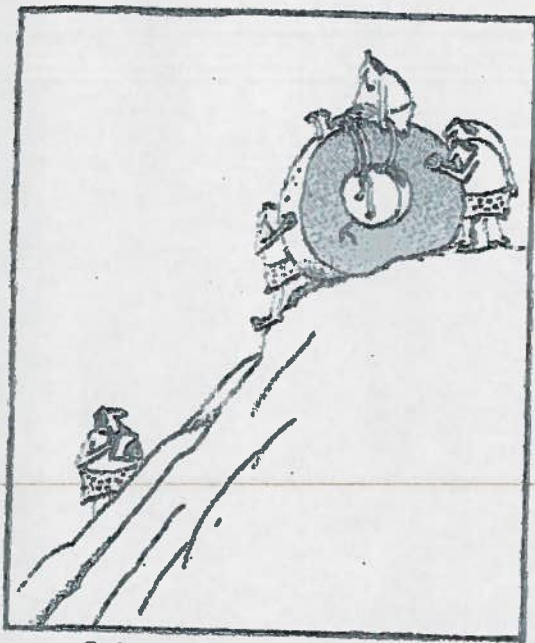
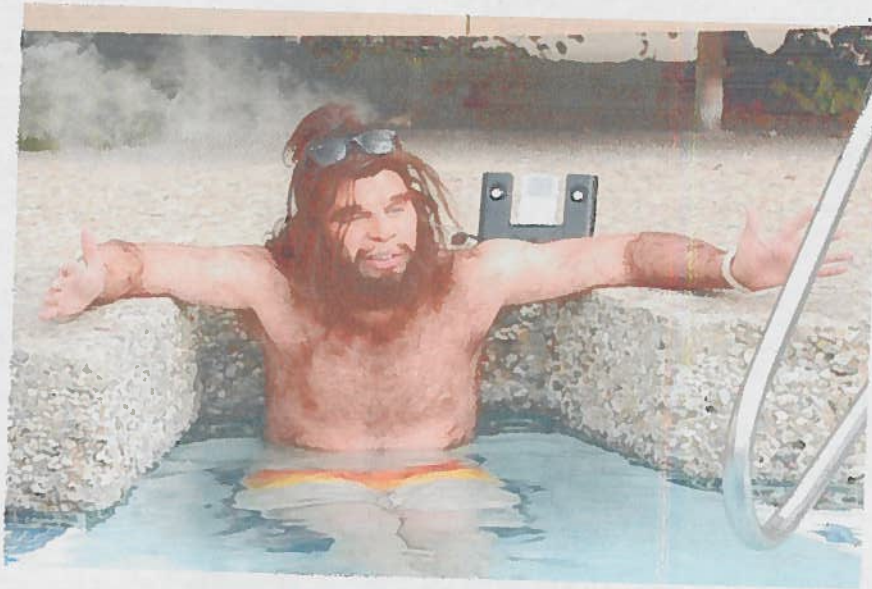
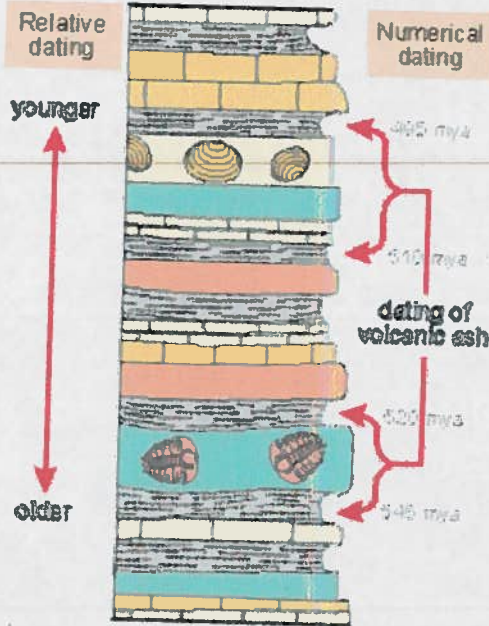


It's a story...
can you see it?



Early experiments in transportation



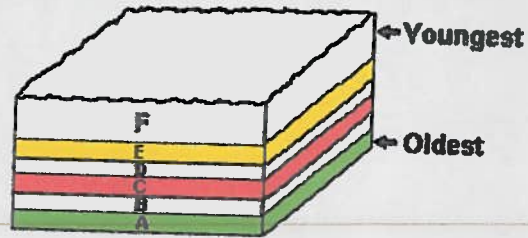
Interpreting Earth's History

Name _____ Per _____ Mendoza/Cousins

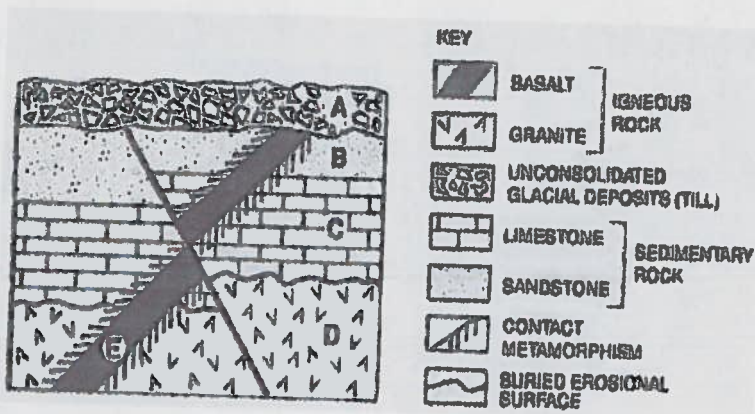
Earth's History Study Guide

(ESRT pages 1, 2, 3, 8 & 9)

1. The Principle of Superposition states that in undisturbed strata, the oldest rock is always on / the bottom.



2. The Principle of Original Horizontality states that sedimentary rocks are ALWAYS deposited / in horizontal layers and under water.



3. Contact metamorphism occurs when / molten rock partially melts the rock around it.

4. Any feature that cross-cuts through a rock layer is / younger than that rock layer (faults, folds, intrusions).

5. If an intrusion has hairs on top it is / younger than the rock layer above it.

6. An extrusion has no hairs on top (bald) so it is / older than the rock layer above it.

7. An index fossil is found / over a wide geographic area AND existed for a short period of time.

8. Volcanic ash is a good time marker because / it spreads out quickly over a wide area.

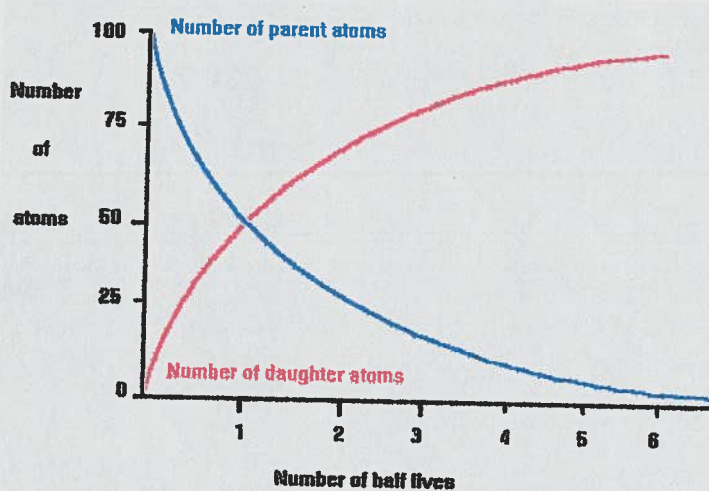
9. An unconformity is a buried erosional surface that represents / a GAP in the rock record. (looks like a wavy line that separates crazy layers from straight layers)



10. Rock layers can be correlated / to **MATCH** up rocks from one geographic area to another.

11. Radioactive (absolute) dating compares / percentage of stable atoms to unstable atoms to get age of rock.

12. One half-life is the amount of time it takes for / $\frac{1}{2}$ of the unstable, radioactive parent atoms to change into the stable, daughter atoms.



13. The half-life of a radioactive isotope / **cannot** be changed no matter what!!

Radioactive elements decay forever!

14. Carbon-14 is used to date / **RECENTLY** living organisms (thousands of years old).

15. Uranium-235 is used to date / **OLD** rocks (billions of years old).

16. Earth's age is / 4.6 billion years- when the Sun and Solar System all formed together.

17. Most of Earth's history (about 4 billion years) is in the Pre-Cambrian when / only simple life forms existed.

18. Most life forms (about 99%) that have existed on Earth / have gone extinct.

19. Mass extinctions are often caused by / asteroid impacts (dinosaurs extinct 65 mya)

Interpreting Earth's History
Part 1: Principles of Geology

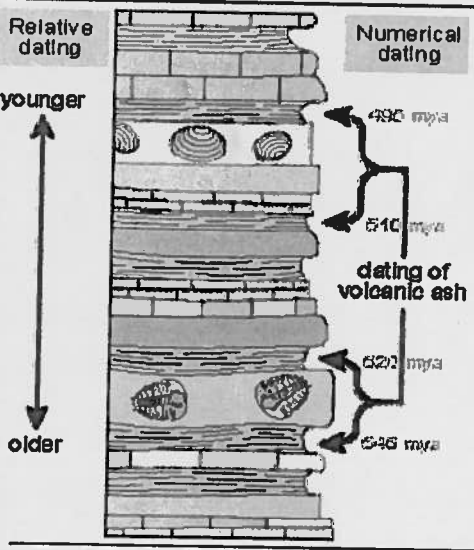
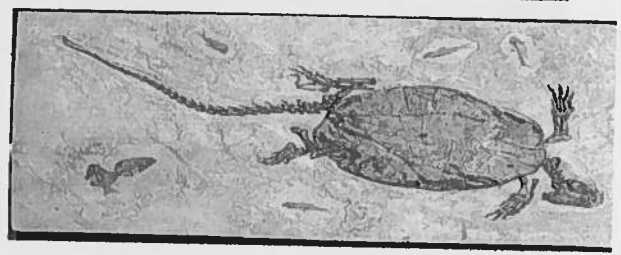
Do NOW: What Do You Think?

1. T F At one point, humans and dinosaurs lived together on Earth.
2. T F An unconformity is a missing piece of the rock record.
3. T F Index fossils can help to determine the absolute age of the rocks they were preserved in.
4. T F Earth's atmosphere has been the same since the Earth formed.
5. T F Radioactive decay occurs naturally.

AIM:

1. How do we know so much about Earth's history?

- The history of Earth is _____
- A geologist's clues are:
 - R _____ and F _____



2. How does a geologist determine the age of rocks and events?

- R _____: Determining whether a rock or event is _____ or _____ than other rocks or events.
- A _____: Determining the _____ by testing a rock's composition

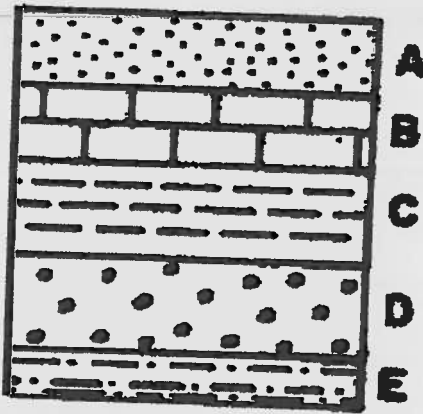
3. What are the rules for understanding the past?

a. Principle of U _____:



b. Principle of O _____ H _____ : Rocks form in _____ layers from sediments depositing _____

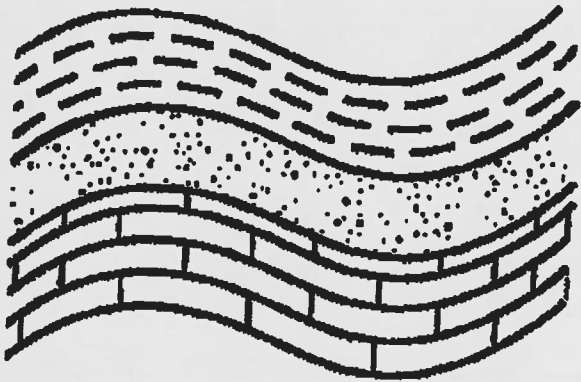
c. Principle of S _____ : The _____ layer of strata (_____ layers) is the _____ (if nothing has been _____)



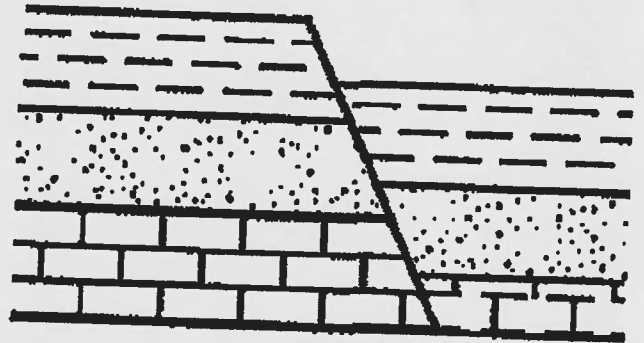
> Place in order from oldest to youngest:

1. _____
2. _____
3. _____
4. _____
5. _____

d. F _____ and F _____ : Always _____ than the layers that are _____ or _____



1. _____
2. _____
3. _____
4. _____



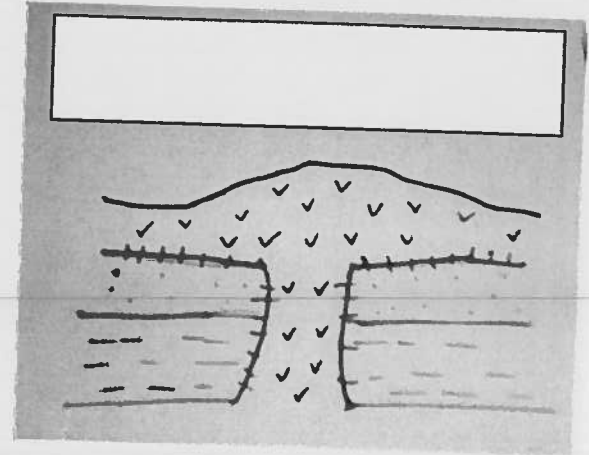
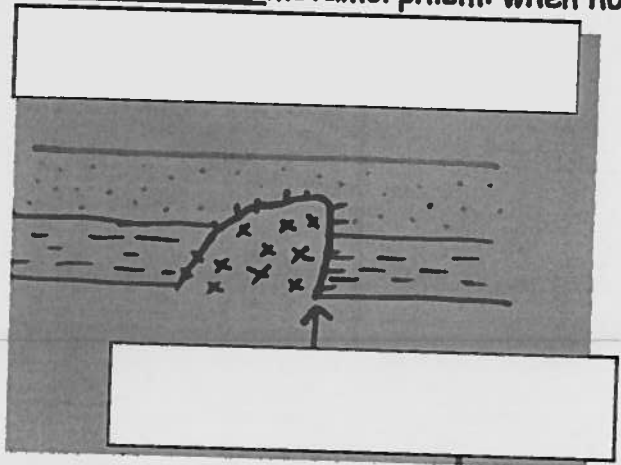
1. _____
2. _____
3. _____
4. _____

e. Principle of C _____ : A rock layer is _____ than a process that _____

> I _____ : when magma squeezes _____ layers of rock and _____

> **E** _____: when lava flows onto _____ and _____.

> **C** _____ metamorphism: when hot magma _____ the rock it touches, _____



1. _____
2. _____
3. _____

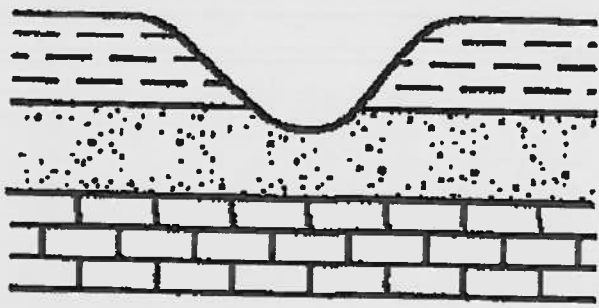
1. _____
2. _____
3. _____

f. **F** _____: Preserved _____ or _____ of creatures

- What types of remains are easiest to preserve? _____
- Provide information about the _____ and type of _____ the rock formed in
- Found in _____ ROCKS
- Most fossils are creatures that became _____

REMEMBER:

- Deposition happens _____
 - Therefore, rock layers _____.
- Erosion happens on _____
 - Therefore, if the rock has been _____, the rock must have been _____
- If more rock layers form _____, the land had to _____ back under _____ in order to form _____ rock layers.

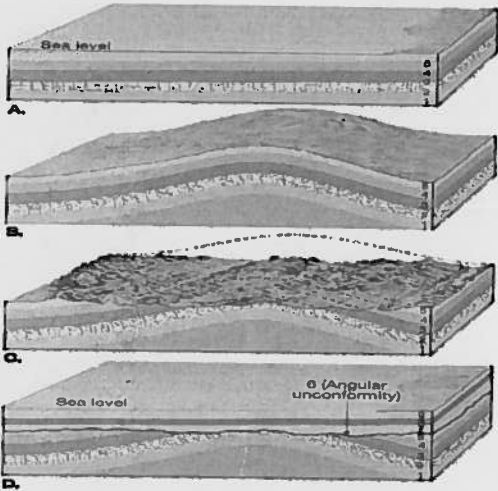


1. _____
2. _____
3. _____
4. _____
5. _____

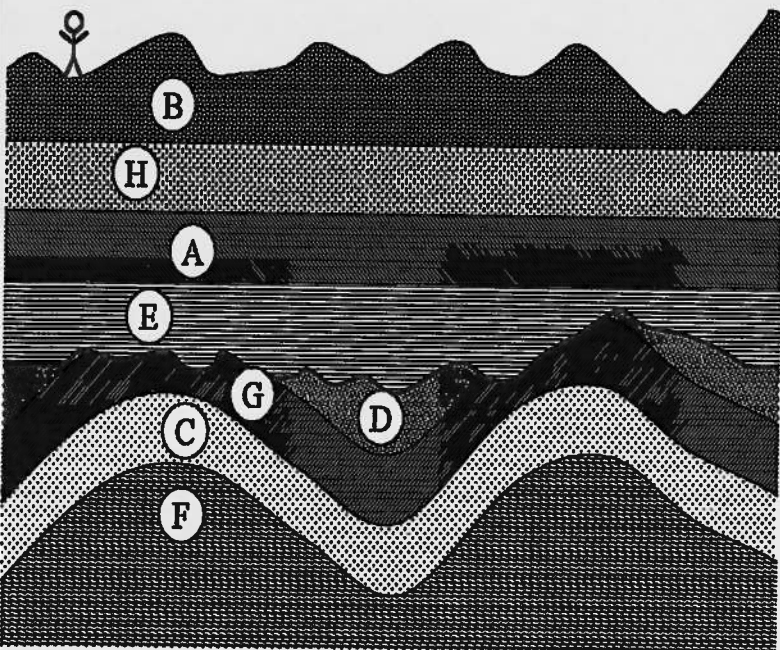
4. Unconformities: a _____ of the geologic record.

- _____ "wipe" away layers of rock and form a _____ in the timeline
- A buried _____

5. What processes form an unconformity?

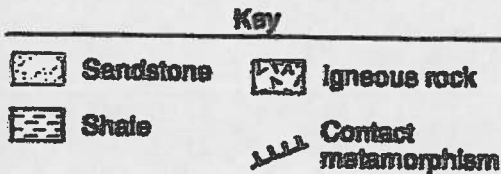
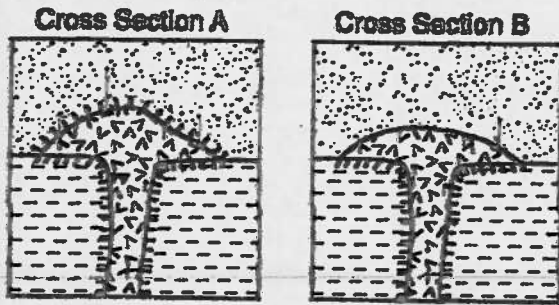


- A. _____
- B. _____
- C. _____
- D. _____



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

1. The diagrams below represent two different geologic cross sections in which an igneous formation is found in sedimentary bedrock layers. The layers have not been overturned.

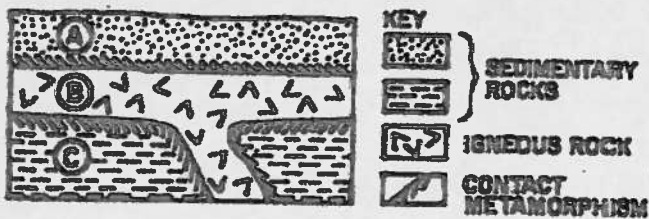


- a. Using the key, write out the sequence for each cross section in order from oldest to youngest.

- | | |
|--|--|
| <p>Cross Section A</p> <ol style="list-style-type: none"> 1. _____ 2. _____ 3. _____ 4. _____ | <p>Cross Section B</p> <ol style="list-style-type: none"> 1. _____ 2. _____ 3. _____ 4. _____ |
|--|--|

- b. How do you know where the igneous rock fits into the sequence?
-

2. The diagram below represents layers of rock.

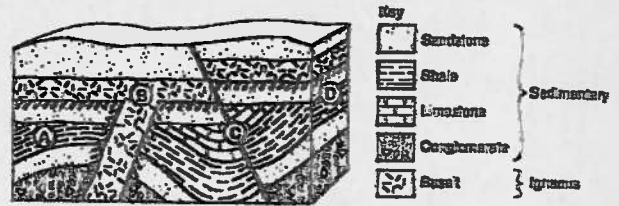


- a. Place rocks A, B and C in order from oldest to youngest:

Oldest: _____

Youngest: _____

3. Base your answer on the geologic cross section below.



- a. Place the letters A, B, C and D in order from oldest to youngest.

- b. Name the rock that would be found on the boundary between rocks B and D.

- c. Which letters show evidence of crustal movement?
-

4. The diagram below represents a geologic cross section of a portion of Earth's crust.

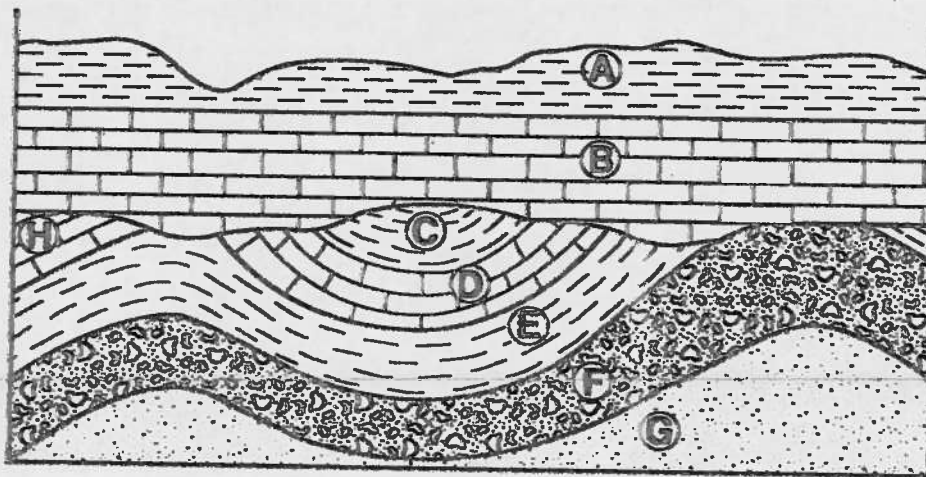


- a. Highlight the unconformity.

- b. Why is the surface uneven?

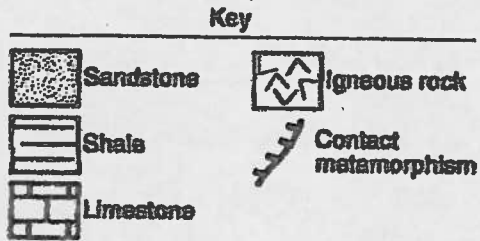
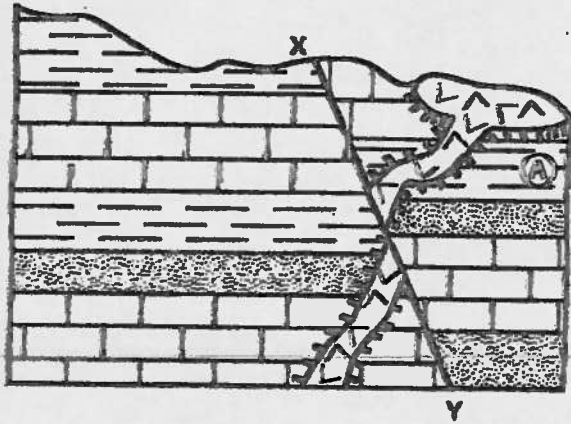
- c. Folding and erosion occurred after the formation of which layer?
-

5. Base your answer to the following question on the geologic cross section below in which overturning has not occurred. Letters A through H represent rock layers.



- a. The folding of rock layers G through C was most likely caused by
- b. Highlight the unconformity.
- c. What agent of erosion is most likely eroding the surface of Rock A?
- d. How can you tell?
- e. Which two layers are the same age?

6. A geologic cross section for a portion of Earth's crust is shown below. Letter *A* is a location in a rock layer, and line *XY* represents a fault.



- a. Place the rock layers in order from oldest to youngest. Include Fault *XY* in your sequence.

Oldest

- | | |
|----|----|
| 1. | 5. |
| 2. | 6. |
| 3. | 7. |
| 4. | 8. |

Youngest

- b. Name the metamorphic rock that would be found at the boundary between:

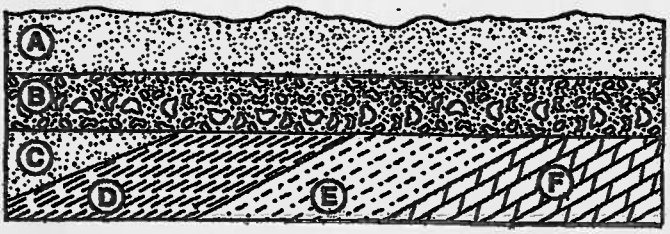
1. Igneous rock and shale
2. Igneous rock and limestone
3. Igneous rock and sandstone

- c. Which rock layer is least likely to contain fossils?

Why? (Where are fossils usually found?)

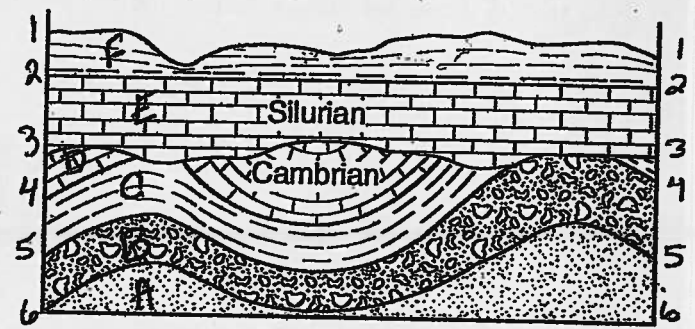
What is an unconformity?

What processes form it?

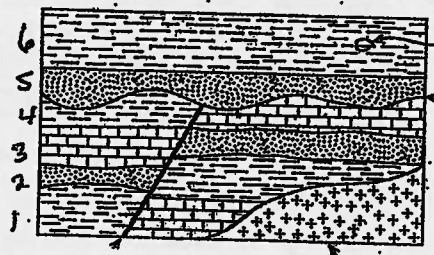


Between which two letters is the conformity?

_____ and _____

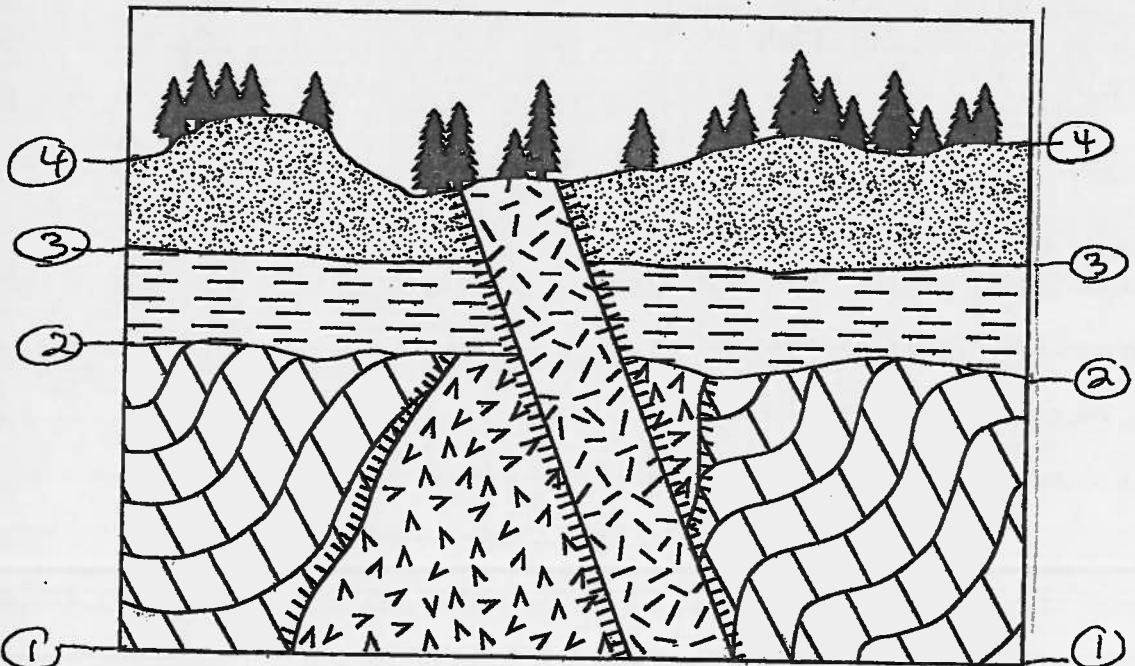


The unconformity is along # _____



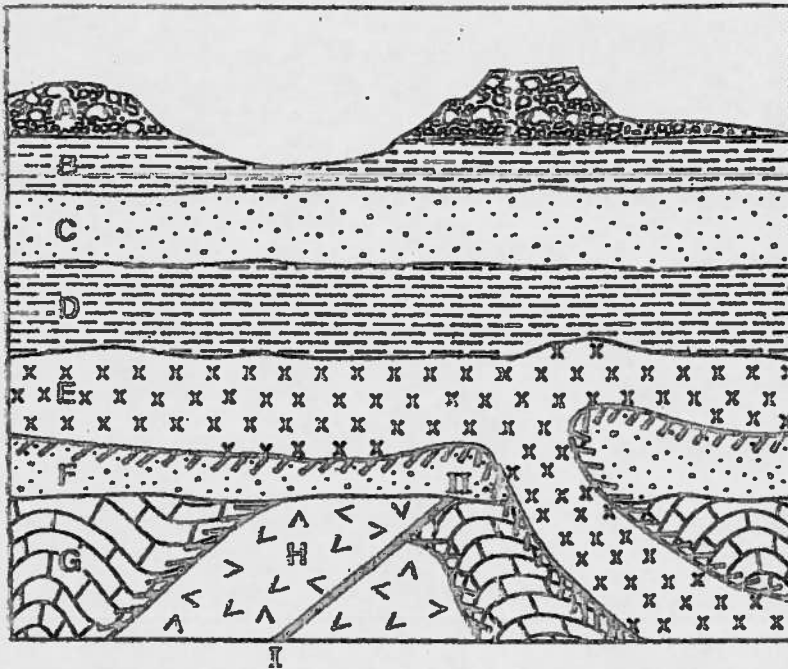
Between which two letters is the unconformity?








_____ and _____



The unconformity is along # _____

Base your answers to questions 1 through 4 on the Earth Science Reference Tables, the diagram below, and your knowledge of earth science. The diagram is a geologic cross section of a portion of the Earth's crust consisting of various sedimentary and nonsedimentary rock units, represented by letters A through H, which have not been overturned. Line I-II represents a fault.



-  CONGLOMERATE
-  SHALE
-  SANDSTONE
-  BASALT
-  GRANITE
-  LIMESTONE
-  CONTACT METAMORPHISM

1. What is the age sequence of the rock units, from oldest to youngest?

- (1) E, F, G, H
- (2) H, G, E, F
- (3) G, H, F, E
- (4) F, E, G, H

2. In which rock unit would unsorted rock fragments of greatly varying size most likely be found?

3. What is the relative age of the fault (line I-II)?

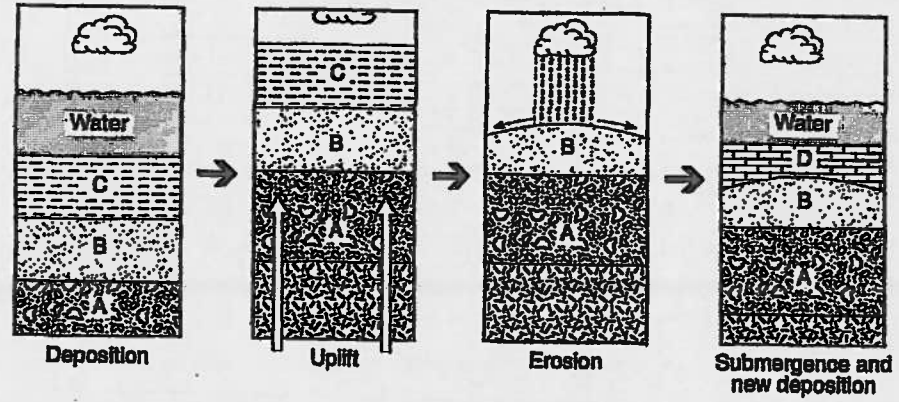
- 1 younger than rock unit F but older than rock unit H
- 2 younger than rock unit G but older than rock unit H
- 3 younger than rock unit F but older than rock unit G
- 4 younger than rock unit H but older than rock unit F

4. Evidence of a buried erosional surface (unconformity) is found at the top of unit _____

How can you tell? _____

Unconformities

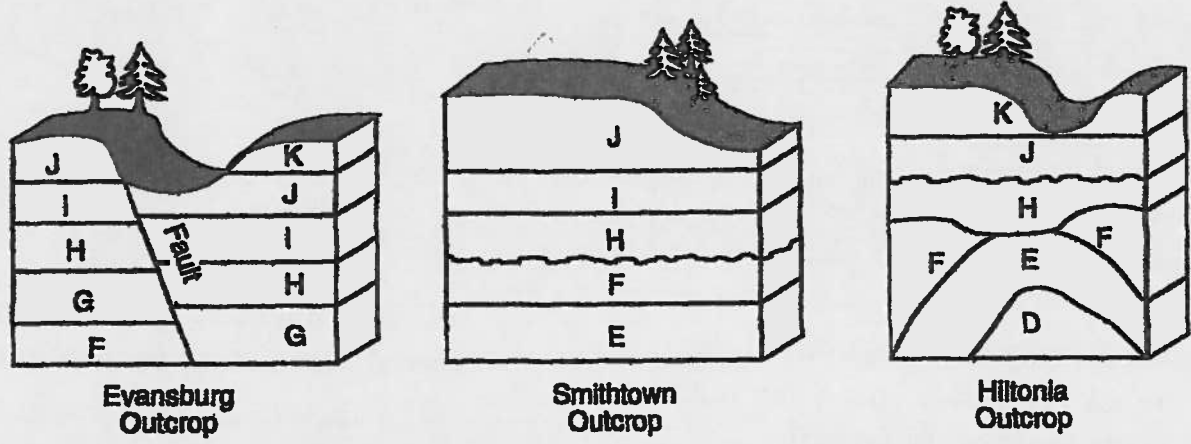
The diagrams below show the sequence of events that formed sedimentary rock layers A, B, C, and D.



This sequence of events best illustrates the

- (1) formation of a buried erosional surface (unconformity)
- (2) movement of rock layers along a fault between layers B and D
- (3) overturning of rock layers
- (4) metamorphism of sandstone (layer B) into quartzite

2. Base your answer to the following question on the block diagrams below, which represent three widely separated outcrops. All rock layers are sedimentary. No overturning has occurred. Layers labeled with the same letter are the same age.

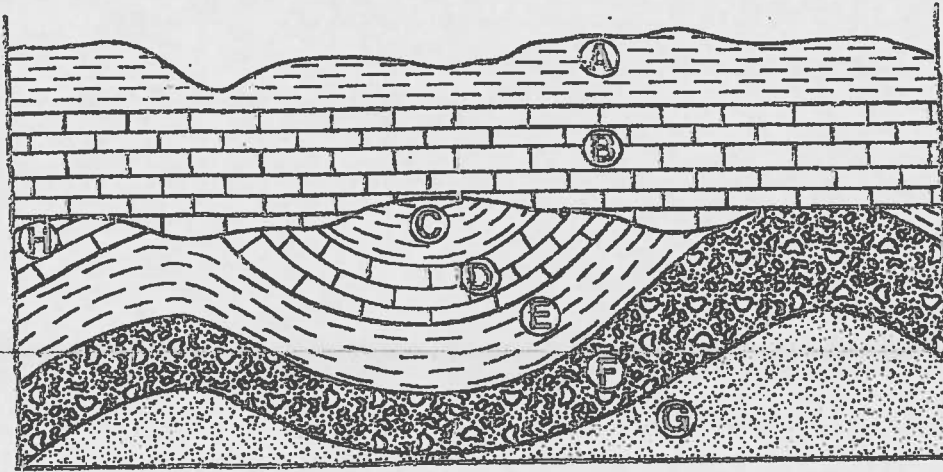


Which order of events occurred at the Hiltonia Outcrop between the formation of layer F and the beginning of the deposition of layer H?

- (1) uplift → erosion → faulting → deposition
- (2) folding → uplift → erosion → subsidence
- (3) subsidence → erosion → deposition → faulting
- (4) folding → erosion → faulting

Base your answer to the following question on the geologic cross section below in which overturning has not occurred. Letters A through H represent rock layers.

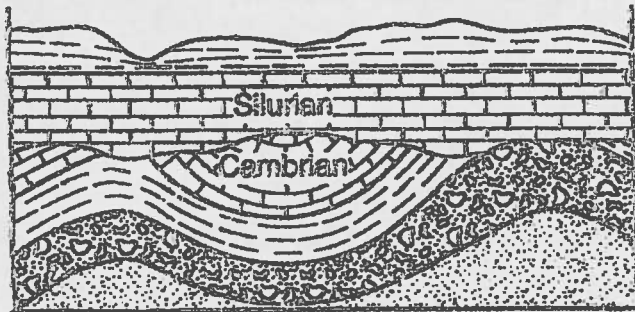
3.



Which sequence of events most likely caused the unconformity shown at the bottom of rock layer B?

- (1) folding → uplift → erosion → deposition (3) erosion → folding → deposition → intrusion
 (2) intrusion → erosion → folding → uplift (4) deposition → uplift → erosion → folding

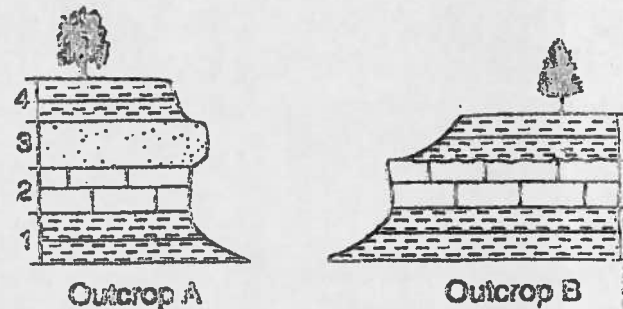
4. The geologic cross section below shows the geologic age of two rock layers separated by an unconformity.



The unconformity at the bottom of the Silurian rock layer indicates a gap in the geologic time record. What is the *minimum* time, in millions of years, shown by the gap?

- (1) 28 (3) 54
 (2) 44 (4) 126

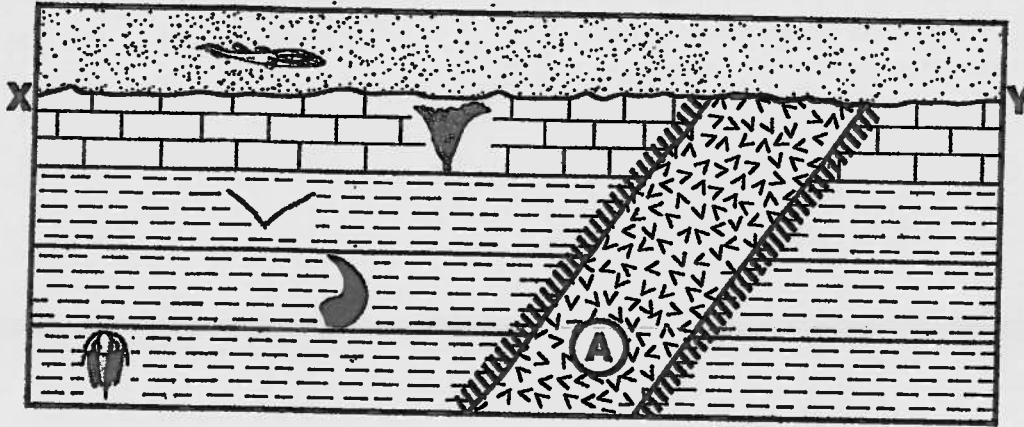
5. Bedrock outcrops A and B are located at two different locations along the Mississippi River. Rock layers 1, 2, and 4 are the same in both outcrops.



Which statement best explains why rock layer 3 is missing from outcrop B?

- (1) A fault exists between outcrops A and B.
 (2) Erosion created an unconformity between rock layers 2 and 4 in outcrop B.
 (3) A volcanic eruption destroyed rock layer 3 in outcrop B.
 (4) Metamorphism of outcrop A created rock layer 3.

Base your answer to the following question on the geologic cross section below. The cross section shows Vermont index fossils in rock layers that have not been overturned. Rock unit *A* is an igneous intrusion and line *XY* represents an unconformity.

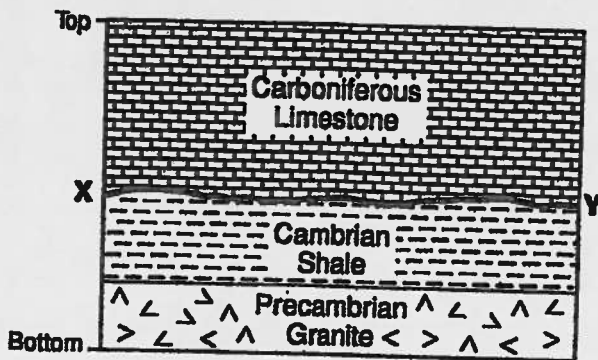


Key Index Fossils.	
	<i>Bothriolepis</i>
	<i>Ctenocrinus</i>
	<i>Dicellograptus</i>
	<i>Valcouroceras</i>
	<i>Elliptocephala</i>

Key Rock Units	
	Sedimentary rocks
	Igneous rock
	Contact metamorphic rock

Based on fossil evidence, determine the geologic period during which the unconformity formed.

7. The diagram below shows a cross-sectional view of part of the Earth's crust.



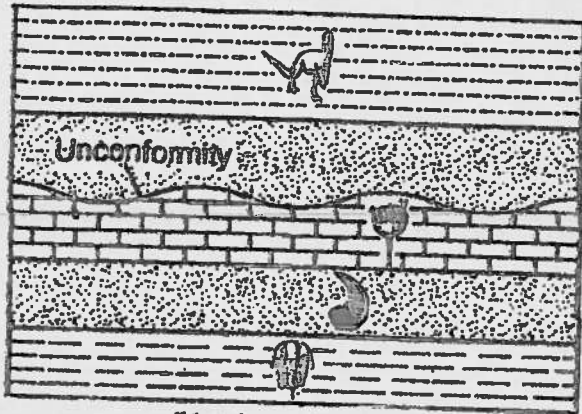
What does the unconformity (buried erosional surface) at line *XY* represent?

- (1) an area of contact metamorphism
- (2) a time gap in the rock record of the area
- (3) proof that no deposition occurred between the Cambrian and Carboniferous periods
- (4) overturning of the Cambrian and Carboniferous rock layers

8. An unconformity between two sedimentary layers is most likely produced by
- (1) the deposition of gravel followed by the deposition of sand and silt
 - (2) continuous sedimentation in a deep basin over a long period
 - (3) uplift followed by extensive erosion, submergence, and deposition
 - (4) a period of extrusive vulcanism followed by another period of extrusive vulcanism

9.

The geologic cross section below shows an unconformity in New York State bedrock layers that have not been overturned. Index fossils found throughout some rock layers are shown.



(Not drawn to scale)

Which New York State index fossil may have been present in a rock layer that is missing due to the unconformity?

(1)



Condor

(2)



Bothriolepis

(3)



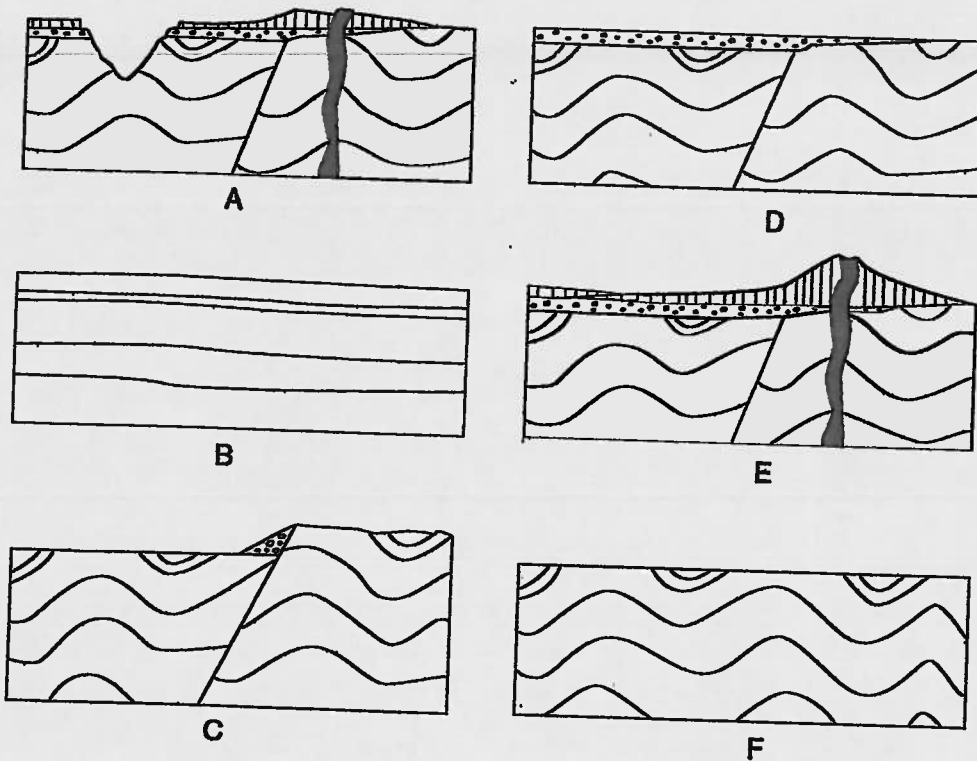
Lichenaria

(4)



Maclurites

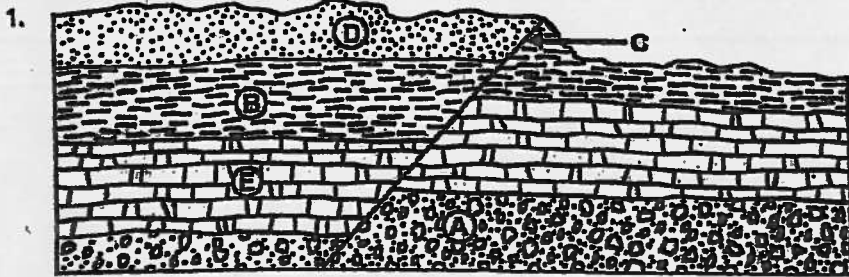
Geologic cross sections *A* through *F* shown below represent different stages in the development of one part of Earth's crust over a long period of geologic time.



What is the correct order of development from the original (oldest) stage to the most recent (youngest) stage?

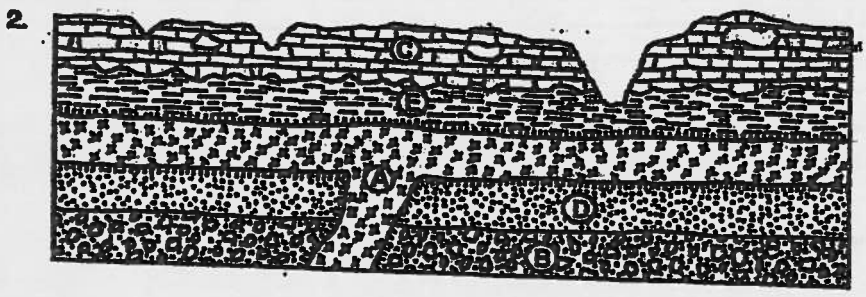
- (1) *B-D-C-F-A-E*
- (2) *B-F-C-D-E-A*

- (3) *E-A-D-F-C-B*
- (4) *E-A-F-C-D-B*



CROSS-SECTION 1	
EVENT	DESCRIPTION
(Youngest)	
(Oldest)	

- KEY**
- Limestone
 - Sandstone
 - Shale
 - Conglomerate
 - Basalt
 - Granite
 - Contact Metamorphism



CROSS-SECTION 2	
EVENT	DESCRIPTION
(Youngest)	
(Oldest)	

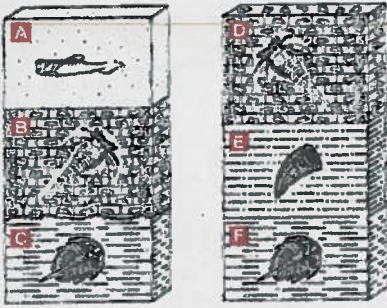
162

Topic 6: Interpreting Earth's History

Part 2: How Can Rocks be Correlated?

AIM:

1. What is rock correlation?



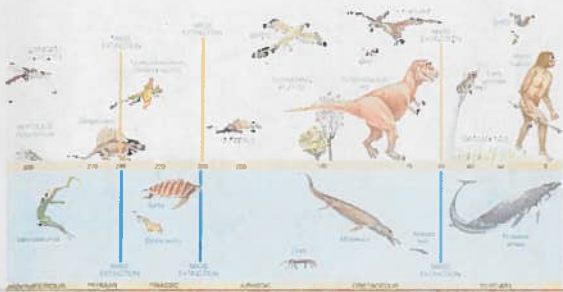
2. What are index fossils?



3. How does a layer of volcanic ash help correlate rock layers?



4. How has evolution of life forms helped geologists?



5. What is a mass extinction?



ESRT- pgs. 8 & 9: Geologic Time Scale

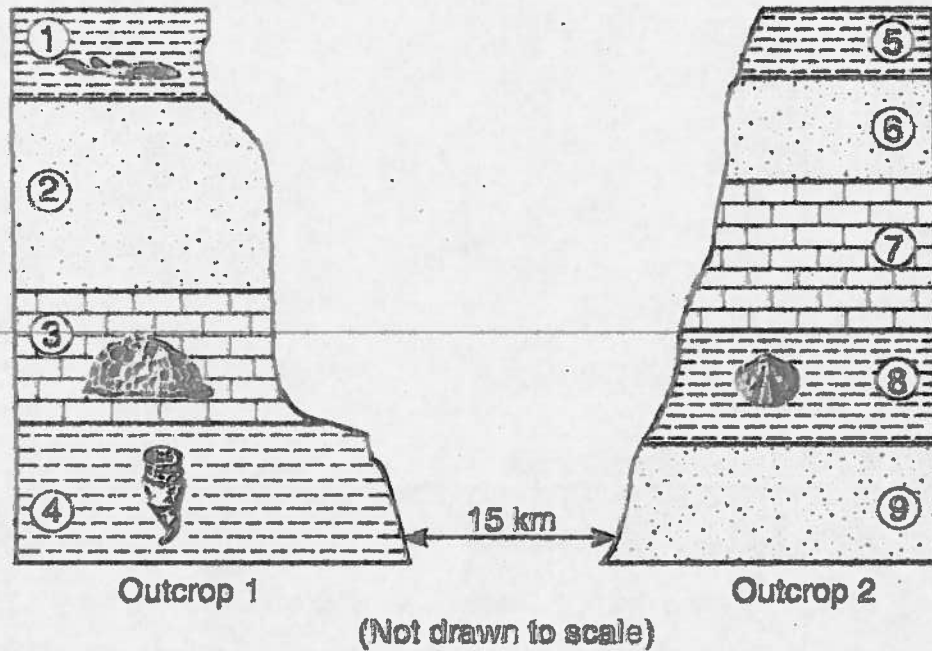
The Earth is _____ years old.

The time periods are determined by _____.

Let's Practicell

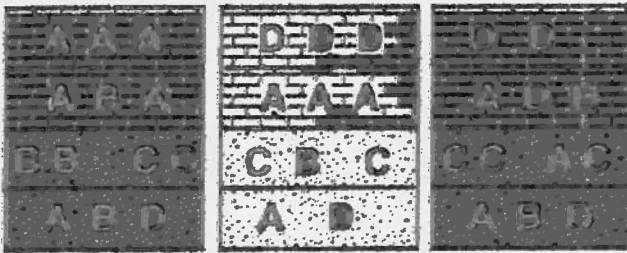
- What are the four divisions of time on Earth?
- What are the names of the two Eons?
- Name the two main divisions of the Precambrian Eon.
- How long ago did the Precambrian begin?
- About how long did the Precambrian last?
- Name the three main divisions of the Phanerozoic Eon.
- About how long ago did the Phanerozoic begin?

1. Base your answer to the following question on the cross sections below, which represent two bedrock outcrops 15 kilometers apart. The rock layers have been numbered for identification and some contain the index fossil remains shown.



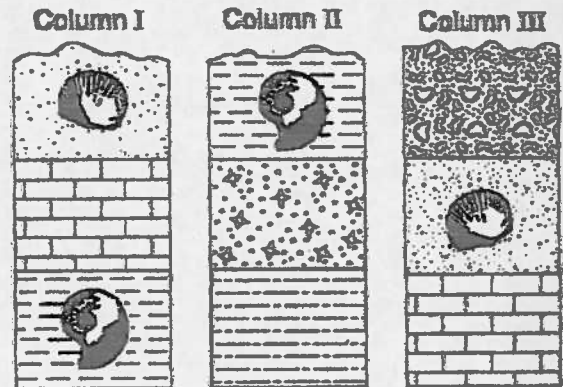
- a. Match the correlating rock layers by drawing a line to connect them.
- b. What evidence helps geologists correlate rock layers?

2. The three cross sections of sedimentary bedrock shown below represent widely separated surface exposures of layers that contain fossils. Letters A, B, C, and D represent four different marine fossils found in these rock layers.



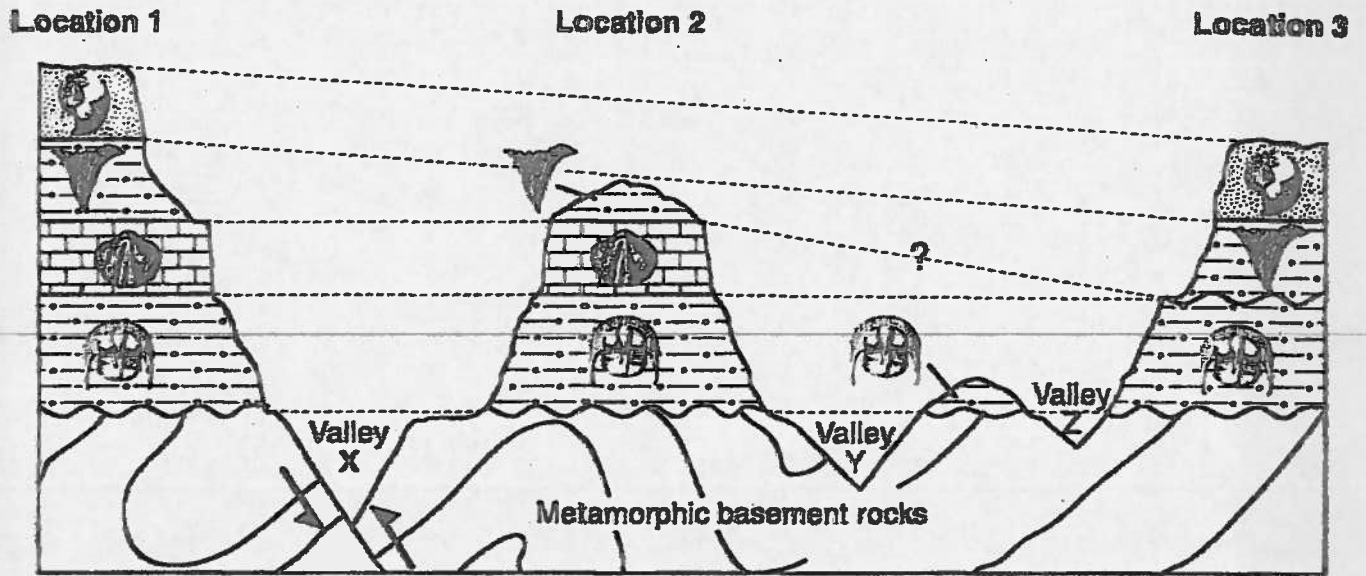
- a. Which letter best represents an index fossil?
- b. What two characteristics make a fossil a good index fossils?

3. The three geologic columns below represent the rock layers in outcrops located several miles apart. The rock layers have not been overturned. Two different index fossils are shown.



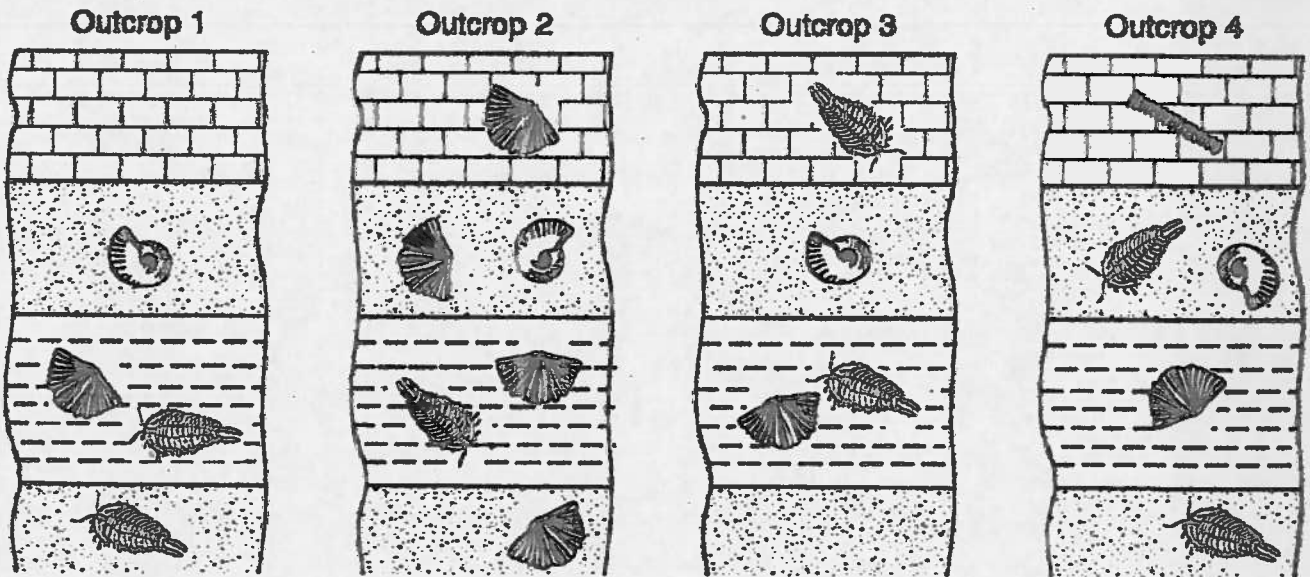
Of the rock layers found in these three outcrops, which layer was probably formed most recently?

4. Base your answer to the following question on the geologic cross section below, which shows a view of rock layers at Earth's surface. The dashed lines connect points of the same age. Major fossils contained within each rock layer are shown. The valleys are labeled X, Y, and Z.



The sedimentary rock layers at the three locations can be most accurately correlated by comparing the:

5. The diagrams below represent the rock layers and fossils found at four widely separated rock outcrops.



Which fossil appears to be the best index fossil?

Why?



Unit 6: Earth's History
Part 3: The Formation of Earth's Atmosphere and Oceans



AIM:

1. How did Earth's atmosphere originally form?

- About _____ years ago, _____ began to bubble out from Earth's interior through _____

➤ This process is called: _____

2. What were the 3 most abundant gases in Earth's early atmosphere?

- C _____
- N _____
- W _____ V _____

✓ What's missing?

3. How did the oceans form?

- About 4 billion years ago, water vapor began to _____ (phase change from _____ to _____). It fell as _____ in the form of _____.



- Earth's oceans formed from _____
- Some scientists believe that _____ bombarding the Earth over this period of time also contributed to the formation of our _____!

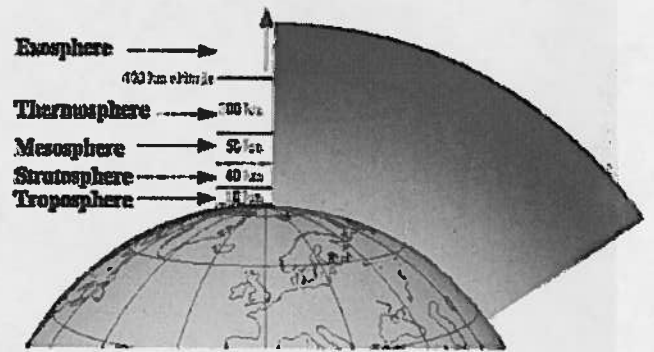
4. What type of life began first on Earth?

- About 3.8 billion years ago, _____ organisms were present.
- Approximately 3.5 bya, colonies of bacteria and algae called _____ evolved.
- Stromatolites use _____ and release _____ into the _____

ESRT pg. 8/9- In what Eon did stromatolites evolve?

5. How did oxygen reach its present day level?

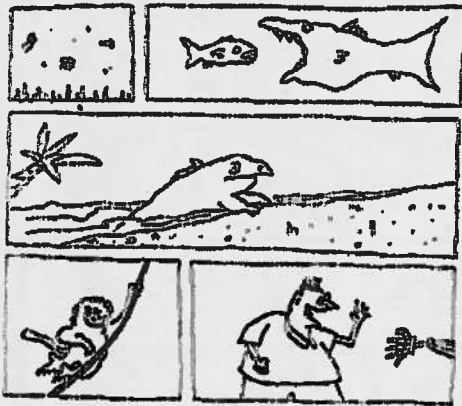
- As _____ evolved on Earth, they released great quantities of _____ into the atmosphere.
- _____ stayed near the bottom of the atmosphere and was later used by animals that _____.



ESRT - What are the present-day main components of Earth's atmosphere?



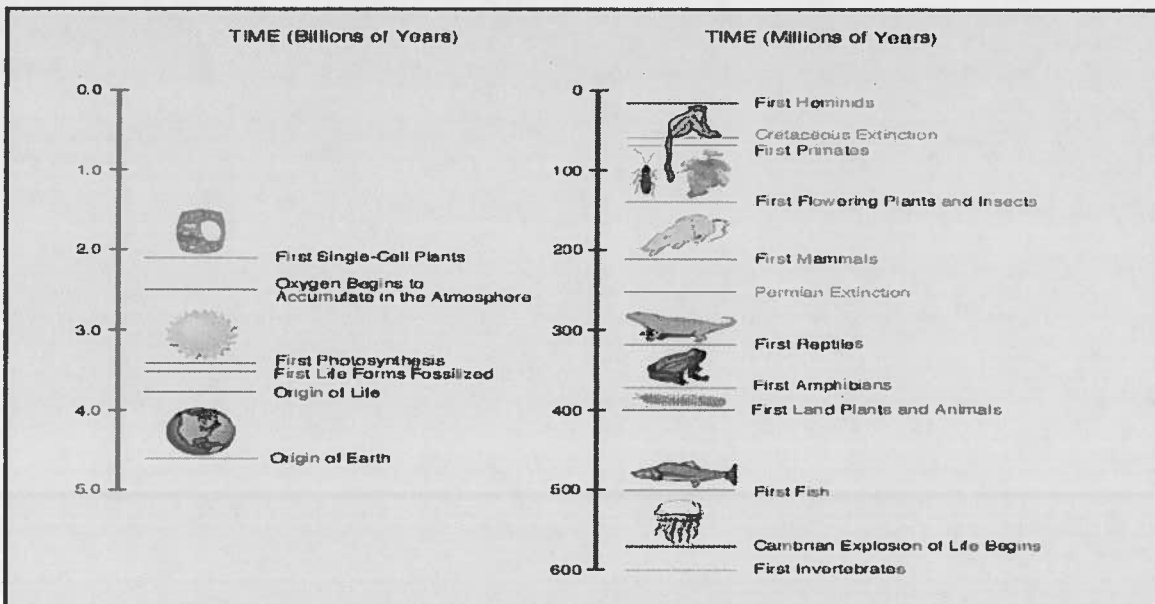
EVOLUTION of Animals



6. How has life evolved on Earth?

- ✓ _____ caused drastic changes in Earth's _____.
- ✓ _____ did not form until _____-producing organisms _____.
- During the _____, life forms slowly evolved from _____-celled _____ to _____ life forms.

➤ The _____ refers to the period of time when life evolved _____ and many _____ animals appear in the rock record



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

- A) addition of free oxygen to Earth's atmosphere
- B) formation of clastic sedimentary rocks
- C) movement of tectonic plates
- D) filling of the oceans by precipitation

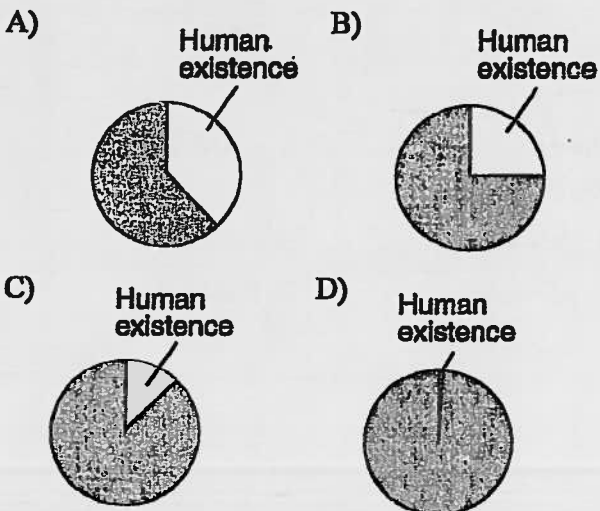
2. According to the fossil record, which sequence correctly represents the evolution of life on Earth?

- A) fish → amphibians → mammals → soft-bodied organisms
- B) fish → soft-bodied organisms → mammals → amphibians
- C) soft-bodied organisms → amphibians → fish → mammals
- D) soft-bodied organisms → fish → amphibians → mammals

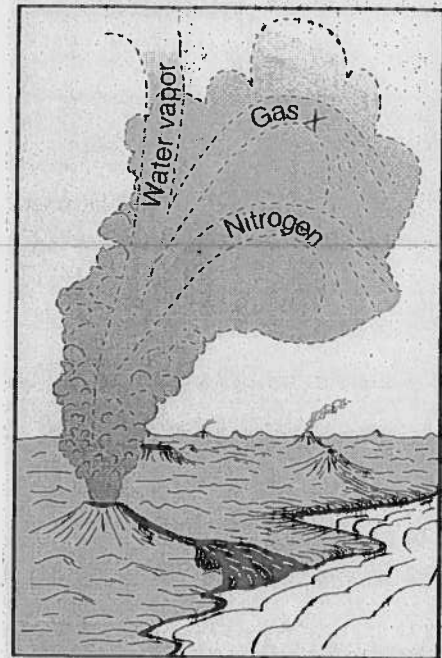
3. The gases in Earth's early atmosphere are inferred to have come primarily from

- A) meteor showers
- B) melting of glacial ice
- C) volcanic eruptions
- D) evaporation of seawater

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



5. The diagram below shows a process thought to have produced Earth's early atmosphere.



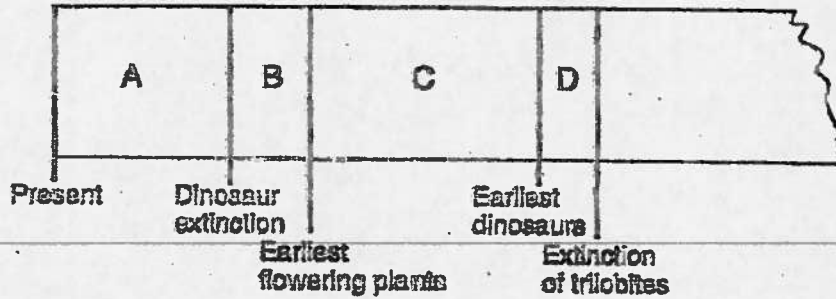
Which major component is shown as gas X?

- A) helium
- B) ozone
- C) carbon dioxide
- D) hydrogen

6. The similarity of some fossil forms from different time periods suggests a gradual transition that may be the result of

- A) unconformities
- B) evolutionary development
- C) folding and faulting
- D) uplift and erosion

7. The diagram below is a portion of a geologic time line. Letters A through between the labeled events, as estimated by some scientists.



Fossil evidence indicates that the earliest birds developed during which time interval?

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

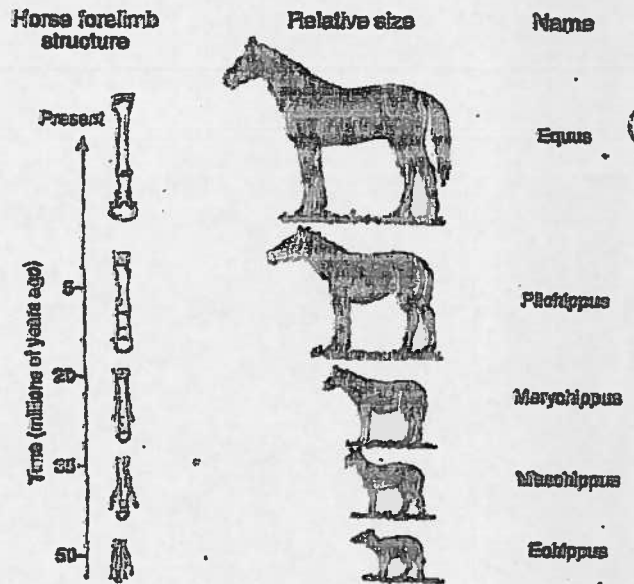
8. Which fact provides the best evidence for the scientific theory of the evolutionary development of life on the Earth?

- A) Fossils are found almost exclusively in sedimentary rocks.
- B) Characteristics of simpler forms of life can be found in more complex forms of life.
- C) Only a small percentage of living things have been preserved as fossils.
- D) Most species of life on the Earth have become extinct.

9. Which statement best explains the changing appearance of the horse, as supported by the fossil record?

- A) The horse evolved due to the influence of humans.
- B) The horse evolved from a complex life-form to a simpler life-form.
- C) The horse evolved into a life-form better able to survive.
- D) The horse evolved from larger ancestors without forelimbs.

Base your answer to questions 9 and 10 on the diagram, which shows the evolutionary development of the horse, as supported by the fossil record.



10. The earliest geologic epoch in which Mesohippus existed was the

- A) Paleocene B) Eocene
- C) Miocene D) Pliocene



Unit 6: Earth's History
Part 4: Radioactive Dating

AIM:

1. What is radioactive dating?



2. What is a radioactive isotope?

Radioactive Decay Data

RADIOACTIVE ISOTOPE	DISINTEGRATION	HALF-LIFE (years)
Carbon-14	$^{14}\text{C} \rightarrow ^{14}\text{N}$	5.7×10^3
Potassium-40	$^{40}\text{K} \rightarrow ^{40}\text{Ar}$ $^{40}\text{K} \rightarrow ^{40}\text{Ca}$	1.3×10^9
Uranium-238	$^{238}\text{U} \rightarrow ^{206}\text{Pb}$	4.5×10^9
Rubidium-87	$^{87}\text{Rb} \rightarrow ^{87}\text{Sr}$	4.9×10^{10}

~An _____ element that _____ into a more _____ element.

~ Radioactive Isotope = _____

~ Decay Product = _____

➤ Complete the chart below using your ESRT- front cover.

Unstable Parent Radioactive Isotope	Stable Daughter Decay Product	Half-Life (Years)

3. What is a half-life?



4. What can be done to change the half-life of a radioactive isotope?



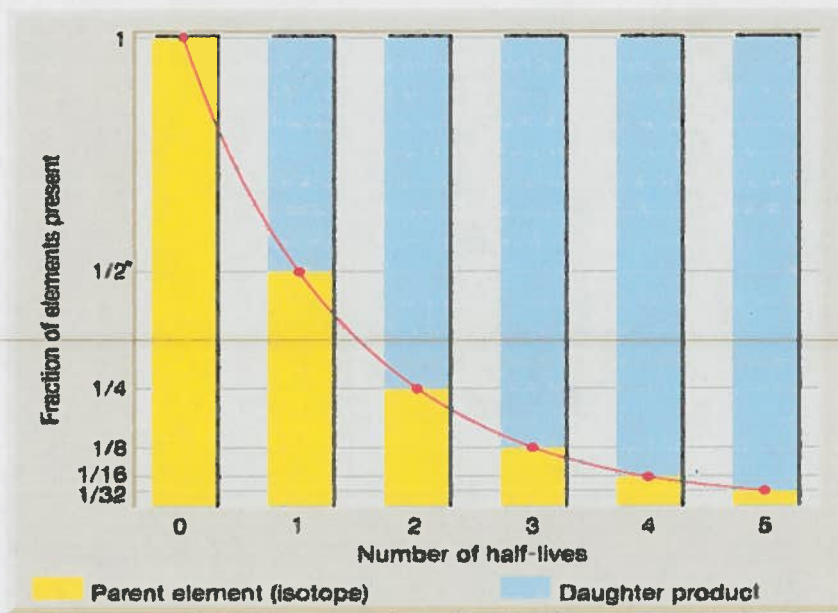
5. Why are radioactive isotopes useful in determining the absolute age of a rock?

6. What are decay-product ratios?

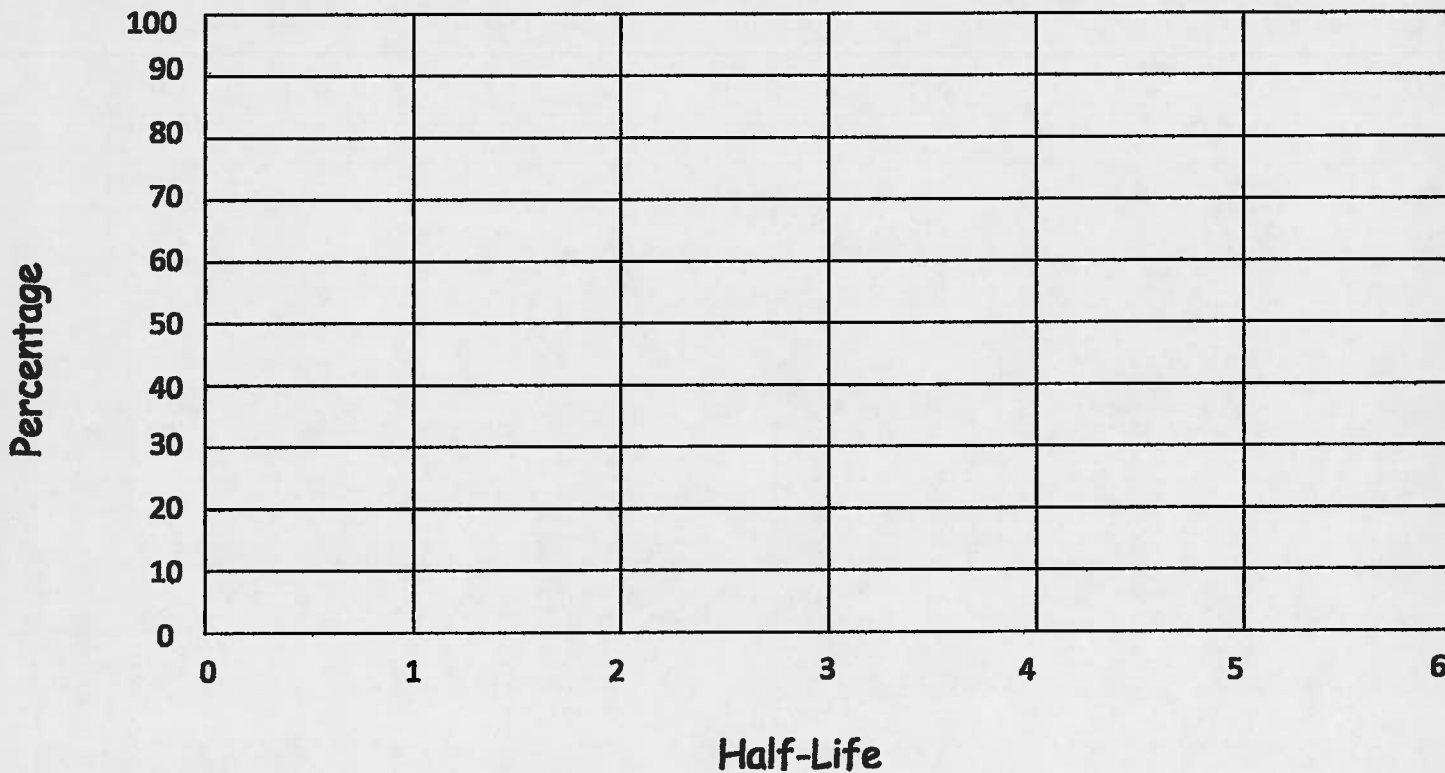
	<u>1 Half-Life</u>	<u>2 Half-Lives</u>
Original Radioactive Parent Element: (white)	<p>() %</p>	<p>() %</p>
Decay Product (Stable Daughter): (black)	<p>() %</p>	<p>() %</p>

	<u>3 Half-Lives</u>	<u>4 Half-Lives</u>
Original Radioactive Parent Element: (white)	<p>() %</p>	<p>() %</p>
Decay Product (Stable Daughter): (black)	<p>() %</p>	<p>() %</p>

The Half-Life Decay Curve



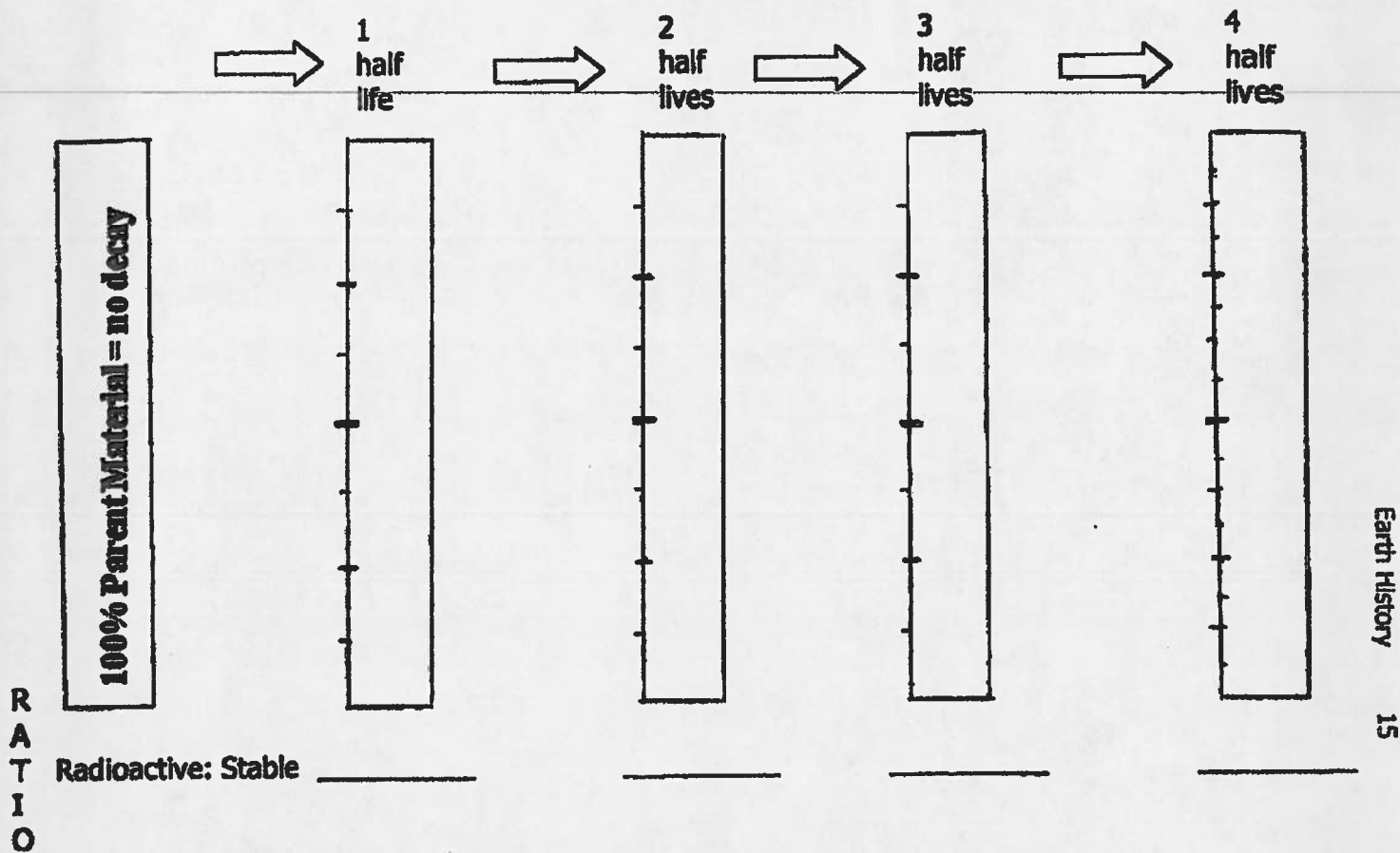
7. Draw the half-life graph for the unstable (parent) and stable (daughter) atoms.



8. Using your ESRT, which radioactive isotope could be used to determine the absolute age of something that was *recently living*?

Radioactive Decay Model

KEY Radioactive Element/Parent Material
 Stable Decay Element/Daughter Material



➤ Use the half-life information for Carbon-14 to find the age of the rock.

% ratio				
Age (years)				

9. What is the half-life of Uranium-238?

- a. 4500 yrs b. 45,000 yrs c. 4,500,000,000 yrs d. 45,000,000,000 yrs

10. a. In a 100g sample of ¹⁴C, how many grams of ¹⁴C remain after three half-lives?

b. How long would this take? Show work.

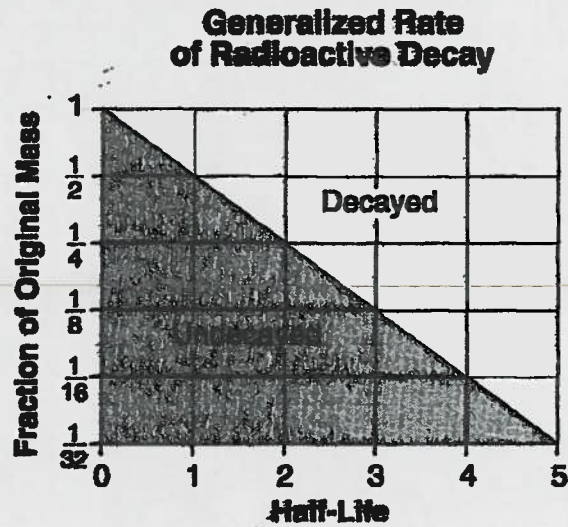
28

Name:

Date:

Per:

Base your answer to the following question on the graph below, which shows the generalized rate of decay of radioactive isotopes over 5 half-lives.



1. If the original mass of a radioactive isotope was 24 grams, how many grams would remain after 3 half-lives?

- 1) 12 2) 24 3) 3 4) 6

2. How old is a fossil that has radioactively decayed through 4 half-lives of carbon-14?

- 1) 5,700 years 3) 22,800 years
2) 17,100 years 4) 28,500 years

3. A whalebone that originally contained 200 grams of radioactive carbon-14 now contains 25 grams of carbon-14. How many carbon-14 half-lives have passed since this whale was alive?



- 1) 1 2) 2 3) 3 4) 4

Practice Problems:
Radioactive Decay

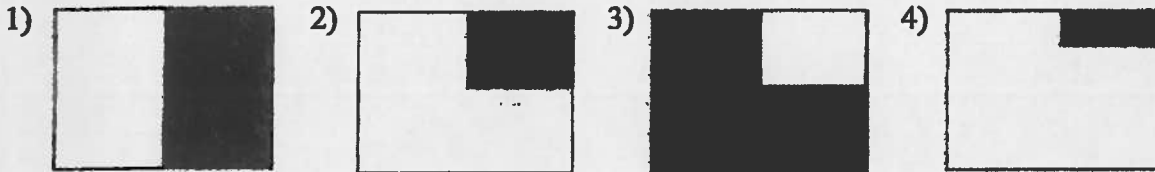
4. The diagram below represents a sample of a radioactive isotope.

Sample before decay

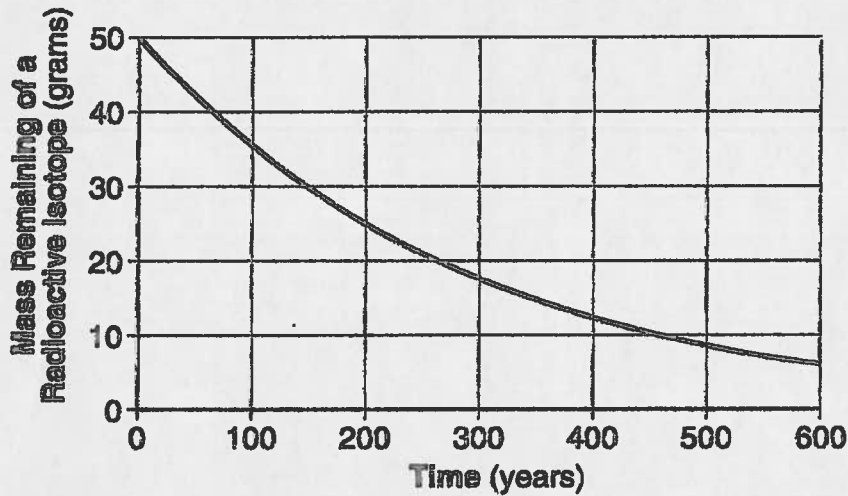


Key	
	Radioactive Isotope
	Decay product

Which diagram best represents the percentage of this radioactive isotope sample that will remain after 2 half-lives?



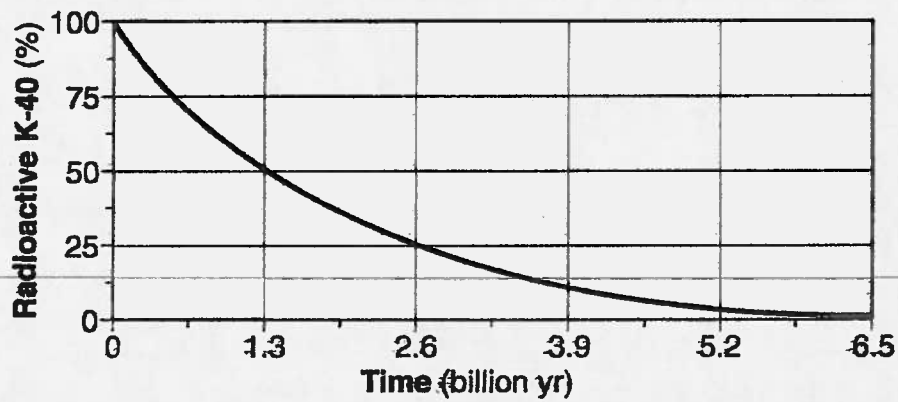
5. The graph below shows the radioactive decay of a 50-gram sample of a radioactive isotope.



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

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

5. The graph below shows the rate of decay of the radioactive isotope K-40 into the decay products Ar-40 and Ca-40.

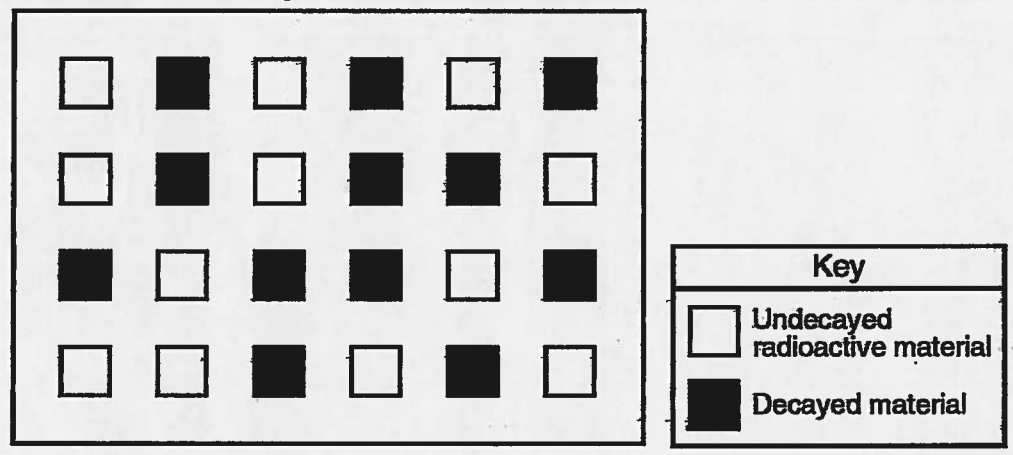


Analysis of a basalt rock sample shows that 25% of its radioactive K-40 remained undecayed. How old is the basalt?

- 1) 1.3 billion years 2) 2.6 billion years 3) 3.9 billion years 4) 4.6 billion years

Base your answer to questions 7 and 8 on the diagram below, which represents a model of a radioactive sample with a half-life of 5000 years. The white boxes represent undecayed radioactive material and the shaded boxes represent the decayed material after the first half-life.

Radioactive Sample After First Half-Life



7. How many *more* boxes should be shaded to represent the additional decayed material formed during the second half-life?

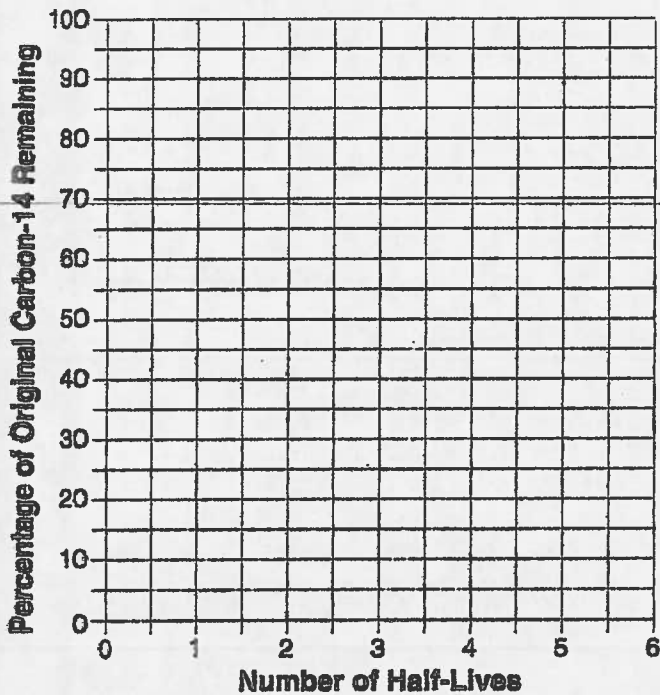
- 1) 12 2) 6 3) 3 4) 0

8. Which radioactive isotope has a half-life closest in duration to this radioactive sample?

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

Base your answer to questions 9 and 10 on the data table below, which shows the radioactive decay of carbon-14. The number of years required to complete four half-lives has been left blank.

Radioactive Decay of Carbon-14

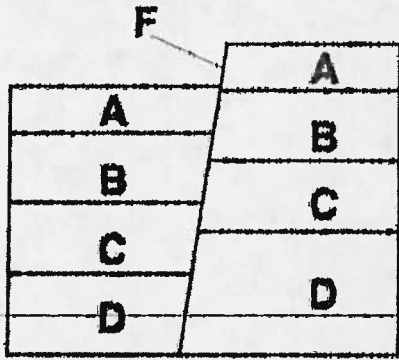


Radioactive Decay of Carbon-14

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

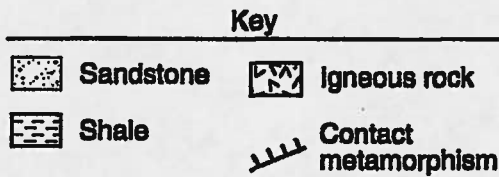
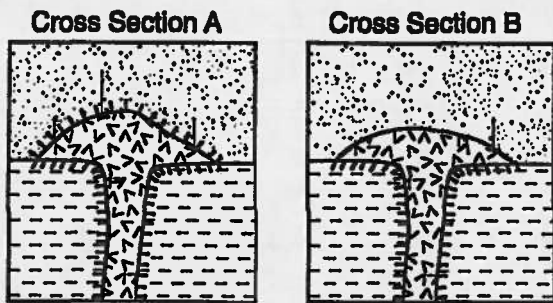
9. On the grid above, construct a graph that shows the radioactive decay of carbon-14 by plotting and X to show the percentage of original carbon-14 remaining after *each* half-life. Connect the Xs with a smooth, curved line.
10. How long does it take for radioactive carbon-14 to complete four half-lives?

1. The cross section below shows rock layers A, B, C, D, and fault F. The rock layers have not been overturned.



Which sequence places the rock layers and fault in order from oldest to youngest?

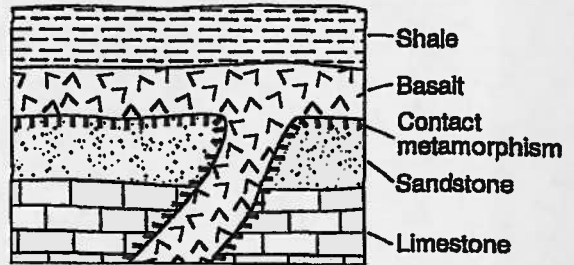
- 1) $D \rightarrow C \rightarrow B \rightarrow A \rightarrow F$ 3) $F \rightarrow D \rightarrow C \rightarrow B \rightarrow A$
 2) $A \rightarrow B \rightarrow C \rightarrow D \rightarrow F$ 4) $F \rightarrow A \rightarrow B \rightarrow C \rightarrow D$
2. The diagrams below represent two different geologic cross sections in which an igneous formation is found in sedimentary bedrock layers. The layers have not been overturned.



Which statement best describes the relative age of each igneous formation compared to the overlying sandstone bedrock?

- 1) In A, the igneous rock is younger than the sandstone and in B, the igneous rock is older than the sandstone.
- 2) In A, the igneous rock is older than the sandstone and in B, the igneous rock is younger than the sandstone.
- 3) In both A and B, the igneous rock is younger than the sandstone.
- 4) In both A and B, the igneous rock is older than the sandstone.

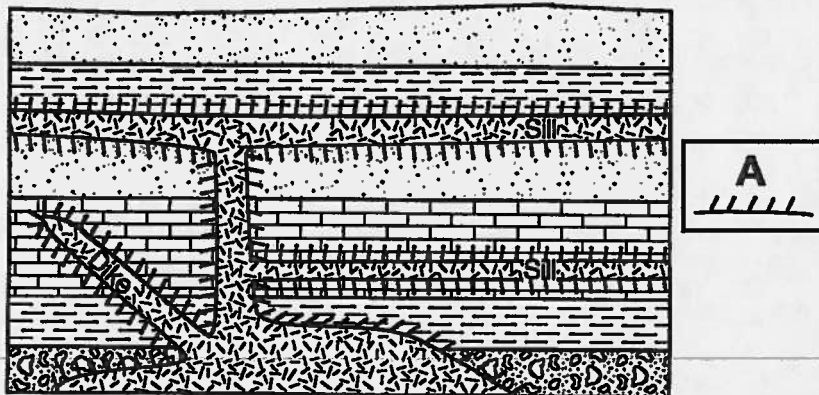
3. Which statement correctly describes an age relationship in the geologic cross section below?



- 1) The sandstone is younger than the basalt.
- 2) The shale is younger than the basalt.
- 3) The limestone is younger than the shale.
- 4) The limestone is younger than the basalt.

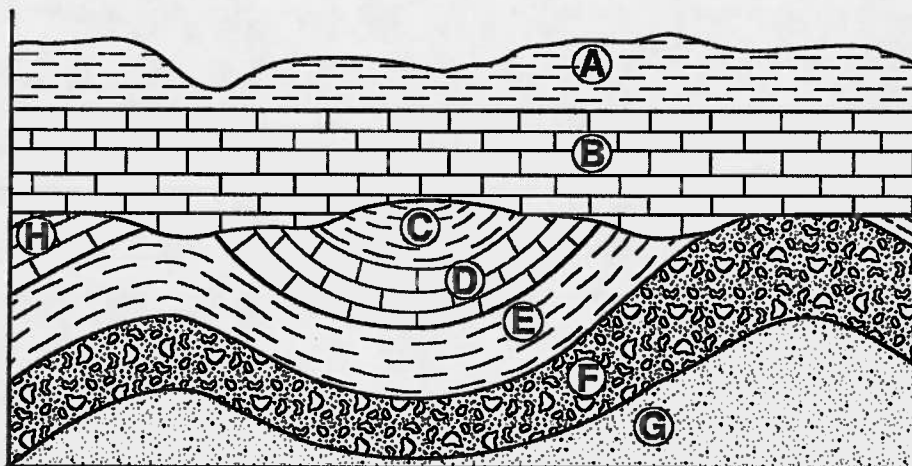
Date

4. Base your answer to the following question on the geologic cross section below. Overturning has not occurred. The dike and sills shown in the cross section are igneous intrusions.



Which feature is represented by symbol A along the edges of the dike and sills?

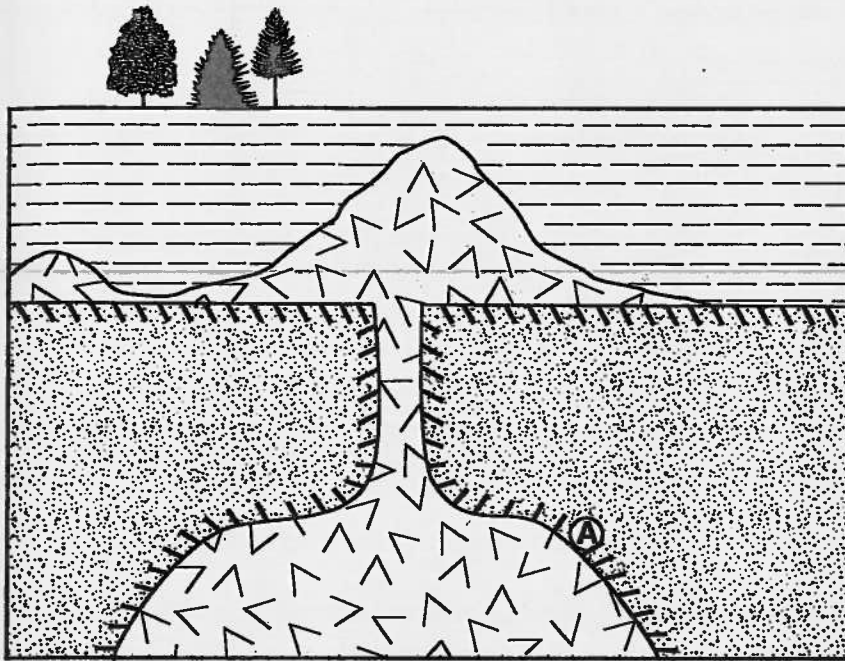
- 1) contact metamorphic rock
 - 2) an unconformity
 - 3) a glacial moraine
 - 4) index fossils
5. Base your answer to the following question on the geologic cross section below in which overturning has not occurred. Letters A through H represent rock layers.



The folding of rock layers G through C was most likely caused by

- 1) erosion of overlying sediments
- 2) contact metamorphism
- 3) the collision of lithospheric plates
- 4) the extrusion of igneous rock

Use your answers to questions 1 and 2 on the geologic cross section below. Location *A* is within the metamorphic rock.



Key	
	Igneous rock
	Contact metamorphic rock
	Sandstone
	Shale

1. Which rock is the youngest?

- (1) shale (2) sandstone (3) igneous rock (4) rock at location *A*

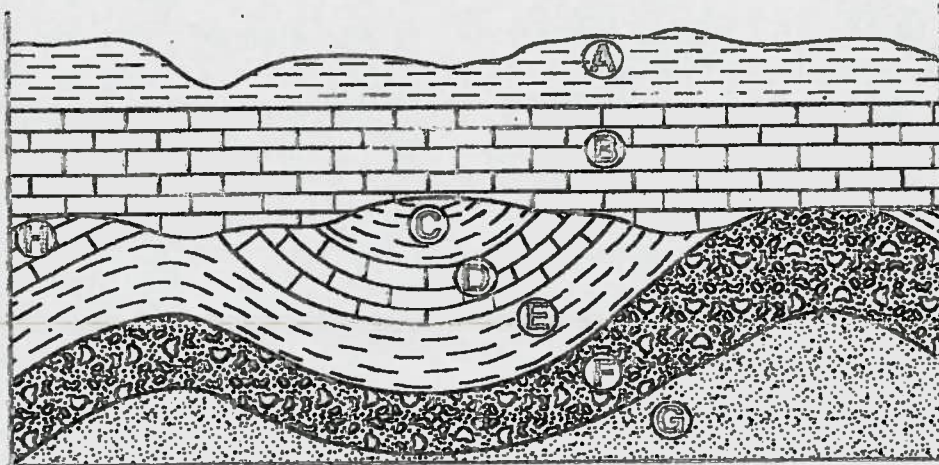
2. The metamorphic rock at location *A* is most likely

- (1) marble (2) quartzite (3) phyllite (4) slate

Do NOW ! 2

35

Use your answers to questions 3 through 5 on the geologic cross section below in which overturning has not occurred. Letters *A* through *H* represent rock layers.



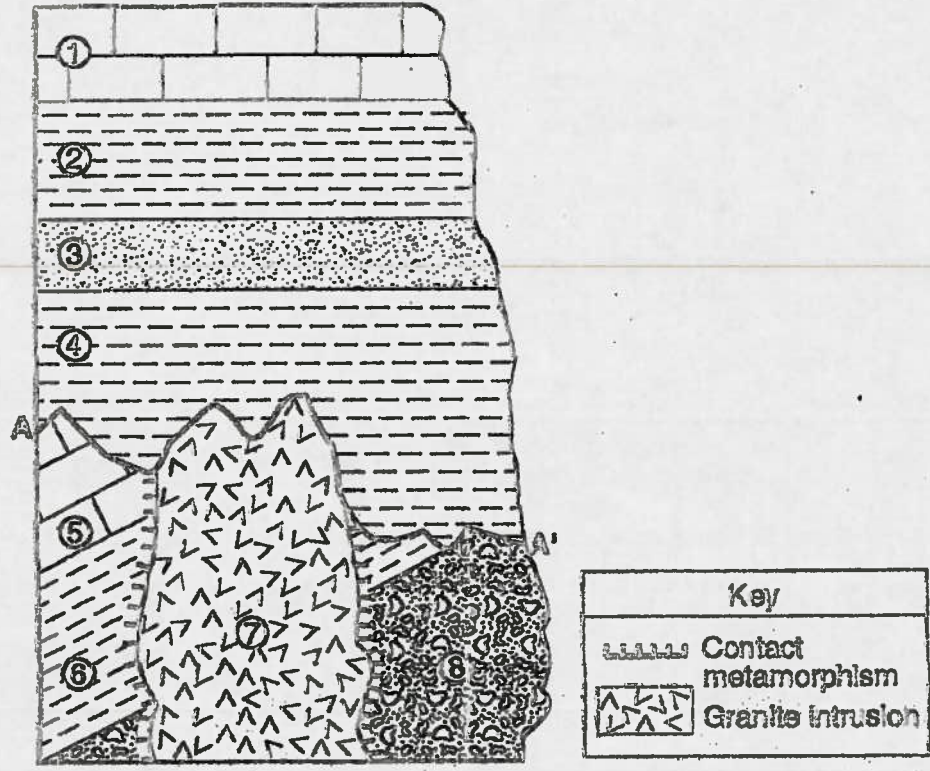
4. Which two letters represent bedrock of the same age?
 - (1) *A* and *E*
 - (2) *B* and *D*
 - (3) *F* and *G*
 - (4) *D* and *H*

5. Which sequence of events most likely caused the unconformity shown at the bottom of rock layer *B*?
 - (1) folding → uplift → erosion → deposition
 - (2) intrusion → erosion → folding → uplift
 - (3) erosion → folding → deposition → intrusion
 - (4) deposition → uplift → erosion → folding

6. The folding of rock layers *G* through *C* was most likely caused by
 - (1) erosion of overlying sediments
 - (2) contact metamorphism
 - (3) the collision of lithospheric plates
 - (4) the extrusion of igneous rock

Do Now 2

Base your answer to questions 1 through 3 on the cross section below. Rock units are labeled 1 through 8.
 A line between A and A' indicates an unconformity.



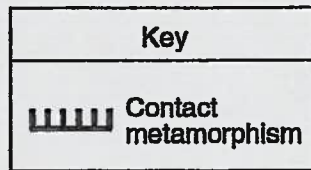
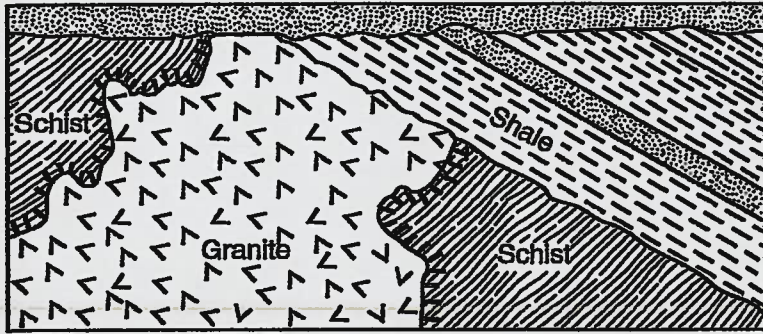
- Which event occurred sometime after the formation of the unconformity?
 - A) formation of rock unit 3
 - B) tilting of rock unit 5
 - C) deposition of the sediments that formed rock unit 8
 - D) intrusion of rock unit 7

2. Which characteristic of the granite intrusion provides the most evidence that it solidified deep underground?
 - A) very hard
 - B) coarse texture
 - C) light color
 - D) felsic composition

3. Which rock most probably formed in the contact metamorphic zone within rock unit 6?
 - A) marble
 - B) basalt
 - C) quartzite
 - D) hornfels

Do NOW 3

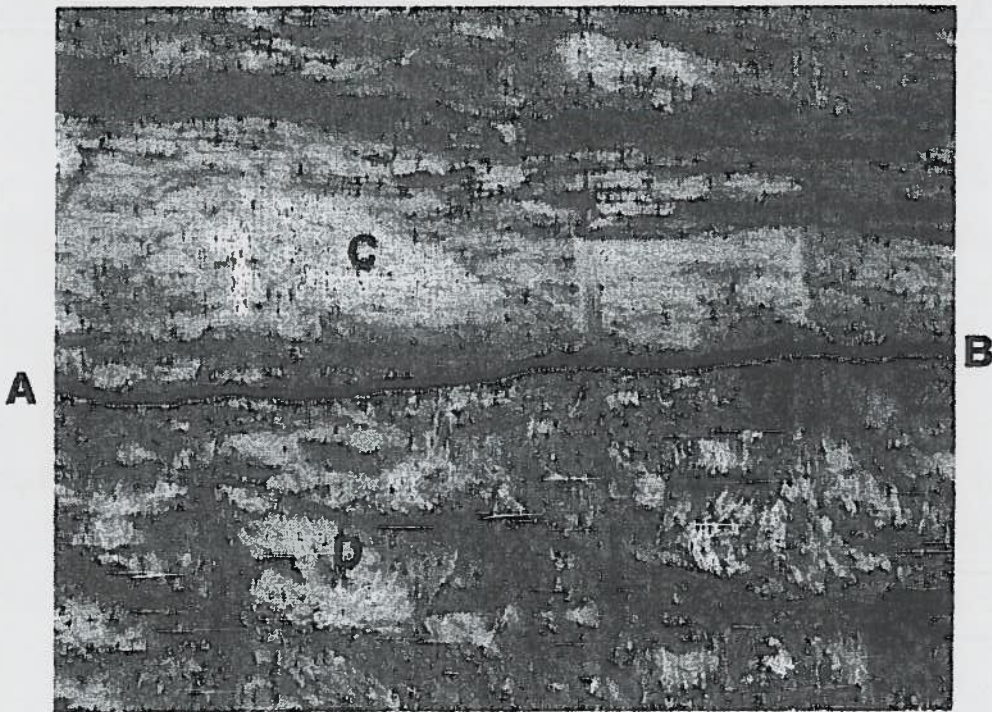
The geologic cross section below shows a complex structure containing a granite intrusion.



If the granite intrusion occurred 24 million years ago, what are the most probable ages of the schist and shale, in millions of years?

- A) schist – 25; shale – 23
- B) schist – 25; shale – 26
- C) schist – 23; shale – 25
- D) schist – 23; shale – 20

Base your answer to the following question on the photograph below, which shows a bedrock outcrop. Line *AB* is an unconformity between sandstone *C* and metamorphic rock *D*.



After the metamorphism of rock *D*, which sequence of events most probably formed unconformity *AB*?

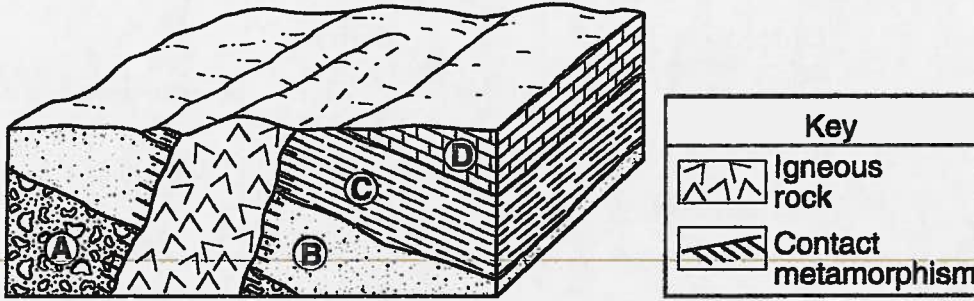
- A) flooding → deposition → erosion → uplift
- B) uplift → erosion → flooding → deposition
- C) deposition → flooding → uplift → erosion
- D) erosion → flooding → uplift → deposition

Do NOW 3

38

Topic 5: Earth's History

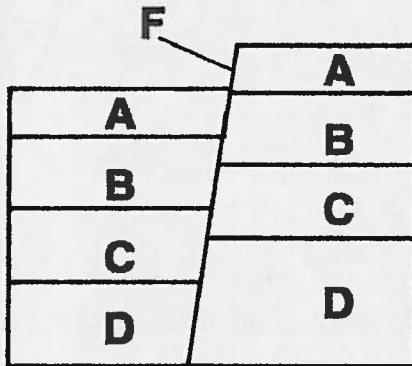
Base your answer to the following question on the block diagram below, which shows a portion of Earth's crust. Letters *A*, *B*, *C*, and *D* indicate sedimentary layers.



Which event occurred most recently?

- A) formation of layer *A*
- B) formation of layer *D*
- C) tilting of all four sedimentary rock layers
- D) erosion of the igneous rock exposed at the surface

The cross section below shows rock layers *A*, *B*, *C*, *D*, and fault *F*. The rock layers have not been overturned.



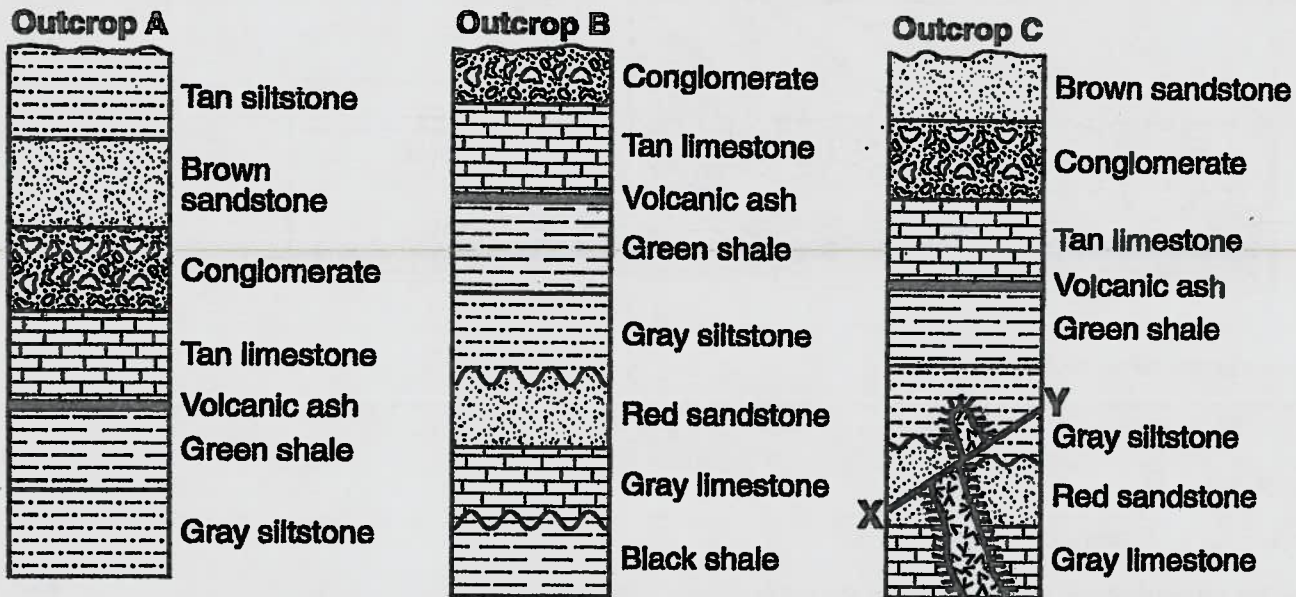
Which sequence places the rock layers and fault in order from oldest to youngest?

- A) $D \rightarrow C \rightarrow B \rightarrow A \rightarrow F$
- B) $A \rightarrow B \rightarrow C \rightarrow D \rightarrow F$
- C) $F \rightarrow D \rightarrow C \rightarrow B \rightarrow A$
- D) $F \rightarrow A \rightarrow B \rightarrow C \rightarrow D$

Do NOW
Topic 5: Earth's History

D
P

Base your answer to questions 3 through 5 on the cross sections of three rock outcrops, A, B, and C. Line XY represents a fault. Overturning has not occurred in the rock outcrops.



Key	
	Unconformity
	Igneous intrusion
	Contact metamorphism

- 3. Which sedimentary rock shown in the outcrops is the youngest?
 A) black shale B) conglomerate C) tan siltstone D) brown sandstone

- 4. The volcanic ash layer is considered a good time marker for correlating rocks because the volcanic ash layer
 A) has a dark color B) can be dated using carbon-14
 C) lacks fossils D) was rapidly deposited over a wide area

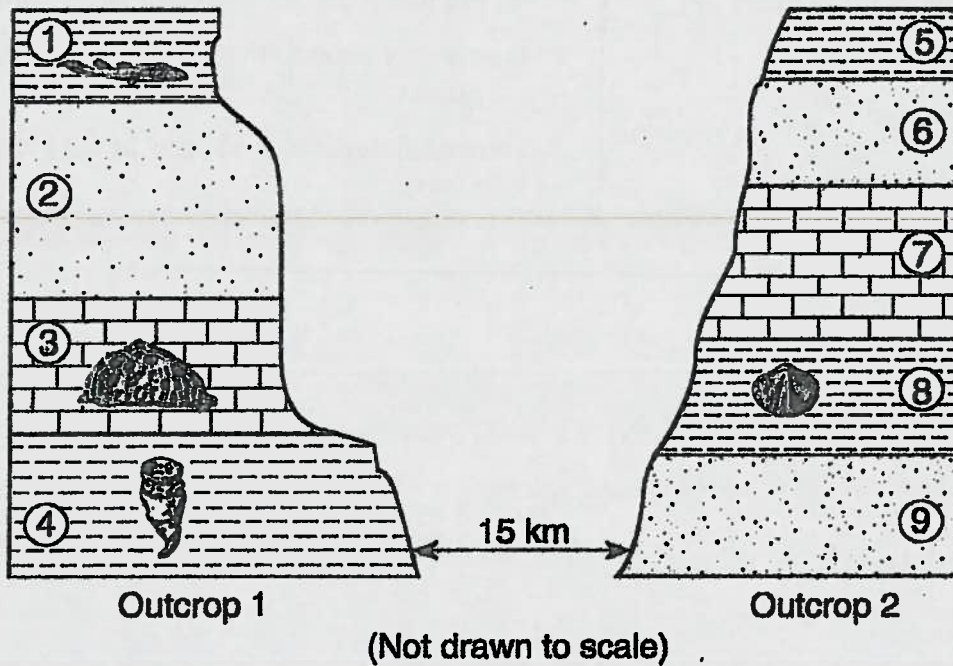
- 5. What is the youngest geologic feature in the three bottom layers of outcrop C?
 A) fault B) igneous intrusion
 C) unconformity D) zone of contact metamorphism

Do NOW 4

40

Topic 5: Earth's History

Base your answer to questions 1 through 4 on the cross sections below, which represent two bedrock outcrops 15 kilometers apart. The rock layers have been numbered for identification and some contain the index fossil remains shown.



Both organisms that formed the fossils found in rock layers 3 and 4

- A) lived during the same period of geologic time
- B) lived in polar regions
- C) are members of the same group of organisms
- D) are still alive today

When these rocks were deposited as sediments, this area was most likely

- A) under the ocean
- B) a desert between high mountains
- C) repeatedly covered by lava flows
- D) glaciated several times

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

- A) contain the same index fossil
- B) are composed of glacial sediments
- C) contain index fossils of the same age
- D) are found in the same area

Do NOW 5

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

- A) existed during a large part of the Paleozoic Era
- B) has no living relatives found on Earth today
- C) existed over a wide geographic area
- D) has been found in New York State

5. Based on fossil evidence, most scientists infer that

- A) life has not changed significantly throughout Earth's history
- B) life has evolved from complex to simple forms
- C) many organisms that lived on Earth have become extinct
- D) mammals developed early in the Precambrian time period

Do NOW 5

42

DO NOW
Topic 5: Earth's History

1. The time line below represents the entire geologic history of Earth.

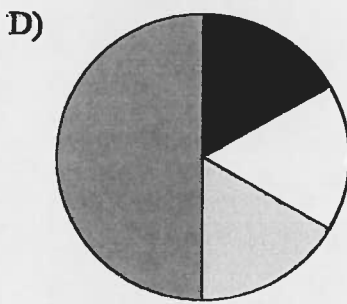
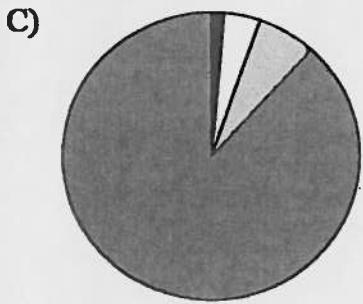
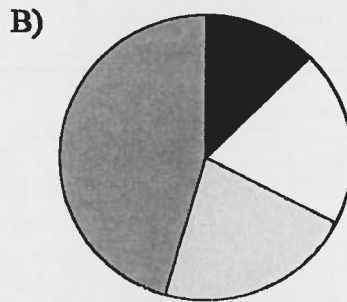
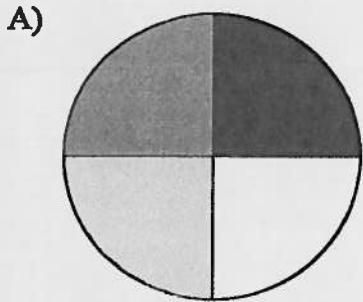


Which letter best represents the first appearance of humans on Earth?

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

2. Which pie graph best represents the percentage of total time for the four major divisions of geologic time?

Key	
Cenozoic	Paleozoic
Mesozoic	Precambrian



3. Which event occurred earliest in geologic history?

- A) appearance of the earliest grasses
- B) appearance of the earliest birds
- C) the Grenville Orogeny
- D) the intrusion of the Palisades Sill

4. The largest meteorite impact crater in North America formed approximately 1,850 million years ago, which was during the

- A) Middle Archean Era
- B) Early Proterozoic Era
- C) Early Jurassic Period
- D) Late Cretaceous Period

Topic 5: Earth's History

5. Which sequence shows the correct order of Earth's geologic time intervals from oldest to youngest?

- A) Archean → Mesozoic → Cenozoic → Paleozoic
→ Proterozoic
- B) Archean → Proterozoic → Paleozoic → Mesozoic
→ Cenozoic
- C) Cenozoic → Mesozoic → Paleozoic →
Proterozoic → Archean
- D) Cenozoic → Paleozoic → Archean → Mesozoic
→ Proterozoic

Do NOW 6

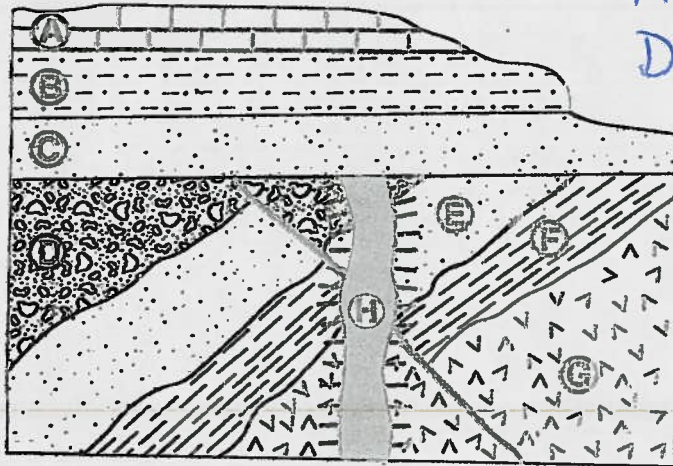
(44)

units in which overturning has not occurred.

Name:

Date:

Per:



Key	
	Basalt
	Granite
	Contact metamorphism

66 Identify *one* metamorphic rock that could have formed at the boundary between rock unit E and rock unit H. [1]

67 Rock unit B contains fossils of *Centroceras* while rock unit F contains fossils of *Tetragraptus*. Identify *one* geologic time period when rock unit D could have formed. [1]

68 Two inferences about the cross section are listed below.

Inference 1: Rock unit G is older than the fault.

Inference 2: Rock unit A is younger than rock unit C.

Explain how *each* inference is supported by evidence in the cross section. [1]

69 Identify *two* processes that formed rock unit D from sediment. [1]

70 State the diameter of a particle normally found in rock unit B. [1]

66 _____

67 _____ Period

68 Evidence for inference 1: _____

Evidence for inference 2: _____

69 Process 1: _____

Process 2: _____

70 _____ cm

(45)

NYS Regents Exam
January 2011