

Name \_\_\_\_\_

Date \_\_\_\_\_

## **Regents Earth Science - Earth History ANSWERS AND EXPLANATIONS**

1. Geologic time is divided into units based upon
- |                 |                          |
|-----------------|--------------------------|
| 1 erosion rates | 3 surface topography     |
| 2 rock types    | 4 <u>fossil evidence</u> |

**As we have spoken about in class, geologic history has been subdivided based on the appearance and disappearance of fossils in the rock record.**

2. According to the *Earth Science Reference Tables*, during which period were North America, Africa, and South America closest?
- |              |                   |
|--------------|-------------------|
| 1 Tertiary   | 3 <u>Triassic</u> |
| 2 Cretaceous | 4 Ordovician      |

**Geologic History Reference Tables – last column shows the pictures of the positions of the continents at different times. It is obvious that they are closest during the Triassic Period.**

3. During the Pleistocene Epoch, what natural event modified much of New York State's existing landscape?
- |  |
|--|
| 1 destruction of ground cover by large forest fires              |
| 2 extinction of many animal forms                                |
| 3 <u>advance of the continental glaciers</u>                     |
| 4 formation of the Adirondack Mountains and the Hudson Highlands |

**Geologic History Reference Tables – Important Geologic Events Column states that the last continental glacier advanced and retreated during the Pleistocene.**

4. According to the *Earth Science Reference Tables*, in New York State there are no rocks of the following ages
- |                               |
|-------------------------------|
| 1 <u>Permian and Tertiary</u> |
| 2 Ordovician and Cretaceous   |
| 3 Ordovician and Cambrian     |
| 4 Triassic and Jurassic       |

**Geologic History Reference Tables – Rock Record in N.Y. column – there are no bars during the Tertiary or Permian Period showing that evidence for rocks during this time do not exist in N.Y.**

5. A timeline is made on a strip of paper to illustrate the Earth's history. A length of 1.0 centimeter is used to represent 10 million years. According to the *Earth Science Reference Tables*, what distance should be used to represent the length of the Mesozoic Era?
- |            |                  |
|------------|------------------|
| 1 0.186 cm | 3 <u>18.6 cm</u> |
| 2 1.86 cm  | 4 186 cm         |

**Geologic History Reference Tables – The Mesozoic began 251 million years ago and ended 65 million years ago – this is a time period of 186 million years. If 1.0 cm = 10 million years, then 18.6 cm would equal 186 million years.**

6. According to the *Earth Science Reference Tables*, which covered the longest period of time?

- 1 Cenozoic
- 2 Mesozoic
- 3 Paleozoic
- 4 **Precambrian**

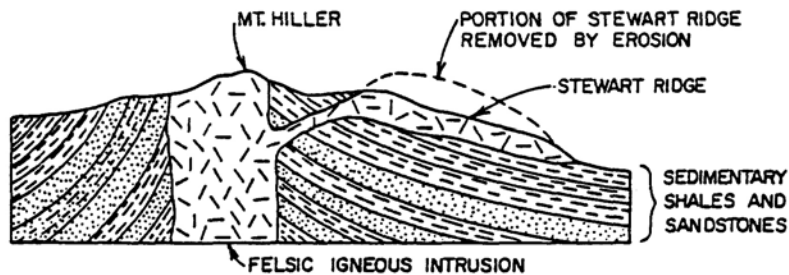
**Geologic History Reference Tables – It is very visible... but if you do the math, the Precambrian existed for over 4 billion years of time.**

7. A sedimentary rock consists of grains of sand cemented together. What is the relative age of the sand grains?

- 1 younger than the rock
- 2 **older than the rock**
- 3 the same age as the rock

**In order to have a sedimentary rock, you need pre-existing sediments. The sand grains are these sediments and therefore are older than the sedimentary rock.**

Base your answers to questions 8 and 9 on the *Earth Science Reference Tables* and the diagram below of a cross section of a portion of the Earth's crust.



8. Which geologic event occurred first?

- 1 folding of the shales and sandstones
- 2 **deposition of the shales and sandstones**
- 3 erosion of part of Stewart Ridge

4 intrusion of the felsic igneous rock

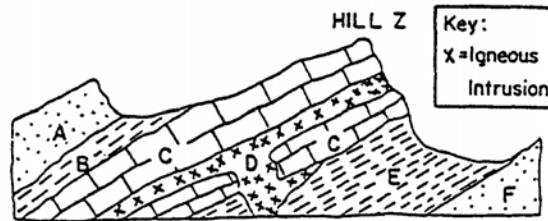
**Layers have to be there before they can be folded, intruded, or eroded.**

9. A rock sample taken from Mt. Hiller would most likely contain

- 1 **quartz, and be light colored**
- 2 pyroxene, and be dark colored
- 3 orthoclase, and be dark colored
- 4 olivine, and be light colored

**Mt. Hiller is in the diagram – it is made of felsic igneous rocks – by looking at the Igneous Rock Chart, felsic rocks must be light colored. Quartz is a light-colored mineral (on left side of the diagram)**

Base your answers to question 10 and 11 on your knowledge of Earth Science and on the cross section below which represents layers of sedimentary rock that have not been overturned but have been intruded by igneous rock.



10. Which rock layer is probably the oldest?

- 1 A  
 2 **F**  
 3 C  
 4 D

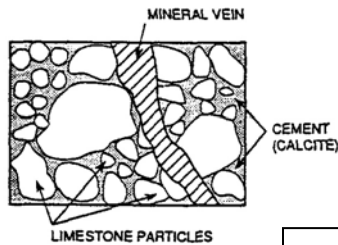
**Layer F is on the bottom of the outcrop. (law of superposition)**

11. Which best explains the presence of hill Z?

- 1 The intrusion of rock layer D weakened rock layer C.  
 2 Rock layer D protected rock layer C from erosion.  
 3 The landscape developed in a moist climate.  
 4 **Rock layer C is more resistant than rock layers above.**

**Differential weathering of the rock layers. Layer C must be more resistant and therefore weathers slower**

12. The diagram below shows a sample of conglomerate rock.

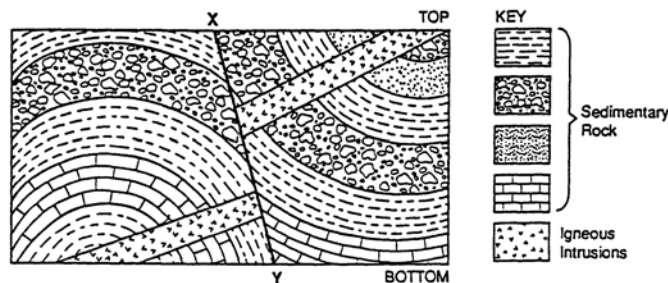


The oldest part of this sample is the

- 1 conglomerate rock sample  
 2 calcite cement  
 3 **limestone particles**  
 4 mineral vein

**Once again, the particles must exist before cementing together to form a rock. The mineral vein is like a mini-intrusion that cuts through after the rock has formed.**

13. The diagram below shows a cross section of the Earth's crust. Line XY is a fault.

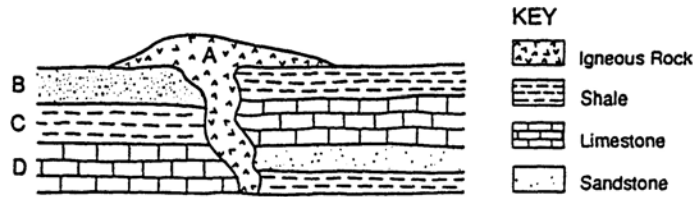


Which sequence of events, from oldest to youngest, has occurred in this outcrop?

- 1 formation of sedimentary layers → igneous intrusion → folding of layers → faulting  
 2 igneous intrusion → formation of sedimentary rock layers → folding of layers → faulting  
 3 **formation of sedimentary layers → folding of layers → igneous intrusion → faulting**  
 4 igneous intrusion → faulting → formation of sedimentary rock layers → folding of layers

**Layers have to be there first. Then folding happened before the intrusion (if the intrusion occurred before folding, it would be wavy) Faulting is last because all features are shifted.**

14. The diagram below shows a geologic cross section of a portion of the Earth's crust that has not been overturned.



Which rock unit is the youngest?

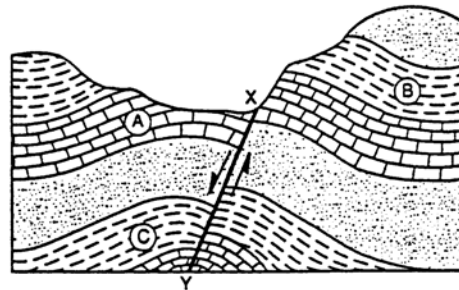
- |   |          |   |   |
|---|----------|---|---|
| 1 | <u>A</u> | 3 | C |
| 2 | B        | 4 | D |

**The intrusion / extrusion located at A cuts through all other layers and therefore is youngest. (law of cross-cutting relations)**

15. The diagram below shows a geologic cross section of a portion of the Earth's crust.

Which geologic event occurred most recently?

- 1 erosion of the surface of rock layer A
- 2 folding of rock layer B
- 3 deposition of rock layer C
- 4 faulting along line XY

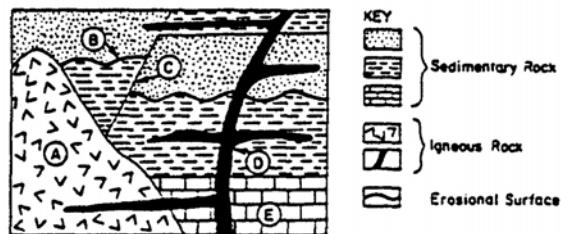


**Faulting led to the uplift that caused the erosion of the more exposed upper layers.**

16. The diagram below shows a geologic cross section of a portion of the Earth's crust.

Which geologic event occurred last?

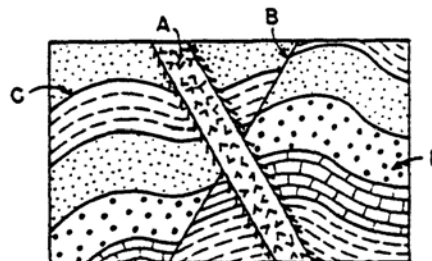
- 1 the formation of rock A
- 2 the erosion of surface B
- 3 the faulting along line C
- 4 the intrusion of rock D



**The intrusion at D cuts through all other features and therefore is youngest. (law of cross-cutting relations)**

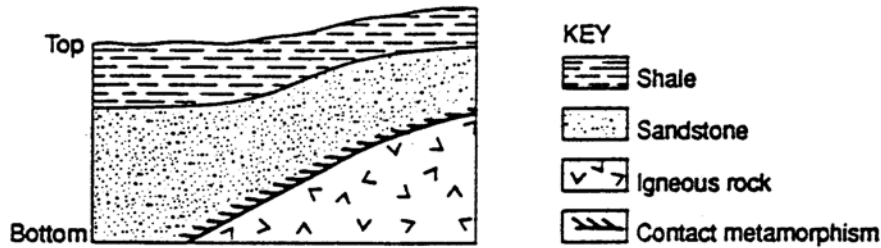
17. The diagram below represents an exposed rock outcrop. Which geologic event occurred last?

- 1 the intrusion of A
- 2 the fault along line B
- 3 the fold at C
- 4 the deposition of gravel at D



**The intrusion at A cuts through all other features and therefore is youngest. (law of cross-cutting relations) Since it is not split, you know it came after the fault.**

18. The diagram below represents a cross section.



Which inference is best supported by the evidence shown in the diagram?

- 1 Igneous rock was changed to sedimentary rock.
- 2 **Contact metamorphism occurred when the igneous rock was in the molten state.**
- 3 Sandstone formed after sand was deposited on top of the metamorphic rock.
- 4 Shale formed from the melting and solidification of the sandstone layer.

**Simply put ... none of the other choices are true.**

19. A layer of volcanic ash may serve as a time marker because the ash is

- 1 generally deposited only on land
- 2 composed of index fossils
- 3 **deposited rapidly over a large area**
- 4 often a distinct color

**Geologic time markers, such as erosional surfaces and volcanic ash, are great for correlation because they represent a short period of time, but occur over a larger area.**

20. Which characteristics of a fossil would make it useful as an index fossil in determining the relative age of widely separated rock layers?

- 1 a wide time range and narrow geographic range
- 2 a wide time range and wide geographic range
- 3 a narrow time range and narrow geographic range
- 4 **a narrow time range and wide geographic range**

**This is the exact definition of an index fossil.**

21. A buried erosion surface always indicates that

- 1 **part of the geologic record has been destroyed**
- 2 a type of animal has become extinct
- 3 a new form of life has appeared
- 4 a series of lava flows have occurred

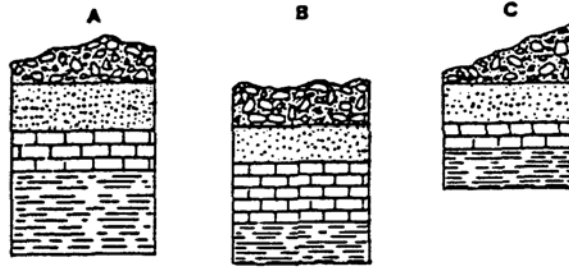
**Erosion creates "time gaps" in the rock record by destroying layers or parts of layers.**

22. Many parts of the rock record in New York State are missing. These parts are most likely missing because of

- 1 **uplift and erosion**
- 2 earthquakes and volcanic activity
- 3 subsidence and deposition
- 4 folding and faulting

**Again, erosion creates "time gaps" in the rock record by destroying layers or parts of layers.**

23. The diagram below represents cross sections of three rock outcrops approximately 100km apart. What could be the best method of correlating the rock layers of each outcrop?



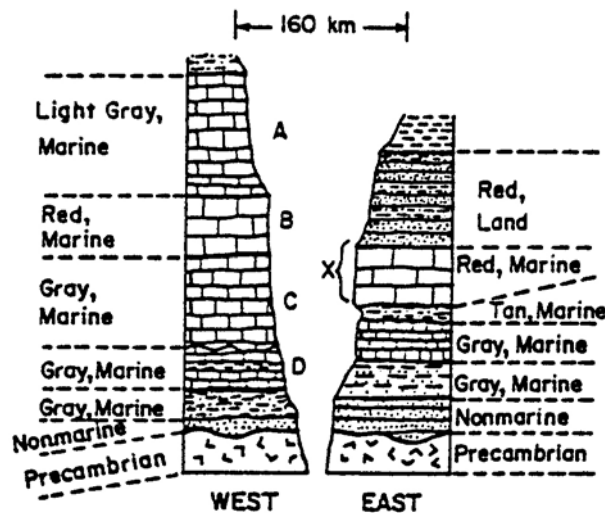
- 1 comparing rock types  
 2 comparing mineral composition  
 3 comparing index fossils  
 4 comparing thickness of rock layers

The diagram is totally unnecessary for this question. Always remember that index fossils are the best way to correlate rock outcrops. The diagrams make you think that there are no fossils present and therefore you would pick choice 1.

24. The changes observed in the fossil record from the Precambrian Era to the Cenozoic Era best provide evidence of
- 1 sublimation  
 2 radioactive decay  
 3 evolution  
 4 planetary motion

I mentioned this briefly with reference to the different trilobites. None of the other choices make sense. Not a big Regents question anymore ... but be prepared anyway.

25. The diagram below represents two rock columns. The color and the environment of deposition of each sedimentary rock are indicated beside the rock layers. Which rock layer in the West geologic column is most likely the same as rock layer X in the East column?

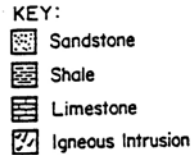
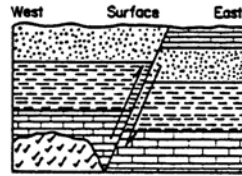


- 1 A  
 2 B  
 3 C  
 4 D

They both say "Red, Marine" and they are both limestone.

26. What evidence is given in the diagram below that erosion has occurred?

- 1 the fault through the middle
- 2 the absence of surface limestone west of the fault**
- 3 the presence of igneous material in the limestone
- 4 the upward movement of the rock layers west of the fault



**Missing layers are always an indication of erosion. Since the west side of the fault moved up, the limestone became more exposed to agents of erosion.**

27. During which geographic time interval was most of our present-day coal deposits formed?

- 1 Cenozoic
- 2 Mesozoic
- 3 Paleozoic**
- 4 Precambrian

**Geologic History Reference Tables – Life on Earth (Carboniferous Period)**

**This is an older Regents question when the Reference Tables actually had the words “coal deposits”. The words “extensive coal forming forests” replaced the words “coal deposits”**

28. Rocks containing fossils of earliest terrestrial plants could most likely be found in New York State bedrock near

- 1 Syracuse**
- 2 Oswego
- 3 Ithaca
- 4 Old Forge

**Geologic History Reference Tables – Life on Earth (Silurian Period)**

**This is an older Regents question when the Reference Tables actually had the words “terrestrial plants”. The words “earliest land plants” replaced the words “terrestrial plants”. We learned that the word “terrestrial” means “ground” or “land” as in “terrestrial radiation”.**

**NYS Bedrock Reference Tables – Look up Silurian rock in key (pinstripes) – Syracuse fits the pattern**

29. According to the *Earth Science Reference Tables*, when did the armored fishes become extinct?

- 1 before the appearance of dinosaurs**
- 2 before the appearance of terrestrial plants
- 3 after the appearance of reptiles
- 4 after the appearance of birds

**Geologic History Reference Tables – Life on Earth column and time distribution of fossils bars.**

**The only correct answer is choice 1. Armored fish became extinct in the Devonian (400 mya) and Dinosaur first appeared in the Triassic (250 mya)**

30. After one half-life, how much of the original sample of  $C^{14}$  would remain?

- 1 12.5%
- 2 25.0%
- 3 50%**
- 4 87.5%

**After one half-life 50% of any radioactive material would remain.**

31. In an original sample of  $U^{238}$  has a mass of 24 grams, what is the total amount of  $U^{238}$  left after 18 billion years?
- |              |                    |
|--------------|--------------------|
| 1 12.0 grams | 3 3.0 grams        |
| 2 6.0 grams  | 4 <u>1.5 grams</u> |

**Ask yourself: "How many half-lives?"** Since the half life of uranium is 4.5 billion years, after 18 billion years, uranium would have gone through 4 half-lives. If you start with 24 grams: after 1 half-life there is 12g, 2 half-lives there is 6g, 3 half-lives 3g, and finally 4 half-lives – you end up with 1.5 grams uranium left.

32. Which two forms of life existed together on the Earth during the same time period?
- |                           |   |
|---------------------------|---|
| 1 dinosaurs and mastodons | 3 flowering plants and trilobites       |
| 2 trilobites and birds    | 4 <u>mastodons and flowering plants</u> |

**Geologic History Reference Tables** – lots of footwork, but in the end you can eliminate the other choices by using the life on earth column and fossil bars. Flowering plants first appeared 100 mya and still exist till today. Mastodons came and left, but were around when the flowering plants were. None of the other choices existed together on earth.

33. According to the *Earth Science Reference Tables*, at which location could a geologist find shale containing eurypterid fossils?
- |                   |                 |
|-------------------|-----------------|
| 1 Old Forge       | 3 New York City |
| 2 <u>Syracuse</u> | 4 Long Island   |

**Geologic History Reference Tables** – Life on Earth (Silurian Period or Devonian Periods)

**NYS Bedrock Reference Tables** – Look up Silurian rock in key (pinstripes) or Devonian (dots) – Syracuse fits the pattern

34. Which form of life existed on the Earth for the longest period of time?
- |                     |                    |
|---------------------|--------------------|
| 1 dinosaurs         | 3 armored fish     |
| 2 <u>trilobites</u> | 4 flowering plants |

**Geologic History Reference Tables** – Life on Earth and/or fossil bars

Dinosaurs – 251-65 my = 186 my  
Trilobites – 520 my-251 = 269 my

Armored fish – 490-400 = 90my  
Flowering plants – 100my-today = 100my

35. The drawing below shows a fish that existed during the Ordovician Period.



According to the *Earth Science Reference Tables*, a fossil of this fish might be found in New York State bedrock that is how many million years old?

- |       |              |
|-------|--------------|
| 1 160 | 3 350        |
| 2 225 | 4 <u>445</u> |

**Geologic History Reference Tables** – Ordovician period lasted from 490-443 my – 445 is the only choice that fits during that time period.



36. For which segment of the Earth's geologic history are fossils rarely found?

- 1 Cenozoic
- 2 Mesozoic
- 3 Paleozoic
- 4 **Precambrian**

**Geologic History Reference Tables – Precambrian – soft-bodied organisms did not fossilize well.**

37. According to the *Earth Science Reference Tables*, which event occurred at the time of the Alleghanian Orogeny?

- 1 **the extinction of many kinds of marine organisms**
- 2 the extinction of many kinds of land animals
- 3 the development of primitive aquatic plants
- 4 the development of birds and mammals

**Geologic History Reference Tables – cross reference life on Earth with important geologic events column. During the Alleghanian Orogeny (Permian Period) there was also the extinction of many marine organisms.**

38. If 12.5% of the radioactive potassium-40 in a sample is remaining, what is the approximate age of the rock?





- 1 1.3 x10<sup>9</sup>
- 2 2.6 x10<sup>9</sup>
- 3 **3.9 x10<sup>9</sup>**
- 4 4.5 x10<sup>9</sup>

**Ask yourself: "How many half-lives?". After one half-life, 50% would remain, 25% after 2 half-lives, and 12.5% after 3. Since the half life of potassium is 1.3 billion years, 3 half-lives would indicate an age of 3.9 by**

39. The chart below shows index fossils found in rocks of various ages.

According to the *Earth Science Reference Tables*, which fossil could be found in the same rock as fossils of the first corals?

- 1 Spirifer
- 2 Muscrospirifer
- 3 Eospirifer
- 4 **Michelinoceras**

BEDROCK AGE	INDEX FOSSIL
MISSISSIPPIAN	 SPIRIFER
DEVONIAN	 MUCROSPIRIFER
SILURIAN	 EOSPIRIFER
ORDOVICIAN	 MICHELINOCERAS

**Geologic History Reference Tables – life on earth column or fossil bars.**

**First corals exist in the Cambrian, first coral reef in Ordovician. Closest answer would be choice 4.**

40. The cartoon below represents the time of the last dinosaurs and the earliest mammals.

According to the *Earth Science Reference Tables*, the cartoon would represent the boundary between which two units of geologic history?

- 1 Archean and Proterozoic
- 2 Precambrian and Paleozoic
- 3 Ordovician and Silurian
- 4 **Mesozoic and Cenozoic**

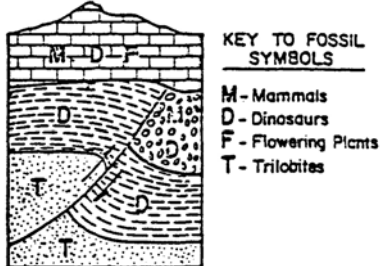


**Geologic History Reference Tables – life on earth column**

**Dinosaurs are out – end of Mesozoic**

**Mammals in – beginning of Cenozoic**

41. The geologic cross section below represents the fossil remains present in several rock layers in the Earth's crust. [If a fossil symbol is not shown in a rock layer, the plant or animal did not exist when the rock layer was formed.]



Based on this diagram and the *Earth Science Reference Tables*, during which geologic time did the faulting shown in the diagram take place.

- 1 Early Permian Period
- 2 Late Cambrian Period
- 3 **Late Jurassic Period**
- 4 Early Tertiary Period (Paleocene Epoch)

**Geologic History Reference Tables – life on earth column**

**Since dinosaurs exist above and below the fault, the fault must have happened during the Mesozoic Era. The Jurassic is the only period that occurs then.**