

3. _____ What happens to the density and temperature of rock within Earth's interior as depth increases?
 - (1) density decreases and temperature decreases
 - (2) density decreases and temperature increases
 - (3) density increases and temperature increases
 - (4) density increases and temperature decreases

4. _____ Which part of Earth's interior is inferred to have convection currents that cause tectonic plates to move?
 - (1) rigid mantle
 - (2) asthenosphere
 - (3) outer core
 - (4) inner core

5. _____ Compared to the continental crust, the oceanic crust is

- (1) less dense and less felsic (3) more dense and more felsic
 (2) less dense and more mafic (4) more dense and more mafic

6. Referring to the cross section to the right, what is the approximate depth at location B?

3000 Km

7. Which layer of Earth is composed of both the crust and the rigid mantle?

Lithosphere

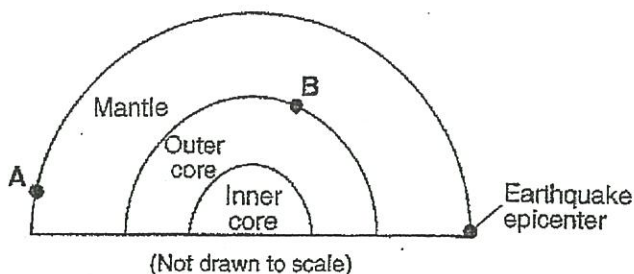


Plate Tectonics Worksheet

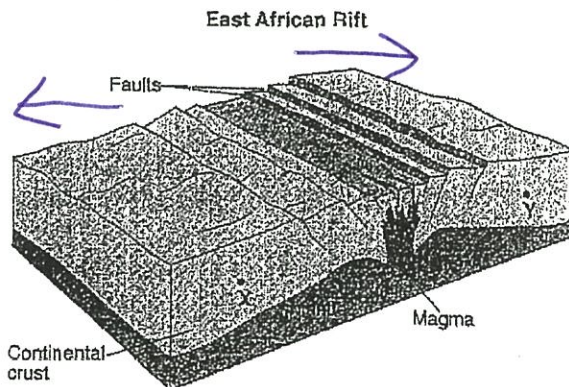
1. _____ When two tectonics plates collide, oceanic crust usually subducts beneath continental crust because oceanic crust is composed of igneous rocks that has

- (1) low density and is mafic (3) high density and is mafic
 (2) low density and is felsic (4) high density and is felsic

_____ Alternating parallel bands of normal and reversed magnetic polarity are found in the basaltic bedrock on either side of the

- (1) Mid-Atlantic Ridge Fault (3) San Andreas
 (2) Yellowstone Hot Spot Trench (4) Peru-Chile Trench

3. The block diagram to the right represents Earth's surface and interior along the East African Rift. Draw *two* arrows, one through point X and one through point Y, to indicate the relative motion of each of these sections of the continental crust.

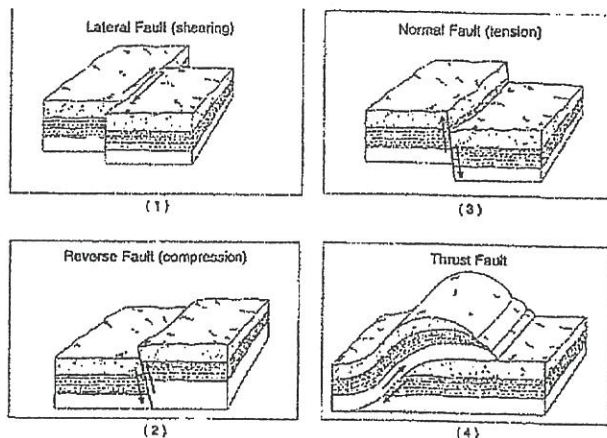


4. _____ The boundary between which two tectonic plates is most similar geologically to the plate boundary at the Mid-Atlantic Ridge?

- (1) Eurasian and Indian-Australian (3) Pacific and Nazca
 (2) Cocos and Caribbean (4) Nazca and South American

5. _____ Active volcanoes are most abundant along the
- (1) edges of tectonic plates (3) 23.5°N and 23.5°S parallels of latitude
 (2) eastern coastlines of continents (4) equatorial ocean floor
6. _____ Which part of Earth's interior is inferred to have convection currents that cause tectonic plates to move?
- (1) rigid mantle (2) asthenosphere (3) outer core (4) inner core

7. _____ The diagram to the right shows four major types of fault motion occurring in Earth's crust. Which type of fault motion best matches the general pattern of crustal movement at California's San Andreas fault?



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

Seismic Waves Worksheet

1. _____ A seismic station 4000 kilometers from the epicenter of an earthquake records the arrival time of the first P-wave at 10:00:00. At what time did the first S-wave arrive at this station?
- (1) 9:55:00 (3) 10:07:05
 (2) 10:05:40 (4) 10:12:40
- $$\begin{array}{r} 10:00:00 \\ + \quad 5:40 \\ \hline \end{array}$$
2. _____ A P-wave takes 8 minutes and 20 seconds to travel from the epicenter of an earthquake to a seismic station. Approximately how long will an S-wave take to travel from the epicenter of the same earthquake to this seismic station?
- (1) 6 min 40 sec (3) 15 min 00 sec
 (2) 9 min 40 sec (4) 19 min 00 sec
3. _____ A seismic station is recording the seismic waves produced by an earthquake that occurred 4200 kilometers away. Approximately how long after the arrival of the first P-wave will the first S-wave arrive?
- (1) 1 min 05 sec (3) 7 min 20 sec
 (2) 5 min 50 sec (4) 13 min 10 sec
4. _____ An earthquake's first P-wave arrives at a seismic station at 12:00:00. This P-wave has traveled 6000 kilometers from the epicenter. At what time will the first S-wave from the same earthquake arrive at the seismic station?
- (1) 11:52:20 (3) 12:09:20
 (2) 12:07:40 (4) 12:17:00
- $$\begin{array}{r} 12:00:00 \\ + \quad 7:40 \\ \hline \end{array}$$

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5. A P-wave arrived at a seismic station at 08:45:40. The seismic station is 6,200 km away from the earthquake epicenter. At what time did the earthquake occur?

- (1) 08:36:00 (3) 08:28:20
 (2) 08:55:20 (4) 08:35:00

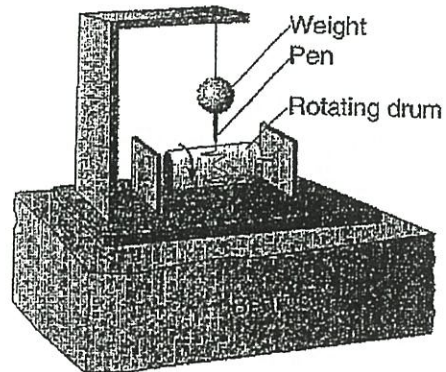
$$\begin{array}{r} 8:45:40 \\ - 9:40 \\ \hline 8:36:00 \end{array}$$

6. P-waves and S-waves from the same earthquake arrived at 3 different seismic stations. The difference in arrival times of the first P-waves and first S-waves at Station A was 9 minutes. The difference in arrival times of the first P-waves and first S-waves at Station B was 7 minutes. The difference in arrival times of the first P-waves and first S-waves at Station C was 5 minutes.

Which statement correctly describes the distance between the earthquake epicenter and the seismic stations?

- (1) A is closest to the epicenter, and C is farthest from the epicenter.
 (2) B is closest to the epicenter, and C is farthest from the epicenter.
 (3) C is closest to the epicenter, and A is farthest from the epicenter.
 (4) A is closest to the epicenter, and B is farthest from the epicenter.

Base your answers to questions 8 through 10 on the diagram to the right, which shows a seismograph that recorded seismic waves from an earthquake located 4000 kilometers from this seismic station.



7. P Which type of seismic wave was recorded first on the rotating drum?

8. State one possible cause of the earthquake that resulted in the movement of the bedrock detected by this seismograph.

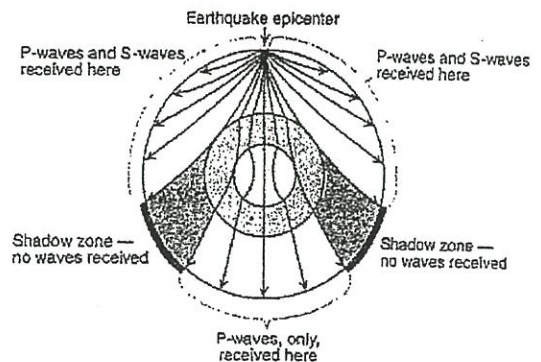
Convection currents

9. 12:40 How long does the first S-wave take to travel from the earthquake epicenter to this seismograph?

Base your answer to question 10 on the cross section to the right, which shows the path of seismic waves traveling from an earthquake epicenter through the different layers of Earth's interior.

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

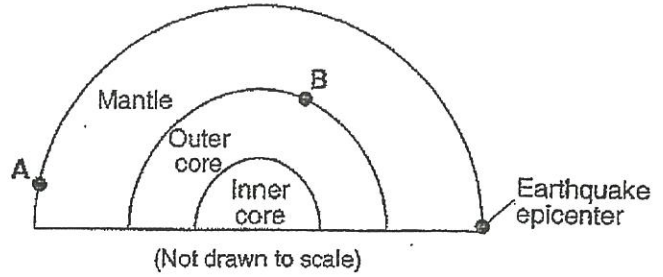
- (1) P-waves are absorbed and S-waves are refracted by Earth's outer core
 (2) P-waves are refracted and S-waves are absorbed by Earth's outer core
 (3) both the P-waves and S-waves are refracted by Earth's outer core



(4) both the P-waves and S-waves are absorbed by Earth's outer core

11. Looking at the cross section to the right, explain why seismic station A receives P-waves, but not S-waves from this earthquake.

S waves cant travel through liquid.



Geologic History Worksheet

1. _____ Earth's early atmosphere formed during the Early Archean Era. Which gas was generally absent from the atmosphere at that time?

- (1) water vapor (2) carbon dioxide (3) nitrogen (4) oxygen

2. _____ Which event in Earth's history was dependent on the development of a certain type of life-form?

- (1) addition of free oxygen to Earth's atmosphere (3) movement of tectonic plates
 (2) formation of clastic sedimentary rocks (4) filling of the oceans by precipitation

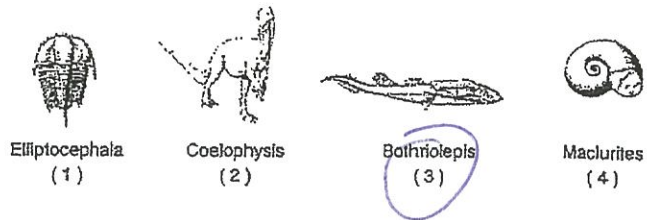
3. _____ A certain layer of rock formed during the early Devonian period. What type of fossils could possibly be found in this rock layer?

- (1) earliest birds (2) earliest reptiles (3) *Tetragraptus* (4) *Ctenocrinus*

4. _____ Which two landscape regions in New York State have the oldest surface bedrock?

- (1) Allegheny Plateau and Newark Lowlands
 (2) Tug Hill Plateau and Erie-Ontario Lowlands
 (3) Taconic Mountains and the Catskills
 (4) Adirondack Mountains and Hudson Highlands

5. _____ Which index fossil to the right may be found in the surface bedrock near Ithaca, New York?



The cross sections to the right represent three widely separated outcrops of exposed bedrock. Letters A, B, C and D represent fossils found in the rock layers.



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6. _____ Which fossil appears to have the best characteristics of an index fossil?

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

7. _____ Scientists believe that a large asteroid struck Earth approximately 65 million years ago. It is often theorized that this event contributed to the

- (1) end of the last ice age (2) breaking up of the supercontinent Pangaea (3) evolution of the first birds (4) extinction of the dinosaurs

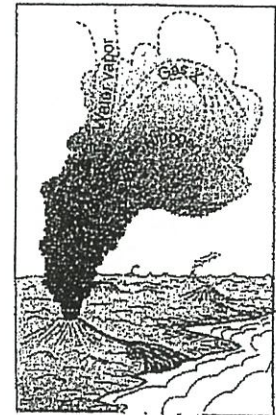
8. _____ Evidence best indicates that rock layers 4 and 8 were deposited during the same geologic period because both layers

- (1) contain the same index fossil (2) are composed of glacial sediments (3) contain index fossils of the same age (4) are found in the same area

9. _____ During which geologic period did a major orogeny form the Taconic Mountains?

- (1) Cretaceous (2) Permian (3) Devonian (4) Ordovician

The diagram to the right shows a process thought to have produced Earth's early atmosphere.



10. _____ In the diagram to the right, what major component of Earth's atmosphere is shown as gas X?

- (1) helium (2) ozone (3) carbon dioxide (4) hydrogen

11. _____ During which two geologic time periods did most of the surface bedrock of the Taconic Mountains form?

- (1) Cambrian and Ordovician (2) Silurian and Devonian (3) Pennsylvanian and Mississippian (4) Triassic and Jurassic

12. _____ Which geologic event occurred in New York State at approximately the same time that eurypterids were becoming extinct?

- (1) the opening of the Atlantic Ocean (2) the formation of the Catskill Delta (3) the uplift of the Appalachian Mountains (4) the intrusion of the Palisades Sill

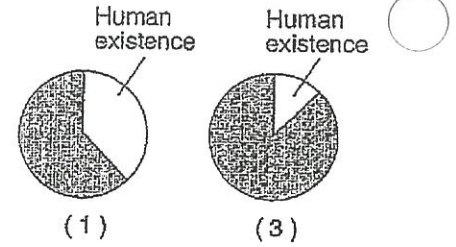
13. _____ One reason *Tetragraptus* is considered a good index fossil is that *Tetragraptus*

- lived a short period of time
- lived over a large area

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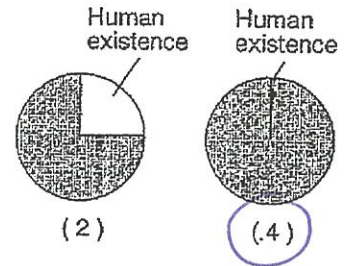
- (1) existed during a large part of the Paleozoic Era
- (2) has no living relatives found on Earth today
- (3) existed over a wide geographic area
- (4) has been found in New York State

14. 4 Which graph to the right best represents human existence on Earth, compared with Earth's entire history?



15. _____ The gases in Earth's early atmosphere are inferred to have come primarily from

- (1) meteor showers
- (2) melting of glacial ice
- (3) volcanic eruptions
- (4) evaporation of seawater



16. _____ Fish known as placoderms lived during which geologic epoch?

- (1) Early Mississippian
- (2) Late Mississippian
- (3) Early Pennsylvanian
- (4) Late Pennsylvanian

17. _____ According to the fossil record, which sequence correctly represents the evolution of life on Earth?

- (1) fish > amphibians > mammals > soft-bodied organisms
- (2) fish > soft-bodied organisms > mammals > amphibians
- (3) soft-bodied organisms > amphibians > fish > mammals
- (4) soft-bodied organisms > fish > amphibians > mammals

18. _____ It is inferred that during the Early Archean Era, the atmosphere of Earth contained water vapor, carbon dioxide, nitrogen, and other gases in small amounts. These gases probably came from

- (1) precipitation of groundwater
- (2) volcanic eruptions
- (3) evaporation of Paleozoic oceans
- (4) convection current in the mantle

19. _____ There is evidence that an asteroid or comet crashed into the Gulf of Mexico at the end of the Mesozoic Era. Consequences of this impact event may explain the

- (1) extinction of many kinds of marine animals, including trilobites
- (2) extinction of ammonoids and dinosaurs
- (3) appearance of the earliest birds and mammals
- (4) appearance of great coal-forming forests and insects

20. _____ Which mountain range resulted from the collision of North America and Africa, as parts of Pangea joined together in the late Pennsylvanian Period?

- (1) Appalachian Mountains (3) Taconic Mountains
 (2) Acadian Mountains (4) Grenville Mountains

21. _____ The feathered dinosaur known as a dromaeosaur is inferred to have lived about 130 million years ago. During which period of geologic time did this animal live?

- (1) Cambrian (2) Cretaceous (3) Paleogene (4) Permian

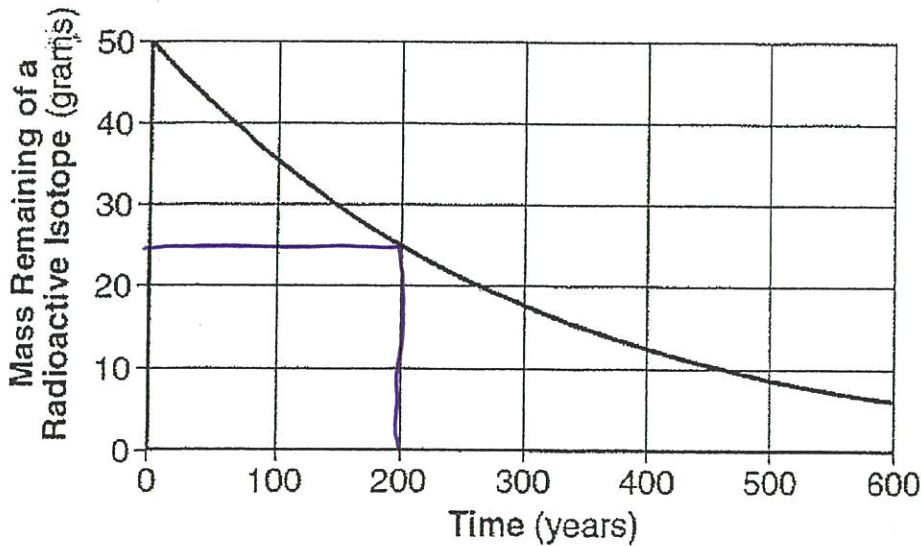
22. _____ A reason that dromaeosaur is not considered to be a good index fossil is because it

- (1) existed too long ago (3) was a land-dwelling animal
 (2) was preserved in ash (4) was found in only one area

23. _____ This feathered dinosaur has been linked to birds, representing an example of the concept of

- (1) plate tectonics (2) evolution (3) dynamic equilibrium (4) recycling

RADIOACTIVE DATING



1. _____ According to the graph, what is the half-life of this isotope?

- (1) 100 years (3) 200 years
 (2) 150 years (4) 300 years

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2. State one difference between dating with the radioactive isotope C¹⁴ and dating with the radioactive isotope uranium-238 (U²³⁸)

C¹⁴ = shorter 1/2 life = dates younger fossils

3. _____ A sample of wood that originally contained 100 grams of Carbon-14 now contains only 25 grams of Carbon-14. Approximately how many years ago was this sample part of a living tree?

- (1) 2,850 years (3) 11,400 years
 (2) 5,700 years (4) 17,100 years

100	0	0
50	5700	1
25	11,400	2

4. _____ A sample of wood found in an ancient tomb contains 25% of its original carbon-14. The age of this wood sample is approximately?

1. 2,800 years (3) 11,400 years
 2. 5,700 years (4) 17,100 years

100 0
 50 5700
 25 11,400

Radioactive Decay of Carbon-14

Number of Half-Lives	Percentage of Original Carbon-14 Remaining	Time (years)
0	100	0
1	50	5700
2	25	11,400
3	12.5	17,100
4	6.3	
5	3.1	28,500
6	1.6	34,200

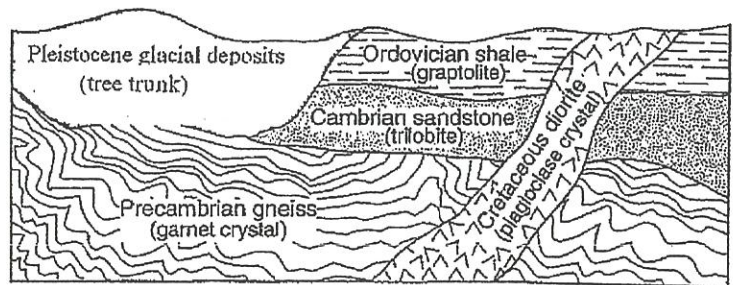
17,100
 5700
 22800

The data table to the right shows the radioactive decay of carbon-14. The numbers of years required to complete four half-lives has been left blank.

5. How long does it take for carbon-14 to complete four half-lives?

22,800

The cross section to the right shows part of Earth's crust. The objects in parentheses indicate materials found within each rock unit or deposit.



6. Which object in parentheses could be accurately dated using carbon-14? **Explain your answer.**

Tree trunk - youngest

7. Radioactive C¹⁴ was used to determine the geologic age of old wood preserved in a glacier. The amount of C¹⁴ in the old wood is half the normal amount of C¹⁴ currently found in the wood of living trees. What is the geologic age of the old wood?

Mass	Time
100	0
50	5700

5700 years

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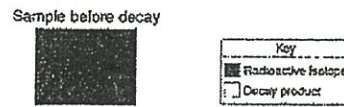
8. State one difference between dating with the radioactive isotope C¹⁴ and dating with the radioactive isotope uranium-238 (U²³⁸)?

C¹⁴ dates younger fossils - 1/2 life 5700

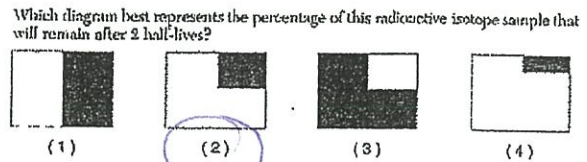
9. _____ Which radioactive isotopes takes the greatest amount of time to undergo the change shown on the graph?

- (1) carbon-14 (2) potassium-40 (3) uranium-238 (4) rubidium-87

The diagram to the right represents a sample of a radioactive isotope.



10. _____ Which diagram to the right best represents the percentage of this radioactive isotope sample that will remain after two half-lives.



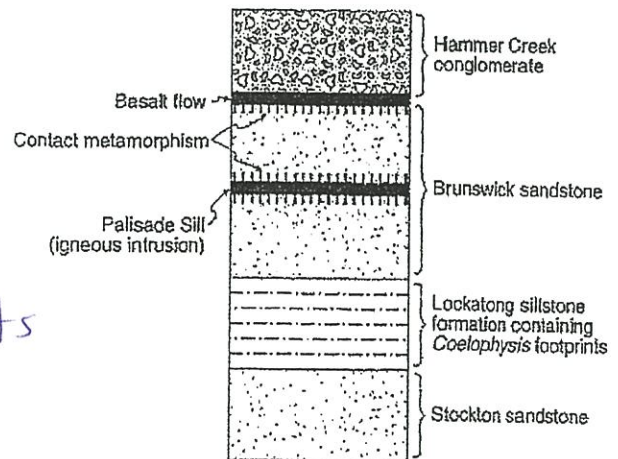
11. _____ An igneous rock containing 10 grams of radioactive potassium-40 and a total of 10 grams of its decay products. During which geologic time interval was this rock most likely formed?

10 / 10

- (1) Middle Archean (2) Late Archean (3) Middle Proterozoic (4) Late Proterozoic

Relative Dating Worksheet

Base your answers to questions 1 through 5 on the cross section to the right, which shows several rock formations found in New York State. The rock layers have not been overturned.



1. How does this cross section indicate that the Stockton sandstone is the oldest rock layer?

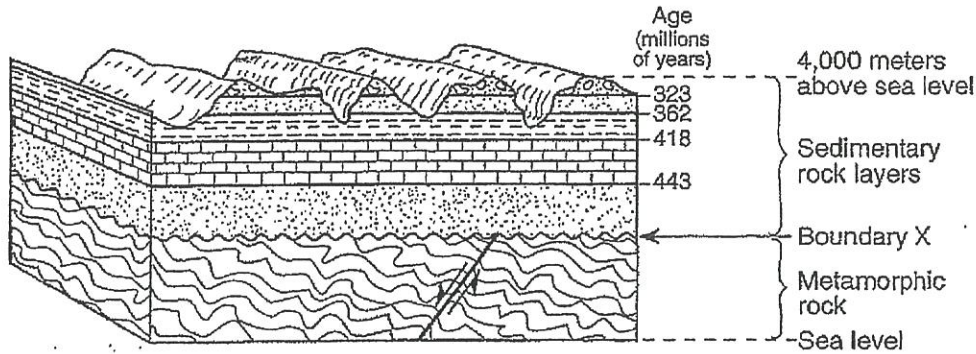
Its on the bottom and its undisturbed

2. State one piece of evidence that supports the fact that the Palisade Sill is younger than the Brunswick sandstone.

lines of contact metamorphism shows that the igneous rock melted the brunswick sandstone

3. State one tectonic event affecting North America that occurred at the same time as the Palisade Sill intrusion.

Base your answers to questions 4 through 7 on the cross section below. The cross section shows a portion of Earth's crust. The age, in millions of years, of each boundary between the different sedimentary rock layers is shown. The age of boundary X between the sedimentary rock and the metamorphic rock is not shown. Assume no overturning has occurred.



4. Identify the geologic feature represented by boundary X.

unconformity

5. Name two processes that were involved in the formation of boundary X?

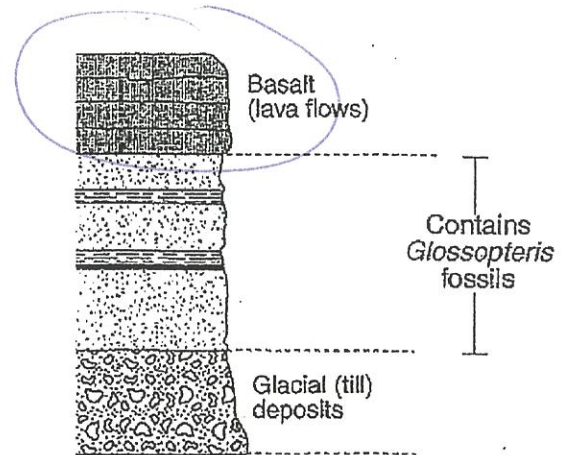
Weathering & Erosion

The cross section to the right shows a rock sequence that has not been overturned.

6. _____ Which event occurred last at this location?

- (1) Shale was deposited.
- (2) Glacial till was deposited.
- (3) Basaltic lava flows solidified.
- (4) *Glossopteris* flourished and then became extinct.

The block diagram to the right shows a portion of Earth's crust. Letters A, B, C and D indicate sedimentary rock layers.



7. _____ Which event occurred most recently?

- (1) formation of layer A
- (2) formation of layer D
- (3) tilting of all four sedimentary rock layers
- (4) erosion of the igneous rock exposed at the surface

