Biological Science, 5e **(Freeman)**
Chapter 1 Biology and the Tree of Life

1) Pasteur's experiments proved that
A) Cells cannot survive in swan necked flasks
B) In order to grow, cells need to be supplied with oxygen
C) Spontaneous generation can only occur if nutrient broth is left open to the environment
D) Sterilizing nutrient broth prevents spontaneous generation
E) Pre-existing cells present in the air can grow in sterilized nutrient broth
Answer: E
Bloom's Taxonomy: Knowledge/Comprehension

2) Recall Pasteur's experiment on spontaneous generation. If he had just warmed the nutrient-rich broth, rather than boiled it, what would have been the likely outcome of his experiment? Cells would _____.
A) not have appeared in either flask
B) have appeared in both flasks
C) have appeared in the swan-neck, but not the straight-neck flask
D) have appeared in the straight-neck, but not the swan-neck flask
Answer: B
Bloom's Taxonomy: Application/Analysis
Section: 1.2

3) Spontaneous generation _____.
A) was demonstrated to occur under normal laboratory conditions by Pasteur
B) apparently occurred at least once—when life on Earth began
C) occurs every time a new species evolves from a preexisting species
D) addresses the formation of new cells from existing cells
Answer: B
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.2

4) What is the process component of the theory of chemical evolution?
A) Acid-base reactions resulted in the formation of large, complex organic molecules.
B) Kinetic energy was transformed into chemical energy.
C) During polymerization reactions, hydrolysis was completed with condensation.
D) The process occurred at black smokers, in the atmosphere and oceans, or in outer space.
Answer: B
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.3

5) What is the pattern component of the theory of chemical evolution?
A) Heat and electrical discharges were required for chemical evolution to occur.
B) Most chemical evolution occurred at black smokers.
C) The process occurred at black smokers, in the atmosphere and oceans, or in outer space.
D) Increasingly complex carbon-containing molecules formed early in Earth history.
Answer: D
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.3

6) Which of these provides evidence of the common ancestry of all life?
A) ubiquitous use of catalysts by living systems
B) near universality of the genetic code
C) structure of the nucleus
D) structure of cilia
E) structure of chloroplasts
Answer: B
Bloom's Taxonomy: Application/Analysis
Section: 1.3

7) Protists and bacteria are grouped into different domains because _____.
A) protists eat bacteria
B) bacteria are not made of cells
C) protists have a membrane-bounded nucleus, which bacterial cells lack
D) bacteria decompose protists
E) protists are photosynthetic
Answer: C
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.3

8) Cells are _____.
A) only found in pairs, because single cells cannot exist independently
B) limited in size to 200 and 500 micrometers in diameter
C) characteristic of eukaryotic but not prokaryotic organisms
D) characteristic of prokaryotic and eukaryotic organisms
Answer: D
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.4

9) In comparison to eukaryotes, prokaryotes _____.
A) are more structurally complex
B) are larger
C) are smaller
D) do not have membranes
Answer: C
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.4

10) Prokaryotes are classified as belonging to two different domains. What are the domains?
A) Bacteria and Eukarya
B) Archaea and Monera
C) Eukarya and Monera
D) Bacteria and Protista
E) Bacteria and Archaea
Answer: E
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.4

11) A water sample from a hot thermal vent contained a single-celled organism that had a cell wall but lacked a nucleus. What is its most likely classification?
A) Eukarya
B) Archaea
C) Animalia
D) Protista
E) Fungi
Answer: B
Bloom's Taxonomy: Application/Analysis
Section: 1.4

12) You have isolated and purified a new species of cells from the rain forest and you want to place this new species in the appropriate branch of the tree of life. You sequence the ribosomal RNA genes from these cells and discover that for one particular region of the ribosomal gene (the rRNA) the RNA sequence is AAUGAAGG.

You have sequences from the same region of the ribosomal genes (the rRNA) from each of these species: bacteria, eukaryote and archaea, which are listed below.

bacteria	AUAGAUGG
eukaryote	AAAGAAGG
archaea	AAUGGAGU

Based on these sequence results to which branch of the tree of life should you assign this new species?
A) archaea
B) bacteria
C) eukaryote
D) bacteria and archaea
E) there is not enough information
Answer: C
Bloom's Taxonomy: Application/Analysis
Section: 1.4

The following experiment is used for the corresponding question(s).

A researcher discovered a species of moth that lays its eggs on oak trees. Eggs are laid at two distinct times of the year: early in spring when the oak trees are flowering and in midsummer when flowering is past. Caterpillars from eggs that hatch in spring feed on oak flowers and look like oak flowers. But caterpillars that hatch in summer feed on oak leaves and look like oak twigs.

How does the same population of moths produce such different-looking caterpillars on the same trees? To answer this question, the biologist caught many female moths from the same population and collected their eggs. He put at least one egg from each female into eight identical cups. The eggs hatched, and at least two larvae from each female were maintained in one of the four temperature and light conditions listed below.

Temperature	Day Length
Springlike	Springlike
Springlike	Summerlike
Summerlike	Springlike
Summerlike	Summerlike

In each of the four environments, one of the caterpillars was fed oak flowers, the other oak leaves. Thus, there were a total of eight treatment groups (4 environments × 2 diets).

13) Refer to the accompanying figure. Which one of the following is NOT a plausible hypothesis to explain the differences in caterpillar appearance observed in this population?
A) The longer day lengths of summer trigger the development of twig-like caterpillars.
B) The cooler temperatures of spring trigger the development of flowerlike caterpillars.
C) Differences in air pressure, due to differences in elevation, trigger the development of different types of caterpillars.
D) Differences in diet trigger the development of different types of caterpillars.
Answer: C
Bloom's Taxonomy: Application/Analysis
Section: 1.5

14) Refer to the accompanying figure. In every case, caterpillars that feed on oak flowers look like oak flowers. In every case, caterpillars that were raised on oak leaves looked like twigs. These results support which of the following hypotheses?
A) The longer day lengths of summer trigger the development of twig-like caterpillars.
B) Differences in air pressure, due to elevation, trigger the development of different types of caterpillars.
C) Differences in diet trigger the development of different types of caterpillars.
D) The differences are genetic. A female will either produce all flowerlike caterpillars or all twig-like caterpillars.
Answer: C
Bloom's Taxonomy: Application/Analysis
Section: 1.5

15) Refer to the accompanying figure. Recall that eggs from the same female were exposed to each of the eight treatments used. This aspect of the experimental design tested which of the following hypotheses?
A) The longer day lengths of summer trigger the development of twig-like caterpillars.
B) Differences in air pressure, due to elevation, trigger the development of different types of caterpillars.
C) Differences in diet trigger the development of different types of caterpillars.
D) The differences are genetic. A female will either produce all flowerlike caterpillars or all twig-like caterpillars.
Answer: D
Bloom's Taxonomy: Application/Analysis
Section: 1.5

16) Recall the caterpillar experiment in which caterpillars born in the spring looked like flowers, and caterpillars born in the summer looked like twigs. What is the most likely selective advantage for this difference in body shape?
A) Looking like their food sources allows the caterpillars to move through their environment more efficiently.
B) Development into the adult moth form is faster for caterpillars shaped like twigs than like flowers.
C) Looking like their food source lets the caterpillars blend into their surroundings, reducing predation.
D) Looking like their food source will increase the caterpillars' feeding efficiency; this would increase their growth rate and survival rate.
Answer: C
Bloom's Taxonomy: Application/Analysis
Section: 1.5

17) How does a scientific theory differ from a scientific hypothesis?
A) Theories are proposed to test scientific hypotheses.
B) Theories are usually an explanation for a more general phenomenon; hypotheses typically address more specific issues.
C) Hypotheses are usually an explanation for a more general phenomenon; theories typically address more specific issues.
D) Confirmed theories become scientific laws; hypotheses become theories.
Answer: B
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.5

18) Louis Pasteur's experiment had a good design because _____.
A) simple equipment was used
B) a major question, spontaneous generation, was tested
C) the possible outcomes led to distinct, unambiguous conclusions
D) the experiment was a success
Answer: C
Bloom's Taxonomy: Application/Analysis
Section: 1.5

19) Recall the experiment on ant navigation. To run a controlled experiment, what parameters were held constant for the test group of 75 ants?
A) stride number
B) leg length
C) stride number, leg length, and environmental temperature
D) all variables except leg length
Answer: D
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.5

20) Your colleague proposes to test the mechanism of ant navigation by placing a food source 7 meters (m) from the nest. She then takes ants from the nest and places them in a spot that is 4 m from the nest and 3 m from the food source. Based on the previous data, where do you expect the ants to start searching for their nest on their return trip?
A) after they have traveled 3 m from the food source
B) after they have traveled 4 m from the food source
C) after they have traveled 7 m from the food source
D) as soon as they leave the food source
Answer: A
Bloom's Taxonomy: Application/Analysis
Section: 1.5

21) For many years, no one bothered to test the food-competition hypothesis for why giraffes have long necks. Why?
A) It had been much too difficult to test.
B) The hypothesis was so plausible that no one thought to question it.
C) They tried, but the results were inconclusive.
D) The hypothesis did not make clear predictions that could be tested.
Answer: B
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.5

22) A friend of yours calls to say that his car would not start this morning. He asks for your help. You say that you think the battery must be dead. If so, then jump-starting the car from a good battery will solve the problem. In doing so, you are _____.
A) testing a theory for why the car will not start
B) making observations to inspire a theory for why the car will not start
C) stating a hypothesis and using that hypothesis to make a testable prediction
D) comparing multiple hypotheses for why the car will not start
Answer: C
Bloom's Taxonomy: Application/Analysis
Section: 1.5

23) *Agrobacterium* infects plants and causes them to form tumors. You are asked to determine how long a plant must be exposed to these bacteria to become infected. Which of the following experiments will provide the best data to address that question?
A) Determine the survival rate of *Agrobacterium* when exposed to different concentrations of an antibiotic.
B) Measure the number of tumors formed on a plant when exposed to various concentrations of *Agrobacterium.*
C) Measure the concentration of *Agrobacterium* in different soil environments where the plants grow.
D) Measure the number of tumors formed on plants, which are exposed to *Agrobacterium* for different lengths of time.
Answer: D
Bloom's Taxonomy: Application/Analysis
Section: 1.5

24) *Agrobacterium* infects plants and causes them to form tumors. You determine that tumor formation requires a large amount of the plant's energy for tissue formation. How might this change the number of offspring a plant produces, and what is the most likely explanation for this change?
A) The number of offspring should increase, because in general, illness increases the reproductive output of organisms.
B) The number of offspring should increase, because the bacteria will provide energy for the plant.
C) The number of offspring should decrease, because the plant will divert energy from reproduction to tumor formation.
D) There should be no effect of infection on offspring production because energy for reproduction is independent of infection.
Answer: C
Bloom's Taxonomy: Application/Analysis
Section: 1.5

Use the following information when answering the corresponding question(s).

In 1668, Francesco Redi performed a series of experiments on spontaneous generation. He began by putting similar pieces of meat into eight identical jars. Four jars were left open to the air, and four were sealed. He then did the same experiment with one variation: Instead of sealing four of the jars completely, he covered them with gauze (the gauze excluded the flies while allowing the meat to be exposed to air). In both experiments, he monitored the jars and recorded whether or not maggots (young flies) appeared in the meat.

25) Refer to the paragraph on Redi's experiments. What hypothesis was being tested in the initial experiment with open versus sealed jars?
A) Spontaneous generation is more likely during the long days of summer.
B) The type of meat used affects the likelihood of spontaneous generation.
C) Maggots do not arise spontaneously, but from eggs laid by adult flies.
D) Spontaneous generation can occur only if meat is exposed to air.
Answer: C
Bloom's Taxonomy: Application/Analysis
Section: 1.5

26) Refer to the paragraph on Redi's experiments. In both experiments, flies appeared in all of the open jars and only in the open jars. Which one of the following statements is correct?
A) The experiment was inconclusive because Redi used only one kind of meat.
B) The experiment was inconclusive because it did not run long enough.
C) The experiment supports the hypothesis that spontaneous generation occurs in rotting meat.
D) The experiment supports the hypothesis that maggots arise only from eggs laid by adult flies.
Answer: D
Bloom's Taxonomy: Application/Analysis
Section: 1.5

27) The best experimental design _____.
A) includes a large sample size for each condition
B) includes a control
C) alters only one condition between the controls and the experimental condition
D) includes a large sample size and a control, and alters only one condition between the controls and the experimental condition
Answer: D
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.5

28) In the process of science, which of these is tested?
A) a conclusion
B) a result
C) an observation
D) a hypothesis
E) a control group
Answer: D
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.5

29) A controlled experiment _____.
A) is repeated many times to ensure that the results are accurate
B) proceeds at a slow pace to guarantee that the scientist can carefully observe all reactions and process all experimental data
C) includes at least two groups, one of which does not receive the experimental treatment
D) includes at least two groups, one differing from the other by two or more variables
E) includes one group for which the scientist controls all variables
Answer: C
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.5

30) Which of the following are qualities of any good scientific hypothesis?
I. It is testable.
II. It is falsifiable.
III. It produces quantitative data.
IV. It produces results that can be replicated.
A) I only
B) II only
C) III only
D) I and II
E) III and IV
Answer: D
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.5

31) In presenting data that result from an experiment, a group of students show that most of their measurements fall on a straight diagonal line on their graph. However, two of their data points are "outliers" and fall far to one side of the expected relationship. What should they do?
A) Do not show these points because clearly something went wrong in the experiment.
B) Average several trials, rule out the improbable results, and do not show them in the final work.
C) Show all results obtained and then try to explore the reason(s) for these outliers.
D) Do not report this set of data and do the research again.
E) Change the details of the experiment until they can obtain the expected results.
Answer: C
Bloom's Taxonomy: Synthesis/Evaluation
Section: 1.5

32) Which of the following is the best description of a control for an experiment?
A) The control group is kept in an unchanging environment.
B) The control group is left alone by the experimenters.
C) The control group is matched with the experimental group except for one experimental variable.
D) The control group is exposed to only one variable rather than several.
E) Only the experimental group is tested or measured.
Answer: C
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.5

33) Why is a scientific topic best discussed by people of varying points of view, from different subdisciplines, and representing diverse cultures?
A) They can correct each other's approach to make it scientific.
B) Robust and critical discussion between diverse groups improves scientific thinking.
C) Scientists can coordinate with others to conduct experiments in similar ways.
D) This is a way of ensuring that everyone gets the same results.
E) People need to exchange their ideas with other disciplines and cultures because everyone has a right to an opinion in science.
Answer: B
Bloom's Taxonomy: Synthesis/Evaluation
Section: 1.5

34) A controlled experiment is one that _____.
A) proceeds slowly enough that a scientist can make careful records of the results
B) tests experimental and control groups in parallel
C) is repeated many times to make sure the results are accurate
D) controls all variables
E) is supervised by an experienced scientist
Answer: B
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.5

35) Which of the following statements best distinguishes scientific hypotheses from scientific theories?
A) Hypotheses describe and theories explain.
B) Hypotheses explain and theories describe.
C) Hypotheses are usually narrower in scope; theories have broader explanatory power.
D) Hypotheses are used in experiments. Theories are not tested.
E) Hypotheses are generally supported by more evidence than theories.
Answer: C
Bloom's Taxonomy: Knowledge/Comprehension
Section: 1.5

36) Which of the following best describes the logic of scientific inquiry?
A) If I generate a testable hypothesis, tests and observations will support it.
B) If my prediction is correct, it will lead to a testable hypothesis.
C) If my observations are accurate, they will support my hypothesis.
D) If my hypothesis is correct, I can expect certain test results.
E) If my experiments are set up right, they will lead to a testable hypothesis.
Answer: D
Bloom's Taxonomy: Application/Analysis
Section: 1.5

37) The formulation of a model for a structure or for a process serves which of the following purposes?
A) It asks a scientific question.
B) It functions as a testable hypothesis.
C) It records observations.
D) It serves as a data point among results.
E) It can be arrived at only after years of experimentation.
Answer: B
Bloom's Taxonomy: Synthesis/Evaluation
Section: 1.5

38) Algae in the genus *Caulerpa* typically grow to a length of over half a meter and have structures similar to stems, leaves, and roots. Reproduction occurs when adults produce sperm and eggs that fuse to form offspring. Each adult *Caulerpa* consists of just a single cell, however. Which of the following statements is true?
A) *Caulerpa* violate the pattern component of the cell theory that all organisms consist of cells.
B) *Caulerpa* violate the process component of the cell theory that all cells come from preexisting cells.
C) *Caulerpa* violate both the pattern and process components of the cell theory.
D) The existence of *Caulerpa* is consistent with the cell theory.
Answer: D
Bloom's Taxonomy: Application/Analysis
Section: 1.5

39) Cotton-topped tamarins are small primates with tufts of long white hair on their heads. While studying these creatures, you notice that males with longer hair get more opportunities to mate and father more offspring. To test the hypothesis that having longer hair is adaptive in these males, you should _____.
A) test whether other traits in these males are also adaptive
B) look for evidence of hair in ancestors of tamarins
C) determine if hair length is heritable
D) test whether males with shaved heads are still able to mate
Answer: C
Bloom's Taxonomy: Application/Analysis
Section: 1.5

40) Which of the following is not related to the five fundamental characteristics of life?
A) A bacterial cell divides to produce two cells
B) Sugars are transported on carrier proteins into cells across the plasma membrane
C) Sugars are broken down inside cells to produce energy
D) The gene that specifies skin color in frogs is expressed during its development from a tad pole into an adult frog
E) Giraffes have longer necks so that they can reach food sources unavailable to other animals
Answer: E
Bloom's Taxonomy: Application/Analysis
Section: 1.5