

Chapter 17

The History of Life

Section 17–1 The Fossil Record (pages 417–422)

This section explains how fossils form and how they can be interpreted. It also describes the geologic time scale that is used to represent evolutionary time.

Fossils and Ancient Life (page 417)

1. Scientists who study fossils are called _____.
2. What is the fossil record? _____

3. What evidence does the fossil record provide? _____

4. Species that died out are said to be _____.
5. Is the following sentence true or false? About half of all species that have ever lived on Earth have become extinct. _____

How Fossils Form (page 418)

6. Circle the letter of each sentence that is true about fossils.
 - a. Most organisms that die are preserved as fossils.
 - b. Fossils can include footprints, eggs, or other traces of organisms.
 - c. Most fossils form in metamorphic rock.
 - d. The quality of fossil preservation varies.
7. How do fossils form in sedimentary rock? _____

Interpreting Fossil Evidence (pages 418–420)

8. List the two techniques paleontologists use to determine the age of fossils.
 - a. _____
 - b. _____
9. Circle the letter of each sentence that is true about relative dating.
 - a. It determines the age of a fossil by comparing its placement with that of fossils in other layers of rock.
 - b. It uses index fossils.
 - c. It allows paleontologists to estimate a fossil’s age in years.
 - d. It provides no information about absolute age.

10. Is the following sentence true or false? Older rock layers are usually closer to Earth's surface than more recent rock layers.

11. Is the following sentence true or false? Scientists use radioactive decay to assign absolute ages to rocks. _____
12. The length of time required for half of the radioactive atoms in a sample to decay is called a(an) _____.
13. The use of half-lives to determine the age of a sample is called _____.
14. How do scientists calculate the age of a sample using radioactive dating? _____

15. Is the following sentence true or false? All radioactive elements have the same half-life. _____

Geologic Time Scale (pages 421–422)

16. Fill in the missing eras and periods in the geologic time scale below.

GEOLOGIC TIME SCALE

Era			Paleozoic										
Period	Quaternary		Cretaceous		Triassic		Permian		Devonian		Ordovician		Vendian
Time (millions of years ago)	1.8 – present	65 – 1.8	145 – 65	208 – 145	245 – 208	290 – 245	363 – 290	410 – 363	440 – 410	505 – 440	544 – 505	650 – 544	

17. Circle the letter of the choice that lists the eras of the geologic time scale in order from most recent to oldest.
 - a. Mesozoic, Paleozoic, Cenozoic c. Cenozoic, Mesozoic, Paleozoic
 - b. Cenozoic, Paleozoic, Mesozoic d. Paleozoic, Mesozoic, Cenozoic

Chapter 17, The History of Life *(continued)*

18. Circle the letter of each sentence that is true about the geologic time scale.
- The scale is used to represent evolutionary time.
 - Major changes in fossil organisms separate segments of geologic time.
 - Divisions of the scale cover standard lengths of 100 million years.
 - Geologic time begins with the Cambrian Period.

Section 17-2 Earth's Early History **(pages 423–428)**

This section explains how Earth formed. It also outlines hypotheses that have been proposed for how life first arose on Earth and describes some of the main evolutionary steps in the early evolution of life.

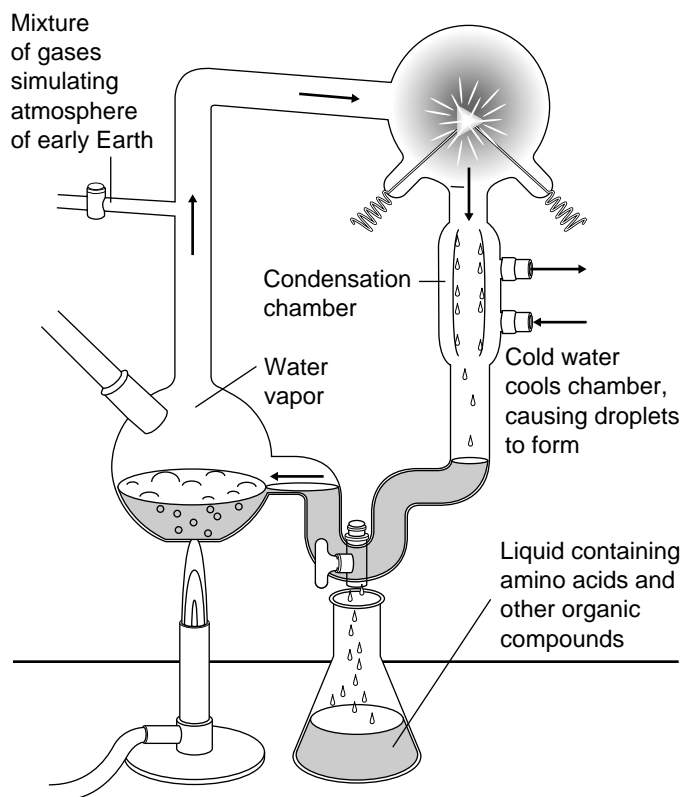
Formation of Earth **(pages 423–424)**

- List the six components of Earth's early atmosphere.

a. _____	c. _____	e. _____
b. _____	d. _____	f. _____
- Is the following sentence true or false? Liquid water first occurred on Earth more than 4 billion years ago. _____

The First Organic Molecules **(page 424)**

- Label the diagram to show which part of Miller and Urey's apparatus simulated lightning storms on early Earth.



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4. Circle the letter of each sentence that is true about Miller and Urey's experiments.
- a. Their purpose was to determine how the first organic molecules evolved.
 - b. They led to the formation of several amino acids.
 - c. They accurately simulated conditions in Earth's early atmosphere.
 - d. The results were never duplicated in experiments by other scientists.

How Did Life Begin? (page 425)

5. What are proteinoid microspheres? _____

6. Is the following sentence true or false? Scientists know how DNA and RNA evolved. _____
7. Why do scientists think that RNA may have evolved before DNA? _____

8. Is the following sentence true or false? Under certain conditions, small sequences of RNA could have formed and replicated on their own. _____

Free Oxygen (page 426)

9. Microscopic fossils are called _____.
10. Circle the letter of each sentence that is true about the earliest life forms on Earth.
- a. They resembled modern bacteria.
 - b. They were eukaryotes.
 - c. They relied on oxygen.
 - d. They were not preserved as fossils.
11. How did early photosynthetic bacteria change Earth? _____

12. Is the following sentence true or false? The rise of oxygen in the atmosphere drove some life forms to extinction.

Origin of Eukaryotic Cells (pages 427–428)

13. Is the following sentence true or false? The ancestor of all eukaryotic cells evolved about 2 billion years ago.

Chapter 17, The History of Life *(continued)*

14. What was the first step in the evolution of eukaryotic cells? _____

15. What does the endosymbiotic theory propose? _____

16. Circle the letter of each choice that provides support for the endosymbiotic theory.
- a. The membranes of mitochondria and chloroplasts resemble the plasma membranes of free-living prokaryotes.
 - b. Mitochondria and chloroplasts do not have DNA.
 - c. Mitochondria and chloroplasts have ribosomes that are similar in size and structure to those of bacteria.
 - d. Mitochondria and chloroplasts reproduce by binary fission as bacteria do.

Sexual Reproduction and Multicellularity *(page 428)*

17. How did sexual reproduction speed up the evolutionary process? _____

18. Is the following sentence true or false? Sexual reproduction evolved after the first multicellular organisms appeared.

Reading Skill Practice

When you read a section that contains new or difficult material, identifying the sentence that best expresses the main topic under each heading can help you focus on the most important points. For each heading in Section 17–2, identify and copy the sentence that best expresses the main topic under that heading. Do your work on a separate sheet of paper.

Section 17–3 Evolution of Multicellular Life *(pages 429–434)*

This section describes how multicellular life evolved from its earliest forms to its present-day diversity.

Precambrian Time *(page 429)*

1. Is the following sentence true or false? Almost 90 percent of Earth’s history occurred during the Precambrian. _____

2. Circle the letter of each sentence that is true about life in the Precambrian.
 - a. Anaerobic and photosynthetic forms of life appeared.
 - b. Aerobic forms of life evolved, and eukaryotes appeared.
 - c. Multicellular life forms evolved.
 - d. Life existed on the land and in the sea.
3. Why do few fossils exist from the Precambrian? _____

Paleozoic Era (pages 429–431)

4. The first part of the Paleozoic Era is the _____ Period.
5. Is the following sentence true or false? Life was not very diverse during the Cambrian Period. _____
6. Circle the letter of each sentence that is true about the Cambrian Period.
 - a. Organisms with hard parts first appeared.
 - b. Most animal phyla first evolved.
 - c. Many animals lived on the land.
 - d. Brachiopods and trilobites were common.

Match the periods of the Paleozoic Era with the evolutionary events that occurred during them.

Periods	Events
_____ 7. Ordovician and Silurian	a. Reptiles evolved from amphibians, and winged insects evolved into many forms.
_____ 8. Devonian	b. The first vertebrates evolved, and insects first appeared.
_____ 9. Carboniferous and Permian	c. Many groups of fishes were present in the oceans, and the first amphibians evolved.

10. Animals first begin to invade the land during the _____ Period.
11. Where does the Carboniferous Period get its name? _____

12. When many types of living things become extinct at the same time, it is called a(an) _____.
13. Is the following sentence true or false? The mass extinction at the end of the Paleozoic affected only land animals.

Chapter 17, The History of Life *(continued)*

Mesozoic Era (pages 431–432)

14. Complete the compare-and-contrast table.

PERIODS OF THE MESOZOIC ERA

Period	Evolutionary Event
	First mammals
	First birds
	First flowering plants

15. The Mesozoic Era is called the Age of _____.

16. The first dinosaurs appeared in the _____ Period.

17. Is the following sentence true or false? The mammals of the Triassic Period were very small. _____

18. Is the following sentence true or false? Many paleontologists now think that dinosaurs are close relatives of birds.

19. The dominant vertebrates throughout the Cretaceous Period were _____.

20. What advantage do flowering plants have over conifers? _____

21. Describe the mass extinction that occurred at the end of the Cretaceous Period. _____

Cenozoic Era (pages 433–434)

22. Is the following sentence true or false? During the Cenozoic Era, mammals evolved adaptations that allowed them to live on land, in water, and in the air. _____

23. The Cenozoic Era is called the Age of _____.

24. What were Earth’s climates like during the Tertiary Period? _____

25. How did Earth’s climate change during the Quaternary Period? _____

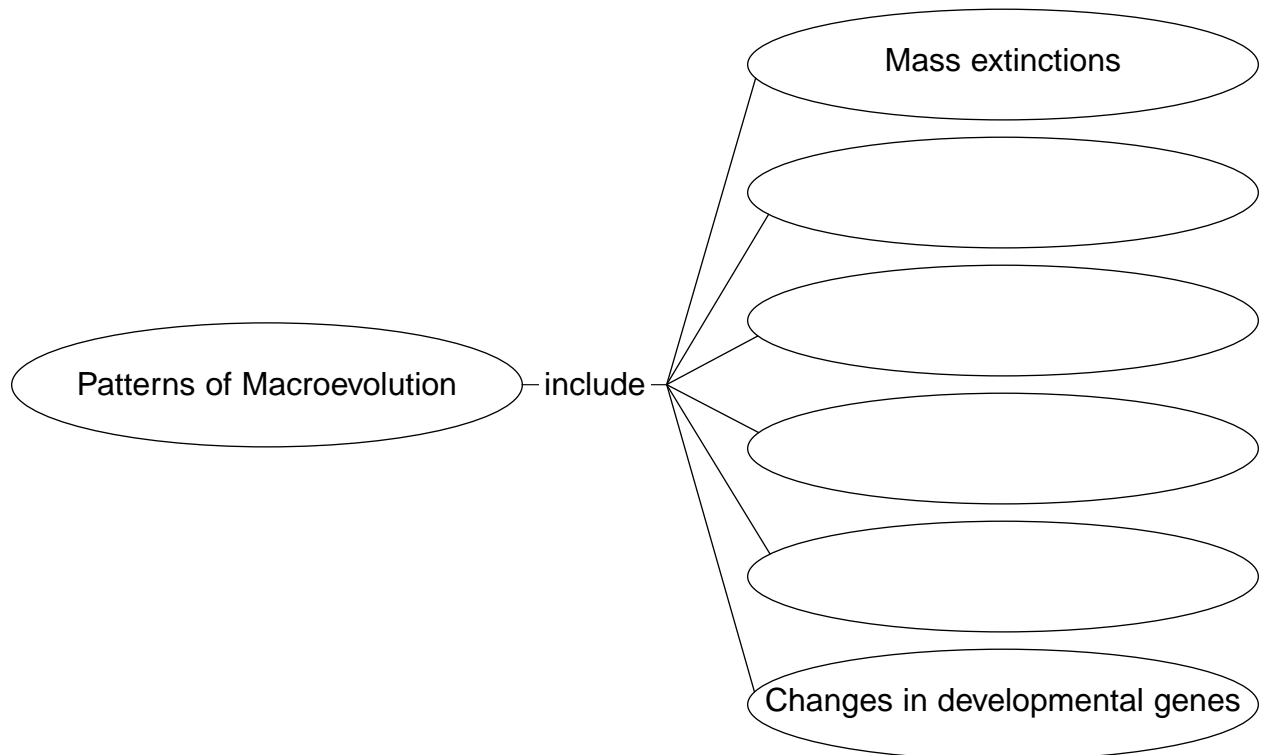
26. Is the following sentence true or false? The very earliest ancestors of our species appeared about 100,000 years ago. _____

Section 17–4 Patterns of Evolution (pages 435–440)

This section describes six important patterns of large-scale, long-term evolutionary change.

Introduction (page 435)

1. The large-scale evolutionary changes that take place over long periods of time are referred to as _____.
2. Complete the concept map.



Mass Extinctions (page 435)

3. What are possible causes of mass extinctions? _____

4. What effects have mass extinctions had on the history of life? _____

Adaptive Radiation (page 436)

5. The process of a single species or a small group of species evolving into several different forms that live in different ways is called _____.

Chapter 17, The History of Life (continued)

6. What led to the adaptive radiation of mammals? _____

Convergent Evolution (pages 436–437)

7. The process by which unrelated organisms come to resemble one another is called _____.
8. Circle the letter of each choice that is an example of convergent evolution.
- a. Bird’s wing and fish’s fin
 - b. Shark’s fin and dolphin’s limb
 - c. Human’s arm and bird’s wing
 - d. Human’s leg and dolphin’s limb

Coevolution (pages 437–438)

9. The process by which two species evolve in response to changes in each other over time is called _____.
10. How have plants and plant-eating insects coevolved? _____

Punctuated Equilibrium (page 439)

11. The idea that evolution occurs at a slow, steady rate is called _____.
12. What are some reasons rapid evolution may occur after long periods of equilibrium? _____

13. The pattern of long, stable periods interrupted by brief periods of more rapid change is called _____.
14. Is the following sentence true or false? Evolution has often proceeded at different rates for different organisms.

Developmental Genes and Body Plans (page 440)

15. How can hox genes help reveal how evolution occurred? _____

16. Is the following sentence true or false? Changes in the timing of genetic control during embryonic development can contribute to the variation involved in natural selection. _____

WordWise

Match each definition in the left column with the correct term in the right column. Then, write the number of each term in the box below on the line under the appropriate letter. When you have filled in all the boxes, add up the numbers in each column, row, and two diagonals. All the sums should be the same.

Definition

- A. Scientist who studies fossils
- B. Term used to refer to a species that has ceased to exist
- C. Process by which a single species evolves into many different forms
- D. Microscopic fossil
- E. Unit of time into which eras are subdivided
- F. Length of time required for half of the radioactive atoms in a sample to decay
- G. Method of determining the age of a fossil by comparing its placement with that of fossils in other layers of rock
- H. Pattern of evolution in which long stable periods are interrupted by brief periods of more rapid change
- I. One of several subdivisions of the time between the Precambrian and the present

Term

- 1. extinct
- 2. relative dating
- 3. half-life
- 4. era
- 5. period
- 6. paleontologist
- 7. microfossil
- 8. adaptive radiation
- 9. punctuated equilibrium

A _____	B _____	C _____	= _____
D _____	E _____	F _____	= _____
G _____	H _____	I _____	= _____
= _____	= _____	= _____	= _____

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