Answer key

Directed Reading A

SECTION: CHANGE OVER TIME

1. differences
2. B
3. C
4. species
5. population
6. species
7. change
8. characteristics
9. New species form.
10. evolution
11. A
12. D
13. A dead organism is covered by a layer of sediment. Over time, the organism is completely covered. Minerals in the sediment may gradually replace the organism with stone or the organism may leave an imprint on the surrounding rock.
14. the fossil record
15. by the fossils' ages and physical similarities
16. organisms
17. less likely
18. exist
19. B
20. A
21. hypotheses
22. by a branch
23. Answers may vary and may include any two of these: camels, llamas, pigs, peccaries, hoofed grazing animals, and hippopotamuses.
24. ancestors
25. tree of life
26. that their knowledge is not complete
27. by examining living organisms
28. Whales breathe air, give birth to live young, and produce milk.
29. tiny hip bones
30. B
31. B
32. D
33. C
34. A

SECTION: HOW DOES EVOLUTION HAPPEN?

1. Scientists learned that Earth is much older than previously thought, gradual processes have changed Earth's surface, and that Earth had a fossil record.
2. A
3. B
4. GalE1pagos Islands
5. Their beaks were different.
6. obtaining food
7. D
8. C
9. The finches were descended from South American finches blown to the islands by a storm. Over many generations, the finches adapted to life on the island.
10. He spent several years analyzing evidence and gathering other people's ideas.
11. C
12. A
13. B
14. to produce plants and animals with desired traits
15. to produce stronger or quicker horses
16. to produce larger fruit
17. offspring
18. competition
19. survive
20. evolve
21. that the Earth was old enough to allow for slow changes
22. *On the Origin of Species by Means of Natural Selection*
23. natural selection
24. C
25. A
26. B
27. D
28. how organisms inherit traits, or why organisms show so much variation
29. genes
30. offspring
31. selection

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SECTION: NATURAL SELECTION IN ACTION

1. A
2. B
3. C
4. C
5. Because people hunt elephants for their tusks and tuskless elephants are not hunted, tuskless elephants are more likely to survive to reproduce.
6. A few insects in the population are resistant to the chemical.
7. generation time
8. generation time
9. colorful
10. because colorful males are more likely to pass on their genes to the next generation
11. D
12. A
13. B
14. C
15. separation
16. traits
17. adaptations
18. species

Directed Reading B

SECTION: CHANGE OVER TIME

1. B
2. A
3. C
4. D
5. B
6. B
7. A
8. C
9. A
10. D
11. C
12. B
13. B
14. C
15. A
16. A
17. C
18. A
19. C
20. B
21. ancestors
22. mammals
23. land
24. water
25. limbs
26. B
27. D
28. A
29. B
30. A

SECTION: HOW DOES EVOLUTION HAPPEN?

1. D
2. A
3. B
4. B
5. C
6. B
7. C
8. A
9. C
10. D
11. A
12. B
13. A
14. populations
15. limited
16. inherit
17. evolve
18. old
19. long
20. older
21. D
22. C
23. D
24. B
25. C
26. A
27. B
28. A
29. C

SECTION: NATURAL SELECTION IN ACTION

1. A
2. C
3. B
4. C
5. A
6. D
7. B
8. genes
9. offspring
10. insecticide
11. resistant
12. B
13. speciation
14. separated
15. adaptations
16. C
17. A

Vocabulary and Section Summary

SECTION: CHANGE OVER TIME

1. adaptation: a characteristic that improves an individual's ability to survive and reproduce in a particular environment
2. species: a group of organisms that are closely related and can mate to produce fertile offspring
3. evolution: the process in which inherited characteristics within a population change over generations such that new species sometimes arise
4. fossil: the trace remains of an organism that lived long ago, most commonly preserved in sedimentary rock
5. fossil record: a historical sequence of life indicated by fossils found in layers of the Earth's crust

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ANSWER KEY

SECTION: HOW DOES EVOLUTION HAPPEN?

1. trait: a genetically determined characteristic
2. selective breeding: the human practice of breeding animals or plants that have certain desired traits
3. natural selection: the process by which individuals that are better adapted to their environment survive and reproduce more successfully than less well adapted individuals do; a theory to explain the mechanism of evolution

SECTION: NATURAL SELECTION IN ACTION

1. generation time: the period between the birth of one generation and the birth of the next generation
2. speciation: the formation of new species as a result of evolution

Section Review

SECTION: CHANGE OVER TIME

1. species
2. adaptation
3. evolution
4. A
5. Sample answer: Fossils of types of organisms that no longer exist are found. These fossils form a sequence of change and adaptation of populations of organisms over time.
6. Sample answer: There are fossils of four-legged land mammals that share some characteristics with modern whales and other hooved mammals. Also, there is a sequence of fossil organisms that have characteristics in between those of the ancient fossils and modern whales.
7. Sample answer: Whales breathe air with lungs (not gills) and breath through a spout that is like a nasal passage. Whales swim in an up-and-down "galloping" motion, as otters (not side to side like fish do).
8. Sample answer: A person's DNA is likely to be most similar to that of his or her biological parents, because the parents are most closely related to the person by birth.
9. Layer c; that layer is under layer b, so layer c was probably deposited earlier than layer b and is thus older.

SECTION: HOW DOES EVOLUTION HAPPEN?

1. Sample answer: A trait is a form of an inherited characteristic.
2. Sample answer: Selective breeding happens when humans choose which organisms will reproduce, and natural selection happens when the environment "chooses".
3. D
4. Darwin observed that many of the species of the GalE1pagos Islands were similar to those of South America but had unique adaptations.
5. From Malthus, Darwin developed the idea that populations are limited by food and other problems. From Lyell, Darwin developed the idea that conditions on Earth could change slowly over long periods of time.
6. Sample answer: *Overproduction* means that every organism can produce more offspring than will likely survive; *inherited variation* means that all offspring will have some differences; *struggle to survive* means the offspring have to compete with each other and with other organisms around them; and *successful reproduction* means those that are best adapted will probably have more offspring like themselves.
7. Sample answer: Darwin lacked the knowledge of genetics that helps explain how organisms inherit traits and why there is so much variety in organisms.
8. $\{ (50 \times 4) + [(80 - 50) \times 6]\} \div 80 =$ 4.75 spots average per beetle
9. Sample answer: natural forces and other organisms
10. Sample answer: Species on the island might evolve in a way similar to those of the GalE1pagos Islands.

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SECTION: NATURAL SELECTION IN ACTION

1. Sample answer: Speciation is one species evolving into two.
2. C
3. Sample answer: The number of tuskless elephants is increasing because hunters are killing off the elephants with tusks before they can breed.
4. 128 cockroaches Calculations:
   First generation:
   80 cockroaches
   Second generation:
   (80 ÷ 2) x 80 = 3,200 cockroaches
   Third generation:
   (3,200 ÷ 2) x 80 = 128,000 cockroaches
5. Sample answer: Cactuses evolved from plants that had adaptations to dry conditions, such as spiny leaves or thick stems.
6. Sample answer: Rodents might adapt to eating our garbage.

Chapter Review

1. speciation
2. natural selection
3. species
4. fossil record
5. selective breeding
6. adaptation
7. generation time
8. A
9. B
10. B
11. C
12. Sample answer: Living organisms can be compared in terms of body structures with other living organisms and with organisms from the fossil record. Also, the DNA of living organisms can be compared.
13. Sample answer: Whales share many internal similarities with hoofed land mammals. Ancient fossils of four-legged land mammals exist from times when whales did not exist, but some of these fossils shared characteristics with modern whales and other hoofed mammals. A sequence of fossil organisms show how the characteristics of modern whales could have evolved from those of ancient mammals.
14. Sample answer: Those animals that are better adapted to the conditions of their environment, including the condition competition with other organisms, are more likely to survive to adulthood.
15. Sample answer: Genetics provides a tool with which to analyze and explain what happens inside of cells as organisms evolve.
16. Answers may vary. Student answers may resemble the description of the speciation of the GalE1pagos finches given in the student text.
17. An answer to this exercise can be found at the end of the Teacher Edition.
18. Sample answer: A bird's song could be an advantage if the song helps the bird find mates or food, but the song could be a disadvantage if it attracts predators. So, natural selection would mean that birds whose songs were not an advantage might not survive, and songs would evolve that gave birds some kind of advantage.
19. Sample answer: Australia is an island, so the marsupials there could have evolved separately from other mammals around the world.
20. Sample answer: As the continents drifted apart, populations of species would have been separated and may have had to adapt to new environmental conditions. The separated populations would likely have evolved into separate species over time.
21. about 7 lb
22. about 7 lb
23. Sample answer: The infants who are best adapted to survive birth are those that weigh about 7 lb at birth.

Reinforcement

BICENTENNIAL CELEBRATION

Answers may vary. Sample answer:
The Secret of the GalE1pagos Finches—In 1831, Charles Darwin, a natural scientist, traveled around the world on the H.M.S. *Beagle.* On the GalE1pagos Islands, 965 km off the coast of Ecuador, Darwin discovered his finches. The GalE1pagos finches are similar to those found in South

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America, but they are distinguished by the shape of their beaks and the food they eat. Darwin theorized that the finches originally came from the mainland but, over many generations, adapted to the different ways the finches obtain food in the environment of the GalE1pagos Islands. Darwin thought that populations of organisms change slowly over time by a process called natural selection. The four steps in natural selection are overproduction, inherited variation, the struggle to survive, and successful reproduction. During overproduction, organisms produce more offspring than can survive. Some of the offspring have different traits from each other, and this is inherited variation. During the struggle to survive, organisms with certain traits are more likely to survive. The organisms that survive pass on those traits to their young through successful reproduction. Over many generations, the process of natural selection can create a new species.

Critical Thinking

TAKING THE EARTH'S PULSE

1. Answers may vary. Sample answer: According to Darwinian theory, evolution occurs continuously as animals compete for resources, but the fossil record suggests that speciations and extinctions occur in pulses.
2. Answers may vary. Sample answer: Sample answer: The dim pulses represent the appearance of a few species, and the brighter pulses represent the appearance of many species.
3. Answers may vary. Environmental forces that change the climate, the landscape, or the availability of food might increase competition between organisms.
4. Answers may vary. Answers must be supported by knowledge of the fossil record, current environmental trends, or recently discovered species.
5. Answers may vary. The symbols that students choose should fit together in a logical and consistent manner

Section Quizzes

SECTION: CHANGE OVER TIME

1. C
2. A
3. D
4. E
5. F
6. B
7. C
8. A

SECTION: HOW DOES EVOLUTION HAPPEN?

1. E
2. B
3. G
4. A
5. F
6. C
7. D
8. D
9. C

SECTION: NATURAL SELECTION IN ACTION

1. D
2. A
3. E
4. C
5. B
6. A
7. D

Chapter Test A

1. A
2. D
3. B
4. B
5. D
6. A
7. D
8. C
9. B
10. B
11. D
12. A
13. C
14. A
15. D
16. B
17. D
18. G
19. F
20. B
21. A
22. E
23. C

Chapter Test B

1. evolution
2. speciation
3. fossils
4. resistant
5. selective breeding
6. selection
7. A
8. D
9. B
10. D
11. D

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12. Answers may vary. Sample answer: Overproduction: Species produce more offspring than will survive to be adults. Inherited variation: Individuals in a population will differ in their traits. Struggle to survive: Individuals compete and many die. Successful reproduction: Individuals with the best adaptations are more likely to survive and reproduce.
13. Answers may vary. Sample answer: The fossil record is incomplete because specific conditions are required for fossils to form.
14. Answers may vary. Sample answer: By comparing the traits, skeletal structure, and DNA of modern organisms, scientists can determine which organisms have common ancestry and can obtain clues as to what those ancestors may have been like.
15. Answers may vary. Sample answer: Evidence for the evolution of whales from land-based mammals is provided by the existence of unused hip bones in modern whales, the fact that whales are mammals, and the existence of a large number of fossils.
16. Answers may vary. Sample answer: Natural selection is involved whenever species reproduce. The ability to attract a mate gives an individual a better chance to reproduce. Some species have intense competition among individuals for mates. This competition can result in instances where organisms that reproduce sexually select mates with certain adaptations.
17. Answers may vary. Sample answer: Evidence for common ancestry might be found in fossils; in similarities in the frogs' physical traits, such as skeletal structure; and the genetic information in the frogs' DNA.
18. Answers may vary. Sample answer: Whenever a population is attacked by a medication or insecticide, there are some surviving individuals. These individuals may have a gene that protects them from the drug or poison. They are likely to pass this protection on to their offspring. This will make future use of the drug or chemical less effective and possibly useless
19. **a**. fossils; **b**. ancient mammals; **c**. whales; **d**. DNA and traits; **e**. related; **f**. adaptations; **g**. separation; **h**. species

Chapter Test C

1. B
2. C
3. B
4. B
5. C
6. A
7. D
8. A
9. C
10. A
11. D
12. D
13. B
14. C
15. A
16. selective breeding
17. evolution
18. species
19. generation time
20. population
21. fossil record

Standardized Test Preparation

MULTIPLE CHOICE

1. A
2. B
3. C
4. A
5. B
6. D
7. B
8. C
9. A

OPEN RESPONSE

10. Full-credit answers should include the following points:
    - Genes determine the characteristics or traits of an organism.
    - Sometimes, an organism that has certain traits makes the organism more likely to survive.
    - The surviving organism reproduces.
    - The trait is passed on to offspring.
    - Over a very long period of time, the passing on of various successful genes may lead to evolution.

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11. Full-credit answers should include the following points:
    - A rough estimate of when an organism existed can be determined from the relative positions of fossils in rock layers.
    - The fossils can resemble each other, even if they are from different time periods.
    - Similarities are evidence of a possible evolutionary relationship between older organisms and more recent organisms.

Vocabulary Activity

1. species
2. speciation
3. trait
4. selective breeding
5. adaptation
6. natural selection
7. generation time
8. fossil
9. fossil record
10. evolution

SciLinks Activity

Answers may vary. Maps should show the major islands and should list some animals and plants found on each.

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