Answers and Explanations

1. **The correct answer is (E).** Because a "family" is more highly classified than kingdom, phylum, class, and order, organisms that share the same family must also share the same kingdom, phylum, class, and order. Only the genus of the two organisms may differ.

2. **The correct answer is (A).** Plasma B cells are specialized immune system cells that secrete antibodies, small Y-shaped proteins that can directly attach to and agglutinate, or clump, invading bacteria. Attaching directly to cells is the job of killer-T cells, and engulfing pathogens is the job of macrophages. Clotting is done primarily by platelets and other protein fibers.

3. **The correct answer is (B).** Amphibians are characterized by their ability to breathe through moist skin (in addition to small lungs) and to walk on four limbs. The do not have rough, scaly skin or lay hard-shelled eggs like their reptile descendants, nor can they run quickly on land with muscular limbs (also like reptiles). Mammals are set apart by their milk-producing abilities.

4. **The correct answer is (C).** The best evidence to support the finding of fossils on widely separated land masses comes from continental drift theory, which states that certain land areas had been connected and slowly drifted apart—this would allow for separation of what were once continuous species' ranges. It is highly unlikely that a reptile species could have moved easily between continents or could have survived frozen seas during the Ice Ages.

5. **The correct answer is (B).** Different forms of the same gene are called alleles. For example, *B* (brown) and *b* (blue) are two different possible eye color alleles in humans. No other answer choices fit the definition of a "factor" that results in the expression of a certain characteristic.

6. **The correct answer is (C).** Carbon dioxide is needed in the Calvin cycle to produce sugars, and there is no connection between the Calvin cycle and the building of nitrogen-producing compounds by a plant. The decrease in carbon dioxide would most likely *not* result in the plant's death, but it might hurt the plant by *decreasing* its ability to produce sugars. Chlorophyll molecules should be unaffected.

7. **The correct answer is (E).** The oviduct, or fallopian tube, is the usual site of fertilization of the ovum. It is here, after being released from the ovary, that an egg is most likely to meet sperm cells coming up from the vagina.

8. **The correct answer is (C).** When DNA is transcribed into messenger RNA, the base-pairings are complementary but not identical. In addition, RNA has no thymine (T), only uracil (U). Thus, the correct complementary pairing would be A's with U's, T's with A's, and C's with G's or CGTAGT → GCAUCA.

9. **The correct answer is (B).** Diabetics may suffer from a buildup of sugar in their bloodstream because their bodies produce too little insulin (which is normally responsible for pulling sugar out of the bloodstream and into cells), and/or their body's response to insulin is reduced (a condition known as insulin resistance). Although the disease may cause damage to the kidneys eventually, the disease is not caused by any kidney malfunction.

10. **The correct answer is (A).** The large intestine is responsible for the absorption of salts and water from the digestive system. If damaged, excess water can remain in the digestive tract and cause watery stools, or diarrhea.

11. **The correct answer is (B).** The mitochondrion is the organelle in which ATP is produced in eukaryotic cells. Most cells have multiple mitochondria to serve their energy needs. The letter C here points to a single mitochondrion within this cell.

12. **The correct answer is (E).** The best conclusion here is that the amount of carbon dioxide produced per gram of body weight is the same for all species (CO_2 production/Weight in grams = 0.006 for all species.). Be careful with choice D, because although production of carbon dioxide for the 24 gram lizard may be twice as great as that of the 12 gram lizard, one cannot necessarily conclude that the oxygen consumption of the larger lizard is exactly double.

13. **The correct answer is (A).** If DPIP is reduced (gains electrons) to lose its color, then the DPIP will show the greatest loss of color wherever the greatest number of electrons are being knocked around. Chlorophyll loses electrons when it is bombarded by photons of light. Thus, only chloroplasts in bright, white light will change DPIP greatly. Boiled chloroplasts will be ineffective due to enzyme denaturation, and chloroplasts in the dark or exposed only to green light will absorb few photons if any. Chloroplasts have no direct effect on sugar production; thus being in a sugar solution should not affect this reaction with DPIP in any way.

14. **The correct answer is (A).** Carbon dioxide produced by the body's cells mixes with water in the bloodstream to form carbonic acid, which then dissociates into H^+ and HCO_3^- (bicarbonate) ions. The hydrogen ions are complexed to hemoglobin in the red blood cells while the bicarbonate ions generally remain in the plasma during the trip to the lungs.

15. **The correct answer is (E).** Bacteria, which are prokaryotes, are classified as such due to their lack of a nuclear membrane housing their DNA. In addition, antibiotics are drugs used to kill bacteria only and do not harm other living organisms or viruses.

16. **The correct answer is (C).** Flowering plants, just like other plants, should be expected to possess chloroplasts, mitochondria, cell walls, and large centralized vacuoles. However, plant cells, unlike animal cells, have no centrioles to act as microtubule organizing centers for cell division.

17. **The correct answer is (B).** The best evidence that modern-day birds evolved from reptile lineages is that transitional fossils are plentiful. These fossils, such as the famous *Archaeopteryx*, show creatures with both reptilian and bird-like characteristics (e.g. the claws and body shape of a reptile with the feathers of a bird).

18. **The correct answer is (D).** Without working pumps, the axon could not maintain a negative potential inside compared to outside (accomplished by the pumping out of 3 Na^+ ions while pumping in only 2 K^+). Therefore, the axon itself would be unable to depolarize and transmit an action potential. In addition, the Na-K pump is needed to reverse the membrane potential along the axon once sodium ions have rushed inside. If this depolarization cannot be reversed, the neuron can no longer carry action potentials.

19. **The correct answer is (B).** Boiling most enzymes will result in their denaturation—loss of 3-D structure. When denatured, enzymes lose their ability to catalyze reactions. Additions or removals beyond Substance C (e.g. choice E) are unlikely to result in any changes to the production of C, which is "upstream" from the change. The addition or mixing of any enzymes is likely to increase Substance C's production.

20. **The correct answer is (A).** The graph of a predator-prey interaction is usually depicted as a series of linked fluctuations. As the prey population rises, the predator population follows with a slight lag; as the predators eat too much prey, the predator population falls with a slight lag behind the fall in the prey population. This will continue as long as the survival of the prey population is linked to the size of the predator's population and vice-versa.

21. **The correct answer is (B).** FSH, known well for its role in the female menstrual cycle as the inducer of egg development, also induces spermatogenesis, or sperm production. Prolactin is involved in female milk production; GnRH causes the release of gonadotropins (FSH and LH) from the pituitary gland; aldosterone helps the kidneys in water balance; and, insulin *decreases* blood glucose concentration.

22. **The correct answer is (E).** Digestion is the process of food breakdown, while ingestion is the act of taking the food into the body via the mouth. Cell respiration refers only to the breakdown of macromolecules such as sugars within a cell's mitochondria in order to produce ATP; and, dehydration synthesis is the process of joining smaller molecules to make larger ones (as in the building of a protein from individual amino acids), and this is the opposite of hydrolysis, which takes place during digestion.

23. **The correct answer is (B).** The chloroplasts of plant cells are where the reactions of photosynthesis take place. This is where chlorophyll molecules can be found within the chloroplast membranes. The production of glucose and other sugars takes place within the stroma (inner fluid) of the chloroplast.

24. **The correct answer is (A).** In order to grow taller than a few centimeters, plants need vascular tissues (xylem and phloem), which serve to carry water and nutrients back and forth from roots to leaves. Mosses are simple land plants that do not have these tissues and must live close to the ground, where available water can diffuse into key tissues. Mosses have chlorophyll (hence their green color) and spores. Whether or not a certain group of plants has a dominant gametophyte or sporophyte generation has nothing to do with how tall the plant can grow—these are merely designations to indicate whether or not the plant we can see with our eyes (the dominant form) is diploid or haploid.

25. **The correct answer is (D).** It is likely that plant B was a parasite of plant A. Plant B dies without its host (plant A) around it, while the host can grow larger in the new pot, no longer weakened by the presence of the parasitic plant B. A polymorphism is not a word that describes a relationship between two different species, but rather indicates that a particular trait (e.g. coloration) exists only as discrete variations in a population (in other words: black *or* white *but* no combination or continuous blending of those colors).

26. **The correct answer is (B).** The choice that makes the most sense here is that fetal hemoglobin can bind to oxygen at lower partial pressures. The "pressure" of oxygen is highest in the bloodstream at the lungs but falls progressively as blood moves through the body, since oxygen is leaving and there is less oxygen gas. By the time maternal blood reaches the placenta, the partial pressure of oxygen has fallen dramatically, yet fetal hemoglobin is able to fully saturate itself with oxygen at these lower partial pressures, something that adult hemoglobin could not do. This is an important physiological adaptation for the fetus in order to pull the maximum amount of oxygen from the mother's bloodstream into the fetal bloodstream.

27. **The correct answer is (B).** Crossing red plants (RR) with green ones (rr) would result in 100% Rr offspring, which would all be red since they have at least one copy of the dominant allele (R).

28. **The correct answer is (A).** Antibodies are Y-shaped proteins secreted by plasma B cells. These proteins can attach to and cause the clumping together of pathogenic cells or toxin molecules, which are then engulfed and destroyed by macrophages. The antigens are the *foreign* proteins on the pathogen surface that the antibodies bind to.

29. **The correct answer is (E).** Only mammals have mammary glands (breasts) for milk production. All other features listed are shared with at least one other group of vertebrates. All vertebrates from fish to mammals have representative species with lungs; all vertebrate groups have some species that can lay eggs; and, birds share endothermy, or warm-bloodedness, with mammals.

30. **The correct answer is (C).** The best explanation is that heat had caused the denaturation of the enzyme. Enzymes are sensitive to temperature, pH, and certain other conditions. If the conditions become too extreme, enzymes lose their 3-D shapes and cannot function.

31. **The correct answer is (C).** These macromolecules are all lipids, a class of organic compounds that contains fats, phospholipids, and steroids. The building blocks (monomers) for some lipids are fatty acids. Therefore, fatty acids may be a component in lipids but lipids such as oils, waxes, and fats are not fatty acids themselves.

32. **The correct answer is (A).** Only the Golgi is correctly matched with its function. The Golgi complex (or apparatus) is responsible for adding sugar groups to proteins in order to make sure that the proteins are shipped to the right places, mainly out of the cell. Ribosomes are involved in *reading* RNA for protein synthesis, not building the RNA; lysosomes are used in intracellular digestion; mitochondria are sites of cellular respiration, not photosynthesis; and, centrioles produce the spindle.

33. **The correct answer is (E).** At each level of the food web, there is a decline in available energy as organisms use the energy they acquired through eating. The energy is used for growth and development, feeding, and reproduction. This is the reason why food webs do not have, say, 10 or 12 trophic levels—there simply is not enough energy available. Energy does not cycle through food webs like certain elements or compounds. It comes in from the sun, is used to build complex molecules, and changed in form entirely.

34. **The correct answer is (C).** If the cell is not permeable to the solutes, only water can move freely back and forth. A higher solute concentration outside the cell will pull water from the cell cytoplasm *out* and cause the cell to shrivel up.

35. **The correct answer is (B).** Because Side B has the higher sucrose concentration and because the membrane is impermeable to the sugar, water will move from Side A to "dilute" the sugar on Side B, causing the water level of Side B to rise up. At equilibrium, the concentrations of sucrose on both sides will be equal.

36. **The correct answer is (E).** The Monera is the kingdom of bacteria, now often represented as two separate kingdoms—Archae- and Eubacteria—due to genetic differences. All bacteria are prokaryotes and vice-versa. All other kingdoms are eukaryotic.

37. **The correct answer is (C).** Small populations with unlimited resources will experience exponential growth—rapid expansion of their population over a brief period of time. Resources are plentiful and organisms can reproduce at their maximal rates. Little parental care is generally offered to the young, and the population will increase until carrying capacity is released, usually over many generations.

38. **The correct answer is (D).** Only mutations in "germ-line" cells, such as sperm and egg cells, can be passed onto offspring. Other mutations remain within the parents' bodies.

39. **The correct answer is (B).** Traits that do not vary in a continuous manner but rather exist as discrete variants within a population are known as polymorphisms and the variants are known as morphs. The typical example used in textbooks is the polymorphism of human ABO blood groups, where there are four distinct morphs (A, B, AB, and O) as blood types, but no phenotypic intermediate types (e.g. some combination between A and O).

40. **The correct answer is (B).** The sympathetic branch of the autonomic nervous system is also known as the "fight or flight" branch, responsible for actions that get the body tense and ready for fighting or running away. Digestion slows or stops, pupils dilate to let in more light for better vision, heart rate increases as does breathing, and hairs stand on their ends. The vagus nerve is the major *para*sympathetic nerve leading to the heart, causing the heartbeat to slow down.

41. **The correct answer is (C).** RNA has bases A, C, G, and U. There is no thymine in RNA.

42. **The correct answer is (D).** Multi-subunit proteins are said to exhibit quaternary structure. Tertiary structure refers to the 3-D structure created by the interactions between monomers on a single chain of amino acids. Secondary structure refers to the local alpha helices and beta-pleated sheets that portions of an amino acid chain form as a protein twists up into its overall 3-D shape. The primary structure of a protein is simply the linear order of the amino acid chain that makes up the protein and that dictates that secondary and tertiary structures.

43. **The correct answer is (A).** To distinguish between NADH and NADPH, just remember the "P" in NADPH can stand for photosynthesis (in reality, it stands for the word "phosphate"). NADPH is the exclusive electron carrier of photosynthesis, which is responsible for ferrying electrons from the light reaction to the Calvin Cycle. NADH and $FADH_2$ are the carriers in cellular respiration, while ATP and the sugar glucose are not electron carriers at all, but energy molecules.

44. **The correct answer is (B).** Similar amino acid sequences mean similar DNA sequences, since DNA codes for proteins. This would indicate that the two proteins have a common evolutionary origin, and if many other proteins between the two species were also closely related in amino acid sequence, it would also show that the two species shared a recent common ancestor. Tertiary structures would not be identical unless the proteins were *identical*, not just similar, and this structure determines function.

45. **The correct answer is (E).** Restriction enzymes are specific for cutting certain sequences of DNA and are used for making recombinant DNA. Reverse transcriptase is a viral enzyme used to convert RNA → DNA; DNA polymerase is used to copy and replicate DNA; catalase is used in cells to break down hydrogen peroxide, a dangerous side-product of many cellular reactions; and, PCR is used to amplify (copy) short segments of DNA.

46. **The correct answer is (B).** Emulsification is the term used for breaking down fats into smaller pieces to facilitate chemical digestion. Bile, secreted by the liver, is responsible for doing this within the lumen of the small intestine.

47. **The correct answer is (C).** Meiosis, not mitosis, is responsible for gamete production.

48. **The correct answer is (B).** DNA is first transcribed into messenger RNA (mRNA) which is then translated into an amino acid chain (protein) at the ribosomes.

49. **The correct answer is (C).** Morgan was the first scientist to show that certain genes were linked to the sex of an organism. These sex-linked traits were coded for by genes carried on the X-chromosome and, if recessive (such as fruit fly white eye coloration), were far more commonly expressed in males (because they have only one X chromosome) than in females. However, rare females did have white eyes in his experiments.

50. **The correct answer is (E).** Iron is the element that is a key part of hemoglobin protein in red blood cells. Iron binds to oxygen in the lungs and allows red blood cells to carry this oxygen to body cells. Without iron, insufficient oxygen reaches cells of the body. Without oxygen, cells cannot produce adequate ATP, and symptoms such as those described can occur.

51. **The correct answer is (C).** If the toads make no sound upon attack, attacks occur at night, and roaches climb on the backs of sitting toads, these observations suggests that roaches are not warned by any auditory, olfactory, or visual cues. However, as the frog opens its mouth and tenses its muscles, the wind nearby would change direction suddenly. This is picked up by the sensitive hairs on the underside and tail end of roaches, which quickly move to escape.

52. **The correct answer is (D).** Neurons respond to stimulation in an all-or-none manner, and they do not show an increased response when presented with a greater stimulus. Rather, they signal the intensity of a stimulus by increasing or decreasing the frequency of action potentials that are generated, not by changing the amplitude (degree) of each action potential.

53. **The correct answer is (A).** Oogenesis, the formation of egg cells (ova) in the female, takes place in the ovaries each month. Because there is an evolutionary advantage to having a large ovum, complete with a supply of organelles, at the end of the process, there is unequal division of the cells leading up to the egg. The result: three polar bodies, which are nonfunctional and will be destroyed, and one large, functional egg cell. Spermatogenesis, in contrast, produces four sperm cells for every diploid spermatocyte that starts the process.

54. **The correct answer is (B).** The lymphocytes are B and T cells, the specific arms of the immune system, producing antibodies and enzymes that destroy pathogens. Erythrocytes are red blood cells, while neutrophils and macrophages engulf and destroy pathogens directly. Platelets are involved in clotting.

55. **The correct answer is (E).** The information about guard cells states that they must be swollen with water in order for them to open the stomata. It is advantageous to have the stomata open during the day, since that is when the sun is shining for photosynthesis to take place. Light falling on the blue-light receptors causes an influx of potassium ions, which draw water into the guard cells via osmosis. This causes the stomata to open.

56. **The correct answer is (D).** The anther is the male part of the flower, on which pollen grains are produced.

57. **The correct answer is (A).** Lichens are, in fact, a fungus and an algae that cohabit. The algae supplies sugar and other organic molecules to the relationship, while the fungus absorbs water and nutrients directly from the rocks, soil, or trees that the lichen lives on.

58. **The correct answer is (B).** The cnidarians include jellyfish, corals, hydra, and other stinging, tentacled animal life. *Porifera* are sponges, *Platy*-and *Aschelminthes* include the flatworms, roundworms, and rotifers; and, annelids are earthworms.

59. **The correct answer is (B).** Plants cannot absorb nitrogen directly from the air, nor can nitrogen compounds be synthesized *de novo* by soil bacteria. The reason that tropical rainforests can hold so much biodiversity and richness despite the poor soil is that there are so many living creatures that are continually dying and supplying the soil with organic nutrients. Therefore, the soil may not hold onto any nutrients for a long time because the rate of nutrient cycling is so great, but there are plentiful nutrients to be recycled at any one time.

60. **The correct answer is (B).** A bottleneck occurs when a population is suddenly reduced in number drastically enough that much of the genetic diversity that had been present in the population has been erased. This can result from natural disasters such as flooding, volcanism, and forest fires, or from overhunting and habitat destruction.

61. **The correct answer is (D).** According to the Hardy-Weinberg equations, $p + q = 1$ and $p^2 + 2pq + q^2 = 1$, an increase in the frequency of the dominant allele (p) would result in a decrease in the frequency of the recessive allele (q), which would mean a decrease in the frequency of q^2 individuals. However, if the dominant allele is a harmful one, then it becomes likelier that both homozygous dominant individuals *and* carriers ($p^2 + 2pq$) would decrease in frequency and recessive individuals would increase.

62. **The correct answer is (A).** While nitrogen fixing (nitrifying) bacteria convert atmospheric nitrogen into nitrates and nitrites for plant use in protein and nucleic acid synthesis, *de*nitrifying bacteria take organic nitrogen-containing matter (usually ammonia) and free up nitrogen from it so that the gas can return to the atmosphere.

63. **The correct answer is (D).** Histamine is released in large amounts during the inflammatory response. It causes localized and sometimes systemic swelling, as it opens up capillaries and makes them permeable to large white blood cells, so that the cells can reach the sites of injury. Antihistamines, such as Benadryl, counter histamine, which can cause life-threatening swelling especially around the face and throat.

64. **The correct answer is (A).** The chloroplast has grana, stacks of thylakoids, for photosynthesis.

65. **The correct answer is (D).** Ribosomes, built of a small and a large subunit, are made up of proteins and ribosomal (r) RNA.

66. **The correct answer is (D).** Ribosomes are the site of protein synthesis, whether or not they are free-floating in the cytoplasm or attached to the membrane of the ER.

67. **The correct answer is (B).** The mitochondrial inner membrane takes many twists and turns into folds called cristae, where the proteins of the electron transport chain can be found.

68. **The correct answer is (D).** Some genes normally contain terminal regions with triplet nucleotide repeats (i.e. …GTCGTCGTCGTC…) or other repeats that can extend up to 50 nucleotides long. Accumulation of repeats can result in genetic illnesses.

69. **The correct answer is (A).** In some cases, a second set of genes determines whether or not a first set of genes will be expressed. For example, there may be genes for black fur (B) and brown (b) that are expressed only if a dominant gene for coloration (C) is present somewhere else. So, and individual could be BbCc and express black fur, or be Bbcc and be albino because of the recessive "no color" genes (c). This is known as epistasis.

70. **The correct answer is (E).** Since eggs contain all organelles and sperm contain no organelles, the organelles of offspring are maternally derived. Not only that, but since mitochondria have their own DNA, distinct from nuclear DNA, diseases or other traits can be passed through maternal lines via mitochondria. They would be passed to all children from a mother, but only female children would continue to pass the trait on.

71. **The correct answer is (C).** Genomic imprinting is the situation in which certain alleles seem to be methylated in different patterns depending upon which parent they come from. Thus, an allele for a certain trait coming from the father's sperm may not be expressed in the offspring at all, even though the *identical* allele from the mother's egg would be expressed.

72. **The correct answer is (E).** The driest of all biomes is the desert.

73. **The correct answer is (D).** The chaparral and savanna are two coastal biomes characterized by long, hot summers and short, rainy winters with fire-resistant plants than can quickly reseed the habitat after fires come through.

74. **The correct answer is (C).** The tundra, found in the upper and lower latitudes, is commonly called the "frozen desert," characterized by a layer of permanently frozen soil (permafrost) a few inches below the surface even during the warmer summer months.

75. **The correct answer is (E).** Skinner was known for his work with operant conditioning: the idea that behaviors can be increased in frequency with positive reinforcement (reward) or extinguished with negative reinforcement (e.g. a shock).

76. **The correct answer is (C).** This is known as habituation—getting used to a stimulus in the environment, so that there is no longer a response to it.

77. **The correct answer is (D).** Pavlov, the Russian behaviorist, worked with dogs and bells to show that certain behaviors can be coupled with outside stimuli that are, at first, unrelated to the stimulus (e.g., ringing a bell when food is presented to a dog). After a period of time, Pavlov's dogs began to salivate when they heard the bell in the absence of food (they became conditioned to associate the bell with food).

78. **The correct answer is (A).** Selective breeding, often done by humans on farms, is known as artificial selection. It is used to carefully breed plants, cows, and other organisms with certain desirable traits.

79. **The correct answer is (C).** Sexual selection, related to natural selection, is a phenomenon whereby organisms are successful in mating not because of environmental influences, but rather because of sexual appeal (attractiveness), due perhaps to a song, tail feathers, or other bodily stimuli.

80. **The correct answer is (E).** Mass extinctions typically wipe out large numbers of organisms so that survivors have plenty of new spaces and resources to spread out into.

81. **The correct answer is (D).** The independent variable of an experiment is the one that is changed by the scientist. The dependent variable is the one the scientist measures. Here, the scientist is changing the temperature and measuring the pulse.

82. **The correct answer is (B).** Choice B is the only graph that shows the relationship between the independent variable (temperature), plotted on the *x*-axis (as it should be), and the dependent variable (pulse), plotted on the *y*-axis (as it should be). The beaker # is not related to either variable —the beakers could just as easily been labeled in a different order (the important thing is the relationship between pulse and temperature that is being studied).

83. **The correct answer is (A).** There is simply no information presented concerning metabolic rate, heart rate between zero and 5 degrees, or swimming speed. Heart rate goes up as temperature goes up—therefore, choice D is also incorrect. The best answer is the extrapolation that heart rate at 45 degrees would be approximately 320 bpm.

84. **The correct answer is (B).** The graph indicates that, as salinity goes up from 0 ppt to 30 ppt, levels of dissolved oxygen decrease. No other answer choice is backed up by the data.

85. **The correct answer is (A).** The experiment is about measuring the oxygen content in the water. Oxygen must be dissolved in water to be used by plants and animals. It cannot be bound to other molecules, and must exist in its free state (as O_2) to be utilized.

86. **The correct answer is (E).** Although the graph shows results only for salinities ranging from 0 ppt to 30 ppt, one could extrapolate that salinities of greater than 30 ppt would show curves on the graph lower than the curve of 30 ppt. In other words, as salinity increases, dissolved oxygen would get lower and lower.

87. **The correct answer is (B).** The sole function of oxygen is to power the mitochondria so that they can produce ATP via cell respiration.

88. **The correct answer is (B).** Because the amount of carbon dioxide *used* is an indicator of the rate of photosynthesis, the plants in the red-light group show the greatest rate of photosynthesis. Carbon dioxide levels began at 220 cm^3 at the start of the experiment, and they dropped to 50 cm^3 in the red-light group. No other group used up as much carbon dioxide.

89. **The correct answer is (D).** White light, which is made up of all of the colors of the rainbow (ROYGBIV), is missing. Without a white light group, it is hard to have a baseline of how a "normal," control plant population might do in regular, everyday light.

90. **The correct answer is (E).** The proper plot shows the independent variable (light color) on the *x*-axis plotted against the dependent variable (carbon dioxide concentration remaining) on the *y*-

axis. The best type of graph to use is a histogram because you have collected data for specific colors of light only. You have no information about the other colors or carbon dioxide use at times other than at the very end of the experiment. Thus, using a line graph forces you to make up information about other colors of light or time periods that you do not have.

91. **The correct answer is (B).** Objects in the natural world appear the color they do because of the light waves they reflect. Green objects look green to us because they reflect green light. Hence, green light should be the worst light for plants to use for photosynthesis, as shown in the experimental data.

92. **The correct answer is (E).** Individual C is a male, as seen by the square on the pedigree. Males are XY to start, and if a sex-linked allele were present, such as the allele for DMD, it would be found on his lone X chromosome—thus, X^dY.

93. **The correct answer is (A).** Because Janey has had three children with DMD, she is at least a carrier of the disease. In particular, her son, individual "C" has the disease, so he must have gotten the disease allele from Janey, since his father could not have passed him an X chromosome.

94. **The correct answer is (E).** If Janey were homozygous recessive, *all* of Jimmy and Janey's children would receive X chromosomes carrying a DMD allele.

95. **The correct answer is (C).** Males have only one X; therefore, if they get passed a defective X, they can only express those alleles. In contrast, females have two X's and can have a dominant, "normal" gene to override a defective one (e.g., one for DMD) on their other X.

96. **The correct answer is (B).** Each level of the pedigree is one generation. John and his wife are the parents of child "B" and another girl, while Jimmy and Janey are the grandchildren of John and his wife, and individuals on the row with "C" and "D" are the great-grandchildren.

97. **The correct answer is (D).** S phase is "synthesis" phase, but not of more ATP than usual. During S phase, cells copy their DNA and organelles in preparation for cell division, which takes place during M phase, or mitosis.

98. **The correct answer is (B).** It is during the first phase of mitosis, prophase, that the nuclear membrane breaks down.

99. **The correct answer is (A).** The pinching off of one cell to create two new cells at the end of mitosis is called cytokinesis.

100. **The correct answer is (A).** DNA is copied during S phase, so G_1 is the only phase during which DNA is still uncopied.

101. **The correct answer is (B).** As one can see from the diagram, two mirror-image sets of 2', 3', and 4' digits develop, both sets identical.

102. **The correct answer is (E).** ZPA regions are clearly inducers of digit development, although placement of the ZPA regions is crucial to normal development. When two ZPAs are in close proximity, interference can result and some digits may develop poorly or not at all. In addition, the relative placement of digits can change as the placement of the second ZPA changes. There is no evidence presented for what type of chemical control the ZPA exerts over development, nor is there any evidence for mechanisms to turn off duplicate ZPAs.

103. **The correct answer is (A).** In all three parts of the experiment, the longest digits (4' and 3') are consistently nearest to the ZPA regions. Digit 2', when it develops, is furthest. These results suggest that the more chemical messages that cells receive in developing digits (i.e. the closer to the ZPA cells), the longer those digits will become.

104. **The correct answer is (B).** Bones and muscle are derived from the mesoderm.

105. **The correct answer is (A).** Green plants are the primary producers in all terrestrial ecosystems. There are no secondary producers. Producers make their own food via photosynthesis.

106. The correct answer is (B). The hawks are the top-level consumer, judging by the diagram that shows that hawks have no predators and feed off of smaller organisms than themselves.

107. The correct answer is (C). Most immediately, an increase in the population of rodent-eating birds would mean fewer rodents, who are the sole predator of spiders, according to this food web diagram. Thus, although the hawk population may fall eventually due to fewer rodents (and therefore fewer snakes), the immediate effect would be on the spiders.

108. The correct answer is (D). Decomposers are organisms that feed off of the remains of dead plants, animals, and other organisms. They are an essential part of any ecosystem as they recycle the nutrients of dead organisms back into the soil for new life to use.

109. The correct answer is (C). Organisms cannot simply pick up and move when adversity hits. Therefore, a food web with many branches and interconnections is best for all organisms, since fluctuations in one population would not crash the whole food web. The spiders, in this case, can depend on the aphids for food.

110. The correct answer is (A). Deciduous forests are the leafy forests of the Northern United States, characterized by lots of maple, beech, elm, and other deciduous trees. All four seasons take turns throughout the year and leaves fall to the ground during the autumn.