

## **CHAPTER 2 Evolution: Constructing a Fundamental Scientific Theory**

### **TRUE/FALSE**

1. Organisms classified in two different biological orders can still belong to the same genus.

ANS: F                      DIF: Easy                      REF: Page 35                      TOP: Context for Darwin (3)  
NOT: Factual

2. Before 1700, most Western scientists thought the earth was about 4.6 billion years old.

ANS: F                      DIF: Easy                      REF: Page 29                      TOP: Context for Darwin (3)  
NOT: Factual

3. Like most of his contemporaries, Charles Darwin believed that physical traits were passed down from each parent and then blended together in the offspring.

ANS: T                      DIF: Easy                      REF: Page 41  
TOP: Mechanisms of Inheritance (7)                      NOT: Factual

4. Genetic drift is most powerful as an evolutionary cause when operating on small populations.

ANS: T                      DIF: Easy                      REF: Page 47  
TOP: Evolutionary Forces and Synthesis (9)                      NOT: Factual

5. Thomas Henry Huxley was a fierce opponent of Darwin's theory of evolution by means of natural selection.

ANS: F                      DIF: Easy                      REF: Page 44  
TOP: What Happened since Darwin? (6)                      NOT: Factual

6. Mutation is the only source of new genetic material.

ANS: T                      DIF: Easy                      REF: Page 46  
TOP: Evolutionary Forces and Synthesis (9)                      NOT: Factual

7. Mendel's discrete units responsible for the characteristics in his pea plants are now known as chromosomes.

ANS: F                      DIF: Easy                      REF: Page 44  
TOP: Mendel's Discovery of Principles of Inheritance (7.b)                      NOT: Factual

8. Gene flow increases the number of genetic differences between populations.

ANS: F                      DIF: Easy                      REF: Page 46  
TOP: Evolutionary Forces and Synthesis (9)                      NOT: Factual

9. The combined efforts of Rosalind Franklin, James Watson, and Francis Crick helped explain how chromosomes are replicated.

ANS: T                      DIF: Easy                      REF: Page 48                      TOP: Structure of DNA (10.a)

NOT: Factual

10. Natural selection works on preexisting variation in a population.

ANS: T                      DIF: Medium                      REF: Page 46

TOP: Evolutionary Forces and Synthesis (9)                      NOT: Factual

### **MULTIPLE CHOICE**

1. Among the first scientists to conceive of evolutionary change was:
- Charles Darwin.
  - Georges Cuvier.
  - Erasmus Darwin.
  - Alfred Wallace.

ANS: C                      DIF: Easy                      REF: Page 38                      TOP: Context for Darwin (3)

NOT: Factual

2. Charles Darwin's book *On the Origin of Species* (1859) was considered an important contribution to modern science because:
- it coined the concept of evolution.
  - it synthesized information from diverse scientific fields in order to document evolutionary change.
  - it was immediately and widely accepted by the scientific community as the mechanism for evolutionary change.
  - none of the above

ANS: B                      DIF: Medium                      REF: Page 40

TOP: What Was Darwin's Contribution to the Theory of Evolution? (4)

NOT: Conceptual

3. Darwin's theory of evolution drew from all of the following scientific disciplines EXCEPT:
- demography.
  - geology.
  - genetics.
  - systematics.
  - paleontology.

ANS: C                      DIF: Easy                      REF: Page 41

TOP: What Was Darwin's Contribution to the Theory of Evolution? (4)

NOT: Factual

4. Why is the work of Alfred Russell Wallace considered when discussing the theory of evolution?
- He was an English naturalist who had arrived at many of the same conclusions as Darwin.
  - His work is not considered as he was mistakenly credited with the theory of natural selection.
  - Because he was a British dog-breeder who worked on artificial selection experiments.
  - Wallace was well-known and gathering even more evidence to support evolution

than Darwin.

ANS: A                      DIF: Easy                      REF: Page 40  
TOP: Darwin's Contemporaries and Competition: Wallace (5.d)  
NOT: Conceptual

5. The evolutionary synthesis:
- occurred in 1900 immediately after Mendel's work was rediscovered.
  - emphasized the important role of mutation and macromutation in evolutionary change.
  - emphasized theoretical differences between diverse scientific fields.
  - accepted Darwin's theory of evolution and Mendel's theory of heredity as explaining most evolutionary change.

ANS: D                      DIF: Medium                      REF: Page 46  
TOP: Evolutionary Forces and Synthesis (9)                      NOT: Factual

6. Deoxyribonucleic acid (DNA):
- was studied during Darwin's lifetime.
  - is the "recipe" for all biological characteristics and functions.
  - was discovered by Mendel.
  - is stored in the cells as ribosomes.

ANS: B                      DIF: Easy                      REF: Page 47                      TOP: Structure of DNA (10.a)  
NOT: Factual

7. While at the gorilla exhibit at the zoo you notice that the sign reads *Gorilla gorilla gorilla*. You recall that this is a scientific name and is part of a naming system known as:
- binomial nomenclature, which was developed by Carolus Linnaeus as a classification system for plants and animals.
  - natural selection, because you know that Linnaeus was a proponent of evolutionary change.
  - independent assortment, developed by Gregor Mendel.
  - none of the above

ANS: A                      DIF: Easy                      REF: Page 35                      TOP: Context for Darwin (3)  
NOT: Applied

8. James Hutton is associated with:
- adaptation.
  - catastrophism.
  - uniformitarianism.
  - principles of heredity.

ANS: C                      DIF: Easy                      REF: Page 29                      TOP: Context for Darwin (3)  
NOT: Factual

9. How is the concept of catastrophism different from the concept of uniformitarianism?
- Catastrophism is the idea that the shape of the earth's surface gradually shifts over time.
  - Catastrophism is only the result of human-induced changes.
  - Unlike uniformitarianism, catastrophism is the result of a single event.

d. none of the above

ANS: C                      DIF: Medium                      REF: Page 32                      TOP: Context for Darwin (3)  
NOT: Factual

10. According to Darwin, natural selection operates at the level of:
- individuals.
  - genes.
  - populations.
  - species.

ANS: A                      DIF: Easy                      REF: Page 26  
TOP: Darwin's Natural Selection Theory as Primary Mechanism of Evolution (5.b)  
NOT: Factual

11. The English demographer whose work on population growth greatly influenced Darwin's thinking was:
- Jean-Baptiste de Lamarck.
  - Georges Cuvier.
  - Thomas Malthus.
  - Charles Lyell.

ANS: C                      DIF: Easy                      REF: Page 37                      TOP: Context for Darwin (3)  
NOT: Factual

12. How was Darwin influenced by Thomas Malthus's work on population growth?
- Darwin was interested in Malthus's examinations of population changes in pea plants.
  - Darwin was influenced by Malthus's work on demography and population responses to food availability.
  - Darwin liked the concept of Latin taxonomic classification as it pertained to human groups.
  - Darwin was greatly influenced by research on acquired characteristics.

ANS: B                      DIF: Medium                      REF: Page 37                      TOP: Context for Darwin (3)  
NOT: Applied

13. How did Lamarck contribute to the theory of evolution?
- He discovered genetic mutation through experiments with pea plants.
  - He proposed the concept of natural selection after his voyage to the Galapagos Islands and his study of finches.
  - He didn't but instead proposed an erroneous evolutionary mechanism known today as inheritance of acquired characteristics.
  - He didn't but instead proposed a concept known today as gene flow.

ANS: C                      DIF: Easy                      REF: Page 38  
TOP: Problems Explaining Heredity: Lamarckian Inheritance (5.c)  
NOT: Applied

14. The English scientist who independently codiscovered the theory of natural selection was:
- Charles Lyell.
  - Jean-Baptiste de Lamarck.
  - Alfred Russell Wallace.

d. Carolus Linnaeus.

ANS: C                      DIF: Easy                      REF: Page 40  
TOP: Darwin's Contemporaries and Competition: Wallace (5.d)  
NOT: Factual

15. Cuvier's work on fossil elephants in France supported the then controversial notion of:
- extinction.
  - evolution.
  - natural selection.
  - genetics.

ANS: A                      DIF: Easy                      REF: Page 30                      TOP: Context for Darwin (3)  
NOT: Applied

16. The physical expression of an organism's genetic constitution is called its:
- karyotype.
  - phenotype.
  - stereotype.
  - genotype.

ANS: B                      DIF: Easy                      REF: Page 44  
TOP: Mendel's Discovery of Principles of Inheritance (7.b)                      NOT: Factual

17. Different versions, or subunits, of the same gene are:
- chromosomes.
  - gemmules.
  - alleles.
  - blenders.

ANS: C                      DIF: Easy                      REF: Page 41  
TOP: Mendel's Discovery of Principles of Inheritance (7.b)                      NOT: Factual

18. The only possible source of new genetic material is:
- natural selection.
  - mutation.
  - gene flow.
  - gene drift.

ANS: B                      DIF: Easy                      REF: Page 46  
TOP: Evolutionary Forces and Synthesis (9)                      NOT: Factual

19. Recessive alleles will be expressed if they are inherited:
- from either parent.
  - from neither parent.
  - from both parents.
  - along with a dominant allele.

ANS: C                      DIF: Easy                      REF: Page 41  
TOP: Mendel's Discovery of Principles of Inheritance (7.b)                      NOT: Applied

20. Which of the following is FALSE regarding populations of living organisms?
- Parents often produce many offspring.

- b. Population size is limited by the food supply.
- c. Individuals in populations actively compete for scarce resources.
- d. Individuals in populations show little or no variation.

ANS: D                      DIF: Easy                      REF: Page 43  
TOP: Darwin's Natural Selection Theory as Primary Mechanism of Evolution (5.b)  
NOT: Applied

21. Mendel's plant hybridization experiments demonstrated that:
- a. inherited traits from each parent blended together in the offspring.
  - b. DNA was the molecule carrying the genetic code.
  - c. peas were a poor choice for understanding basic hereditary principles.
  - d. traits inherited from each parent remained distinct in the offspring.

ANS: D                      DIF: Easy                      REF: Page 44  
TOP: Mendel's Discovery of Principles of Inheritance (7.b)                      NOT: Applied

22. The geneticist who studied the workings of fruit flies' chromosomes was:
- a. Charles Darwin.
  - b. Gregor Mendel.
  - c. Thomas Hunt Morgan.
  - d. Thomas Huxley.

ANS: C                      DIF: Easy                      REF: Page 44  
TOP: Discovery of Chromosomes (8)                      NOT: Factual

23. The scientist who coined the name *Homo sapiens* for human beings and placed them in a higher taxonomic group (primates) was:
- a. Charles Darwin.
  - b. Georges Cuvier.
  - c. Carolus Linnaeus.
  - d. Robert Hooke.

ANS: C                      DIF: Easy                      REF: Page 35                      TOP: Context for Darwin (3)  
NOT: Factual

24. The individual genotypes in a breeding population, taken as a whole, are the:
- a. gene pool.
  - b. DNA.
  - c. genome.
  - d. polygene.

ANS: A                      DIF: Easy                      REF: Page 46  
TOP: Evolutionary Forces and Synthesis (9)                      NOT: Factual

25. You're watching a show on TV about the history of scientific thought in Europe prior to 1800. At that time:
- a. all species were believed to have evolved from a common ancestor.
  - b. all forms were thought to have been created by God and to remain constant over time.
  - c. most species were thought to go extinct over time.
  - d. evolution was attributed to natural selection acting upon genetic variation.

ANS: B                      DIF: Medium                      REF: Page 28                      TOP: Context for Darwin (3)  
NOT: Applied

26. All of the following are formal taxonomic categories EXCEPT:
- kingdom.
  - population.
  - order.
  - family.

ANS: B                      DIF: Easy                      REF: Page 36                      TOP: Context for Darwin (3)  
NOT: Factual

27. The Human Genome Project is most likely to contribute to an understanding of which disease?
- cystic fibrosis
  - influenza
  - tuberculosis
  - smallpox

ANS: A                      DIF: Medium                      REF: Page 50  
TOP: Modern Understanding of Evolution (11)                      NOT: Factual

28. The scientist whose work provided the foundation for later understandings of genetics was:
- John Ray.
  - Gregor Mendel.
  - Charles Darwin.
  - Robert Hook.

ANS: B                      DIF: Easy                      REF: Page 41  
TOP: Mendel's Discovery of Principles of Inheritance (7.b)                      NOT: Factual

29. Thomas Hunt Morgan:
- demonstrated that chromosomes carry genetic material in the form of genes.
  - studied mutations in *Homo sapiens*.
  - thought change was gradual and occurred over long time periods.
  - none of the above

ANS: A                      DIF: Easy                      REF: Page 44  
TOP: Discovery of Chromosomes (8)                      NOT: Factual

30. Darwin observed that adaptations:
- resulted from supernatural forces.
  - did not vary among Galápagos finches living in different habitats.
  - were physical traits that enhanced survival and reproduction.
  - were peripheral to evolutionary change.

ANS: C                      DIF: Medium                      REF: Page 26                      TOP: Natural selection (9.a.iv)  
NOT: Factual

31. By the mid-twentieth century, the causes of evolution were seen as all of the following EXCEPT:
- natural selection.
  - macromutation.

- c. gene flow.
- d. genetic drift.

ANS: B                      DIF: Medium                      REF: Page 46  
TOP: Evolutionary Forces and Synthesis (9)                      NOT: Factual

32. In your textbook, the smaller frequency of sickle-cell anemia among present day American blacks as compared to West African blacks is attributed to:
- a. genetic drift.
  - b. gene flow.
  - c. new mutations.
  - d. none of the above

ANS: B                      DIF: Medium                      REF: Page 46  
TOP: Evolutionary Forces and Synthesis (9)                      NOT: Factual

33. Why are Darwin's finches considered good examples of natural selection?
- a. They are found on every continent.
  - b. There is fossil evidence that they originated in North America.
  - c. They embody the idea of descent with modification.
  - d. They did not differ between populations.

ANS: C                      DIF: Medium                      REF: Page 26                      TOP: Natural selection (9.a.iv)  
NOT: Conceptual

34. Linnaeus's taxonomic system is referred to as a "hierarchy" because:
- a. each species has a "higher level" genus and "lower level" species.
  - b. species are placed in a ranked list called "The Great Chain of Being."
  - c. humans are considered the most evolved species.
  - d. none of the above

ANS: A                      DIF: Easy                      REF: Page 36                      TOP: Context for Darwin (3)  
NOT: Conceptual

35. How do modern-day lemurs of Madagascar demonstrate the concept of adaptive radiation?
- a. They are closely related species that have branched from one species.
  - b. They are no different than ancient species of lemurs.
  - c. They have radiated from ancient species of monkeys.
  - d. They show great cultural flexibility.

ANS: A                      DIF: Medium                      REF: Page 26                      TOP: Adaptive radiation (5.a.iv)  
NOT: Applied

36. Gene flow differs from genetic drift because:
- a. it is the random change in the frequency of alleles.
  - b. it is the random change in a gene or chromosome.
  - c. it is the guiding force of evolution.
  - d. it is the spread of new genetic material from one gene pool to another.

ANS: D                      DIF: Medium                      REF: Page 47  
TOP: Evolutionary Forces and Synthesis (9)                      NOT: Applied



37. Darwin was a crew member on \_\_\_\_\_, a ship whose voyage informed his later theory of natural selection.
- the HMS *Labrador*
  - the HMS *Beagle*
  - the HMS *Papillon*
  - the HMS *Elizabeth*

ANS: B

DIF: Easy

REF: Page 25

TOP: Observations (5.a)

NOT: Factual

## ESSAY

1. Detail Darwin's major contribution to the theory of evolution.

ANS:

Darwin's key contribution was deducing that natural selection is the primary driver of evolution. According to this principle, the number of adults in a population remains the same even though parents tend to produce multiple offspring. Variation exists among members of a population. Individuals having variations that lend advantages for both survival and reproduction increase in relative frequency over time.

DIF: Hard

REF: Pages 42–43

TOP: Natural selection (5.a.iii)

NOT: Factual

2. Why was Darwin's 1859 published theory of natural selection not widely accepted by his peers? What later scientific advance was critical to the subsequent broad acceptance of natural selection as a major force in evolutionary change?

ANS:

Darwin's theory lacked a mechanism for the inheritance of desirable characteristics. Gregor Mendel discovered the principles of inheritance, i.e., the basis for understanding how traits are transmitted from parent to offspring. Mendel's discovery that traits are passed as discrete units (genes) laid the foundation for our understanding of chromosomes and of population genetics.

DIF: Hard

REF: Pages 40–41

TOP: What Happened since Darwin? (6)

NOT: Factual

3. What are some of the important scientific discoveries that laid the groundwork for Darwin's theory of evolution?

ANS:

Scientists working in geology, paleontology, taxonomy and systematics, demography, and what is now evolutionary biology had shown that the earth is old and has changed over its history; fossils represent remains of once living, sometimes extinct, organisms and provide a record of the history of life; life evolves over time; groups of related species provide insight into evolutionary history; and the number of adults in a population tends to remain the same over time.

DIF: Hard

REF: Pages 28–38

TOP: Context for Darwin (3)

NOT: Conceptual

4. What is the significance for evolutionary theory of Darwin's analysis of the Galápagos finches? Provide at least one example in your answer.

ANS:

The diversity of the various finch populations lent support to the idea that over time natural selection could transform a single common ancestral form into a variety of descendant species. This phenomenon is referred to as adaptive radiation. Each descendant species had adapted to its particular habitat; for example, the ground finch had evolved a more robust beak to accommodate a diet including hard objects such as seeds.

DIF: Hard

REF: Pages 25–26

TOP: What Was Darwin's Contribution to the Theory of Evolution? (4)

NOT: Conceptual

5. Why is Linnaeus's taxonomic system called a "nested hierarchy"? Considering that Linnaeus was not an evolutionist, why is his system still used today by evolutionary biologists?

ANS:

Linnaeus organized species into ever more inclusive higher-order taxonomic groups based on overall similarity. So although each species was unique, several of them could be combined into a single genus as a result of their shared traits. Similarly, different genera could be collected into a single, more inclusive family, families combined into orders, etc. Linnaeus's system is still useful because in many cases he identified similarities among species that reflect common ancestry (homologous traits). For example, while Linnaeus placed humans, monkeys, and lemurs into a single order (the primates) based on a simple acknowledgement of similarity, a modern biologist would see those species' shared traits as evidence of common evolutionary history.

DIF: Hard

REF: Pages 35–36

TOP: Context for Darwin (3)

NOT: Conceptual