9-7 What is the geologic time scale?

Objective ▸ Describe and read the geologic time scale.

TechTerm

▸ **geologic** (jee-uh-LAJ-ik) **time scale:** outline of the major events in the earth's history

Age of the Earth Scientists use radioactive dating to help them find the ages of rocks found on the earth and the moon. The oldest rocks found on the earth are about 4 billion years old. Moon rocks are older. Scientists think the earth and moon were formed at about the same time. Using the age of the moon and earth rocks, scientists estimate that the earth may be more than 4.6 billion years old.

Describe: About how old is the earth?

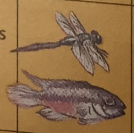
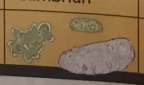
Geologic Time Scale By making many observations of rocks and fossils, geologists have developed a **geologic** (jee-uh-LAJ-ik) **time scale.** The geologic time scale is an outline of the major events in the earth's history. The time scale also outlines the kinds of organisms that lived on the earth in the past. The geologic time scale begins when the earth was formed and goes on until the present.

Describe: What is the geologic time scale?

Divisions of Geologic Time How is a year divided? It is divided into units called months, weeks, and days. Geologic time also is divided into units. The largest unit is an era. Each era lasted for millions of years. There are four eras in geologic time. The eras are divided into periods. The more recent periods are divided into epochs (EP-uks). The divisions of geologic time are based on changes that occurred on the earth.

Name: What are the divisions of geologic time?

Table 1 Geologic Time Scale

ERA	PERIOD	EPOCH	START DATE (MILLIONS OF YEARS AGO)	ORGANISMS
Cenozoic	Quaternary	Recent	0.025	Modern Humans
		Pleistocene	1.75	Mammoths
	Tertiary	Pliocene	14	Large carnivores
		Miocene	26	Many land mammals
		Oligocene	40	Primitive apes
		Eocene	55	Early horses
		Paleocene	65	Primates
Mesozoic	Cretaceous		130	Flowering plants
	Jurassic		180	Dinosaurs, birds
	Triassic		225	Conifers
Paleozoic	Permian		275	Seed Plants
	Carboniferous		345	Reptiles
	Devonian		405	Insects, amphibians
	Silurian		435	Fishes
	Ordovician		480	Algae, fungi
	Cambrian		600	Invertebrates
Precambrian			4,600	Bacteria, blue-green algae

LESSON SUMMARY

- Scientists estimate that the earth is more than 4.6 billion years old.
- The geologic time scale is a record of the major events and living things in the earth's history.
- The divisions of geologic time are eras, periods, and epochs.

CHECK *Complete the following.*

1. How many geologic eras make up the geologic time scale?
2. What is the age of the oldest earth rocks ever found?
3. List two things that the geologic time scale outlines.
4. What is the largest unit of geologic time?

APPLY *Complete the following.*

5. **Infer:** Why do you think only the most recent period is divided into epochs?
6. **Hypothesize:** If the oldest earth rocks are only 4.1 billion years old, why do scientists think the earth is 4.6 billion years old?

InfoSearch

Read the passage. Ask two questions about the topic that you cannot answer from the information in the passage.

Dinosaurs The dinosaurs lived during the Mesozoic (mes-uh-ZOH-ik) Era. They first appeared during the Triassic (try-AS-ik) Period. You probably think of dinosaurs as giant animals. Actually, some dinosaurs were small. The smallest dinosaur was less than 1 m tall. The largest dinosaur was more than 30 m tall. Some dinosaurs that you may know about are *Apatosaurus* and *Stegosaurus*. *Apatosaurus* was about 25 m long. It weighed about 50 tons. *Stegosaurus* was about 9 m long. Probably the most famous dinosaur was *Tyrannosaurus rex*. It was more than 6 m tall.

SEARCH: Use library references to find answers to your questions.

ACTIVITY

MAKING A MODEL OF GEOLOGIC TIME

You will need 5 meters of adding machine tape, a metric ruler, and a pencil.

1. Use the adding machine tape to make a time line. Each centimeter equals 10 million years.
2. Calculate the length of each era in centimeters for the time line. Draw a line across the tape to show where each era begins.
3. Mark each of these events on your time line.

Questions

1. During which era did the first birds appear?
2. During which era did the first reptile appear?
3. During which era was the last ice age?
4. During which era did the age of dinosaurs begin?
5. During which era did the first humanlike animals appear?

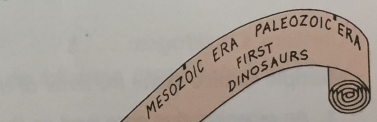


Table 2 Events in Geologic Time

EVENT	YEARS AGO
Precambrian Era	4,600,000,000
First fossils	3,500,000,000
First primitive fish	500,000,000
Paleozoic Era	375,000,000
First reptile	290,000,000
Age of dinosaurs starts	225,000,000
First mammals	200,000,000
Mesozoic Era	160,000,000
First birds appear	160,000,000
Cenozoic Era	65,000,000
First humanlike animal	1,000,000
Last ice age	10,000

UNIT 9 Challenges

STUDY HINT Before you begin the Unit Challenges, review the TechTerms and Lesson Summary for each lesson in this unit.

TechTerms

absolute age (176)
amber (168)
cast (166)
fossil (166)
fossil fuels (170)
geologic time scale (178)
half-life (176)
index fossil (174)
mold (166)
relative age (174)

TechTerm Challenges

Matching *Write the TechTerm that best matches each description.*

1. outline of the major events in the earth's history
2. cavity in a rock that has the shape of an extinct organism
3. length of time it takes for one-half of a radioactive element to change into another element
4. specific age of a rock or fossil
5. age of an object compared to the age of another object

Fill-in *Write the TechTerm that best completes each statement.*

1. Oil, coal, and natural gas are three kinds of _____ .
2. A mold that has filled with sediments forms a _____ .
3. The bodies of entire insects have been found preserved in hardened tree sap called _____ .
4. The traces or remains of living things that lived long ago are called _____ .
5. A trilobite can be used as an _____ .

Content Challenges

Multiple Choice *Write the letter of the term that best completes each statement.*

1. An organism that once lived on the earth, but is no longer found alive is
   a. a fossil. **b.** an imprint. **c.** a cast. **d.** extinct.
2. Most fossils are found in
   a. metamorphic rock. **b.** sedimentary rock. **c.** mud. **d.** igneous rock.
3. Footprints are a kind of fossil called
   a. a mold. **b.** a cast. **c.** an imprint. **d.** an amber.
4. The bodies of wooly mammoths and furry rhinoceroses have been found preserved in
   a. amber. **b.** sedimentary rocks. **c.** ice. **d.** petrified forests.
5. Three ways in which the entire bodies of organisms are preserved are
   a. ice, tar, and amber. **b.** ice, molds, and casts. **c.** tar, molds, and casts. **d.** molds, petrified wood, and amber.
6. Graptolites and trilobites are two kinds of
   a. radioactive elements. **b.** molds. **c.** casts . **d.** index fossils.
7. Fossil fuels are made up mostly of
   a. hydrogen and carbon. **b.** hydrogen and oxygen . **c.** oxygen and carbon. **d.** carbon and nitrogen.

8. Peat is the first stage in the formation of
   a. natural gas. **b.** tar. **c.** coal. **d.** petroleum.
9. The law of superposition states that each rock layer is older than the one
   a. beside it. **b.** above it. **c.** below it. **d.** to its left.
10. The decay element of uranium is
    a. lead. **b.** nitrogen. **c.** carbon. **d.** carbon-14.
11. Uranium has a half-life of
    a. 45 billion years. **b.** 4.5 billion years. **c.** 50,000 years. **d.** 5800 years.

True/False *Write true if the statement is true. If the statement is false, change the underlined term to make the statement true.*

1. Imprints usually are formed from the hard parts of organisms.
2. Elephantlike animals called saber-toothed cats have been discovered preserved in ice.
3. The LaBrea Tar Pits are located in southern California.
4. The bodies of entire insects have been found preserved in amber.
5. When fossil fuels are burned, they give off energy in the forms of heat and electricity.
6. Fossil fuels are formed when bacteria, heat, and pressure act upon decaying plants and animals.
7. Fossils of alligatorlike animals found in Canada indicate that the climate of Canada was always cold.
8. The horses that lived long ago were larger than those that live today.
9. Horses that lived long ago had more toes than horses that live today.
10. Scientists use the law of superposition to tell the absolute age of rocks and fossils.

Understanding the Features

Reading Critically *Use the feature reading selections to answer the following. Page numbers for the features are shown in parentheses.*

1. **Infer:** What tools are helpful to a fossil collector? Why? (169)
2. How could you find out more information about a career as a mine inspector? (171)
3. What kind of scientist was Mary Leakey? (173)
4. Why did the Leakeys name the humanlike fossil they found "Handyman"? (173)
5. How are lasers used in earth science? (177)

Concept Challenges

Critical Thinking *Answer each of the following in complete sentences.*

1. **Infer:** Suppose you find fossils of clams in rock high on a mountain. What can you infer about the mountain?
2. During which period of geologic time are you living?
3. Why is carbon-14 not useful for dating rocks that are more than 50,000 years old?
4. **Analyze:** What method would you use to date a sedimentary rock that you think is about 1 million years old? Why?
5. **Infer:** Suppose you discovered a clam fossil in a layer of rock that also contained trilobite fossils. What inferences could you make from this discovery?