3. Radioactive decay occurs as a radioactive isotope breaks down into a stable isotope. This happens as the isotope loses an electron and a neutron becomes a proton.
4. Radioactive decay occurs at a constant rate. By determining the ratio between the parent material and the daughter material in an object, scientists can determine how old an object is.
5. potassium-argon, uranium-lead, strontium-rubidium, and carbon-14
6. One-eighth of the parent material will be left. After one half-life, 1/2 of the sample is left. After two half-lives, 1/4 of the sample is left. After three half-lives, 1/8 of the sample is left.
7. If decay rates were inconsistent, scientists would not have a specific half-life number to compare with an object's ratio of parent material to daughter material. Therefore, a precise age could never be determined.
8. Carbon-14 would be the best method to date artifacts from Effigy Mounds. This is because carbon-14 has a relatively short half-life of 5,730 years.

SECTION: LOOKING AT FOSSILS

1. mold
2. Index fossils
3. D
4. Three types of trace fossils are tracks, burrows, and coprolites.
5. Because index fossils are organisms that lived during a relatively short, well-defined time span and are found in rock layers throughout the world, index fossils can be used to obtain relative dates for rock layers.
6. The fossil record is incomplete because most organisms, such as organisms with soft body parts, did not become fossils, and many fossils have yet to be discovered.
7. Scientists can examine fossils of plants and animals in different rock layers to see how these organisms or their environment have changed over time.
8. Scientists can infer that the plant existed sometime between 400 million to 230 million years ago.
9. Answers may vary. The desert was once an aquatic environment, such as an ocean, lake, or stream.
10. Scientists know more about organisms that had hard body parts than organisms that had soft body parts. Scientists also know more about organisms that lived in environments that favored fossilization than in environments that did not favor fossilization.

SECTION: TIME MARCHES ON

1. Sample answer: Eras are divisions of geologic time that are divided into periods, and periods are units of geologic time that are divided into epochs.
2. B
3. The major time intervals represented by the geologic time scale are eons, eras, periods, and epochs.
4. Geologic time is recorded in rock layers by the differences in the fossils they contain.
5. Environmental changes that cause mass extinctions include global climate change, changes in ocean currents, and possible asteroid strikes.
6. Answers may vary. Sample answer: a major change in the Earth's climate
7. A decrease in the competition between species allows species to move into new parts of the environment and to adapt to use new resources.
8. 25×6.4 million years = 160 million years; 7×6.4 million years = 44.8 million years; 160 – 44.8 million years = 115.2 million years

Chapter Review

1. Sample answer: Superposition is the principle that states that younger rocks lie above older rocks in undisturbed sequences. The geologic column is an ideal sequence of rock layers that contains all the known fossil and rock layers on Earth, arranged from oldest to youngest. The geologic time scale is a scale that divides Earth's 4.6 billion year history into distinct intervals of time.

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. 2. Sample answer: Uniformitarianism is the theory that gradual geologic processes that we observe in the present were also active in the past. This theory argues that slow gradual change shapes the Earth. Catastrophism is the theory that past episodes of sudden and drastic change are responsible for the major geologic features that change the Earth.
3. Sample answer: Relative dating is a method of comparing rocks or fossils to each other to determine which ones are older. Absolute dating is a method of determining the age of something in years.
4. Sample answer: A trace fossil is any naturally preserved evidence of animal activity. And index fossil is a fossil of an organism that lived during a relatively short, well-defined geologic time span that is used to establish the age of rock layers.
5. D
6. B
7. D
8. C
9. B
10. C
11. C
12. A
13. Sample answer: Fossils are formed by the process of petrifaction, in which minerals replace an organism's tissue. Fossils are formed when organisms become trapped in hardened tree sap, or amber. Fossils are formed by sediment that slows decay.
14. Uniformitarianism is the guiding principle in Earth science. The same geologic processes shaping the Earth today have been at work throughout Earth's history.
15. Radioactive decay occurs as an unstable isotope breaks down into a stable isotope. This happens as the isotope loses an electron and a neutron becomes a proton.
16. Paleontologists use fossils to reconstruct past climates and to determine water depth in the oceans.
17. Paleontologists piece together the history of life on Earth using fossils as their data.
18. An answer to this exercise can be found at the end of the Teacher Edition
19. Changes in environmental conditions can change or eliminate a species' habitat, so a species cannot meet its basic needs. Both global climate changes and changes in ocean currents can cause the extinction of species.
20. Hard-bodied organisms are more easily preserved, so more of these organisms have been studied.
21. The tree is not made of wood because the wood tissue in the tree was completely replaced by minerals.
22. younger
23. an angular unconformity
24. Intrusion A is younger than fault 10 because the intrusion is not disturbed by the fault.
25. folding; Folding occurred, and then the fault occurred. After erosion and deposition of layers X and Y, the intrusion occurred.

Reinforcement

WELCOME TO THE GEOLOGY ROCKS CAFÉ

a. rye bread
b. pickles
c. tomatoes
d. provolone cheese
e. turkey
f. mustard
g. sourdough bread
h. onions
i. lettuce
j. Cheddar cheese
k. ham
l. mustard
m. sourdough bread
n. relish
o. provolone cheese
p. turkey
q. mayonnaise
r. sourdough bread
s. pickles
t. tomatoes
u. lettuce
v. ham
w. mustard
x. rye bread

Dessert bonus: disconformity

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