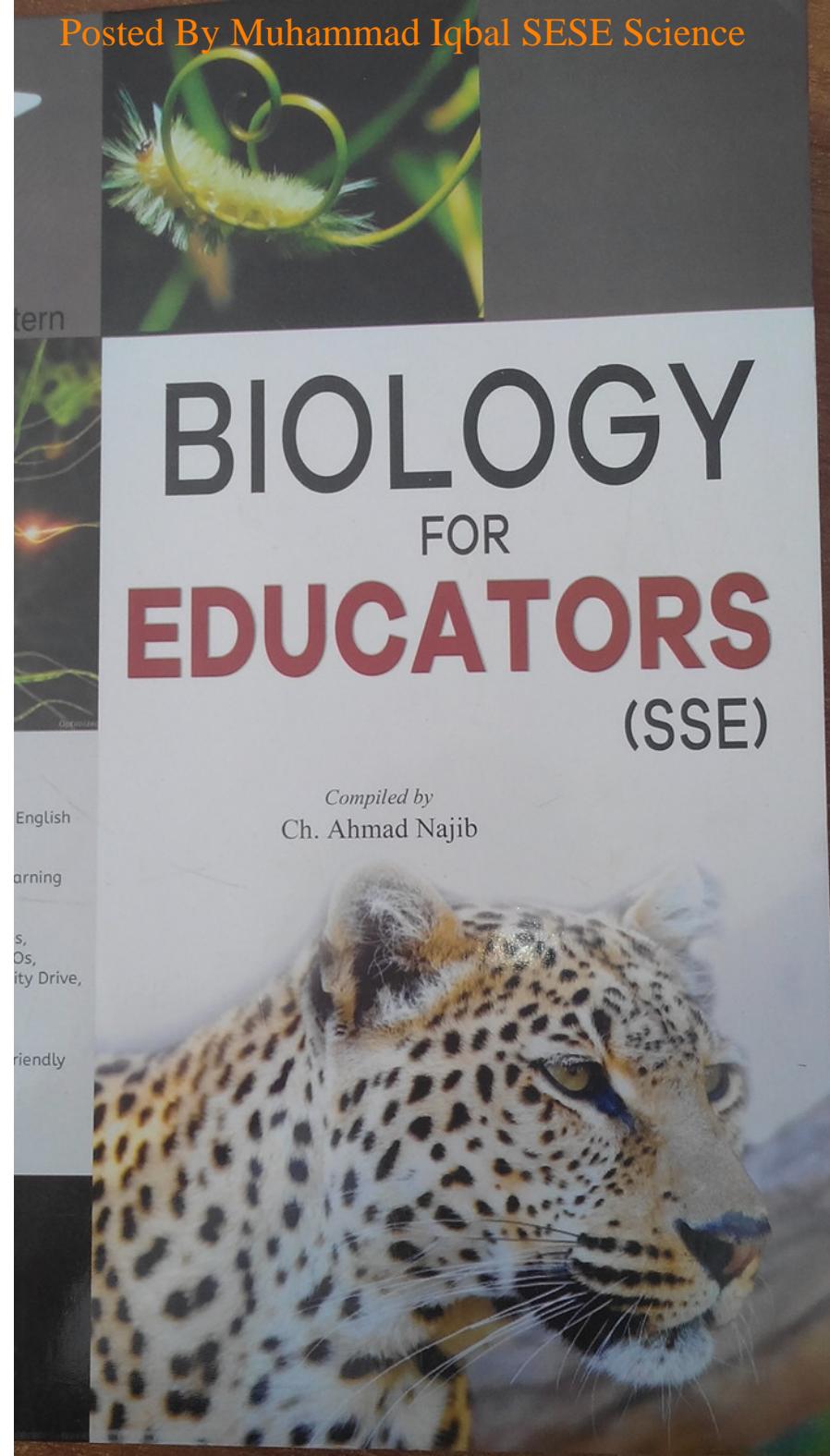


Posted by Muhammad  
Iqbal SESE Sci Darya  
khan Bhakkar

[Miqbal.bzu@gmail.com](mailto:Miqbal.bzu@gmail.com)

0333-345-7200

Always Pray For me



### 1.1: EXPLORING LIFE

1. An organ, such as the liver, is composed of \_\_\_\_\_.  
(a) organs      (b) populations  
(c) atoms      (d) tissues
2. Which of these is an organ system?  
(a) stomach      (b) mucosa  
(c) dog      (d) digestive
3. What are the two main types of cells?  
(a) bacteria and archaea  
(b) plant and animal  
(c) bacteria and protists  
(d) prokaryotes and eukaryotes
4. DNA is composed of building blocks called \_\_\_\_\_.  
(a) nucleic acids      (b) Gs  
(c) nucleotides      (d) adenines
5. In eukaryotic cells DNA has the appearance of a \_\_\_\_\_.  
(a) single strand  
(b) letter U  
(c) double helix  
(d) triple helix
6. Which of the following is a correct match of cell type with structure?  
(a) nerve cell... closely joined  
(b) skin cell... has a large volume  
(c) intestinal cell... closely joined  
(d) muscle cell... has proteins that slide back and forth
7. Which of these provides your body with energy?  
(a) minerals      (b) fats  
(c) oxygen      (d) vitamins
8. Plants use \_\_\_\_\_ as a source of energy.  
(a) light      (b) fats  
(c) oxygen      (d) vitamins
9. To be of value to science, hypotheses must be \_\_\_\_\_.  
(a) established facts  
(b) testable and falsifiable  
(c) proven correct  
(d) popular
10. Which is not part of the process of scientific inquiry?  
(a) observation and the analysis of quantitative data  
(b) observation and the analysis of qualitative data  
(c) proposing and testing hypotheses  
(d) proving a hypothesis to be true
11. What element is found in all organic compounds?  
(a) carbon      (b) oxygen  
(c) helium      (d) iron
12. Plants obtain carbon from \_\_\_\_\_.  
(a) water      (b) carbon dioxide  
(c) sugar      (d) oxygen
13. What name is given to organisms that convert the carbon in organic compounds into carbon in carbon dioxide?  
(a) autotrophs      (b) heterotrophs  
(c) decomposers      (d) recyclers
14. Prokaryotic cells are found in the domain(s) \_\_\_\_\_.  
(a) Bacteria and Archaea  
(b) Bacteria and Eukarya  
(c) Bacteria and Protista  
(d) Bacteria
15. In the five-kingdom system, prokaryotes are placed in the kingdom \_\_\_\_\_.  
(a) Monera      (b) Animalia  
(c) Fungi      (d) Plantae
16. Which one of the following statements is true?  
(a) DDT does not help prevent disease from passing from agricultural animals to humans.  
(b) Cost was a major factor in the United States government's decision to ban DDT.  
(c) Many African governments concluded that the potential long-term health effects of DDT were not as serious as the immediate problem of insect control.  
(d) DDT cannot accumulate in the fat of animals.
17. What is the correct order for the hierarchy of biological organization from the least to the most complex?  
(a) molecule, organelle, cell, tissue, organ, organ system, organism, population, community, ecosystem

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- (b) molecule, cell, tissue, organelle, organ, organ system, organism, population, community, ecosystem  
 (c) molecule, organelle, tissue, cell, organ, organ system, organism, population, community, ecosystem  
 (d) molecule, organelle, cell, tissue, organ, organ system, organism, ecosystem, community, population
18. Which of the following statements concerning prokaryotic cells and eukaryotic cells is incorrect?  
 (a) Eukaryotic cells lack a membrane-enclosed nucleus and are generally smaller and simpler than prokaryotic cells.  
 (b) Prokaryotic cells lack a membrane-enclosed nucleus and are generally smaller and simpler than eukaryotic cells.  
 (c) The genetic information, or DNA, of a eukaryotic cell is located in a membrane-enclosed nucleus.  
 (d) Prokaryotic cells lack a nucleus and membrane-enclosed organelles.
19. Which of the following statements is true about chemical nutrients in an ecosystem?  
 (a) They flow through the system, losing some nutrients in the process.  
 (b) They recycle within the ecosystem, being constantly reused.  
 (c) They can be converted into energy.  
 (d) They depend on sunlight as their source.
20. Which of the following statements concerning a molecule of DNA (deoxyribonucleic acid) is not correct?  
 (a) The DNA molecule is composed of two chains of nucleotides arranged in a double helix.  
 (b) Every chromosome is composed of one DNA molecule with thousands of genes arranged along its length.  
 (c) Every DNA molecule is composed of two long chains of building blocks called nucleotides.

- (d) The DNA molecule is composed of many amino acids joined together to form a functional protein.
21. No amino acid molecule by itself can speed up or catalyze reactions between other molecules; however, when amino acids are joined together to make a protein with catalytic properties, the new structure (enzymatic protein) can speed up the rate of a specific chemical reaction. This type of phenomenon is an illustration of \_\_\_\_\_.  
 (a) polymer duality  
 (b) the complexity/simplicity paradox  
 (c) the summation theory  
 (d) emergent properties
22. Which taxonomic domain includes multicellular photosynthetic organisms?  
 (a) Bacteria (b) Archaea  
 (c) Eukarya (d) Fungi
23. The evolutionary process of natural selection does not depend on \_\_\_\_\_.  
 (a) heritable variations  
 (b) adaptation to the environment  
 (c) reproductive success of the adapted organisms  
 (d) random mating
24. Scientists discard a model of biological or other natural processes when \_\_\_\_\_.  
 (a) new experimental results are obtained that cannot be explained by the old model  
 (b) the old model has been in place a long time  
 (c) the individuals who first developed the old model have died  
 (d) no experiments related to the model have been done recently

**ANSWERS**

1. d      2. d      3. d      4. c  
 5. c      6. d      7. b      8. a  
 9. b      10. d     11. a     12. b  
 13. c     14. a     15. a     16. c  
 17. a     18. a     19. b     20. d  
 21. d     22. c     23. d     24. a

**1.2: THE CHEMICAL CONTEXT OF LIFE**

1. What is the atomic number of an atom that has 6 protons, 6 neutrons, and 6 electrons?  
 (a) 18      (b) 12  
 (c) 0      (d) 6
2. Which of these refers to atoms with the same atomic number but different atomic masses?  
 (a) These atoms are different elements.  
 (b) These atoms have different numbers of electrons.  
 (c) These atoms are isomers.  
 (d) These atoms are isotopes.
3. Fluorine's atomic number is 9 and its atomic mass is 19. How many neutrons does fluorine have?  
 (a) 81      (b) 9  
 (c) 10      (d) 28
4. An uncharged atom of boron has an atomic number of 5 and an atomic mass of 11. How many protons does boron have?  
 (a) 0      (b) 5  
 (c) 6      (d) 8
5. The innermost electron shell of an atom can hold up to \_\_\_\_ electrons.  
 (a) 2      (b) 18  
 (c) 32      (d) 8
6. Which of these relationships is true of an uncharged atom?  
 (a) The atomic mass is equal to the number of electrons.  
 (b) The number of protons is equal to the number of electrons.  
 (c) The number of neutrons is equal to the number of protons.  
 (d) The atomic mass is equal to the atomic number.
7. What determines the types of chemical reactions that an atom participates in?  
 (a) its atomic mass  
 (b) the number of electrons in the innermost electron shell  
 (c) the number of electrons in the outermost electron shell  
 (d) the number of protons it contains
8. What type of bond joins the two hydrogen atoms?  
 (a) covalent      (b) hydrogen  
 (c) ionic      (d) hydrophobic
9. A(n) \_\_\_\_ refers to two or more atoms held together by covalent bonds.  
 (a) ion      (b) molecule  
 (c) community      (d) shell
11. The bond which joins the two oxygen atoms is.  
 (a) single covalent  
 (b) ionic  
 (c) quadruple covalent  
 (d) double covalent
12. What type of bond joins the carbon atom to each of the four hydrogen atoms in methane?  
 (a) hydrogen  
 (b) single (nonpolar) covalent  
 (c) ionic  
 (d) polar covalent
13. Atoms with the same number of protons but with different electrical charges \_\_\_\_\_.  
 (a) have different atomic masses  
 (b) have different numbers of neutrons  
 (c) are different ions  
 (d) have different atomic numbers
14. In salt, what is the nature of the bond between sodium and chlorine?  
 (a) polar covalent  
 (b) ionic  
 (c) hydrogen  
 (d) hydrophobic
15. Click to open the animation. What is the result of the animated process?  
 (a) a positively charged sodium ion and a negatively charged chlorine ion  
 (b) a positively charged sodium ion and a positively charged chlorine ion  
 (c) covalent bond formation  
 (d) a negatively charged sodium ion and a positively charged chlorine ion
16. An ionic bond involves \_\_\_\_\_.  
 (a) the sharing of a single pair of electrons  
 (b) an attraction between ions of opposite charge  
 (c) no atoms other than sodium and chlorine  
 (d) the unequal sharing of an electron pair

17. What name is given to the bond between water molecules?  
 (a) hydrogen (b) hydrophobic  
 (c) ionic (d) polar covalent
18. A substance that cannot be broken down into other substances by ordinary chemical procedures is a(n) \_\_\_\_\_.  
 (a) molecule (b) element  
 (c) compound (d) isotope
19. Which of the following is a trace element required by most living organisms?  
 (a) oxygen (b) magnesium  
 (c) nitrogen (d) carbon
20. Which of the following subatomic particles always has a positive charge?  
 (a) proton (b) neutron  
 (c) electron (d) atom
21. Changing the number of \_\_\_\_\_ would change an atom into an atom of a different element.  
 (a) bonds formed by an atom  
 (b) electrons circling the nucleus of an atom  
 (c) protons in an atom  
 (d) particles in the nucleus of an atom
22. The atoms of different phosphorus isotopes \_\_\_\_\_.  
 (a) have different atomic numbers  
 (b) have different numbers of neutrons  
 (c) react differently with other atoms  
 (d) have different numbers of electrons
23. How an atom chemically behaves when it comes into contact with other atoms is determined by its \_\_\_\_\_.  
 (a) nucleus  
 (b) size; smaller things are chemically more reactive  
 (c) protons  
 (d) electron configuration
24. Which of the following holds atoms together in a molecule?  
 (a) ionic bonds between atoms  
 (b) the transfer of protons from one atom to another
25. Hydrogen bonding is most often seen \_\_\_\_\_.  
 (a) in molecules whose three-dimensional shape is tetrahedral  
 (b) when hydrogen is covalently bonded to an electronegative atom  
 (c) when multiple carbon atoms are present  
 (d) if the molecule consists of three or fewer atoms
26. An ionic bond is formed when \_\_\_\_\_.  
 (a) both atoms are equally attractive to electrons  
 (b) atoms are subjected to radioactive isotopes  
 (c) one atom transfers an electron to another atom  
 (d) both atoms are nonpolar
27. Which of the following is not a chemical reaction?  
 (a) Glucose ( $C_6H_{12}O_6$ ) and oxygen gas ( $O_2$ ) combine to form carbon dioxide ( $CO_2$ ) and water ( $H_2O$ ).  
 (b) Sodium metal and chlorine gas  $Cl_2$  unite to form sodium chloride ( $NaCl$ ).  
 (c) Hydrogen gas ( $H_2$ ) combines with oxygen gas ( $O_2$ ) to form liquid water ( $H_2O$ ).  
 (d) Solid ice melts to form liquid water.

## ANSWERS

1. d      2. d      3. c      4. b  
 5. a      6. b      7. a      8. a  
 9. b      10. d     11. d     12. b  
 13. c     14. b     15. a     16. b  
 17. a     18. b     19. b     20. a  
 21. c     22. b     23. d     24. c  
 25. b     26. c     27. d

## 1.3: WATER AND THE FITNESS OF THE ENVIRONMENT

1. Cells are surrounded by water, and cells themselves consist of about 70% to 95% water. As a result \_\_\_\_\_.  
 (a) the temperature of living things tends to change relatively slowly  
 (b) a variety of nutrient molecules are readily available as dissolved solutes  
 (c) waste products produced by cell metabolism can be easily removed  
 (d) all of the above
2. Water is a polar molecule. This means that \_\_\_\_\_.  
 (a) the opposite ends of the molecule have opposite electrical charges  
 (b) water molecules are linear, like a pole  
 (c) water is one of the many hydrophobic molecules  
 (d) the atoms in water have equal electronegativities
3. The tendency of water molecules to stay close to each other as a result of hydrogen bonding \_\_\_\_\_.  
 (a) provides the surface tension that allows leaves to float on water  
 (b) is called cohesion  
 (c) keeps water moving through the vessels in a tree trunk  
 (d) all of the above
4. In a group of water molecules, hydrogen bonds form between \_\_\_\_\_.  
 (a) two hydrogen atoms in different water molecules  
 (b) the oxygen atoms in different water molecules  
 (c) the oxygen atom in one water molecule and a hydrogen atom in another water molecule  
 (d) the hydrogen atoms in a single water molecule
5. What do cohesion, surface tension, and adhesion have in common with reference to water?  
 (a) All are results of the structure of the hydrogen atom.  
 (b) All are produced by covalent bonding.
6. Most of water's unique features (for example, its versatility as a solvent, ability to moderate temperature, and cohesive behavior) result from the fact that \_\_\_\_\_.  
 (a) hydrogen is the only element without any neutrons  
 (b) oxygen attracts electrons more than hydrogen does  
 (c) oxygen has only one stable isotope, but hydrogen has three  
 (d) oxygen has two unfilled electron shells
7. The partial charges on a water molecule occur because of \_\_\_\_\_.  
 (a) the unequal sharing of electrons between the hydrogen and the oxygen atoms of a water molecule  
 (b) the achievement of a stable configuration by one atom of a bond but not by the other partner  
 (c) covalent bonding  
 (d) widespread ionization
8. The ability of water molecules to form hydrogen bonds with other water molecules and water's ability to dissolve substances that have charges or partial charges are \_\_\_\_\_.  
 (a) both caused by water's ability to form covalent bonds with hydrophobic substances  
 (b) due to water's partial charges and low molecular mass, respectively  
 (c) both caused by water's partial charges  
 (d) both caused by water's two electron shells and the opposite spins of those shells
9. The phenomenon responsible for the maintenance of a column of water as it moves upward through a vessel is \_\_\_\_\_.  
 (a) cohesion (b) adhesion  
 (c) surface tension (d) evaporation
10. Adhesion is best described as \_\_\_\_\_.  
 (a) a property of water that helps moderate Earth's temperature  
 (b) the process by which a crystalline lattice forms

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- (c) the process that contributes to the transport of water and dissolved nutrients in plants by causing water molecules to tug on other water molecules  
 (d) the clinging of one substance to another substance
11. You can fill a glass of water to just slightly above the rim without it spilling over the glass. What property of water best explains this phenomenon?  
 (a) surface tension  
 (b) adhesion  
 (c) its polarity  
 (d) evaporative cooling
12. Which action would involve the greatest transfer of heat?  
 (a) changing the temperature of 1 g of water from 10°C to 90°C  
 (b) cooling 10 g of water from 80°C to 40°C  
 (c) evaporating 1 g of water at 25°C  
 (d) condensing 5 g of steam to liquid water
13. Which example is not an effect of water's high specific heat?  
 (a) Organisms are able to resist changes in their own temperatures.  
 (b) Inland regions generally have milder climates than coastal regions.  
 (c) Ocean temperatures are stabilized.  
 (d) A large body of water can store a huge amount of heat from the sun, but only warm up a few degrees.
14. The amount of heat required to change the temperature of 1 g of any substance by 1°C is defined as \_\_\_\_\_.  
 (a) the specific heat of that substance  
 (b) 1 calorie  
 (c) the heat of vaporization of that substance  
 (d) 1 kilocalorie
15. The amount of heat required to convert 1 g of any substance from the liquid to the gaseous state is defined as \_\_\_\_\_.  
 (a) the specific heat of that substance  
 (b) 1 calorie  
 (c) the heat of vaporization of that substance  
 (d) the heat of fusion of that substance
16. The reason that coastal climates are more moderate than inland climates is due primarily to water's high \_\_\_\_\_.  
 (a) heat of fusion  
 (b) surface tension  
 (c) heat of vaporization  
 (d) specific heat
17. Sweating has a cooling effect because of water's high \_\_\_\_\_.  
 (a) heat of fusion  
 (b) surface tension
- (c) heat of vaporization  
 (d) specific heat
18. Water molecules have \_\_\_\_\_ than molecules of similar size, such as ammonia and methane.  
 (a) lower specific heat  
 (b) a higher boiling point  
 (c) a lower melting point  
 (d) lower heat of fusion
19. Because molecules of water are farther apart in ice than in liquid water, \_\_\_\_\_.  
 (a) ice floats  
 (b) ice is denser than liquid water  
 (c) ice expands when it melts  
 (d) ice vaporizes before liquid water does
20. Water is a very versatile solvent because water molecules are \_\_\_\_\_.  
 (a) polar  
 (b) nonpolar  
 (c) ionic  
 (d) hydrophobic
21. Sodium chloride (NaCl) dissolves in water because water molecules \_\_\_\_\_.  
 (a) have a high specific heat  
 (b) lose electrons  
 (c) are polar  
 (d) have a pH near 7
22. Nonpolar molecules that cluster away from water molecules are called \_\_\_\_\_ molecules.  
 (a) ionic  
 (b) hydrophilic  
 (c) hydrophobic  
 (d) saponified
23. Hydrophilic substances, but not hydrophobic substances, \_\_\_\_\_.  
 (a) have charges and partial charges to which water molecules can adhere  
 (b) have a higher bond energy than water  
 (c) give up electrons to solvents  
 (d) accept electrons from solvents
24. A molecule that has all nonpolar covalent bonds would be \_\_\_\_\_.  
 (a) hydrophobic  
 (b) hydrophilic  
 (c) acidic  
 (d) basic (alkaline)
25. Hydrophobic molecules are \_\_\_\_\_ water.  
 (a) attracted to  
 (b) absorbed by  
 (c) repelled by  
 (d) neutralized by
26. Some substances, such as oil and gasoline, will not dissolve in water because \_\_\_\_\_.  
 (a) their molecules are so large  
 (b) their molecules have no charges or partial charges to which water molecules can adhere  
 (c) they do not ionize

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- (d) their electrons are so stable that they do not exchange atoms with water molecules
27. An acid is \_\_\_\_\_.  
 (a) any compound with a pH  
 (b) any compound that accepts hydrogen ions  
 (c) a material that resists changes in the pH of a solution  
 (d) a compound that donates hydrogen ions to a solution
28. Sucrose has a molecular mass of 342 daltons. To make a 2-molar (2 M) solution of sucrose, \_\_\_\_\_.  
 (a) stir 342 g of sucrose in water to dissolve the sugar, and then add enough water to bring the total volume of the solution up to 0.5 L  
 (b) stir 684 g of sucrose in water to dissolve the sugar, and then add enough water to bring the total volume of the solution up to 2 L  
 (c) stir 684 g of sucrose in water to dissolve the sugar, and then add enough water to bring the total volume of the solution up to 0.5 L  
 (d) stir 342 g of sucrose in water to dissolve the sugar, and then add enough water to bring the total volume of the solution up to 2 L
29. A mole of ethyl alcohol weighs 46 g. How many grams of ethyl alcohol are needed to produce 1 L of a 2-millimolar (2 mM) solution?  
 (a) 92 g  
 (b) 9.2 g  
 (c) 0.92 g  
 (d) 0.092 g
30. Adding acid tends to \_\_\_\_\_ of a solution.  
 (a) increase the hydrogen ion concentration and raise the pH  
 (b) increase the hydrogen ion concentration and lower the pH  
 (c) decrease the hydrogen ion concentration and raise the pH  
 (d) decrease the hydrogen ion concentration and lower the pH
31. Which of the following dissociations is that of an acid?  
 (a)  $\text{H}_2\text{O} \rightarrow \text{H}^+ + \text{OH}^-$   
 (b)  $\text{NaOH} \rightarrow \text{Na}^+ + \text{OH}^-$   
 (c)  $\text{HF} \rightarrow \text{H}^+ + \text{F}^-$   
 (d)  $\text{NH}_3 + \text{H}^+ \rightarrow \text{NH}_4^+$
32. A glass of grapefruit juice, at pH 3, contains \_\_\_\_\_  $\text{H}^+$  as a glass of tomato juice, at pH 4.  
 (a) ten times as much  
 (b) half as much  
 (c) twice as much  
 (d) three times as much
33. A solution at pH 6 contains \_\_\_\_\_ than the same amount of solution at pH 8.  
 (a) 2 times more  $\text{H}^+$   
 (b) 4 times more  $\text{H}^+$   
 (c) 100 times more  $\text{H}^+$   
 (d) 4 times less  $\text{H}^+$
34. Adding a base tends to \_\_\_\_\_ of a solution.  
 (a) lower the hydrogen ion concentration and lower the pH  
 (b) lower the hydrogen ion concentration and increase the pH  
 (c) increase the hydrogen ion concentration and lower the pH  
 (d) increase the hydrogen ion concentration and increase the pH
35. When the pH of a solution shifts from 7 to 3, how has the hydrogen ion concentration changed?  
 (a) It has increased by 4 times.  
 (b) It has decreased by 4 times.  
 (c) It has increased by 10,000 times.  
 (d) It has decreased by 10,000 times.
36. Pure water has a pH of 7. Why does uncontaminated rainwater have a pH of 5.6?  
 (a) formation of carbonic acid from carbon dioxide and water  
 (b) presence of sulfuric acid  
 (c) presence of nitric acid  
 (d) burning of fossil fuels
37. A substance that minimizes changes in the concentration of  $\text{H}^+$  and  $\text{OH}^-$  in a solution is a(n) \_\_\_\_\_.  
 (a) hydrocarbon  
 (b) buffer  
 (c) NaCl  
 (d) strong acid
38. Which of the following statements does not correctly describe a buffer?  
 (a) A buffer can accept  $\text{H}^+$  ions when needed.  
 (b) A buffer can donate  $\text{H}^+$  ions when needed.  
 (c) A buffer resists changes in the pH of a solution.  
 (d) None of the above (all the above statements correctly describe a buffer).

39. Which of the following statements is true about acid precipitation?  
 (a) It harms aquatic life, but has little effect on terrestrial life.  
 (b) It washes away some minerals that are plant nutrients, while causing some toxic minerals to accumulate.  
 (c) Automobile use is the leading contributor to acid rain.  
 (d) Industrial areas are hit hardest by acid rain.

40. Water molecules have a polarity, which allows them to be electrically attracted to other water molecules and other polar molecules by weak chemical bonds known as \_\_\_\_\_.

- (a) hydrogen bonds  
 (b) ionic bonds  
 (c) polar covalent bonds  
 (d) nonpolar covalent bonds

## ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. d  | 2. a  | 3. d  | 4. c  |
| 5. c  | 6. b  | 7. a  | 8. c  |
| 9. a  | 10. d | 11. a | 12. d |
| 13. b | 14. a | 15. c | 16. d |
| 17. c | 18. b | 19. a | 20. a |
| 21. c | 22. c | 23. a | 24. a |
| 25. c | 26. b | 27. d | 28. a |
| 29. d | 30. b | 31. c | 32. a |
| 33. c | 34. b | 35. c | 36. a |
| 37. b | 38. d | 39. b | 40. a |

## 1.4: CARBON AND THE MOLECULAR DIVERSITY OF LIFE

1. Most organic compounds contain carbon and \_\_\_\_\_.  
 (a) phosphate    (b) oxygen  
 (c) hydrogen    (d) nitrogen
2. The experiments of Wöhler, Kolbe, Miller, and other chemists invalidated the concept of vitalism by demonstrating that \_\_\_\_\_.  
 (a) one organic substance could be transformed into another organic substance  
 (b) organic molecules could be produced apart from living organisms using inorganic materials  
 (c) complex organic substances are the result of a series of sequential synthetic reactions occurring in both living organisms and nonliving systems.
3. The large diversity of shapes of biological molecules is possible because of the extensive presence of \_\_\_\_\_ in the molecules.  
 (a) carbon    (b) oxygen  
 (c) hydrogen    (d) nitrogen
4. Which of the following is a hydrocarbon?  
 (a)  $C_3H_8$     (b)  $CO_2$   
 (c)  $C_6H_{12}O_6$     (d)  $H_2CO_3$
5. The valence for nitrogen is 3 because \_\_\_\_\_.  
 (a) the molecular mass of nitrogen is 3  
 (b) that is the number of electrons needed to complete nitrogen's innermost electron shell  
 (c) that is the number of electrons needed to complete nitrogen's outermost electron shell  
 (d) that is the number of hydrogen bonds a nitrogen atom can form
6. Citric acid makes lemons taste sour. Which of the following is a functional group that would cause a molecule like citric acid to be acidic?  
 (a) hydroxyl    (b) hydrocarbon  
 (c) amino    (d) carbonyl
7. Variations in the reactive properties of different organic molecules are most closely associated with \_\_\_\_\_.  
 (a) the number of carbon atoms comprising the molecule's skeleton  
 (b) the presence or absence of double bonds
8. Choose the pair of terms that completes this sentence: Sulphydryl is to \_\_\_\_\_ as \_\_\_\_\_ is to amine.  
 (a) hydroxyl...alcohol  
 (b) ketone...amino  
 (c) carbon...nitrogen  
 (d) thiol...amino
9. Which of the following functional groups has a polar covalent bond, which helps alcohols dissolve in water?  
 (a) amino    (b) hydroxyl  
 (c) carboxyl    (d) sulphydryl
10. Which functional group would you predict is part of indoleacetic acid (a plant hormone)?  
 (a) sulphydryl    (b) carbonyl  
 (c) amino    (d) carboxyl
11. At the beginning of the 19th century, it was thought that the substances that made up living things were special and could not be synthesized by ordinary chemical methods. This now-discarded theory was called the theory of \_\_\_\_\_.  
 (a) special creation  
 (b) spontaneous generation  
 (c) vitalism  
 (d) materialism
12. The first organic molecule to be synthesized from inorganic substances was \_\_\_\_\_.  
 (a) urea  
 (b) acetic acid  
 (c) ammonium cyanate  
 (d) insulin
13. Stanley Miller's experiments were significant because he demonstrated that \_\_\_\_\_.  
 (a) the behavior of any molecule containing a carbon atom was fundamentally the same  
 (b) under certain circumstances the theory of vitalism was valid  
 (c) a variety of simple organic compounds could be spontaneously synthesized from

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- components in Earth's primitive atmosphere  
(d) lightning discharges could produce the molecules previously presumed to have originated in volcanic outgassings
14. Which is an organic molecule?  
(a) Ne      (b) O<sub>2</sub>  
(c) CH<sub>4</sub>    (d) NaCl
15. Which element is most particularly associated with organic chemistry?  
(a) carbon      (b) sulfur  
(c) nitrogen    (d) hydrogen
16. What is the three-dimensional shape created by hybrid orbitals that are formed when a carbon atom is covalently bonded with four other atoms?  
(a) a flat sheet with carbon in the center  
(b) a triangle with carbon in the center  
(c) a cube with carbon in the center  
(d) a tetrahedron with carbon in the center
17. A straight-chain carbon compound constructed from \_\_\_\_\_ must contain at least one carbon-carbon double bond.  
(a) 6 hydrogen, 2 carbon  
(b) 6 hydrogen, 3 carbon  
(c) 6 hydrogen, 2 carbon, 1 oxygen  
(d) 8 hydrogen, 3 carbon, 3 oxygen
18. Carbon atoms are the most versatile building blocks of the molecules used by living organisms because \_\_\_\_\_.  
(a) carbon is the central atom of carbon dioxide, a necessary molecule for photosynthesis  
(b) carbon is the central atom in urea, a molecule used by many living organisms to transport wastes from the body  
(c) each carbon atom acts as an intersection point from which a molecule can branch off in up to four directions  
(d) carbon can combine with hydrogen to form hydrocarbons
19. The carbon atom is tetravalent; this means that \_\_\_\_\_.  
(a) carbon readily forms ionic bonds  
(b) carbon's first electron shell holds 4 electrons  
(c) a carbon atom can complete its valence shell by forming four covalent bonds  
(d) the bond angle between each bond is 90°, forming an arrangement like the points of a compass
20. A molecule has one carbon-carbon double bond and four monovalent atoms or groups. How many different geometric isomers exist for this molecule?  
(a) none      (b) two  
(c) four      (d) six
21. Which of the following functional groups is present in all amino acids?  
(a) -SH      (b) -COH  
(c) -OH      (d) -NH<sub>2</sub>
22. Which of these is found in all amino acids?  
(a) -COOH  
(b) -COH  
(c) -NH<sub>2</sub>  
(d) Both -COOH and -NH<sub>2</sub>
23. Freon, CCl<sub>2</sub>F<sub>2</sub>, is \_\_\_\_\_ because \_\_\_\_\_.  
(a) not an isomer...there is only one structural configuration for the molecule  
(b) a geometric isomer...free rotation about the bond axis is not possible  
(c) an enantiomer...the carbon is asymmetric  
(d) an enantiomer...the molecule exists in two mirror-image configurations
24. Glucose and hexanoic acid each contain six carbon atoms, but they have completely different properties. Glucose is a nutrient found in food; hexanoic acid is poisonous. Their differences must be due to different \_\_\_\_\_.  
(a) monomers  
(b) macromolecules  
(c) functional groups  
(d) quaternary structures
25. Although the structures of the functional groups that are most important to life vary, they share one thing in common: They \_\_\_\_\_.  
(a) all contain oxygen  
(b) all have at least one double bond  
(c) always cause the carbon to which they are attached to become an asymmetric carbon, thus they convert the molecule into an enantiomer  
(d) all are hydrophilic and increase the organic compound's water solubility
26. Ethanol, propanol, and methanol are three simple alcohols. They can be grouped together because they \_\_\_\_\_.  
(a) all share the same functional group: a hydroxyl

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- (c) are hydrophobic  
(d) all contain a carbonyl group
27. Which one of the following molecules has a carboxyl functional group?  
(a) R-NH<sub>2</sub>      (b) R-COH  
(c) R-COOH    (d) R-OPO<sub>3</sub><sup>-2</sup>
28. Which one of the following molecules is a weak base?  
(a) R-NH<sub>2</sub>      (b) R-SH  
(c) R-OH      (d) R-COOH
29. Which of the following molecules is a weak acid?  
(a) R-NH<sub>2</sub>      (b) R-SH  
(c) R-OH      (d) R-COOH
30. Which one of the following functional groups increases the solubility of organic compounds in water?  
(a) -SH      (b) -COOH  
(c) -COH    (d) all of the above
31. Which of the following examples describes a unique functional property of the carboxyl group?  
(a) Its compounds may be structural isomers with different properties.  
(b) Two groups can interact to help stabilize protein structure.  
(c) It is polar as a result of the electronegative oxygen atom drawing electrons toward itself.  
(d) The covalent bond between oxygen and hydrogen is so polar that hydrogen ions tend to dissociate reversibly.
32. Which of the following functional groups is associated with a release of energy that cells can harvest to perform many functions?  
(a) amino      (b) phosphate  
(c) sulfhydryl    (d) hydroxyl
33. Which functional group would you predict is part of abscisic acid (ABA)?  
(a) carboxyl      (b) hydroxyl  
(c) carbonyl    (d) amino
34. The ionized or dissociated carboxyl group may be written as \_\_\_\_\_.  
(a) -COOH      (b) -OH  
(c) -COO<sup>-</sup>    (d) NH<sub>4</sub><sup>+</sup>
35. Which one of the following groups would not be capable of hydrogen bonding with an oxygen atom on another functional group?  
(a) amino  
(b) hydroxyl  
(c) carboxylic acid  
(d) none of the above
36. Which of these is a thiol?  
(a) -SH      (b) -COH  
(c) -OH      (d) -NH<sub>2</sub>

## ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. c  | 2. b  | 3. a  | 4. a  |
| 5. c  | 6. a  | 7. c  | 8. d  |
| 9. b  | 10. d | 11. c | 12. a |
| 13. c | 14. c | 15. a | 16. d |
| 17. b | 18. c | 19. c | 20. b |
| 21. d | 22. d | 23. a | 24. c |
| 25. a | 26. a | 27. c | 28. a |
| 29. d | 30. d | 31. d | 32. b |
| 33. a | 34. c | 35. d | 36. A |

## 1.5: THE STRUCTURE AND FUNCTION OF MACROMOLECULES

1. Some regions of a polypeptide may coil or fold back on itself. This is called \_\_\_\_\_, and the coils or folds are held in place by \_\_\_\_\_.
  - (a) tertiary structure... hydrogen bonds
  - (b) primary structure... covalent bonds
  - (c) secondary structure... hydrogen bonds
  - (d) tertiary structure... covalent bonds
2. Glycogen is \_\_\_\_\_.
  - (a) the form in which plants store sugars
  - (b) a polysaccharide found in animals
  - (c) a polysaccharide found in plant cell walls
  - (d) a transport protein that carries oxygen
3. glucose + glucose → \_\_\_\_\_ by \_\_\_\_\_.
  - (a) lactose + water... hydrolysis
  - (b) starch + water... dehydration synthesis
  - (c) sucrose + water... dehydration synthesis
  - (d) maltose + water... dehydration synthesis
4. Which of these is a source of lactose?
  - (a) sugar beets
  - (b) milk
  - (c) potatoes
  - (d) sugar cane
5. Which of these is a polysaccharide?
  - (a) cellulose
  - (b) glucose
  - (c) galactose
  - (d) lactose
6. \_\_\_\_\_ is the most abundant organic compound on Earth.
  - (a) Glucose
  - (b) Cellulose
  - (c) Lactose
  - (d) Starch
7. Which of these is not a lipid?
  - (a) phospholipid
  - (b) cholesterol
  - (c) steroids
  - (d) RNA
8. Some regions of a polypeptide may coil or fold back on itself. This is called \_\_\_\_\_, and the coils or folds are held in place by \_\_\_\_\_.
  - (a) tertiary structure... hydrogen bonds
  - (b) primary structure... covalent bonds
  - (c) secondary structure... hydrogen bonds
  - (d) tertiary structure... covalent bonds
9. A hydrophobic amino acid R group (side group) would be found where in a protein?
  - (a) forming a peptide bond with the next amino acid in the polypeptide chain
  - (b) on the outside of the folded chain, in the water
  - (c) on the inside of the folded chain, away from water
  - (d) forming hydrogen bonds with other R groups
10. Which of these is rich in unsaturated fats?
  - (a) olive oil
  - (b) butter
  - (c) beef fat
  - (d) lard
11. A function of cholesterol that does not harm health is its role \_\_\_\_\_.
  - (a) in calcium and phosphate metabolism
  - (b) as a component of animal cell membranes
  - (c) as the primary female sex hormone
  - (d) the most abundant male sex hormone
12. A nucleotide is composed of a(n) \_\_\_\_\_.
  - (a) phosphate group, a nitrogen-containing base, and a hydrocarbon
  - (b) phosphate group, a nitrogen-containing base, and a five-carbon sugar
  - (c) glycerol, a nitrogen-containing base, and a five-carbon sugar
  - (d) amino group, a nitrogen-containing base, and a five-carbon sugar
13. The building blocks or monomers of nucleic acid molecules are called \_\_\_\_\_.
  - (a) polysaccharides
  - (b) pyrimidines and purines
  - (c) fatty acids
  - (d) nucleotides
14. The building blocks or monomers of nucleic acid molecules are called \_\_\_\_\_.
  - (a) polysaccharides
  - (b) pyrimidines and purines
  - (c) fatty acids
  - (d) nucleotides
15. Which of these does not contain a structural protein?
  - (a) muscles
  - (b) tendons
  - (c) ovalbumin
  - (d) spider silk
16. Defensive proteins are manufactured by the \_\_\_\_\_ system.
  - (a) immune
  - (b) nervous
  - (c) digestive
  - (d) integumentary
17. Proteins are polymers of \_\_\_\_\_.
  - (a) CH<sub>2</sub>O units
  - (b) nucleotides
  - (c) amino acids
  - (d) hydrocarbons
18. What type of bond joins the monomers in a protein's primary structure?
  - (a) ionic
  - (b) hydrophobic
  - (c) peptide
  - (d) S—S

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19. A hydrophobic amino acid R group (side group) would be found where in a protein?
    - (a) forming a peptide bond with the next amino acid in the polypeptide chain
    - (b) on the outside of the folded chain, in the water
    - (c) on the inside of the folded chain, away from water
    - (d) forming hydrogen bonds with other R groups
  20. The secondary structure of a protein results from \_\_\_\_\_.
    - (a) hydrogen bonds
    - (b) ionic bonds
    - (c) hydrophobic interactions
    - (d) peptide bonds
  21. Tertiary structure is not directly dependent on \_\_\_\_\_.
    - (a) hydrophobic interactions
    - (b) peptide bonds
    - (c) hydrogen bonds
    - (d) ionic bonds
  22. If a strand of DNA has the nitrogen base sequence ATTTGC, what will be the sequence of the matching strand?
    - (a) GCAAAT
    - (b) ATTTGC
    - (c) TAAACG
    - (d) TUUUCG
  23. If a DNA double helix is 100 nucleotide pairs long and contains 25 adenine bases, how many guanine bases does it contain?
    - (a) 25
    - (b) 150
    - (c) 75
    - (d) 50
  24. The two strands of a DNA double helix are held together by \_\_\_\_\_ that form between pairs of nitrogenous bases.
    - (a) hydrogen bonds
    - (b) ionic bonds
    - (c) hydrophilic interactions
    - (d) S—S bonds
  25. A dehydration reaction (or condensation reaction) is the process in which \_\_\_\_\_.
    - (a) water molecules are attracted to each other
    - (b) water molecules are used as a source of raw material to break down polymers to monomers
    - (c) water molecules are produced as a polymer is formed from monomers
    - (d) the bonds between the individual monomers of a polymer are broken by the addition of water molecules
  26. The four main categories of macromolecules present in living systems are \_\_\_\_\_.
    - (a) proteins, DNA, RNA, and steroids
    - (b) monosaccharides, lipids, polysaccharides, and proteins
    - (c) proteins, nucleic acids, carbohydrates, and lipids
    - (d) nucleic acids, carbohydrates, monosaccharides, and proteins
  27. What is the main monosaccharide used by human cells for energy?
    - (a) any monosaccharide
    - (b) glycogen
    - (c) sucrose
    - (d) glucose
  28. The disaccharide that is formed when glucose is joined to fructose by a glycosidic linkage type of covalent bond is called \_\_\_\_\_.
    - (a) maltose
    - (b) sucrose
    - (c) starch
    - (d) glycogen
  29. Plant cell walls consist mainly of \_\_\_\_\_.
    - (a) chitin
    - (b) cellulose
    - (c) peptidoglycan
    - (d) chlorophyll
  30. The characteristic that all lipids have in common is that \_\_\_\_\_.
    - (a) they are all made of fatty acids and glycerol
    - (b) they all contain nitrogen
    - (c) they do not have a high-energy content
    - (d) none of them dissolves in water
  31. Palm oil and coconut oil are more like animal fats than are other plant oils. Because they \_\_\_\_\_ than other plant oils, they may contribute to cardiovascular disease.
    - (a) contain fewer double bonds
    - (b) contain more double bonds
    - (c) contain more sodium
    - (d) are less soluble in water
  32. Some regions of a polypeptide may coil or fold back on itself. This is called \_\_\_\_\_, and the coils or folds are held in place by \_\_\_\_\_.
    - (a) tertiary structure... hydrogen bonds
    - (b) primary structure... covalent bonds
    - (c) secondary structure... hydrogen bonds
    - (d) tertiary structure... covalent bonds

### ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. c  | 2. b  | 3. d  | 4. b  |
| 5. a  | 6. b  | 7. d  | 8. c  |
| 9. c  | 10. a | 11. b | 12. a |
| 13. d | 14. d | 15. c | 16. a |
| 17. c | 18. c | 19. c | 20. a |
| 21. b | 22. c | 23. c | 24. a |
| 25. c | 26. c | 27. a | 28. b |
| 29. b | 30. b | 31. a | 32. c |

## 2.1: A TOUR OF THE CELL

1. 1 meter = \_\_\_\_\_ centimeters.
  - (a) 100
  - (b) 1,000,000,000
  - (c) 1,000
  - (d) 1,000,000,000,000
2. \_\_\_\_\_ are surface appendages that allow a bacterium to stick to a surface
  - (a) Cell walls
  - (b) Flagella
  - (c) Ribosomes
  - (d) Pili
3. What is the function of a bacterium's capsule?
  - (a) protection
  - (b) adhesion
  - (c) protein synthesis
  - (d) DNA storage
4. In eukaryotic cells the first step in protein synthesis is the \_\_\_\_\_.
  - (a) translation of an RNA nucleotide sequence into a sequence of amino acids
  - (b) linking of nucleotides to form a polypeptide
  - (c) translation of a DNA nucleotide sequence into a sequence of amino acids
  - (d) transferring of information from DNA to messenger RNA
5. Which organelle plays a role in intracellular digestion?
  - (a) lysosome
  - (b) ribosome
  - (c) chloroplast
  - (d) Golgi apparatus
6. The cilia and flagella of eukaryotic cells are composed of \_\_\_\_\_.
  - (a) microtubules
  - (b) intermediate filaments
  - (c) microfilaments
  - (d) pili
7. Which of the following functions is not likely to be associated with the cytoskeleton in eukaryotic cells?
  - (a) the beating of cilia or flagella
  - (b) maintaining the position of the nucleus in the cell
  - (c) determining which proteins are synthesized by the cell
8. Which statement about extracellular structures (plant cell walls and the extracellular matrix of animal cells) is incorrect?
  - (a) Some extracellular structures can play a role in determining cell shape.
  - (b) Some extracellular structures provide for cytoplasmic connections between adjacent cells.
  - (c) Extracellular structures are barriers that prevent small molecules from entering or leaving the cell.
  - (d) Proteins and carbohydrates are common components of extracellular structures.
9. Which of the following correctly matches an organelle with its function?
  - (a) mitochondrion... photosynthesis
  - (b) nucleus... cellular respiration
  - (c) ribosome... manufacture of lipids
  - (d) central vacuole... storage
10. If one is trying to understand cellular function, what is the most important limitation associated with the study of isolated organelles?
  - (a) Organelles can only function for a short time independently from the rest of the cell.
  - (b) In a functioning cell, organelles are not independent of each other.
  - (c) The membranes of the endomembrane system all have a common site of membrane and protein synthesis.
  - (d) Each organelle is responsible for a unique set of functions in the cell.
11. Which of these organelles carries out cellular respiration?
  - (a) nucleolus
  - (b) chromatin
  - (c) smooth endoplasmic reticulum
  - (d) mitochondrion
12. Which of these cell junctions form a barrier to the passage of materials?
  - (a) tight junctions
  - (b) gap (communicating) junctions
  - (c) desmosomes (anchoring junctions)
  - (d) keratin fibers

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13. The \_\_\_\_\_ is composed of DNA and protein.  
 (a) mitochondrion (b) flagellum  
 (c) centriole (d) chromatin
14. Ribosomal subunits are manufactured by the \_\_\_\_\_.  
 (a) lysosome (b) nucleolus  
 (c) peroxisome (d) rough endoplasmic reticulum
15. \_\_\_\_\_ are the sites of protein synthesis.  
 (a) Mitochondria (b) Peroxisomes  
 (c) Golgi apparatuses (d) Ribosomes
16. Which of these is involved in the manufacture of membrane?  
 (a) rough endoplasmic reticulum  
 (b) ribosomes  
 (c) Golgi apparatus  
 (d) nucleolus
17. The \_\_\_\_\_ is a selective barrier, regulating the passage of material into and out of the cell.  
 (a) lysosome (b) nuclear envelope  
 (c) chloroplast (d) plasma membrane
18. Where is calcium stored?  
 (a) mitochondria  
 (b) smooth endoplasmic reticulum  
 (c) centrioles  
 (d) rough endoplasmic reticulum
19. The primary role of \_\_\_\_\_ is to bind animal cells together.  
 (a) plasmodesmata  
 (b) gap (communicating) junctions  
 (c) the cytoskeleton  
 (d) desmosomes
20. Which of these are hollow rods that shape and support the cell?  
 (a) plasma membrane  
 (b) microtubules  
 (c) chloroplasts  
 (d) microfilaments
21. \_\_\_\_\_ is/are identical in structure to centrioles.  
 (a) Mitochondria (b) Nuclear envelopes  
 (c) Basal bodies (d) Microfilaments
22. Which of these organelles produces H<sub>2</sub>O<sub>2</sub> as a by-product?  
 (a) mitochondrion (b) nucleus  
 (c) centrioles (d) peroxisome
23. \_\_\_\_\_ aid in the coordination of the activities of adjacent animal cells.  
 (a) gap (communicating) junctions  
 (b) Tight junctions
24. Mitochondria are found in \_\_\_\_\_.  
 (a) all cells  
 (b) animal cells only  
 (c) plant cells only  
 (d) both plant and animal cells
25. Which of the following choices incorrectly matches a tool that biologists use to study cells with a type of experiment the tool might be used for?  
 (a) scanning electron microscopy (SEM) to study the detailed structure of the surfaces of cells  
 (b) transmission electron microscopy (TEM) to study the distribution of organelles in a living cell  
 (c) transmission electron microscopy (TEM) to study ultrastructural features inside the cell  
 (d) light microscopy to study the movement of cells growing on a surface
26. Which of the following clues would tell you whether a cell is prokaryotic or eukaryotic?  
 (a) the presence or absence of a rigid cell wall  
 (b) whether or not the cell is partitioned by internal membranes  
 (c) the presence or absence of ribosomes  
 (d) whether or not the cell carries out cellular metabolism
27. Which statement(s) correctly describe(s) the relationship between the nucleus and ribosomes of a eukaryotic cell?  
 (a) The components of the ribosomes are first assembled in the nucleus.  
 (b) The nucleus contains the instructions for protein synthesis by the ribosomes.  
 (c) All of the proteins of the cell are synthesized on ribosomes bound on the nuclear envelope.  
 (d) The first two answers are correct.
28. Which statement describes a process that is not part of the function of the endomembrane system?  
 (a) Most of the phospholipids of the endomembrane system are synthesized in the endoplasmic reticulum.  
 (b) Direct physical contact among all the organelles of the endomembrane system is needed to permit movement of lipid and protein components among the organelles.

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- (c) Keratin fibers  
 (d) Plasmodesmata
- (c) The Golgi apparatus functions in the modification and sorting of lipids and proteins.  
 (d) Proteins that will be secreted from the cell are likely to be found in closed spaces bounded by membranes of the endomembrane system.
29. A cell has formed a food vacuole as it ingested a food particle. Which of the following events is not likely to occur associated with the breakdown of that food particle?  
 (a) The membrane of the food vacuole is derived from the plasma membrane.  
 (b) Enzymes for the breakdown of the food are delivered to the food vacuole from the cytoplasm.  
 (c) Digestion of the food particle occurs in a vesicle with a membrane that separates the digestion from the cytoplasm.  
 (d) Proteins for digestion of the food are made by ribosomes in the rough endoplasmic reticulum.
30. \_\_\_\_\_ aid in the coordination of the activities of adjacent animal cells.  
 (a) gap (communicating) junctions  
 (b) Tight junctions  
 (c) Keratin fibers  
 (d) Plasmodesmata
31. Mitochondria are found in \_\_\_\_\_.  
 (a) all cells  
 (b) animal cells only  
 (c) plant cells only  
 (d) both plant and animal cells
32. A substance moving from outside the cell into the cytoplasm must pass through \_\_\_\_\_.  
 (a) a microtubule  
 (b) several different organelle membranes  
 (c) the plasma membrane  
 (d) the nucleus
33. Which of the following categories best describes the function of the rough endoplasmic reticulum?  
 (a) breakdown of complex foods  
 (b) energy processing  
 (c) manufacturing  
 (d) structural support of cells
34. A protein that ultimately functions in the plasma membrane of a cell is most likely to have been synthesized \_\_\_\_\_.  
 (a) on ribosomes on the nuclear envelope  
 (b) on free cytoplasmic ribosomes
- ANSWERS
- |       |       |       |       |
|-------|-------|-------|-------|
| 1. a  | 2. d  | 3. a  | 4. d  |
| 5. a  | 6. a  | 7. c  | 8. c  |
| 9. d  | 10. b | 11. d | 12. a |
| 13. d | 14. b | 15. d | 16. a |
| 17. d | 18. b | 19. d | 20. b |
| 21. c | 22. d | 23. a | 24. d |
| 25. b | 26. b | 27. d | 28. b |
| 29. b | 30. a | 31. d | 32. c |
| 33. c | 34. c | 35. c | 36. d |
| 37. c | 38. d | 39. b | 40. c |

## 2.2: MEMBRANE STRUCTURE AND FUNCTION

1. Which of the following statements about a typical plasma membrane is correct?
  - (a) the sides of the plasma membrane that face the cytoplasm and the outside of the cell have different lipid and protein composition.
  - (b) phospholipids are the primary component that determines which solutes can cross the plasma membrane.
  - (c) carbohydrates on the membrane surface are important in determining the overall bilayer structure.
  - (d) the hydrophilic interior of the membrane is composed primarily of the fatty acid tails of the phospholipids.
  
2. Which of the following best describes the structure of a biological membrane?
  - (a) a mixture of covalently linked phospholipids and proteins that determines which solutes can cross the membrane and which cannot
  - (b) two layers of phospholipids (with opposite orientations of the phospholipids in each layer) with each layer covered on the outside with proteins
  - (c) two layers of phospholipids with proteins embedded between the two layers
  - (d) two layers of phospholipids with proteins either crossing the layers or on the surface of the layers
  
3. The permeability of a biological membrane to a specific solute may depend on which of the following?
  - (a) the size and polarity of the solute
  - (b) the types of transport proteins in the membrane
  - (c) the phospholipid composition of the membrane
  - (d) The first and second answers are both correct.
  
4. Which of the following is least likely to be important in holding the components of a biological membrane together?
  - (a) polar interactions among the phospholipid head groups on the same surface of the membrane
  - (b) hydrophobic interactions among the fatty acid tails of phospholipids on the same side of the membrane
  
5. Which of the following statements about osmosis is incorrect?
  - (a) osmosis is the diffusion of water from a region of higher water concentration to a region of lower water concentration.
  - (b) if a solution outside the cell is hypotonic compared to the cytoplasm, water will move into the cell by osmosis.
  - (c) osmotic movement of water into a cell would likely occur if the cell accumulates solutes from its environment.
  - (d) the presence of aquaporins (proteins that form water channels in the membrane) should speed up the process of osmosis.
  
6. In facilitated diffusion, what is the role of the transport protein?
  - (a) transport proteins provide the energy for diffusion of the solute.
  - (b) transport proteins provide a hydrophilic route for the solute to cross the membrane.
  - (c) transport proteins organize the phospholipids to allow the solute to cross the membrane.
  - (d) transport proteins provide a low-resistance channel for water molecules to cross the membrane.
  
7. If the concentration of calcium in the cytoplasm is 2.0 mM and the concentration of calcium in the surrounding fluid is 0.1 mM, how could the cell increase the concentration of calcium in the cytoplasm?
  - (a) passive transport
  - (b) diffusion
  - (c) active transport
  - (d) osmosis
  
8. The movement of glucose into a cell against a concentration gradient is most likely to be accomplished by which of the following?
  - (a) passive diffusion of the glucose through the lipid bilayer
  - (b) ATP-dependent changes in the conformation of a transport protein that moves the glucose across the membrane

- (c) facilitated diffusion of the glucose using a carrier protein
  - (d) cotransport of the glucose with a proton or sodium ion that was pumped across the membrane using the energy of ATP hydrolysis
- 
9. Active and passive transport of solutes across a membrane typically differ in which of the following ways?
    - (a) active transport is usually against the concentration gradient of the solute, whereas passive transport is always down the concentration gradient of the solute.
    - (b) active transport always involves the utilization of cellular energy, whereas passive transport does not require cellular energy.
    - (c) active transport always requires the use of transport proteins, but passive transport can sometimes be accomplished without a protein.
    - (d) a, b and c are all correct.
  
  10. Which of the following does not correctly describe some aspect of either exocytosis or endocytosis?
    - (a) both processes provide a mechanism for exchanging membrane-impermeable molecules between the inside and the outside of the cell.
    - (b) these two processes always require the participation of transport vesicles.
    - (c) both endocytosis and exocytosis involve active transport.
    - (d) exocytosis and endocytosis always result in a change in the surface area of the plasma membrane.
  
  11. Which of the following statements about the role of phospholipids in forming membranes is correct?
    - (a) phospholipids are completely insoluble in water.
    - (b) phospholipids form a single sheet in water.
    - (c) phospholipids form a structure in which the hydrophobic portion faces outward.
    - (d) phospholipids form a selectively permeable structure.
  
  12. The plasma membrane is referred to as a "fluid mosaic" structure. Which of the following statements is true?
    - (a) the fluid component of the membrane is composed of phospholipids, and the mosaic part is composed of carbohydrates.
    - (b) the fluid aspect of the membrane describes its structure at normal temperatures, and the mosaic aspect describes the membrane as the temperature is lowered.
    - (c) the mosaic comprises the carbohydrate chains on the inner surface of the membrane.
    - (d) the fluid component of the membrane is phospholipid, and the mosaic is protein.
  
  13. Which of the following types of information is (are) most likely to be derived from freeze-fracture of biological samples?
    - (a) the coded information in DNA
    - (b) thin sections (slices) of fixed and embedded cells
    - (c) proteins imbedded in membrane bilayers
    - (d) patterns of movement in living cells
  
  14. Consider the currently accepted fluid mosaic model of the plasma membrane. Where in the plasma membrane would cholesterol most likely be found?
    - (a) on the outside (external) surface of the membrane
    - (b) in the interior of the membrane
    - (c) on the inside (cytoplasmic) surface
    - (d) in the interior and on the inside surface, but not on the outside surface
  
  15. Which of the following functional processes result(s) from the presence of proteins in or on the plasma membrane?
    - (a) enzymatic activity
    - (b) cell-cell recognition
    - (c) intercellular joining
    - (d) all of the above
  
  16. Which of the following is not a function of membrane proteins?
    - (a) membrane proteins attach the membrane to the cytoskeleton.
    - (b) membrane proteins provide receptors for chemical messengers.
    - (c) membrane proteins form channels, which move substances across the membrane.
    - (d) all of these are functions of membrane proteins.
  
  17. Select the correct statement concerning carbohydrates associated with the plasma membrane.
    - (a) carbohydrates are only found associated with the membranes of prokaryotic cells.
    - (b) the carbohydrate composition of most eukaryotic plasma membranes is quite similar.

## 2.2: MEMBRANE STRUCTURE AND FUNCTION

1. Which of the following statements about a typical plasma membrane is correct?
  - (a) the sides of the plasma membrane that face the cytoplasm and the outside of the cell have different lipid and protein composition.
  - (b) phospholipids are the primary component that determines which solutes can cross the plasma membrane.
  - (c) carbohydrates on the membrane surface are important in determining the overall bilayer structure.
  - (d) the hydrophilic interior of the membrane is composed primarily of the fatty acid tails of the phospholipids.
  
2. Which of the following best describes the structure of a biological membrane?
  - (a) a mixture of covalently linked phospholipids and proteins that determines which solutes can cross the membrane and which cannot
  - (b) two layers of phospholipids (with opposite orientations of the phospholipids in each layer) with each layer covered on the outside with proteins
  - (c) two layers of phospholipids with proteins embedded between the two layers
  - (d) two layers of phospholipids with proteins either crossing the layers or on the surface of the layers
  
3. The permeability of a biological membrane to a specific solute may depend on which of the following?
  - (a) the size and polarity of the solute
  - (b) the types of transport proteins in the membrane
  - (c) the phospholipid composition of the membrane
  - (d) The first and second answers are both correct.
  
4. Which of the following is least likely to be important in holding the components of a biological membrane together?
  - (a) polar interactions among the phospholipid head groups on the same surface of the membrane
  - (b) hydrophobic interactions among the fatty acid tails of phospholipids on the same side of the membrane
  
5. Which of the following statements about osmosis is incorrect?
  - (a) osmosis is the diffusion of water from a region of higher water concentration to a region of lower water concentration.
  - (b) if a solution outside the cell is hypotonic compared to the cytoplasm, water will move into the cell by osmosis.
  - (c) osmotic movement of water into a cell would likely occur if the cell accumulates solutes from its environment.
  - (d) the presence of aquaporins (proteins that form water channels in the membrane) should speed up the process of osmosis.
  
6. In facilitated diffusion, what is the role of the transport protein?
  - (a) transport proteins provide the energy for diffusion of the solute.
  - (b) transport proteins provide a hydrophilic route for the solute to cross the membrane.
  - (c) transport proteins organize the phospholipids to allow the solute to cross the membrane.
  - (d) transport proteins provide a low-resistance channel for water molecules to cross the membrane.
  
7. If the concentration of calcium in the cytoplasm is 2.0 mM and the concentration of calcium in the surrounding fluid is 0.1 mM, how could the cell increase the concentration of calcium in the cytoplasm?
  - (a) passive transport
  - (b) diffusion
  - (c) active transport
  - (d) osmosis
  
8. The movement of glucose into a cell against a concentration gradient is most likely to be accomplished by which of the following?
  - (a) passive diffusion of the glucose through the lipid bilayer
  - (b) ATP-dependent changes in the conformation of a transport protein that moves the glucose across the membrane

9. Active and passive transport of solutes across a membrane typically differ in which of the following ways?
  - (a) active transport is usually against the concentration gradient of the solute, whereas passive transport is always down the concentration gradient of the solute.
  - (b) active transport always involves the utilization of cellular energy, whereas passive transport does not require cellular energy.
  - (c) active transport always requires the use of transport proteins, but passive transport can sometimes be accomplished without a protein.
  - (d) a, b and c are all correct.
  
10. Which of the following does not correctly describe some aspect of either exocytosis or endocytosis?
  - (a) both processes provide a mechanism for exchanging membrane-impermeable molecules between the inside and the outside of the cell.
  - (b) these two processes always require the participation of transport vesicles.
  - (c) both endocytosis and exocytosis involve active transport.
  - (d) exocytosis and endocytosis always result in a change in the surface area of the plasma membrane.
  
11. Which of the following statements about the role of phospholipids in forming membranes is correct?
  - (a) phospholipids are completely insoluble in water.
  - (b) phospholipids form a single sheet in water.
  - (c) phospholipids form a structure in which the hydrophobic portion faces outward.
  - (d) phospholipids form a selectively permeable structure.
  
12. The plasma membrane is referred to as a "fluid mosaic" structure. Which of the following statements is true?
  - (a) the fluid component of the membrane is composed of phospholipids, and the mosaic part is composed of carbohydrates.
  
13. Which of the following types of information is (are) most likely to be derived from freeze-fracture of biological samples?
  - (a) the coded information in DNA
  - (b) thin sections (slices) of fixed and embedded cells
  - (c) proteins imbedded in membrane bilayers
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  - (b) membrane proteins provide receptors for chemical messengers.
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17. Select the correct statement concerning carbohydrates associated with the plasma membrane.
  - (a) carbohydrates are only found associated with the membranes of prokaryotic cells.
  - (b) the carbohydrate composition of most eukaryotic plasma membranes is quite similar.

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24. Carbohydrates on the plasma membrane are typically short chains of 2-5 monosaccharides.
- (d) membrane carbohydrates function primarily in cell-cell recognition.
18. Consider the currently accepted fluid mosaic model of the plasma membrane. Where in the membrane would oligosaccharides most likely be found?
- (a) on the outside (external) surface of the membrane
- (b) in the interior of the membrane
- (c) on the inside (cytoplasmic) surface of the membrane
- (d) on both hydrophilic surfaces of the membrane but not in the hydrophobic interior
19. Which statement(s) about the sidedness of the plasma membrane is (are) correct?
- (a) parts of proteins that are exposed on the cytoplasmic side of the endoplasmic reticulum are also exposed on the cytoplasmic side of the plasma membrane.
- (b) the asymmetrical distribution of membrane proteins, lipids, and carbohydrates across the plasma membrane is determined as the membrane is being constructed.
- (c) every integral membrane protein has specific orientation in the plasma membrane.
- (d) the first, second, and third answers are all correct.
20. Which one of the following molecules is most likely to diffuse freely across the lipid bilayer of the plasma membrane without the involvement of a transport protein?
- (a) carbon dioxide (b) glucose
- (c) sodium ion (d) DNA
21. Which of the following would be least likely to diffuse through a plasma membrane without the help of a transport protein?
- (a) a large polar molecule
- (b) a large nonpolar molecule
- (c) dissolved gases such as oxygen or carbon dioxide
- (d) a small nonpolar molecule
22. Which of the following structures is most consistent with the selective permeability property of biological membranes?
- (a) proteins sandwiched between two layers of phospholipid
- (b) proteins embedded in two layers of phospholipid
- (c) a layer of protein coating a layer of phospholipid
- (d) phospholipids sandwiched between two layers of protein
23. Which of the following statements is true about passive transport?
- (a) passive transport operates independently of diffusion.
- (b) passive transport operates independently of the concentrations of the substance being transported.
- (c) passive transport permits the transported molecule to move in either direction, but the majority of transport occurs down the concentration gradient of the molecule.
- (d) passive transport does not occur in the human body.
24. Cells A and B are the same size, shape, and temperature, but cell A is metabolically quiet and cell B is actively consuming oxygen. Oxygen will diffuse more quickly into cell \_\_\_\_\_ because
- (a) ... the diffusion gradient there is shallower
- (b) ... its membrane transport proteins will not be saturated
- (c) ... the diffusion gradient in cell B is steeper
- (d) ... the oxygen molecules inside cell B have a higher kinetic energy
25. Which one of the following statements is true about diffusion?
- (a) it is very rapid over long distances.
- (b) it requires expenditure of energy by the cell.
- (c) it is a passive process.
- (d) it occurs when molecules move from a region of lower concentration to a region of higher concentration.
26. The internal solute concentration of a plant cell is about 0.8 M. To demonstrate plasmolysis, it would be necessary to suspend the cell in what solution?
- (a) distilled water (b) 0.4 M
- (c) 0.8 M (d) 1.0 M
27. A single plant cell is placed in an isotonic solution. Salt is then added to the solution. Which of the following would occur as a result of the salt addition?
- (a) the added salt would enter the cell, causing the cell to take up water and swell.

- (b) water would enter the cell by osmosis, and the cell would swell.
- (c) water would leave the cell by osmosis, causing the volume of the cytoplasm to decrease.
- (d) there would be no osmotic movement of water in response to the added salt.
28. If a red blood cell and a plant cell were placed in seawater, what would happen to the two types of cells?
- (a) the red blood cell would burst, and the plant cell would shrink.
- (b) both cells would lose water; the red blood cell would shrivel, and the plant plasma membrane would pull away from the cell wall.
- (c) seawater is isotonic to both cells. There will be no change in water content of the cells.
- (d) both cells would gain water by osmosis, the red blood cell would burst, and the plant cell would increase in turgor pressure.
29. Which of these statements describes some aspect of facilitated diffusion?
- (a) facilitated diffusion is another name for osmosis.
- (b) facilitated diffusion of solutes occurs through phospholipid pores in the membrane.
- (c) facilitated diffusion requires energy to drive a concentration gradient.
- (d) facilitated diffusion of solutes may occur through protein pores in the membrane.
30. Which one of the following is not in some way involved in facilitated diffusion?
- (a) a concentration gradient
- (b) a membrane
- (c) a protein
- (d) an outside energy source
31. Movement of phospholipids from one side of a membrane to the other does occur under appropriate circumstances. Based on your understanding of membrane structure and transport, which of the following is likely to describe this movement of phospholipids between the two sides of a membrane?
- (a) free movement of phospholipids between the two sides of the membrane
- (b) making the phospholipids more unsaturated
- (c) making the phospholipids more saturated
- (d) none of the above could facilitate movement of phospholipids from one side of the membrane to the other.
32. Imagine two solutions separated by a selectively permeable membrane that allows water to pass, but not sucrose or glucose. The membrane separates a 0.2-molar sucrose solution from a 0.2-molar glucose solution. With time, how will the solutions change?
- (a) nothing happens because the two solutions are isotonic to one another
- (b) water enters the sucrose solution because the sucrose molecule is a disaccharide and thus larger than the monosaccharide glucose
- (c) water leaves the sucrose solution because the sucrose molecule is a disaccharide and thus larger than the monosaccharide glucose.
- (d) the sucrose solution is hypertonic and will gain water because the total mass of sucrose is greater than that of glucose.
33. The concentration of solutes in a red blood cell is about 2%, but red blood cells contain almost no sucrose or urea. Sucrose cannot pass through the membrane, but water and urea can. Osmosis would cause red blood cells to shrink the most when immersed in which of the following solutions?
- (a) a hypertonic sucrose solution
- (b) a hypotonic sucrose solution
- (c) a hypertonic urea solution
- (d) a hypotonic urea solution
34. Green olives may be preserved in brine, which is a 30% salt solution. How does this method of preservation prevent contamination by microorganisms?
- (a) bacterial cells shrivel up in high salt solutions, causing the cell to burst.
- (b) high salt concentration lowers the pH, thus inhibiting bacterial metabolism.
- (c) high salt concentration raises the pH, thus inhibiting bacterial metabolism.
- (d) a 30% salt solution is hypertonic to the bacteria, so they lose too much water and cannot survive.
35. Active transport requires a cell to expend energy. Which of the following statements is not true?
- (a) for most solutes, active transport most often involves an ATP-powered ion pump and a cotransport protein.
- (b) active transport uses ATP as its energy source.
- (c) active transport usually moves solutes down the concentration gradient.
- (d) active transport requires a protein carrier.

36. Glucose is a six-carbon sugar that diffuses slowly through artificial membranes. The cells lining the small intestine, however, rapidly move glucose from the gut into their cytoplasm. This occurs whether the gut concentrations of glucose are higher or lower than the glucose concentrations in intestinal cell cytoplasm. Using this information, which transport mechanism is most likely responsible for the glucose transport in intestinal cells?
- simple diffusion
  - phagocytosis
  - active transport
  - exocytosis
37. Which of the following is a difference between active transport and facilitated diffusion?
- Active transport involves transport proteins, and facilitated diffusion does not.
  - Facilitated diffusion can move solutes against a concentration gradient, and active transport cannot.
  - Active transport requires energy from ATP, and facilitated diffusion does not.
  - Facilitated diffusion involves transport proteins, and active transport does not.
38. Which of the following statements about the sodium-potassium pump is incorrect?
- the sodium-potassium pump transports  $\text{Na}^+$  and  $\text{K}^+$  ions across the plasma membrane in opposite directions at the expense of ATP hydrolysis.
  - the sodium-potassium pump creates an electrochemical gradient.
  - the sodium-potassium pump is electrogenic.
  - the sodium-potassium pump causes a pH gradient across the plasma membrane.
39. A cell has a membrane potential of  $-100\text{ mV}$  (more negative inside than outside) and has 1,000 times more calcium ions outside the cell than inside. Which of the following best describes a mechanism by which  $\text{Ca}^{2+}$  enters the cell?
- movement of  $\text{Ca}^{2+}$  into the cell through an ion channel down its concentration gradient
  - passive diffusion of  $\text{Ca}^{2+}$  into the cell down its electrochemical gradient
  - cotransport of  $\text{Ca}^{2+}$  into the cell with  $\text{Cl}^-$  ions
  - facilitated diffusion of  $\text{Ca}^{2+}$  into the cell down its electrochemical gradient
40. Which of the following correctly describes a general property of all electrogenic pumps?
- pumps sodium out of the cell and potassium into the cell
  - creates a voltage difference across the membrane
  - can pump a large variety of solutes across a membrane against their concentration gradient
  - a cell with an interior that is positively charged relative to the outside of the cell
41. Which of the following statements about cotransport of solutes across a membrane is correct?
- cotransport involves the hydrolysis of ATP by the transporting protein
  - a cotransport protein is most commonly an ion channel
  - cotransport proteins allow a single ATP-powered pump to drive the active transport of many different solutes
  - the sodium-potassium pump is an example of a cotransport protein
42. Consider the transport of protons and sucrose into a plant cell by the sucrose-proton cotransport protein. Plant cells continuously produce a proton gradient by using the energy of ATP hydrolysis to pump protons out of the cell. Why, in the absence of sucrose, don't protons move back into the cell through the sucrose-proton cotransport protein?
- protons cannot move through membrane transport proteins
  - protons are freely permeable through the phospholipid bilayer, so no transport protein is needed for protons
  - the movement of protons through the cotransport protein cannot occur unless sucrose also moves at the same time
  - in the absence of sucrose, the ATP-powered proton pump does not function, so there is no proton gradient
43. Which of the following enables a cell to pick up and concentrate a specific kind of molecule?
- passive transport
  - facilitated diffusion
  - osmosis
  - receptor-mediated endocytosis
44. Which of the following processes, normally associated with membrane transport, must occur in order to account for the increase in the surface area of a cell?
- endocytosis

- (b) active transport  
(c) receptor-mediated endocytosis  
(d) exocytosis
45. A nursing infant is able to obtain disease-fighting antibodies, which are large protein molecules, from its mother's milk. These baby's digestive tract via which process?
- endocytosis
  - passive transport
  - exocytosis
  - active transport
46. The transmission of nerve impulses between adjacent nerve cells requires the release of a neurotransmitter (a molecule or small peptide) by exocytosis. Which of the following processes would most likely follow the release of neurotransmitter to bring the cell back to its original state?
- endocytosis
  - pinocytosis
  - active transport of the neurotransmitter back into the cell
  - receptor-mediated endocytosis
47. Which one of the following pairs matches the name of a membrane transport process with the primary function of that process?
- phagocytosis—secretion of large particles from the cell by fusion of vesicles with the plasma membrane
  - exocytosis—the movement of water and solutes out of the cell by vesicle fusion with the plasma membrane
  - pinocytosis—the uptake of water and small solutes into the cell by formation of vesicles at the plasma membrane
  - osmosis—passive diffusion of water and small solutes across a membrane

## ANSWERS

- |       |        |       |       |
|-------|--------|-------|-------|
| 1. a  | 2. d   | 3. d  | 4. d  |
| 5. a  | 6. b   | 7. c  | 8. d  |
| 9. d  | 10. c  | 11. d | 12. d |
| 13. c | 14. b  | 15. d | 16. d |
| 17. d | 18. a  | 19. d | 20. a |
| 21. a | 22. b  | 23. c | 24. c |
| 25. c | 26. d  | 27. c | 28. b |
| 29. d | 30. dc | 31. d | 32. a |
| 33. b | 34. d  | 35. c | 36. c |
| 37. c | 38. d  | 39. d | 40. b |
| 41. c | 42. c  | 43. d | 44. d |
| 45. a | 46. d  | 47. c | 48. c |
| 49. b | 50. d  |       |       |

### 2.3: CELL COMMUNICATION

1. A signal transduction pathway is initiated when a \_\_\_\_\_ binds to a receptor.  
 (a) G protein    (b) tyrosine kinase  
 (c) calmodulin    (d) signal molecule
2. A signal molecule is also known as a(n)  
 \_\_\_\_\_  
 (a) ligand    (b) protein  
 (c) initiator    (d) key
3. Which of these extracellular signal molecules could diffuse through a plasma membrane and bind to an intracellular receptor?  
 (a) estrogen    (b) glycerol  
 (c) cellulose    (d) glucose
4. A(n) \_\_\_\_\_ is an example of a signal molecule that can bind to an intracellular receptor and thereby cause a gene to be turned on or off.  
 (a) ion    (b) protein  
 (c) carbohydrate    (d) steroid
5. Thyroid hormones bind to \_\_\_\_\_ receptors.  
 (a) tyrosine-kinase  
 (b) plasma membrane ion-channel  
 (c) steroid  
 (d) intracellular  
 (e) G-protein-linked
6. Which of these acts as a second messenger?  
 (a) cyclic AMP  
 (b) G-protein-linked receptor  
 (c) protein kinase  
 (d) adenylyl kinase
7. Calcium ions that act as second messengers are stored in \_\_\_\_\_.  
 (a) mitochondria    (b) peroxisomes  
 (c) lysosomes    (d) endoplasmic reticulum
8. \_\_\_\_\_ catalyzes the production of \_\_\_\_\_ which then opens an ion channel that releases \_\_\_\_\_ into the cell's cytoplasm.  
 (a) Adenylyl cyclase... cyclic AMP... Ca<sup>2+</sup>  
 (b) Adenylyl cyclase... IP3... Ca<sup>2+</sup>  
 (c) Protein kinase... PIP2... Na<sup>+</sup>  
 (d) Phospholipase C... cyclic AMP... Ca<sup>2+</sup>
9. A protein kinase activating many other protein kinases is an example of \_\_\_\_\_.  
 (a) amplification    (b) sensitization  
 (c) mutualism    (d) a cellular response
10. The cleavage of glycogen by glycogen phosphorylase releases \_\_\_\_\_.  
 (a) glucose-1-phosphate  
 (b) cellulose  
 (c) galactose-1-phosphate  
 (d) fructose-1-phosphate
11. Epinephrine acts as a signal molecule that attaches to \_\_\_\_\_ proteins.  
 (a) intracellular receptor  
 (b) G-protein-linked receptor  
 (c) nuclear receptor  
 (d) receptor tyrosine kinase
12. Which of these is a receptor for calcium ions?  
 (a) calmodulin    (b) PIP2  
 (c) G protein    (d) IP3
13. Which of these is not correct?  
 (a) Phospholipase C catalyzes the formation of IP3.  
 (b) Tyrosine-kinase receptors consist of two polypeptides that join when activated by a signal molecule.  
 (c) Ion channels are found on both the plasma membrane and the endoplasmic reticulum.  
 (d) Cyclic AMP binds to calmodulin.
14. A toxin that inhibits the production of GTP would interfere with the function of a signal transduction pathway that is initiated by the binding of a signal molecule to \_\_\_\_\_.  
 (a) G-protein-linked    (b) ion-channel  
 (c) intracellular    (d) steroid
15. Which of these is a logical signal transduction pathway?  
 (a) A receptor tyrosine kinase activates adenylyl cyclase, which activates phospholipase C, which converts ATP into cyclic AMP, which binds to an intracellular enzyme that carries out a response.  
 (b) An ion-channel receptor opens, allowing a steroid hormone to enter the cell; the steroid hormone then activates protein kinases that convert GTP to GDP, which binds to an intracellular enzyme that carries out a response.

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- (c) An intracellular receptor activates phospholipase C, which cleaves a membrane protein to form IP3, which then activates the opening of an ER channel protein, which releases cyclic AMP into the cytoplasm, where it binds to an intracellular enzyme that carries out a response.
  - (d) A G-protein-linked receptor activates G protein, which activates phospholipase C, which cleaves a membrane protein to form IP3, which binds to a calcium channel on the ER, which opens to release calcium ions into the cytoplasm, which bind to an intracellular enzyme that carries out a response.
  16. Molecular biologists think that signal transduction pathways evolved early in the history of life because \_\_\_\_\_.  
 (a) receptor molecules have been identified in preparations of fossilized organisms billions of years old  
 (b) simple forms of life, such as prokaryotic cells, utilize cell signaling  
 (c) cell signaling is observed in organisms that do not utilize sexual reproduction  
 (d) the molecular details of cell signaling are quite similar in organisms whose last common ancestor was a billion years ago
  17. A substance that acts at a long distance from the site at which it is secreted is a \_\_\_\_\_.  
 (a) neurotransmitter    (b) paracrine signal  
 (c) local regulator    (d) hormone  
 (e) synaptic signal
  18. Cell biologists use the term "ligand" to refer to \_\_\_\_\_.  
 (a) the target cell of a signal molecule  
 (b) any small molecule that can bind in a specific manner to a larger one  
 (c) the bond that forms between a signal molecule and its receptor  
 (d) the change in shape that occurs when a signal molecule binds to its receptor
  19. Dioxin, produced as a by-product of various industrial chemical processes, is suspected of contributing to the development of cancer and birth defects in animals and humans. It apparently acts by entering cells by simple diffusion and binding to proteins in the cytoplasm, altering the pattern of gene expression. Among the cytoplasmic proteins to which dioxin binds are likely to be \_\_\_\_\_.  
 (a) growth factor receptors  
 (b) DNA polymerase
  20. Tyrosine-kinase receptors are characterized by their \_\_\_\_\_.  
 (a) enzymatic phosphorylation of tyrosine in the receptor protein  
 (b) enzymatic degrading of GTP to GDP  
 (c) allowing specific ions to enter the cell after ligand binding  
 (d) binding to nonpolar signal molecules such as nitric oxide or the steroid hormones
  21. Two of the most common second messengers are \_\_\_\_\_.  
 (a) calcium ion and cAMP  
 (b) GTP and GDP  
 (c) kinase and phosphate groups  
 (d) G proteins and GTP
  22. Which of the following sequences is incorrect?  
 (a) diffusion of a signaling molecule across the plasma membrane → binding of the signaling molecule to its receptor → movement of the signal molecule-receptor complex into the nucleus → transcription  
 (b) binding of a growth factor to its receptor → phosphorylation cascade → activation of transcription factor → transcription  
 (c) binding of a signaling molecule to its receptor → G-protein activation → adenylyl cyclase activation → cAMP production → protein phosphorylation  
 (d) Binding of a signaling molecule to its receptor → G-protein activation → phosphodiesterase activation → increase in cytoplasmic cAMP levels → protein kinase A activation
  23. Why are there often so many steps between the original signal event and the cell's response?  
 (a) Each transduction is a checkpoint.  
 (b) Each step in a cascade produces a large number of activated products, causing signal amplification as the cascade progresses.  
 (c) Long, highly specific pathways minimize the possibility that a relay molecule accidentally could activate a pathway leading to a secondary response.  
 (d) The accumulation of genetic mutations over time has added redundant steps to the pathway.
  24. A signal molecule can cause different responses in different cells because \_\_\_\_\_.  
 (a) different cells possess different enzymes, which modify the signal molecule into different molecules after it has arrived

- (b) the transduction process is unique to each cell type, to respond to a signal, different cells require only a similar membrane receptor  
(c) different cells have membrane receptors that bind to different sides of the signal molecule  
(d) the transduction pathway in cells has a variable length
25. Which of the following statements is true?  
(a) In most cases, signaling molecules never actually enter the cytoplasm, but interact only with the outer surface of the cell.  
(b) Increased cytoplasmic levels of IP<sub>3</sub> cause calcium ions to move rapidly out of the cell.  
(c) Local regulators bind their receptors and are internalized by endocytosis, triggering the cell's response  
(d) Steroid hormone receptors have kinase activity
26. Which of the following is not a second messenger for signal transduction?  
(a) calcium ions (b) nitric oxide gas  
(c) ATP (d) cyclic AMP
27. The major difference between a cell that responds to a signal and one that does not is the presence of  
(a) a DNA sequence that responds to the signal.  
(b) a nearby circulatory vessel.  
(c) a receptor.  
(d) a second messenger.
28. Which of the following is not a consequence of binding of a signal to a receptor?  
(a) change in conformation of the receptor  
(b) activation of receptor enzyme activity  
(c) diffusion of the receptor in the plasma membrane  
(d) Breakdown of the receptor to amino acids
29. Which of the following is not a common type of receptor?  
(a) channel-linked (b) enzymatic  
(c) g protein-coupled (d) steroid
30. A nonpolar molecule such as a steroid hormone usually binds to  
(a) a cytoplasmic receptor.  
(b) a protein kinase.  
(c) an ion channel.  
(d) a phospholipid.
31. Which of the following is usually not true of the protein kinase cascade?  
(a) the signal is amplified.  
(b) a second messenger is formed.  
(c) target proteins are phosphorylated.  
(d) the cascade begins outside the plasma membrane
32. A protein kinase is an enzyme that  
(a) becomes active in all signal transduction events.  
(b) adds phosphate groups to certain proteins.  
(c) cannot be part of an actual receptor.  
(d) only activates target proteins
33. Which of the following are common secondary messengers?  
(a) DAG (b) cAMP  
(c) calcium (d) All of the above
34. Why are some ligand substances potential carcinogens?  
(a) they can stimulate the cell to divide too often.  
(b) they can trick a cell into creating more surface receptors.  
(c) by binding to a receptor, they have ambiguous messages.  
(d) the binding of ligand causes the release of mutagens.
35. Why are receptor proteins important to a cell's well-being?  
(a) some messengers cannot cross the plasma membrane and therefore need a mechanism to activate a response  
(b) cells are very busy centers of activity and therefore need to have a mechanism to "wake them up" and respond  
(c) proteins are simple structures and need sophisticated mechanisms to enable them to do their job  
(d) proteins accidentally bind to sugars, and it's the receptor proteins which correct these mistakes
36. Which type of cell junction would best serve to prevent cardiac (heart muscle) cells from separating?  
(a) tight junction (b) gap Junctions  
(c) desmosomes  
(d) communicating junctions
37. Which method of communication is most often observed between nerve cells?  
(a) paracrine (b) direct contact  
(c) synaptic (d) endocrine

38. What is a ligand?  
(a) something that crosses the plasma membrane  
(b) a molecule which infuses itself into the fatty acid region of a phospholipids bilayer  
(c) structures which contain a lot of energy  
(d) a substance which binds to receptors on the surface of a cell
39. Recall from chapter 3, that protein domains are important in the function of the protein. What is the minimum number of functional domains required for a typical intracellular receptor protein?  
(a) 1 (b) 2  
(c) 3 (d) 4
40. What is the purpose of signal amplification?  
(a) it stimulates many pathways that will all result in the same outcome.  
(b) it allows for different messages to be created during a signaling event.  
(c) it is the mechanism of protein phosphorylation.  
(d) it allows a threshold to be achieved so that a dilute ligand can quickly cause a reaction.
41. The term "glycolipid" refers to a molecule constructed from which macromolecule classes?  
(a) polysaccharides and nucleotides  
(b) nucleic acids, polypeptides, and polysaccharides  
(c) polypeptides, lipids, and nucleotides  
(d) only polysaccharides and lipids
42. Which of these activates G proteins by binding to them?  
(a) GTP (b) GDP  
(c) ATP (d) ADP
43. The receptor proteins that bind neurotransmitters  
(a) have multiple transmembrane domains.  
(b) are intracellular.  
(c) are translocated to the nucleus.  
(d) are autophosphorylated on the intracellular domain.

**ANSWERS**

1. d 2. a 3. a 4. d  
5. d 6. a 7. d 8. d  
9. a 10. a 11. b 12. a  
13. d 14. a 15. d 16. d  
17. d 18. b 19. c 20. a  
21. a 22. d 23. b 24. b  
25. a 26. c 27. c 28. d  
29. d 30. a 31. d 32. b  
33. d 34. a 35. a 36. c  
37. c 38. d 39. c 40. d  
41. d 42. a 43. a

**2.4: AN INTRODUCTION TO METABOLISM**

1. Which of these is exhibiting kinetic energy?
    - (a) a rock on a mountain ledge
    - (b) a space station orbiting Earth
    - (c) a person sitting on a couch while watching TV
    - (d) an archer with a flexed bow
  
  2. "Conservation of energy" refers to the fact that
    - (a) the entropy of the universe is always increasing
    - (b) if you conserve energy you will not be as tired
    - (c) the net amount of disorder is always increasing
    - (d) energy cannot be created or destroyed but can be converted from one form to another
  
  3. Chemical energy is a form of \_\_\_\_\_ energy.
    - (a) kinetic energy
    - (b) heat energy
    - (c) potential
    - (d) motion
  
  4. In your body, what process converts the chemical energy found in glucose into the chemical energy found in ATP?
    - (a) potentiation
    - (b) cellular respiration
    - (c) digestion
    - (d) anabolism
  
  5. Which of these are by-products of cellular respiration?
    - (a) ATP, carbon dioxide, and water
    - (b) glucose, carbon dioxide, and water
    - (c) ATP and carbon dioxide
    - (d) heat, carbon dioxide, and water
  
  6. Enzymes are described as catalysts, which means that they \_\_\_\_\_.
    - (a) are proteins
    - (b) provide activation energy for the reactions they facilitate
    - (c) increase the rate of a reaction without being consumed by the reaction
    - (d) can alter the free energy change ( $\Delta G$ ) for a chemical reaction
  
  7. What type of reaction breaks the bonds that join the phosphate groups in an ATP molecule?
    - (a) anabolism
- (b) hydrolysis  
(c) dehydration decomposition  
(d) dehydration synthesis
8. The binding of a compound to an enzyme is observed to slow down or stop the rate of the reaction catalyzed by the enzyme. Which of the following could account for this observation?
- (a) the compound is a competitive inhibitor
  - (b) the compound is a negative allosteric regulator
  - (c) the compound causes a cofactor to be lost from the enzyme.
  - (d) the first three choices are correct.
9. Which of the following statements about feedback regulation of a metabolic pathway is incorrect?
- (a) the final product of a metabolic pathway is the compound that regulates the pathway
  - (b) the products of the pathway become the reactants for a different reaction, and thus products are unable to accumulate.
  - (c) the enzyme that is regulated by feedback inhibition is usually the first enzyme in the metabolic pathway.
  - (d) the compound that regulates
10. The reaction  $A \rightarrow B + C + \text{heat}$  is released in a(n) \_\_\_\_\_ reaction.
- (a) endergonic
  - (b) dehydration synthesis
  - (c) exergonic
  - (d) exchange
11. A(n) \_\_\_\_\_ reaction occurs spontaneously.
- (a) anabolic
  - (b) endergonic
  - (c) chemical
  - (d) exergonic
12. Which of these reactions requires a net input of energy from its surroundings?
- (a) exergonic
  - (b) hydrolysis
  - (c) endergonic
  - (d)  $\text{ATP} \rightarrow \text{ADP} + \text{P}$
13. In cells, what is usually the immediate source of energy for an endergonic reaction?
- (a) glucose
  - (b) as spontaneous reactions, endergonic reactions do not need an addition of energy
  - (c) ADP
  - (d) ATP

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14. The reaction  $\text{ADP} + \text{P} \rightarrow \text{ATP}$  is a(n) \_\_\_\_\_ reaction.
    - (a) hydrolysis
    - (b) exergonic
    - (c) chemical
    - (d) endergonic
  
  15. The energy for an endergonic reaction comes from a(n) \_\_\_\_\_ reaction.
    - (a) anabolic
    - (b) exergonic
    - (c) synthesis
    - (d)  $\text{ADP} + \text{P} \rightarrow \text{ATP}$
  
  16. What is the fate of the phosphate group that is removed when ATP is converted to ADP?
    - (a) it is acquired by a reactant in an endergonic reaction.
    - (b) it is used to convert an ATP into an AQP.
    - (c) it is acquired by a reactant in a spontaneous reaction.
    - (d) it is acquired by a reactant in an exergonic reaction.
  
  17. Which of the following is not a way in which an enzyme can speed up the reaction that it catalyzes?
    - (a) the active site can provide heat from the environment that raises the energy content of the substrate.
    - (b) binding of the substrate to the active site can stretch bonds in the substrate that need to be broken.
    - (c) the active site of the enzyme can provide a microenvironment with a different pH that facilitates the reaction.
    - (d) the binding of two substrates in the active site provides the correct orientation for them to react to form a product.
  
  18. Select the incorrect association.
    - (a) potential energy... positional energy
    - (b) exergonic(c)... uphill
    - (c) enzym(e)... protein
    - (d) exergonic(c)... spontaneous
  
  19. What is energy coupling?
    - (a) a description of the energetic relationship between the reactants and products in an exergonic reaction
    - (b) the use of an enzyme to reduce EA
    - (c) a barrier to the initiation of a reaction
    - (d) the use of energy released from an exergonic reaction to drive an endergonic reaction
  
  20. Enzymes are \_\_\_\_\_.
    - (a) carbohydrates
    - (b) proteins
    - (c) lipids
    - (d) nucleic acids
  
  21. Enzymes work by \_\_\_\_\_.
    - (a) adding a phosphate group to a reactant
- (b) decreasing the potential energy difference between reactant and product  
(c) adding energy to a reaction  
(d) reducing EA
22. An enzyme \_\_\_\_\_.
  - (a) is a source of energy for endergonic reactions
  - (b) is an organic catalyst
  - (c) increases the EA of a reaction
  - (d) is an inorganic catalyst
23. What name is given to the reactants in an enzymatically catalyzed reaction?
  - (a) substrate
  - (b) products
  - (c) active sites
  - (d) reactors
24. As a result of its involvement in a reaction, an enzyme \_\_\_\_\_.
  - (a) loses a phosphate group
  - (b) permanently alters its shape
  - (c) loses energy
  - (d) is unchanged
25. Which of the following would be unlikely to contribute to the substrate specificity of an enzyme?
  - (a) a similar shape exists between a pocket on the surface of the enzyme and a functional group on the substrate.
  - (b) the free energy of the enzyme is greater than the free energy of the substrate, which attracts the substrate to the enzyme.
  - (c) a positive charge on the substrate is attracted to a negative charge in the active site of the enzyme.
  - (d) the enzyme has the ability to change its configuration in response to the substrate binding.
26. The process of cellular respiration, which converts simple sugars such as glucose into  $\text{CO}_2$  and water, is an example of \_\_\_\_\_.
  - (a) a catabolic pathway
  - (b) an energy-releasing pathway
  - (c) a pathway in which the entropy of the system increases
  - (d) The first, second, and third choices are correct.
27. Energy is observed in two basic forms: potential and kinetic. Which of the following correctly matches these forms with a source of energy?
  - (a) the motion of individual molecules—potential energy
  - (b) the heat released from a living organism—potential energy

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- (c) the energy related to the height of a bird above the ground—kinetic energy  
 (d) the covalent bonds of a sugar molecule—potential energy
28. Which of the following statements about the combustion of glucose with oxygen to form water and carbon dioxide ( $C_6H_{12}O_6 + 6 O_2 \rightarrow 6 CO_2 + 6 H_2O$ ) is incorrect?  
 (a) This reaction is spontaneous with the release of free energy.  
 (b) The entropy of the products is greater than the entropy of the reactants.  
 (c) The free energy lost in this combustion is greater than the energy that appears as heat.  
 (d) The entropy of the universe increases as the result of this reaction.
29. Which of the following statements about equilibrium of chemical reactions is correct?  
 (a) reactions can only go in the direction toward equilibrium  
 (b) most reactions in a living cell are close to equilibrium  
 (c) a reaction that is at equilibrium is not capable of doing any work.  
 (d) the equilibrium point of a reaction represents the least stable configuration for that reaction.
30. Which of the following statements about ATP (adenosine triphosphate) is incorrect?  
 (a) the hydrolysis of ATP is an endergonic process that can supply needed energy for anabolic pathways.  
 (b) the cycling between ATP and ADP + Pi provides an energy coupling between catabolic and anabolic pathways.  
 (c) the energy release on hydrolysis of ATP is the result of breaking a high-energy bond.  
 (d) much of the free energy released on the hydrolysis of ATP is available to do cellular work.
31. Which is the most abundant form of energy in a cell?  
 (a) chemical and electrical gradients  
 (b) mechanical energy  
 (c) heat  
 (d) chemical energy
32. Which of the following is an example of the second law of thermodynamics as it applies to biological reactions?  
 (a) The aerobic respiration of one molecule of glucose produces six molecules each of carbon dioxide and water.
- (b) All types of cellular respiration produce ATP  
 (c) Cellular respiration releases some energy as heat.  
 (d) The first and second choices are correct.
33. According to the second law of thermodynamics, which of the following is true?  
 (a) Energy conversions increase the order in the universe.  
 (b) The total amount of energy in the universe is constant.  
 (c) The decrease in entropy associated with life must be compensated for by an increase in entropy in the environment that life occurs in.  
 (d) The entropy of the universe is constantly decreasing.
34. Which one of the following has the most free energy per molecule?  
 (a) a sugar molecule  
 (b) an amino acid molecule  
 (c) a starch molecule  
 (d) a fatty acid molecule
35. An exergonic (spontaneous) reaction is a chemical reaction that \_\_\_\_\_.  
 (a) occurs only when an enzyme or other catalyst is present  
 (b) cannot occur outside of a living cell  
 (c) releases energy when proceeding in the forward direction  
 (d) is common in anabolic pathways
36. Which compound could be most easily modified to form ATP?  
 (a) the RNA nucleotide adenosine  
 (b) the amino acid tryptophan  
 (c) the DNA nucleotide adenosine  
 (d) the nitrogenous base adenine
37. In general, the hydrolysis of ATP drives cellular work by \_\_\_\_\_.  
 (a) changing to ADP and phosphate  
 (b) releasing free energy that can be coupled to other reactions  
 (c) releasing heat  
 (d) acting as a catalyst
38. The mechanism of enzyme action is \_\_\_\_\_.  
 (a) providing energy to speed up the rate of the reaction  
 (b) lowering the energy of activation for a reaction  
 (c) changing the direction of thermodynamic equilibrium

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- (d) lowering the free energy change of a reaction
39. A chemical reaction is designated as exergonic rather than endergonic when \_\_\_\_\_.  
 (a) activation energy is required  
 (b) the products are less complex than the reactants  
 (c) activation energy exceeds net energy release  
 (d) the potential energy of the products is less than the potential energy of the reactants
40. Which of the following statements about enzymes is incorrect?  
 (a) Most enzymes are proteins.  
 (b) An enzyme is not consumed by the catalytic process.  
 (c) All of the above are correct statements about enzymes.  
 (d) An enzyme lowers the activation energy of a chemical reaction.
41. Which of the following environments or actions does not affect the rate of an enzyme reaction?  
 (a) heating the enzyme  
 (b) cooling the enzyme  
 (c) substrate concentration.  
 (d) all of the above
42. The process of stabilizing the structure of an enzyme in its active form by the binding of a molecule is an example of \_\_\_\_\_.  
 (a) feedback inhibition  
 (b) competitive inhibition  
 (c) allosteric regulation  
 (d) non-competitive inhibition
43. Which, if any, of the following statements is not true about allosteric proteins?  
 (a) They are sensitive to environmental conditions.  
 (b) They are acted on by inhibitors.  
 (c) They exist in active and inactive conformations  
 (d) They can bind to a range of substrates

## ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. b  | 2. d  | 3. c  | 4. b  |
| 5. d  | 6. c  | 7. b  | 8. d  |
| 9. b  | 10. c | 11. d | 12. c |
| 13. d | 14. d | 15. b | 16. a |
| 17. a | 18. b | 19. d | 20. b |
| 21. d | 22. b | 23. a | 24. d |
| 25. b | 26. d | 27. d | 28. c |
| 29. c | 30. c | 31. d | 32. a |
| 33. c | 34. c | 35. c | 36. a |
| 37. b | 38. d | 39. d | 40. c |
| 41. d | 42. c | 43. D |       |

## 2.5: CELLULAR RESPIRATION: HARVESTING CHEMICAL ENERGY

1. How many NADH are produced by glycolysis?  
 (a) 1 (b) 2 (c) 3 (d) 4
2. In glycolysis, ATP molecules are produced by \_\_\_\_\_.  
 (a) photophosphorylation  
 (b) substrate-level phosphorylation  
 (c) cellular respiration  
 (d) oxidative phosphorylation
3. Which of these is not a product of glycolysis?  
 (a) water (b)  $\text{NADH} + \text{H}^+$   
 (c) ATP (d) FADH<sub>2</sub>
4. In glycolysis, what starts the process of glucose oxidation?  
 (a) hexokinase (b) NADPH  
 (c) ADP (d) ATP
5. In glycolysis there is a net gain of \_\_\_\_\_ ATP.  
 (a) 1 (b) 2  
 (c) 3 (d) 4
6. Which of these enters the citric acid cycle?  
 (a)  $\text{NADH} + \text{H}^+$  (b) acetyl CoA  
 (c) G3P (d) pyruvate
7. How does pyruvate enter a mitochondrion?  
 (a) osmosis (b) phagocytosis  
 (c) pinocytosis (d) diffusion
8. In the citric acid cycle, ATP molecules are produced by \_\_\_\_\_.  
 (a) photophosphorylation  
 (b) substrate-level phosphorylation  
 (c) cellular respiration  
 (d) oxidative phosphorylation
9. Which of these is NOT a product of the citric acid cycle?  
 (a) ATP (b)  $\text{NADH} + \text{H}^+$   
 (c) FADH<sub>2</sub> (d) acetyl CO<sub>2</sub>
10. For each glucose that enters glycolysis, \_\_\_\_\_ acetyl CoA enter the citric acid cycle.  
 (a) 0 (b) 1  
 (c) 2 (d) 4
11. For each glucose that enters glycolysis, \_\_\_\_\_  $\text{NADH} + \text{H}^+$  are produced by the citric acid cycle.  
 (a) 0 (b) 2 (c) 3 (d) 6
12. In cellular respiration, most ATP molecules are produced by \_\_\_\_\_.  
 (a) photophosphorylation  
 (b) substrate-level phosphorylation
13. The final electron acceptor of cellular respiration is \_\_\_\_\_.  
 (a) water (b) oxygen  
 (c) FADH<sub>2</sub> (d) CO<sub>2</sub>
14. During electron transport, energy from \_\_\_\_\_ is used to pump hydrogen ions into the \_\_\_\_\_.  
 (a) NADH and FADH<sub>2</sub>... intermembrane space  
 (b) NADH and FADH<sub>2</sub>... mitochondrial matrix  
 (c) NADH... intermembrane space  
 (d) NADH... mitochondrial matrix
15. The proximate (immediate) source of energy for oxidative phosphorylation is \_\_\_\_\_.  
 (a) kinetic energy that is released as hydrogen ions diffuse down their concentration gradient  
 (b) substrate-level phosphorylation  
 (c) NADH and FADH<sub>2</sub>  
 (d) ATP synthase
16. In muscle cells, fermentation produces \_\_\_\_\_.  
 (a) pyruvate  
 (b) carbon dioxide, ethanol, NAD<sup>+</sup>, and ATP  
 (c) carbon dioxide, ethanol, NADH, and ATP  
 (d) carbon dioxide, lactate, NADH, and ATP
17. In fermentation \_\_\_\_\_ is reduced and \_\_\_\_\_ is oxidized.  
 (a) lactate... NADH (b) NAD<sup>+</sup>... pyruvate  
 (c) pyruvate... NADH (d) lactate... ethanol
18. Which of the following best describes the main purpose of the combined processes of glycolysis and cellular respiration?  
 (a) the breakdown of glucose to carbon dioxide and water  
 (b) conserving the energy in glucose and related molecules in a chemical form that cells can use for work  
 (c) catabolism of sugars and related compounds  
 (d) producing complex molecules from chemical building blocks
19. In the combined processes of glycolysis and cellular respiration, what is consumed and what is produced?  
 (a) Carbon dioxide is consumed, and water is produced.

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- (b) Oxygen is consumed, and glucose is produced.  
 (c) Water is consumed, and ATP is produced.  
 (d) Glucose is consumed, and carbon dioxide is produced.
  20. Which of the following describes the process of glycolysis?  
 (a) It represents the first steps in the chemical oxidation of glucose by the cell.  
 (b) It produces both ATP and NADH.  
 (c) It converts one glucose molecule to two molecules of pyruvate and carbon dioxide.  
 (d) The first two answers are correct.
  21. A glucose molecule is completely broken down to carbon dioxide and water in glycolysis and the citric acid cycle, but together these two processes yield only a few molecules of ATP. What happened to most of the energy that the cell obtains from the oxidation of glucose?  
 (a) It is stored in pyruvate.  
 (b) It is stored in the carbon dioxide and water molecules released by these processes.  
 (c) It was lost as heat.  
 (d) It is stored in NADH.
  22. The electrons stripped from glucose in cellular respiration end up in which compound?  
 (a) ATP (b) NADH  
 (c) oxygen (d) water
  23. Which of the following statements about the redox reactions of the electron transport chain is correct?  
 (a) The oxidation of NADH is directly coupled to the reduction of oxygen to water.  
 (b) The redox reactions of the electron transport chain are directly coupled to the movement of protons across a membrane.  
 (c) The redox reactions of the electron transport chain are directly coupled with the synthesis of ATP.  
 (d) NADH gains electrons in the initial reaction of the electron transport chain.
  24. Which statement about the citric acid cycle is incorrect?  
 (a) The citric acid cycle oxidizes the products of glycolysis to carbon dioxide.  
 (b) The citric acid cycle produces most of the NADH that is subsequently used by the electron transport chain.  
 (c) The oxidation of compounds by the citric acid cycle requires molecular oxygen.
  25. The last reaction in the citric acid cycle produces a product that is a substrate for the first reaction of the citric acid cycle.  
 In the absence of oxygen, what is the net gain of ATP for each glucose molecule that enters glycolysis?  
 (a) 38 ATP (b) 4 ATP  
 (c) 2 ATP  
 (d) none, because in the absence of oxygen, no ATP can be made.
  26. Which of the following statements is correct about the chemiosmotic synthesis of ATP?  
 (a) The energy for production of ATP from ADP comes directly from a gradient of electrons across the inner mitochondrial membrane.  
 (b) Oxygen participates directly in the reaction that makes ATP from ADP and P.  
 (c) The chemiosmotic synthesis of ATP requires that the electron transport in the inner mitochondrial membrane be coupled to proton transport across the same membrane.  
 (d) The first two choices are correct.
  27. In most cells, not all of the carbon that enters glycolysis is converted to carbon dioxide by cellular respiration. What happens to this carbon that does not end up as CO<sub>2</sub>?  
 (a) It is used to convert ADP to ATP via chemiosmosis.  
 (b) It is converted to heat.  
 (c) The carbon atoms are removed from these processes to serve as building blocks for other complex molecules.  
 (d) It is used to make ATP.
  28. In the overall process of glycolysis and cellular respiration, \_\_\_\_\_ is oxidized and \_\_\_\_\_ is reduced.  
 (a) oxygen... ATP (b) ATP... oxygen  
 (c) glucose... oxygen (d) carbon dioxide... water
  29. Most of the ATP produced in cellular respiration comes from which of the following processes?  
 (a) glycolysis  
 (b) oxidative phosphorylation  
 (c) reduction of NADH  
 (d) substrate-level phosphorylation
  30. Oxygen gas (O<sub>2</sub>) is one of the strongest oxidizing agents known. The explanation for this is that \_\_\_\_\_.  
 (a) oxygen is so abundant in the atmosphere  
 (b) oxygen gas is composed of two atoms of oxygen  
 (c) oxygen gas contains a double bond

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- (d) the oxygen atom is very electronegative
31. During the reaction  $C_6H_{12}O_6 + 6 O_2 \rightarrow 6 CO_2 + 6 H_2O$ , which compound is reduced as a result of the reaction?  
 (a) oxygen  
 (b) glucose  
 (c) carbon dioxide  
 (d) water
32. What is the name of the process in which glucose is converted to pyruvate with the production of ATP and NADH?  
 (a) chemiosmotic theory  
 (b) fermentation  
 (c) glycolysis  
 (d) the citric acid cycle
33. Most of the NADH that delivers electrons to the electron transport chain comes from which of the following?  
 (a) oxidative phosphorylation  
 (b) substrate-level phosphorylation  
 (c) glycolysis  
 (d) the citric acid cycle
34. How many molecules of ATP are gained by substrate-level phosphorylation from the complete breakdown of a single molecule of glucose in the presence of oxygen?  
 (a) 2  
 (b) 4  
 (c) 3  
 (d) about 38 ATP
35. Which of the following represents the major (but not the only) energy accomplishment of the citric acid cycle?  
 (a) formation of  $CO_2$   
 (b) formation of ATP  
 (c) formation of NADH and  $FADH_2$   
 (d) utilization of  $O_2$
36. After completion of the citric acid cycle, most of the usable energy from the original glucose molecule is in the form of \_\_\_\_\_.  
 (a) acetyl CoA  
 (b) ATP  
 (c) NADH  
 (d)  $CO_2$
37. Which of the following accompanies the conversion of pyruvate to acetyl CoA before the citric acid cycle?  
 (a) formation of  $CO_2$  and ATP  
 (b) formation of  $CO_2$  and NADH  
 (c) formation of  $CO_2$  and coenzyme A  
 (d) completion of one turn of the citric acid cycle
38. Which part of the cellular catabolism of glucose both requires molecular oxygen ( $O_2$ ) and produces  $CO_2$ ?  
 (a) glycolysis  
 (b) the citric acid cycle  
 (c) the electron transport chain  
 (d) the combination of the citric acid cycle and electron transport
39. Which of the following substances, if any, is not directly involved in oxidative phosphorylation?  
 (a) ADP  
 (b) oxygen  
 (c) ATP  
 (d) glucose
40. The overall efficiency of respiration (the percentage of the energy released that is saved in ATP) is approximately \_\_\_\_\_.  
 (a) 0.5%  
 (b) 2%  
 (c) 40%  
 (d) 94%
41. In glycolysis in the absence of oxygen, cells need a way to regenerate which compound?  
 (a) ethanol  
 (b) carbon dioxide  
 (c)  $NAD^+$   
 (d) lactate
42. Muscle tissues make lactate from pyruvate in order to do which of the following?  
 (a) regenerate  $NAD^+$   
 (b) get rid of pyruvate produced by glycolysis  
 (c) utilize the energy in pyruvate  
 (d) produce additional  $CO_2$
43. Of the metabolic pathways listed below, which is the only pathway found in all organisms?  
 (a) cellular respiration  
 (b) the citric acid cycle  
 (c) the electron transport chain  
 (d) glycolysis
44. When protein molecules are used as fuel for cellular respiration, \_\_\_\_ are produced as waste.  
 (a) amino groups  
 (b) fatty acids  
 (c) sugar molecules  
 (d) molecules of lactate
45. If muscle cells in the human body consume  $O_2$  faster than it can be supplied, which of the following is likely to result?  
 (a) The muscle cells will have more trouble making enough ATP to meet their energy requirements.  
 (b) The cells will not be able to carry out oxidative phosphorylation.  
 (c) The cells will consume glucose at an increased rate.  
 (d) The first three answers are correct.

**ANSWERS**

1. b    2. b    3. d    4. d  
 5. b    6. b    7. d    8. b  
 9. d    10. c    11. d    12. d  
 13. b    14. a    15. a    16. d  
 17. c    18. b    19. d    20. d  
 21. d    22. d    23. b    24. c  
 25. c    26. c    27. c    28. c  
 29. b    30. d    31. a    32. c  
 33. d    34. b    35. c    36. c  
 37. b    38. d    39. d    40. c  
 41. c    42. a    43. d    44. a  
 45. d

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**2.6: PHOTOSYNTHESIS**

1. Which of these equations best summarizes photosynthesis?  
 (a)  $C_6H_{12}O_6 + 6 O_2 \rightarrow 6 CO_2 + 12 H_2O$   
 (b)  $C_6H_{12}O_6 + 6 O_2 \rightarrow 6 CO_2 + 6 H_2O +$  Energy  
 (c)  $6 CO_2 + 6 O_2 \rightarrow C_6H_{12}O_6 + 6 H_2O$   
 (d)  $6 CO_2 + 6 H_2O \rightarrow C_6H_{12}O_6 + 6 O_2$
2. The light reactions of photosynthesis use \_\_\_\_\_ and produce \_\_\_\_\_.  
 (a)  $NADPH...NADP^+$   
 (b) water...  $NADPH$   
 (c) carbon dioxide... oxygen  
 (d) carbon dioxide... sugar
3. \_\_\_\_\_ has a longer wavelength than \_\_\_\_\_.  
 (a) Red... green  
 (b) Violet... blue  
 (c) Yellow... red  
 (d) Green... yellow
4. Carbon fixation involves the addition of carbon dioxide to \_\_\_\_\_.  
 (a) rubisco  
 (b) RuBP  
 (c) G3P  
 (d) 3-PGA
5. After 3-PGA is phosphorylated, it is reduced by \_\_\_\_\_.  
 (a)  $NADP^+$   
 (b) ADP  
 (c)  $CO_2$   
 (d)  $NADPH$
6. How many carbon dioxide molecules must be added to RuBP to make a single molecule of glucose?  
 (a) 2  
 (b) 4  
 (c) 6  
 (d) 8
7. In the Calvin cycle, how many ATP molecules are required to regenerate RuBP from five G3P molecules?  
 (a) 1  
 (b) 2  
 (c) 3  
 (d) 4
8. In C3 plants the conservation of water promotes \_\_\_\_\_.  
 (a) photorespiration  
 (b) the light reactions  
 (c) a shift to C4 photosynthesis  
 (d) the opening of stomata
9. In C4 and CAM plants carbon dioxide is fixed in the \_\_\_\_\_ of mesophyll cells.  
 (a) stoma  
 (b) cytoplasm  
 (c) thylakoids  
 (d) stroma
10. C4 plants differ from C3 and CAM plants in that C4 plants \_\_\_\_\_.  
 (a) open their stomata only at night  
 (b) are better adapted to wet conditions
11. Plants are photoautotrophs. What does this mean?  
 (a) They make their own food from inorganic materials.  
 (b) They are among the producers of the biosphere.  
 (c) They are in the same category as algae and cyanobacteria  
 (d) All of the above
12. The ultimate source of energy to support most life on Earth is \_\_\_\_\_.  
 (a) sunlight  
 (b) chemosynthetic microbes  
 (c) geothermal heat  
 (d) the carbon cycle
13. The photosynthetic membranes are found in the \_\_\_\_\_ in plant cells.  
 (a) Golgi apparatus  
 (b) endoplasmic reticulum  
 (c) mitochondria  
 (d) chloroplasts
14. In the electromagnetic spectrum, the type of radiation that we call visible light occurs between \_\_\_\_\_.  
 (a) radio waves and microwaves  
 (b) infrared radiation and microwaves  
 (c) infrared radiation and radio waves  
 (d) ultraviolet radiation and infrared radiation
15. Which of the following is not a product of the light reactions of photosynthesis?  
 (a) oxygen  
 (b) sugar  
 (c) high-energy electrons  
 (d) ATP
16. When light strikes chlorophyll molecules, they lose electrons, which are ultimately replaced by \_\_\_\_\_.  
 (a) splitting water  
 (b) breaking down ATP  
 (c) removing them from  $NADPH$   
 (d) fixing carbon
17. Photosynthesis is an \_\_\_\_\_ process of carbon \_\_\_\_\_, while respiration is an \_\_\_\_\_ process of carbon \_\_\_\_\_.

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18. Which of the following is produced by the light reactions of photosynthesis and consumed by the Calvin cycle?  
 (a) NADPH      (b) oxygen  
 (c) water      (d) sugar
19. The overall function of the Calvin cycle is \_\_\_\_\_.  
 (a) capturing sunlight  
 (b) making sugar  
 (c) producing carbon dioxide  
 (d) splitting water
20. C<sub>4</sub> plants occur more commonly in desert conditions because \_\_\_\_\_.  
 (a) they can fix carbon at the lower CO<sub>2</sub> concentrations that develop when the stomata are closed  
 (b) they produce water as a product of their photosynthetic pathways  
 (c) they produce carbon dioxide internally via photorespiration  
 (d) the stomata open at night and close in the day
21. The energy in photosynthesis is required to create  
 (a) ATP      (b) NADPH  
 (c) FADH<sub>2</sub>      (d) Two of the above
22. The formation of organic molecules from carbon dioxide occurs as a result of  
 (a) oxidation reactions  
 (b) reduction reactions  
 (c) hydrolysis  
 (d) condensation
23. What is the purpose of the C-H rich hydrocarbon tail of chlorophyll?  
 (a) it is easily oxidized to provide energy to the cell  
 (b) it acts as a conjugated ring system to stabilize the pigment through resonance  
 (c) it supports magnesium in its centre as a site for electron withdrawal  
 (d) it can help anchor the pigment to the thylakoid membrane
24. When bacteria use a single photosystem (such as the sulfur bacteria), which term best describes the path of the electron?  
 (a) linear      (b) branching  
 (c) redundant      (d) cyclic
25. In the generalized schematic of the Calvin Cycle, what is the correct order of the events starting with CO<sub>2</sub> and ending with the production of an organic molecule?  
 (a) regeneration, fixation, reduction  
 (b) reduction, regeneration, fixation  
 (c) Fixation, Reduction, Regeneration  
 (d) Reduction, Fixation, Regeneration
26. The apertures which control gas exchange in photosynthetic tissues are called  
 (a) aerophiles      (b) mesophyll  
 (c) epidermis      (d) stomata
27. The stage of photosynthesis that actually produces sugar is  
 (a) the Calvin cycle      (b) photosystem I  
 (c) photosystem II      (d) the light reaction
28. The light reaction of photosynthesis does not include  
 (a) chemiosmosis  
 (b) oxygen liberation  
 (c) charge separation  
 (d) electron transport
29. The final product of the Calvin cycle is  
 (a) RuBP      (b) PGA  
 (c) ATP      (d) G3P
30. Photosynthesis takes place in the membranes of small sacs called  
 (a) thylakoids      (b) grana  
 (c) photosystems      (d) photons
31. The dark reaction in photosynthesis is limited by  
 (a) CO<sub>2</sub>, temperature, and light  
 (b) CO<sub>2</sub>, light, and water  
 (c) water, temperature, and CO<sub>2</sub>  
 (d) oxygen, water, and temperature
32. Colors of light most useful in photosynthesis are  
 (a) green, yellow, and orange  
 (b) red, violet, and blue  
 (c) infrared, red, and yellow  
 (d) red, white, and blue
33. For every CO<sub>2</sub> molecule fixed by photosynthesis, how many molecules of O<sub>2</sub> are released?  
 (a) 1      (b) 3

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34. During what stage of photosynthesis are ATP and NADPH converted to ADP + Pi and NADP<sup>+</sup>?  
 (a) the light-dependent reactions  
 (b) the light-independent reactions  
 (c) both of the above  
 (d) none of the above
35. Water vapor exits and CO<sub>2</sub> enters a leaf through the  
 (a) stomata      (b) grana  
 (c) porphyrin rings      (d) photons
36. High-energy photons  
 (a) have long wavelengths  
 (b) have short wavelengths  
 (c) are more likely to produce red light than blue light  
 (d) cannot be absorbed
37. Light that is visible to humans occupies what part of the electromagnetic spectrum?  
 (a) the entire upper half  
 (b) the entire lower half  
 (c) a small portion in the middle  
 (d) the entire spectrum
38. During photosynthesis, photons raise electrons to higher energy levels. These excited electrons belong to what compound?  
 (a) H<sub>2</sub>O      (b) ATP  
 (c) RuBP      (d) chlorophyll
39. Which of the following conclusions does not follow from studying the absorption spectrum for chlorophyll a and the action spectrum for photosynthesis?  
 (a) not all wavelengths are equally effective for photosynthesis  
 (b) there must be accessory pigments that broaden the spectrum of light that contributes energy for photosynthesis  
 (c) the red and blue areas of the spectrum are most effective in driving photosynthesis  
 (d) chlorophyll owes its color to the absorption of green light.

## ANSWERS

1. d      2. b      3. a      4. a  
 5. d      6. c      7. c      8. a  
 9. b      10. c      11. d      12. a  
 13. d      14. d      15. b      16. a  
 17. a      18. a      19. b      20. a  
 21. d      22. b      23. c      24. D  
 25. c      26. d      27. b      28. b  
 29. d      30. a      31. a      32. b  
 33. a      34. b      35. a      36. b  
 37. c      38. d      39. d      40. a  
 41. c      42. b      43. a

## 2.7: THE CELL CYCLE

1. A diploid organism whose somatic (nurse) cells each contain 32 chromosomes produces gametes containing \_\_\_\_ chromosomes.  
 (a) 32      (b) 8  
 (c) 16      (d) 30
  2. During \_\_\_\_ both the contents of the nucleus and the cytoplasm are divided.  
 (a) the mitotic phase    (b) G1  
 (c) S                (d) G2
  3. During \_\_\_\_ the cell grows and replicates both its organelles and its chromosomes.  
 (a) S                (b) cytokinesis  
 (c) G1              (d) interphase
  4. Nucleoli are present during \_\_\_\_.  
 (a) interphase    (b) prophase  
 (c) prometaphase    (d) metaphase
  5. Cytokinesis often, but not always, accompanies \_\_\_\_.  
 (a) telophase    (b) prometaphase  
 (c) metaphase    (d) anaphase
  6. Chromosomes become visible during \_\_\_\_.  
 (a) metaphase    (b) prophase  
 (c) interphase    (d) prometaphase
  7. Centromeres divide and sister chromosomes become full-fledged chromosomes during \_\_\_\_.  
 (a) metaphase    (b) prometaphase  
 (c) interphase    (d) anaphase.
  8. Spindle fibers attach to kinetochores during \_\_\_\_.  
 (a) metaphase    (b) prometaphase  
 (c) interphase    (d) anaphase
  9. During prophase a homologous pair of chromosomes consists of \_\_\_\_.  
 (a) four chromosomes and two chromatids  
 (b) two chromosomes and two chromatids  
 (c) two chromosomes and four chromatids  
 (d) one chromosome and two chromatids
  10. Which of these is not a carcinogen?  
 (a) testosterone  
 (b) cigarette smoke  
 (c) UV light  
 (d) all of the above are carcinogens
  11. Which of the following is not a function of the mitotic cell cycle in eukaryotes?  
 (a) asexual reproduction
- (b) growth  
 (c) repair of damaged organs  
 (d) production of gametes
12. A human bone marrow cell, in prophase of mitosis, contains 46 chromosomes. How many chromatids does it contain?  
 (a) 46                (b) 92      (c) 23  
 (d) 23 or 46, depending on the portion of prophase examined
  13. The kinetochores \_\_\_\_.  
 (a) are located at the center of the centrosome; their function is to organize tubulin into elongated bundles called spindle fibers  
 (b) are the primary centromere structures that maintain the attachment of the sister chromatids prior to mitosis  
 (c) are sites at which microtubules attach to chromosomes  
 (d) of each spindle interdigitate at the cell's equator and then move apart, causing the cell to elongate
  14. It is difficult to observe individual chromosomes with a light microscope during interphase because \_\_\_\_.  
 (a) the DNA has not been replicated yet  
 (b) they have uncoiled to form long, thin strands  
 (c) they leave the nucleus and are dispersed to other parts of the cell  
 (d) sister chromatids do not pair up until division starts
  15. Which of the following correctly matches a phase of the cell cycle with its description?  
 (a) M: duplication of DNA  
 (b) S: immediately precedes cell division  
 (c) G2: cell division  
 (d) G1: follows cell division
  16. In some organisms such as certain fungi and algae, cells undergo the cell cycle repeatedly without subsequently undergoing cytokinesis. What would result from this?  
 (a) a decrease in chromosome number  
 (b) inability to duplicate DNA  
 (c) division of the organism into many cells, most lacking nuclei  
 (d) large cells containing many nuclei

17. There are a number of differences between the fission of a bacterium and human cell division. Which of the following is not one of these differences?  
 (a) A bacterium has only one chromosome.  
 (b) Duplicated bacterial chromosomes attach to the plasma membrane.  
 (c) Bacteria are smaller and simpler than human cells.  
 (d) Bacteria have to duplicate their DNA before dividing
18. Cytochalasin B is a chemical that disrupts microfilament formation. This chemical would interfere with \_\_\_\_.  
 (a) DNA replication  
 (b) formation of the mitotic spindle  
 (c) cleavage  
 (d) formation of the cell plate
19. Cells will usually divide if they receive the proper signal at a checkpoint in the \_\_\_\_ phase of the cell cycle.  
 (a) M                (b) G1  
 (c) S                (d) G2
20. A benign tumor, but not a malignant tumor, is one in which the cancerous cells \_\_\_\_.  
 (a) migrate from the initial site of transformation to other organs or tissues  
 (b) can divide indefinitely if an adequate supply of nutrients is available  
 (c) remain confined to their original site  
 (d) have an unusual number of chromosomes
21. Prophase in mitotic division is characterized by which of these events.  
 (a) nuclear membrane starts disintegrating  
 (b) chromatin material changes into chromosomes  
 (c) nucleolus starts disappearing and centrioles start moving towards opposite poles  
 (d) all a, b and c
22. Which of the following is not a function of mitosis in humans?  
 (a) growth  
 (b) production of gametes  
 (c) embryonic development  
 (d) wound repair
23. Meiosis differs from mitosis because in meiosis:  
 (a) homologous chromosomes pair and exchange segments  
 (b) chromosomal number is halved  
 (c) the four daughter-nuclei form  
 (d) all of a, b and c
24. Chromosomes during metaphase:  
 (a) occupy equatorial position  
 (b) are not yet ready to divide  
 (c) assemble at one end of spindle  
 (d) occupy any place in spindle
25. Mitotic cell division results in the:  
 (a) reduction in chromosomal number  
 (b) doubling of chromosomes  
 (c) no change in chromosomal number  
 (d) increase in cell volume
26. One difference between a cancer cell and a normal cell is that:  
 (a) the cancer cell is unable to synthesize DNA  
 (b) cancer cells are always in the M phase of the cell cycle  
 (c) the cell cycle of the cancer cell is arrested at the S phase  
 (d) cancer cells continue to divide even when they are tightly packed
27. Which of these organelles are not shared by the daughter cells?  
 (a) Golgi complex  
 (b) mitochondria  
 (c) endoplasmic reticula  
 (d) lysosomes
28. Anaphase occurs in:  
 (a) amitosis    (b) mitosis  
 (c) meiosis    (d) both mitosis and meiosis
29. You would be unlikely to see which of the following human cells dividing?  
 (a) nerve cell    (b) skin cell  
 (c) cancer cell    (d) cell from an embryo
30. The phase of mitosis during which the chromosomes move toward separate poles of the cell is \_\_\_\_.  
 (a) telophase    (b) anaphase  
 (c) metaphase    (d) prophase
31. One event occurring during prophase is \_\_\_\_.  
 (a) the beginning of the formation of a spindle apparatus  
 (b) the synthesis of a new nuclear envelope  
 (c) the alignment of chromosomes in a single plane  
 (d) cytokinesis
32. At which stage of mitosis are chromosomes lined up in one plane in preparation for their separation to opposite poles of the cell?  
 (a) prophase    (b) metaphase  
 (c) anaphase    (d) interphase

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33. A cell cycle has which of the following phases:  
 (a) G<sub>1</sub> and G<sub>2</sub> phase  
 (b) S phase  
 (c) M or D phase  
 (d) all of a, b and c
34. Inter-phase is constituted in cell cycle by:  
 (a) G<sub>1</sub> phase (b) G<sub>2</sub> phase  
 (c) S phase (d) all of a, b and c
35. Activated MPF plays a role in cell cycle  
 (a) condensation of chromosomes  
 (b) reorganization of cell structure and break down of nuclear envelope  
 (c) segregation of chromosomes into daughter cells during mitosis  
 (d) all of a, b and c
36. If an intestinal cell in a grasshopper contains 24 chromosomes, a grasshopper sperm cell would contain \_\_\_\_ chromosomes.  
 (a) 3 (b) 6  
 (c) 12 (d) 24
37. How many maternal chromosomes are present in a somatic human cell in G<sub>1</sub>?  
 (a) 23 (b) 46  
 (c) 92 (d) 184
38. A cell entering the cell cycle with 32 chromosomes will produce two daughter cells, each with \_\_\_\_\_.  
 (a) 16 chromosomes  
 (b) 32 chromosomes  
 (c) 32 pairs of chromosomes  
 (d) 64 pairs of chromosomes
39. "Cytokinesis" refers to \_\_\_\_\_.  
 (a) division of the entire cell  
 (b) division of the nucleus  
 (c) division of the cytoplasm  
 (d) reduction in the number of chromosomes
40. The region of a chromosome holding the two double strands of replicated DNA together is called \_\_\_\_\_.  
 (a) chromatin (b) a centriole  
 (c) a centromere (d) a chromatid
41. If a cell contains 60 chromatids at the start of mitosis, how many chromosomes will be found in each daughter cell at the completion of the cell cycle?  
 (a) 15 (b) 30  
 (c) 45 (d) 60
42. Chromatids form \_\_\_\_\_.  
 (a) during G<sub>1</sub>  
 (b) during G<sub>2</sub>  
 (c) during the S phase  
 (d) at the start of mitosis
43. If a somatic human cell is just about to divide, it has \_\_\_\_ chromatids?  
 (a) 92 (b) 23  
 (c) 46 (d) 0
44. Which one of the following does not occur during, or because of, mitosis?  
 (a) the production of two genetically identical daughter cells  
 (b) condensed chromatin  
 (c) separation of chromatids  
 (d) replication of chromosomes
45. During what phase in the cell cycle would you find the most DNA per cell?  
 (a) G<sub>1</sub> (b) G<sub>2</sub>  
 (c) S (d) G<sub>0</sub>
46. Which of the following phases of mitosis is essentially the opposite of prometaphase in terms of the nuclear envelope?  
 (a) telophase (b) metaphase  
 (c) S phase (d) interphase
47. Sister chromatids separate during \_\_\_\_\_.  
 (a) anaphase (b) G<sub>1</sub> phase  
 (c) G<sub>2</sub> phase (d) metaphase
48. At which point in the cell cycle do centrosomes begin to move apart to two poles of the cell in a dividing human skin cell?  
 (a) S phase (b) G<sub>2</sub> phase  
 (c) prophase (d) metaphase

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## Part III

**Genetics and Molecular Biology****ANSWERS**

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. c  | 2. a  | 3. d  | 4. a  |
| 5. a  | 6. b  | 7. d  | 8. b  |
| 9. c  | 10. d | 11. d | 12. b |
| 13. c | 14. b | 15. d | 16. d |
| 17. d | 18. c | 19. b | 20. c |
| 21. d | 22. b | 23. d | 24. a |
| 25. c | 26. d | 27. a | 28. d |
| 29. a | 30. b | 31. a | 32. c |
| 33. d | 34. d | 35. d | 36. c |
| 37. a | 38. b | 39. c | 40. c |
| 41. b | 42. c | 43. a | 44. d |
| 45. b | 46. a | 47. a | 48. c |

### 3.1: MENDEL AND THE GENE IDEA

1. A single genetic locus that controls more than one trait is said to be \_\_\_\_\_.  
(a) polygenic (b) epistatic  
(c) pleiotropic (d) autotrophic
2. If O represents the allele for black eyes (dominant) and o represents the allele for orange eyes (recessive), what would be the genotypic ratio of a cross between a heterozygous black-eyed MendAlien and an orange-eyed MendAlien?  
(a) 1 homozygous black (OO): 1 heterozygote (black) (Oo): 1 homozygous orange (oo)  
(b) 2 homozygous black (OO): 1 heterozygote (black) (Oo): 1 homozygous orange (oo)  
(c) 1 homozygous black (OO): 0 heterozygote (black) (Oo): 1 homozygous orange (oo)  
(d) 0 homozygous black (OO): 1 heterozygote (black) (Oo): 1 homozygous orange (oo)
3. If O represents the allele for black eyes (dominant) and o represents the allele for orange eyes (recessive), what would be the phenotypic ratio of a cross between a heterozygous black-eyed MendAlien and an orange-eyed MendAlien?  
(a) 3 black : 1 orange  
(b) 1 black : 3 orange  
(c) 0 black : 1 orange  
(d) 1 black : 1 orange
4. Which of these is a testcross?  
(a) A? x aa (b) A? x AA  
(c) A? x Aa (d) A? x A?
5. A cross between an individual with orange eyes and green skin and an individual with black eyes and white skin is an example of a \_\_\_\_\_ cross.  
(a) test (b) difficult  
(c) dihybrid (d) trihybrid
6. A phenotypic ratio of 9:3:3:1 in the offspring of a cross indicates that \_\_\_\_\_.  
(a) one parent is homozygous dominant and one parent is homozygous recessive  
(b) one parent is heterozygous and one parent is homozygous recessive
7. Inheritance of sickle - cell anemia is an example of  
(a) Codominance  
(b) Incomplete dominance  
(c) mutation  
(d) none of these
8. A OoWw x ooww cross yields a phenotypic ratio of approximately 5 black eyes, green skin : 5 orange eyes, white skin : 1 black eyes, white skin : 1 orange eyes, green skin. Which of the following best explains these results?  
(a) Mendel's law of independent assortment is being violated.  
(b) Mendel's law of segregation is being violated.  
(c) The genes for eye color and skin color are co-dominant.  
(d) The heterozygous individual is male, and the homozygous individual is female.
9. Out breeding in sheep produces improved strains of sheep which provide increased amount of meat and wool than in breeds. This is an example of  
(a) heterosis (b) crossbreeding  
(c) inbreeding (d) all of these
10. In a situation in which genes assort independently, what is the ratio of the gametes produced by an AaBB individual?  
(a) 1 A : 1 B (b) 3 A : 1 B  
(c) 3 AB : 1 ab (d) 1 AB : 1 ab
11. Mendel worked \_\_\_\_\_.  
(a) on the Human Genome Project  
(b) with fruit flies  
(c) on problems involving characters that were inherited together more often than expected by chance  
(d) in a monastery
12. Andalusian chickens with the genotype CBCB are black, those with the genotype CWCW are white, and those with the genotype CBCW are gray. What is the relationship between the CB and CW alleles?  
(a) CB is dominant to CW

- (b) CB is recessive to CW  
 (c) CW is dominant to CB  
 (d) The relationship between the alleles is one of incomplete dominance.
13. Andalusian chickens with the genotype CBCB are black, those with the genotype CWCW are white, and those with the genotype CBCW are gray. What is the expected phenotypic ratio of a CBCB x CBCW cross?  
 (a) 1 black : 1 white  
 (b) 3 black : 1 white  
 (c) 1 black : 2 gray : 1 white  
 (d) 3 gray : 1 white
14. Andalusian chickens with the genotype CBCB are black, those with the genotype CWCW are white, and those with the genotype CBCW are gray. What is the expected genotypic ratio of a CBCW x CBCW cross?  
 (a) 1  $C^B C^B$  : 1  $C^B C^W$   
 (b) 3  $C^B C^B$  : 1  $C^W C^W$   
 (c) 1  $C^B C^B$  : 2  $C^B C^W$  : 1  $C^W C^W$   
 (d) 2  $C^B C^B$  : 1  $C^B C^W$  : 2  $C^W C^W$   
 (e) 9  $C^B C^B$  : 3  $C^B C^W$  : 3  $C^W C^B$  : 1  $C^W C^W$
15. Andalusian chickens with the genotype CBCB are black, those with the genotype CWCW are white, and those with the genotype CBCW are gray. What is the expected genotypic ratio of a CBCB x CBCW cross?  
 (a) 1  $C^B C^B$  : 1  $C^B C^W$   
 (b) 3  $C^B C^B$  : 1  $C^W C^W$   
 (c) 1  $C^B C^B$  : 2  $C^B C^W$  : 1  $C^W C^W$   
 (d) 2  $C^B C^B$  : 1  $C^B C^W$  : 2  $C^W C^W$
16. Andalusian chickens with the genotype CBCB are black, those with the genotype CWCW are white, and those with the genotype CBCW are gray. What is the expected phenotypic ratio of a CBCB x CBCW cross?  
 (a) 1 black : 1 white  
 (b) 3 black : 1 white  
 (c) 1 black : 2 gray : 1 white  
 (d) 1 black : 1 gray
17. In his breeding experiments, Mendel first crossed true-breeding \_\_\_\_\_ generation plants to produce the \_\_\_\_\_ generation, which were then allowed to self-pollinate to generate the \_\_\_\_\_ offspring.  
 (a) P... F1... F2  
 (b) F... P1... P2  
 (c) P1... P2... F  
 (d) P1... P2... P3
18. A plant with the genotype AABbcc \_\_\_\_\_.  
 (a) is homozygous at two loci
- (b) is heterozygous at two loci  
 (c) has recessive alleles at three loci  
 (d) is triploid
19. An allele is \_\_\_\_\_.  
 (a) a type of chromosome  
 (b) the dominant form of a gene  
 (c) a variety of pea plant used by Mendel  
 (d) an alternative version of a gene
20. GgTt pea plants can produce \_\_\_\_\_ type(s) of gametes, but a ggtt plant can produce \_\_\_\_\_ type(s) of gametes.  
 (a) one... two (b) two... one  
 (c) four... two (d) four... one
21. Two organisms with genotype AaBbCcDdEE mate. These loci are all independent. What fraction of the offspring will have the same genotype as the parents?  
 (a)  $\frac{1}{4}$ , (b)  $\frac{1}{16}$   
 (c)  $\frac{9}{64}$  (d)  $\frac{1}{16}$
22. You cross a true-breeding red-flowered snapdragon with a true-breeding white-flowered one. All of the F1 are pink. What does this say about the alleles for the parental traits?  
 (a) Red and white are codominant.  
 (b) Red is completely dominant.  
 (c) Both red and white are pleiotropic.  
 (d) Red shows incomplete dominance over white.
23. All of the following represent possible types of interactions between alleles except \_\_\_\_\_.  
 (a) complete dominance  
 (b) codominance  
 (c) incomplete dominance  
 (d) epistasis
24. Folk singer Woody Guthrie died of Huntington's disease, an autosomal dominant disorder. Which statement below must be true?  
 (a) All of his children will develop Huntington's disease.  
 (b) His sons will develop Huntington's disease but not his daughters.  
 (c) His daughters will die of Huntington's disease but not his sons.  
 (d) At least one of Woody Guthrie's parents must also have had the allele for Huntington's disease.
25. If an individual is heterozygous for the sickle cell trait \_\_\_\_\_.  
 (a) he or she will show no symptoms of the disease because the allele that causes sickle-cell disease is recessive

- (b) he or she will have full-blown sickle-cell disease because the allele is dominant  
 (c) he or she will be more apt to acquire a serious case of malaria  
 (d) he or she will not develop full-blown sickle-cell disease but may show symptoms under certain circumstances
26. Assume tall (*T*) is completely dominant to dwarf (*t*). If a homozygous dominant individual is crossed with a homozygous dwarf, the offspring will \_\_\_\_\_.  
 (a) all be intermediate in height  
 (b) all be tall  
 (c) be 1/2 tall and 1/2 dwarf  
 (d) be 3/4 tall and 1/4 dwarf
27. What is indicated when a single-character testcross yields offspring that all have the dominant phenotype?  
 (a) The parent with the dominant phenotype was homozygous.  
 (b) The parent with the dominant phenotype was heterozygous.  
 (c) Epistasis has occurred.  
 (d) The alleles are codominant.
28. If a homozygous dominant is crossed with a heterozygote for a given trait, the offspring will be \_\_\_\_\_.  
 (a) all of the dominant phenotype  
 (b) 1/4 of the recessive phenotype  
 (c) all homozygous dominant  
 (d) all homozygous recessive
29. An individual with the genotype *AABbCcDD* can make how many different kinds of gametes?  
 (a) 2                    (b) 4  
 (c) 8                    (d) 16
30. Homologous pairs of chromosomes often \_\_\_\_\_.  
 (a) carry different genes for different traits  
 (b) differ in length  
 (c) contain different alleles  
 (d) are not both present in diploid somatic cells
31. Which of the following matings cannot produce a child with blood type O? The letters refer to blood types (phenotypes).  
 (a) A x A              (b) A x B  
 (c) O x AB            (d) O x O
32. Term Genetics was first used by  
 (a) Bateson            (b) Sutton  
 (c) Mendel            (d) Morgan
33. Genetics is a branch of biology which deals with  
 (a) laws of heredity and variations  
 (b) process of cell division at gametogenesis  
 (c) formation of new species through natural selection  
 (d) none of these
34. Genotype of an organism is  
 (a) its physical appearance  
 (b) genetic constitution  
 (c) homozygous nature  
 (d) heterozygous
35. Microbial genetics is  
 (a) genetics of plants  
 (b) genetics of animals  
 (c) genetics of man  
 (d) genetics of bacteria and viruses
36. A complete set of chromosomes which is inherited as a unit from one parent is called  
 (a) genotype            (b) genome  
 (c) gamete            (d) gene
37. Mule is an example of  
 (a) heterosis            (b) hybrid vigour  
 (c) both of these        (d) none of these
38. Skin colour inheritance in mammals is usually  
 (a) monogenic            (b) multiple allelism  
 (c) polygenic            (d) pseudoallelism
39. Which of these do not follow Mendelian ratios  
 (a) complementary and supplementary genes  
 (b) lethal genes and incomplete dominance  
 (c) modifier genes  
 (d) all of these
40. A cross between F<sub>1</sub> hybrid with either of the parent is called  
 (a) test cross            (b) back cross  
 (c) reverse cross        (d) none of these

**ANSWERS**

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. c  | 2. d  | 3. d  | 4. a  |
| 5. c  | 6. d  | 7. a  | 8. a  |
| 9. a  | 10. d | 11. d | 12. d |
| 13. c | 14. c | 15. a | 16. d |
| 17. a | 18. a | 19. d | 20. b |
| 21. d | 22. d | 23. d | 24. d |
| 25. d | 26. a | 27. a | 28. a |
| 29. b | 30. c | 31. c | 32. a |
| 33. a | 34. b | 35. d | 36. b |
| 37. c | 38. c | 39. d | 40. b |

### 3.2: THE CHROMOSOMAL BASIS OF INHERITANCE

1. The recombination frequency between gene A and gene B is 8.4%, the recombination frequency between gene A and gene C is 6.8%, and the recombination frequency between gene B and gene C is 15.2%. Which of these is the correct arrangement of these genes?  
 (a) ABC      (b) ACB  
 (c) BCA      (d) CAB
2. A color-blind woman mates with a male with normal color vision. Which of these results would indicate that color blindness is caused by an X-linked recessive allele?  
 (a) Half of the sons and half of the daughters are color-blind.  
 (b) All of the daughters, and none of the sons, are color-blind.  
 (c) All of the sons, and none of the daughters, are color-blind.  
 (d) The offspring occur in a ratio of 3 color-blind : 1 normal vision.
3. Color blindness is an X-linked recessive trait. A color-blind man has a daughter with normal color vision. What is the genotype of the daughter?  
 (a)  $X^cX^c$       (b)  $X^cX^c$   
 (c)  $X^cX^c$       (d)  $X^cY$
4. Color blindness is an X-linked recessive trait. A color-blind man has a daughter with normal color vision. She mates with a male who has normal color vision. What is the expected phenotypic ratio of their offspring?  
 (a) 1 normal vision female : 1 color-blind female : 1 normal vision male : 1 color-blind male  
 (b) All the offspring have normal color vision.  
 (c) 2 normal vision females : 1 normal vision male : 1 color-blind male  
 (d) 3 normal vision female : 1 color-blind male
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5. Color blindness is an X-linked recessive trait. A woman who is homozygous for normal color vision mates with a color-blind male. What is the expected phenotypic ratio of their offspring?  
 (b) 2 normal vision females : 1 normal vision male : 1 color-blind male  
 (c) 3 normal vision female : 1 color-blind male  
 (d) 1 normal vision female : 1 color-blind female : 1 normal male : 1 color-blind male
6. Color blindness is an X-linked recessive trait. A woman who is homozygous for normal color vision mates with a color-blind male. What is the expected phenotypic ratio of their offspring?  
 (a) 2 normal vision females : 1 normal vision male : 1 color-blind male  
 (b) 3 normal vision female : 1 color-blind male  
 (c) All the offspring have normal color vision.  
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 (a) 1 normal vision female : 1 color-blind female : 1 normal male : 1 color-blind male  
 (b) 1 normal vision daughter : 1 color-blind son  
 (c) 2 normal vision females : 1 normal-vision male : 1 color-blind male  
 (d) 3 normal vision female : 1 color-blind male
8. Color blindness is an X-linked recessive trait. Under what conditions can an unaffected male have a color-blind daughter?  
 (a) His mate is color-blind.  
 (b) He can't.  
 (c) He is heterozygous for color vision.  
 (d) His father is color-blind.
9. Hypophosphatemia (vitamin D-resistant rickets) is inherited as an X-linked dominant. An unaffected woman mates with a male with hypophosphatemia. What is the expected phenotypic ratio of their offspring?  
 (a) 1 normal female : 1 female with hypophosphatemia : 1 normal male : 1 male with hypophosphatemia

- (b) 1 normal daughter hypophosphatemia : 1 son with hypophosphatemia  
 (c) 1 daughter with hypophosphatemia : 1 normal son  
 (d) 2 normal females : 1 normal male : 1 male with hypophosphatemia
10. Hypophosphatemia (vitamin D-resistant rickets) is inherited as an X-linked dominant. A woman without hypophosphatemia and a man with hypophosphatemia have a daughter. The daughter mates with a male without hypophosphatemia. What is the expected phenotypic ratio of their offspring?  
 (a) 2 unaffected females : 1 unaffected male : 1 male with hypophosphatemia  
 (b) 1 unaffected female : 1 female with hypophosphatemia : 1 unaffected male : 1 male with hypophosphatemia  
 (c) 1 unaffected daughter : 1 son with hypophosphatemia  
 (d) 1 daughter with hypophosphatemia : 1 unaffected son
11. Suppose that having three nostrils is a Y-linked character. A woman with two nostrils mates with a man with three nostrils. What is the expected phenotypic ratio of their offspring?  
 (a) 1 daughter with two nostrils : 1 son with three nostrils  
 (b) 1 daughter with two nostrils: 1 daughter with three nostrils: 1 son with two nostrils : 1 son with three nostrils  
 (c) 2 daughters with two nostrils: 1 son with two nostrils: 1 son with three nostrils  
 (d) 2 daughters with three nostrils: 1 son with two nostrils: 1 son with three nostrils
12. Humans are diploid and have 46 chromosomes (or two sets). How many sets of chromosomes are found in each human gamete?  
 (a) 1      (b) 2  
 (c) 3      (d) 4
13. Humans are diploid and have 46 chromosomes. How many chromosomes are found in each human gamete?  
 (a) 12      (b) 23  
 (c) 36      (d) 45
14. \_\_\_\_\_ is the process by which haploid gametes form a diploid zygote.  
 (a) Embryogenesis      (b) Meiosis  
 (c) Gastrulation      (d) Fertilization
15. A particular diploid plant species has 48 chromosomes, or two sets. A mutation occurs and gametes with 48 chromosomes are produced. If self-fertilization occurs, the gametes will have \_\_\_\_\_ set(s) of chromosomes.  
 (a) 1      (b) 2  
 (c) 3      (d) 4
16. Which of these terms applies to an organism with extra sets of chromosomes?  
 (a) monosomy      (b) haploid  
 (c) trisomy      (d) polyploid
17. Mutant tetraploid plants \_\_\_\_\_  
 (a) are usually sickly  
 (b) are able to interbreed with their parents  
 (c) have an odd number of chromosomes  
 (d) are unable to interbreed with a diploid plant
18. Most polyploid plants arise as a result of \_\_\_\_\_  
 (a) hybridization  
 (b) a mutation of gamete formation  
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19. The final proof that genes are carried on the chromosomes was obtained through the work of  
 (a) Mendel      (b) Sutton  
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20. Drosophila has only  
 (a) 10 chromosomes  
 (b) 8 chromosomes  
 (c) 6 chromosomes  
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21. The other chromosomes besides X and Y are termed as  
 (a) sex chromosomes      (b) sex-linked  
 (c) autosomes      (d) none of these
22. An autosome means  
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 (b) absence of one sex chromosome  
 (c) presence of one more sex chromosome  
 (d) absence of one autosome

25. Triploid, tetraploid is example of  
 (a) aneuploidy (b) euploidy  
 (c) both of these (d) None of these
26. Genes are made up of  
 (a) histones  
 (b) polynucleotides  
 (c) both a and b  
 (d) lipids and carbohydrates
27. Sutton and Boveri are associated with  
 (a) gene theory of inheritance  
 (b) recapitulation theory  
 (c) chromosomal theory of inheritance  
 (d) Morgan
28. Sex in human beings is determined by  
 (a) size of sperm  
 (b) size of egg being fertilized  
 (c) sex chromosome of father  
 (d) sex chromosome of mother
29. A deficiency in a chromosome resulting from the loss of fragment through breaking is called  
 (a) deletion (b) inversion  
 (c) translocation (d) duplication
30. Who discovered a densely staining patch of chromatin present in cell nuclei of females but not males.  
 (a) Murray L. Barr  
 (b) Edouard Van Beneden  
 (c) Lyon  
 (d) W.S. Sutton
31. Traits controlled by X-chromosomes are said to the  
 (a) sex linked (b) sex limited  
 (c) sex influenced (d) dominant
32. Phenotypes in which of these conditions are called syndromes  
 (a) aneuploidy (b) euploidy  
 (c) polyplodiy (d) all of above
33. Down's syndrome is resulted due to  
 (a) 45 chromosomes instead of 46  
 (b) 47 chromosomes instead of 46  
 (c) 23rd pair has three doses  
 (d) 21st pair of chromosome having single number
34. A woman is red-green color-blind. What can we conclude, if anything, about her father?  
 (a) We have too little information to tell.  
 (b) There is a 50% probability that he has normal vision.  
 (c) He is red-green color-blind.  
 (d) He has two Y chromosomes.

35. What is the probability that a male will inherit an X-linked recessive allele from his father?  
 (a) 0% (b) 25%  
 (c) 50% (d) 75%
36. Hemophilia is a sex-linked disorder. The daughter of a father with hemophilia and a carrier mother has a \_\_\_\_\_ probability of having hemophilia.  
 (a) 100% (b) 25%  
 (c) 50% (d) 0%
37. Which one of the following is the only known viable human monosomy?  
 (a) XYY (b) XO  
 (c) YO (d) XY
38. The exchange of segments between nonhomologous chromosomes is called \_\_\_\_\_.  
 (a) inversion (b) translocation  
 (c) transduction (d) transformation
39. Which type of chromosomal alteration is responsible for the disorder cri du chat?  
 (a) inversion (b) duplication  
 (c) genetic imprinting (d) deletion
40. Cells that have more than two complete sets of chromosomes are termed \_\_\_\_\_.  
 (a) aneuploid (b) diploid  
 (c) polyplodiy (d) nanoploid
41. During meiosis, homologous chromosomes sometimes "stick together" and do not separate properly. This phenomenon is known as \_\_\_\_\_.  
 (a) cellular sterility (b) meiotic failure  
 (c) gametic infertility (d) nondisjunction
42. Linked genes can be separated by anywhere from \_\_\_\_\_ to \_\_\_\_\_ centimorgans.  
 (a) 0... 100 (b) 50... 100  
 (c) 0... 25 (d) 0... 50

## ANSWERS

1. d 2. c 3. a 4. c  
 5. d 6. c 7. b 8. b  
 9. c 10. b 11. a 12. a  
 13. b 14. d 15. d 16. d  
 17. d 18. a 19. c 20. b  
 21. c 22. c 23. b 24. a  
 25. b 26. c 27. c 28. c  
 29. a 30. a 31. a 32. a  
 33. b 34. c 35. a 36. c  
 37. b 38. b 39. d 40. c  
 41. d 42. d

## 3.3: THE MOLECULAR BASIS OF INHERITANCE

1. Who demonstrated that DNA is the genetic material of the T2 phage?  
 (a) Franklin  
 (b) Hershey and Chase  
 (c) Meselson and Stahl  
 (d) Watson and Crick
2. The radioactive isotope  $^{32}\text{P}$  labels the T2 phage's \_\_\_\_\_.  
 (a) DNA (b) tail  
 (c) base plate (d) protein coat
3. Hershey and Chase used \_\_\_\_\_ to radioactively label the T2 phage's proteins.  
 (a)  $^{35}\text{S}$  (b)  $^{14}\text{C}$   
 (c)  $^{222}\text{Ra}$  (d)  $^{32}\text{P}$
4. After allowing phages grown with bacteria in a medium that contained  $^{32}\text{P}$  and  $^{35}\text{S}$ , Hershey and Chase used a centrifuge to separate the phage ghosts from the infected cell. They then examined the infected cells and found that they contained \_\_\_\_\_, which demonstrated that \_\_\_\_\_ is the phage's genetic material.  
 (a) labeled protein... DNA  
 (b) labeled protein... protein  
 (c) labeled DNA... labeled protein  
 (d) labeled DNA... DNA
5. Which of these is a difference between a DNA and an RNA molecule?  
 (a) DNA contains uracil, whereas RNA contains thymine.  
 (b) DNA is a polymer composed of nucleotides, whereas RNA is a polymer composed of nucleic acids.  
 (c) DNA is double-stranded, whereas RNA is single-stranded.  
 (d) DNA contains five-carbon sugars, whereas RNA contains six-carbon sugars.
6. In a nucleotide, the nitrogenous base is attached to the sugar's \_\_\_\_\_ carbon and the phosphate group is attached to the sugar's \_\_\_\_\_ carbon.  
 (a) 1'... 2' (b) 1'... 5'  
 (c) 2'... 3' (d) 1'... 3'
7. Nucleic acids are assembled in the \_\_\_\_\_ direction.  
 (a) 1' to 5' (b) 2' to 3'  
 (c) 5' to 3' (d) 4' to 5'
8. In a DNA double helix an adenine of one strand always pairs with a(n) \_\_\_\_\_ of the complementary strand, and a guanine of one strand always pairs with a(n) \_\_\_\_\_ of the complementary strand.  
 (a) guanine... adenine  
 (b) cytosine... uracil  
 (c) cytosine... thymine  
 (d) thymine... cytosine
9. Short segments of newly synthesized DNA are joined into a continuous strand by \_\_\_\_\_.  
 (a) helicase  
 (b) DNA polymerase  
 (c) ligase  
 (d) primase
10. After DNA replication is completed, \_\_\_\_\_.  
 (a) each new DNA double helix consists of one old DNA strand and one new DNA strand  
 (b) each new DNA double helix consists of two new strands  
 (c) one DNA double helix consists of two old strands and one DNA double helix consists of two new strands  
 (d) each of the four DNA strands consists of some old strand parts and some new strand parts
11. The first step in the replication of DNA is catalyzed by \_\_\_\_\_.  
 (a) helicase  
 (b) DNA polymerase  
 (c) ligase  
 (d) primase
12. The action of helicase creates \_\_\_\_\_.  
 (a) primers and DNA fragments  
 (b) primers and replication bubbles  
 (c) DNA fragments and replication forks  
 (d) replication forks and replication bubbles
13. Why is the new DNA strand complementary to the 3' to 5' strands assembled in short segments?  
 (a) the replication forks block the formation of longer strands  
 (b) DNA polymerase can assemble DNA only in the 3' to 5' direction  
 (c) DNA polymerase can assemble DNA only in the 5' to 3' direction

14. The synthesis of a new strand begins with the synthesis of a(n) \_\_\_\_\_.  
 (a) single-strand binding protein  
 (b) Okazaki fragment  
 (c) poly(A) tail  
 (d) RNA primer complementary to a preexisting DNA strand
15. An old DNA strand is used as a \_\_\_\_\_ for the assembly of a new DNA strand.  
 (a) complement  
 (b) primer  
 (c) template  
 (d) source of nucleotides
16. In Griffith's experiments, a harmless variant of *S. pneumoniae* became pathogenic when mixed with a heat-killed pathogenic variant as a result of \_\_\_\_\_.  
 (a) transformation  
 (b) transduction  
 (c) mutation  
 (d) natural selection
17. In the Hershey and Chase experiment that helped confirm that DNA, not protein, was the hereditary material, the key finding was that \_\_\_\_\_.  
 (a) radioactively labeled sulfur was present inside the infected bacteria  
 (b) radioactively labeled phosphorus was present inside the infected bacteria  
 (c) radioactively labeled carbon was present inside the infected bacteria  
 (d) radioactively labeled phosphorus was found outside of the infected bacteria
18. The X-ray diffraction studies conducted by \_\_\_\_\_ were key to the discovery of the structure of DNA.  
 (a) McClintock (b) Franklin  
 (c) Meselson and Stahl  
 (d) Chargaff
19. Which of the following is not true of DNA?  
 (a) It pairs with C, and G pairs with T.  
 (b) Nitrogenous bases are 0.34 nm apart on a DNA strand.  
 (c) The double helix is about 2.0 nm wide.  
 (d) Its purine bases are larger than its pyrimidine bases.
20. Who demonstrated that DNA replication is semiconservative?  
 (a) Morgan (b) Meselson and Stahl  
 (c) Chargaff (d) Franklin
21. Which of the following is not needed for DNA replication?  
 (a) ribosomes (b) DNA  
 (c) nucleotides  
 (d) All of the above are needed.
22. DNA replication is said to be semiconservative. This means that \_\_\_\_\_ is used as a template for the replication of a new strand.  
 (a) half of the old strand is degraded and half is used as a template for the replication of a new strand  
 (b) one of the two resulting double helices is made of two old strands, and the other is made of two new strands  
 (c) the old double helix is degraded and half of its nucleotides are used in the construction of two new double helices  
 (d) each new double helix consists of one old and one new strand
23. \_\_\_\_\_ fixes mistakes made during DNA replication; \_\_\_\_\_ repairs damage to a preexisting double helix.  
 (a) Mismatch repair... nucleotide excision repair  
 (b) The leading strand... the lagging strand  
 (c) Operon repair... histone repair  
 (d) Transformation... transduction
24. In nucleotide excision repair, damaged DNA is excised by \_\_\_\_\_.  
 (a) restriction enzymes (b) ligase  
 (c) nuclease (d) helicase
25. The repetitive DNA sequences present at the ends of eukaryotic chromosomes are called \_\_\_\_\_.  
 (a) telomeres (b) sarcomeres  
 (c) polypeptides (d) centromeres
26. In a Nucleosome, the DNA is wrapped around  
 (a) satellite DNA (b) the nucleolus  
 (c) histones (d) ribosomes
27. The decoding of the message at the ribosome is called  
 (a) central dogma (b) transcription  
 (c) translation (d) elongation
28. The synthesis of an RNA molecule from a DNA template is known as  
 (a) transcription (b) translation  
 (c) replication (d) recombination
29. Unusual method of DNA duplication is called  
 (a) semi-conservative  
 (b) non-conservative  
 (c) conservative  
 (d) none of these

30. Mutations are harmful  
 (a) always (b) never  
 (c) rarely (d) mostly
31. Central dogma of molecular genetics is  
 (a) DNA RNA proteins  
 (b) RNA DNA proteins  
 (c) proteins DNA RNA  
 (d) none of these
32. Nucleosomes are beaded structures on chromosomes and formed of  
 (a) DNA and histones  
 (b) RNA and histones  
 (c) RNA and proteins  
 (d) DNA and RNA
33. The primer required to initiate synthesis of a new DNA strand consists of  
 (a) DNA  
 (b) structural protein  
 (c) an Okazaki fragment  
 (d) RNA
34. An operon is constituted by  
 (a) operator genes  
 (b) promoter genes  
 (c) regulator genes  
 (d) all of these
35. Which of the following mutations would be most likely to have a harmful effect on an organism?  
 (a) a base pair substitution  
 (b) a deletion of three bases near the middle of the gene  
 (c) a single base insertion near the start of the coding sequence  
 (d) a single base deletion near the middle of an intron
36. The template used to make cDNA is  
 (a) DNA (b) mRNA  
 (c) a plasmid (d) a DNA probe
37. That along with proteins makes up ribosomes  
 (a) DNA (b) mRNA  
 (c) tRNA (d) rRNA
38. Which of the following is not true of a codon?  
 (a) It is the basic unit of the genetic code  
 (b) It extends from one end of a tRNA molecule
1. b 2. a 3. a 4. d  
 5. c 6. b 7. c 8. d  
 9. c 10. a 11. a 12. d  
 13. c 14. d 15. c 16. a  
 17. b 18. b 19. a 20. b  
 21. a 22. d 23. a 24. c  
 25. a 26. c 27. c 28. a  
 29. a 30. a 31. a 32. a  
 33. d 34. d 35. c 36. b  
 37. d 38. b 39. a 40. b  
 41. a 42. c 43. b 44. b

## ANSWERS

## 3.4: FROM GENE TO PROTEIN

1. Polypeptides are assembled from \_\_\_\_\_.
  - (a) hexoses
  - (b) amino acids
  - (c) nucleotides
  - (d) proteins
2. RNA processing converts the RNA transcript into \_\_\_\_\_.
  - (a) a protein
  - (b) DNA
  - (c) a eukaryotic cell
  - (d) mRNA
3. Protein synthesis, controlled by DNA, requires all of the following except \_\_\_\_\_.
  - (a) ribosomes
  - (b) mRNA
  - (c) tRNA
  - (d) endoplasmic reticulum
4. Which one of the following is true of tRNAs?
  - (a) Each tRNA binds a particular amino acid.
  - (b) tRNAs are extremely small molecules.
  - (c) tRNAs carry special sequences known as codons.
  - (d) There are four types of tRNA.
5. Which of these correctly illustrates the pairing of DNA and RNA nucleotides?
  - (a) GTTACG - CAATCG
  - (b) GTTACG - CAAUGC
  - (c) GTTACG - GTTACG
  - (d) GTTACG - ACCGTA
6. The direction of synthesis of an RNA transcript is \_\_\_\_\_.
  - (a) 1' → 5'
  - (b) 5' → 3'
  - (c) 1' → 3'
  - (d) 3' → 5'
7. During RNA processing a(n) \_\_\_\_\_ is added to the 5' end of the RNA.
  - (a) 3' untranslated region
  - (b) a long string of adenine nucleotides
  - (c) 5' untranslated region
  - (d) modified guanine nucleotide
8. During RNA processing a(n) \_\_\_\_\_ is added to the 3' end of the RNA.
  - (a) 3' untranslated region
  - (b) a long string of adenine nucleotides
  - (c) 5' untranslated region
  - (d) coding segment
9. Spliceosomes are composed of \_\_\_\_\_.
  - (a) snRNPs and other proteins
  - (b) polymerases and ligases
10. The RNA segments joined to one another by spliceosomes are \_\_\_\_\_.
  - (a) caps
  - (b) exons
  - (c) snRNPs
  - (d) tails
11. Translation occurs in the \_\_\_\_\_.
  - (a) cytoplasm
  - (b) lysosome
  - (c) nucleus
  - (d) mitochondrion
12. What enzyme catalyzes the attachment of an amino acid to tRNA?
  - (a) aminoacyl-tRNA synthetase
  - (b) rubisco
  - (c) dextrinase
  - (d) arginine-succinate lyase
13. The tRNA anticodon, GAC, is complementary to the mRNA codon with the sequence \_\_\_\_\_.
  - (a) CAG
  - (b) CTG
  - (c) GAC
  - (d) CUG
14. A mutagen causes \_\_\_\_\_.
  - (a) problems with mitosis
  - (b) a change in the base sequence of DNA
  - (c) decreased enzyme activity throughout the cell
  - (d) decreased permeability of the nuclear envelope
15. The initiator tRNA attaches at the ribosome's site.
  - (a) A
  - (b) translocation
  - (c) E
  - (d) P
16. Beadle and Tatum showed that each kind of mutant bread mold they studied lacked a specific enzyme. Their experiments demonstrated that \_\_\_\_\_.
  - (a) genes carry information for making proteins
  - (b) mutations are changes in genetic information
  - (c) genes are made of DNA
  - (d) enzymes are required to repair damaged DNA information
17. The flow of information in a cell proceeds \_\_\_\_\_.
  - (a) from RNA to DNA to protein
  - (b) from protein to RNA to DNA

18. A gene is usually \_\_\_\_\_.
  - (a) the same thing as a chromosome
  - (b) the information for making a polypeptide
  - (c) made of RNA
  - (d) made by a ribosome
19. A template strand of DNA has the sequence 3'-AGCCGTTCACGC-5'. An mRNA transcribed from the DNA will have which of the following sequences?
  - (a) 5'-UCGGCAAAUGCG-3'
  - (b) 3'-UCGGCAAAUGCG-5'
  - (c) 5'-TCGGCAAATGCG-3'
  - (d) 3'-AGCCGUUUACGC-5'
20. How does RNA polymerase know where to start transcribing a gene into mRNA?
  - (a) It starts at one end of the chromosome.
  - (b) Transfer RNA acts to translate the message to RNA polymerase.
  - (c) It starts at a certain nucleotide sequence called a promoter.
  - (d) The ribosome directs it to the correct portion of the DNA molecule.
21. After an RNA molecule is transcribed from a eukaryotic gene, portions called \_\_\_\_\_ are removed and the remaining \_\_\_\_\_ are spliced together to produce an mRNA molecule with a continuous coding sequence.
  - (a) operators... promoters
  - (b) exons... introns
  - (c) silencers... enhancers
  - (d) introns... exons
22. Which of the following processes occurs in the cytoplasm of a eukaryotic cell?
  - (a) DNA replication
  - (b) translation
  - (c) transcription
  - (d) DNA replication and translation
23. During the replication of DNA, \_\_\_\_\_.
  - (a) both strands of a molecule act as templates
  - (b) the reaction is catalyzed by RNA polymerase

## ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. b  | 2. c  | 3. d  | 4. a  |
| 5. b  | 6. b  | 7. d  | 8. b  |
| 9. a  | 10. b | 11. a | 12. a |
| 13. d | 14. a | 15. a | 16. a |
| 17. d | 18. b | 19. a | 20. c |
| 21. d | 22. b | 23. a | 24. b |
| 25. d | 26. a | 27. a |       |

### 3.5: THE GENETICS OF VIRUSES AND BACTERIA

1. Viral DNA makes mRNA by the process of \_\_\_\_\_.
  - (a) replication
  - (b) infection
  - (c) translation
  - (d) lysis
2. The lytic cycle of bacteriophage infection ends with the \_\_\_\_\_.
  - (a) replication of viral DNA
  - (b) entry of the phage protein coat into the host cell
  - (c) assembly of viral particles into phages
  - (d) rupture of the bacterium
3. As a result of the lytic cycle, \_\_\_\_\_.
  - (a) the host cell is not destroyed
  - (b) the host cell's DNA is destroyed
  - (c) viral ribosomes are produced
  - (d) viral DNA is incorporated into host cell DNA
4. In the lysogenic cycle \_\_\_\_\_.
  - (a) host DNA is destroyed and viral DNA is replicated
  - (b) a bacterium replicates without passing viral DNA to its daughter cells
  - (c) viral DNA is replicated along with host DNA
  - (d) a bacterium divides once before the lytic cycle is initiated
5. The genetic material of HIV consists of \_\_\_\_\_.
  - (a) single-stranded DNA
  - (b) single-stranded RNA
  - (c) double-stranded DNA
  - (d) double-stranded RNA
6. What is the function of reverse transcriptase?
  - (a) It catalyzes the formation of a polypeptide from an RNA template.
  - (b) It catalyzes the formation of DNA from a polypeptide template.
  - (c) It catalyzes the formation of RNA from a polypeptide template.
  - (d) It catalyzes the formation of DNA from an RNA template.
7. What is the source of a viral envelope?
  - (a) host cell DNA
  - (b) prophages
  - (c) provirus
  - (d) host cell membrane
8. Double-stranded viral DNA is incorporated into a host cell as a \_\_\_\_\_.
  - (a) promoter
  - (b) provirus
  - (c) transposon
  - (d) lac
9. The operon model of the regulation of expression in bacteria was proposed by \_\_\_\_\_.
  - (a) Watson and Crick
  - (b) Franklin
  - (c) Darwin
  - (d) Jacob and Monod
10. Which of these is not a component of an operon?
  - (a) lactose-utilization genes only
  - (b) promoter only
  - (c) regulatory gene only
  - (d) operator only
11. Regulatory proteins bind to \_\_\_\_\_.
  - (a) the operator
  - (b) the lactose-utilization genes
  - (c) the regulatory gene
  - (d) RNA polymerase
12. In the presence of a regulatory protein the operon is \_\_\_\_\_.
  - (a) transcribed
  - (b) not transcribed
  - (c) transcribed at a faster than usual rate
  - (d) is turned on
13. In general, the lactose operon \_\_\_\_\_ until all of the lactose is used up.
  - (a) continuously produces beta-galactosidase
  - (b) is transcribed only in the presence of lactose
  - (c) is transcribed when allolactose binds the lactose repressor protein
  - (d) all of the above
14. When the lac operon is strongly active, \_\_\_\_\_.
  - (a) glucose levels are high
  - (b) cAMP levels are high
  - (c) allolactose is absent
  - (d) the lac repressor protein is active
15. The nucleic acid of a virus particle is enclosed in a protein coat known as a(n) \_\_\_\_\_.
  - (a) nuclear envelope
  - (b) capsid
  - (c) nucleoid
  - (d) envelope
16. A virus that attacks a bacterium is called \_\_\_\_\_.
  - (a) phage
  - (b) retrovirus
  - (c) viroid
  - (d) paramyxovirus

17. When a phage infects a bacterial cell and enters the lysogenic cycle, all of the following happen except \_\_\_\_\_.
  - (a) viral DNA is injected into the bacterium
  - (b) the host cell is lysed by the invasion
  - (c) viral DNA becomes inserted into the bacterial chromosome
  - (d) when the bacterial chromosome replicates, viral DNA is also replicated
18. HIV uses which one of the following processes to synthesize a DNA strand using its RNA genome as a template?
  - (a) transcription
  - (b) reverse transcription
  - (c) translation
  - (d) reverse translation
19. A plant that has been raised in a sterile environment shows symptoms of a viral infection. How would you explain this?
  - (a) The viral infection was acquired by horizontal transmission.
  - (b) A group of plant genes mutated to become a viral genome.
  - (c) The viral infection was acquired by vertical transmission.
  - (d) The viral infection was acquired from the environment.
20. \_\_\_\_\_ are circular strands of RNA molecules, and \_\_\_\_\_ are infectious protein particles.
  - (a) Retroviruses... transposons
  - (b) Retrotransposons... viruses
  - (c) Prophages... bacteriophages
  - (d) Viroids... prions
21. A geneticist discovers that a particular nucleotide sequence is present on different chromosomes in different mouse skin cells. This suggests that \_\_\_\_\_.
  - (a) transformation was occurring in some skin cells
  - (b) transposons were moving around
  - (c) the cells were engaging in conjugation
  - (d) the mouse had been exposed to a mutagen
22. One of the ways you could tell a prokaryotic cell from a eukaryotic cell is that only the prokaryotic cell would \_\_\_\_\_.
  - (a) be larger
  - (b) have a nucleus
  - (c) have circular DNA molecules concentrated in a region called the nucleoid
  - (d) have a true cell membrane
23. According to the operon model, multiple genes within a single metabolic pathway are coordinately controlled by \_\_\_\_\_.
24. A correct sequence of DNA segments composing an operon is \_\_\_\_\_.
  - (a) regulatory gene, promoter, operator, enzyme-coding genes
  - (b) promoter, lacI, operator, lacZ, lacY, lacA
  - (c) enzyme-coding genes, promoter, operator
  - (d) promoter, operator, enzyme-coding genes
25. Viruses can vary with respect to all of the following characteristics except \_\_\_\_\_.
  - (a) DNA or RNA as the genetic material
  - (b) presence or absence of metabolic machinery
  - (c) single- or double-stranded nucleic acids
  - (d) presence or absence of a membranous envelope
26. A microbiologist analyzes chemicals obtained from an enveloped RNA virus that infects monkeys. He finds that the viral envelope contains a protein characteristic of monkey cells. Which of the following is the most likely explanation?
  - (a) The viral envelope forms as the virus leaves the host cell.
  - (b) The virus forced the monkey cell to make proteins for its envelope.
  - (c) The virus is a prophage.
  - (d) Its presence is a result of the monkey's immunological response.
27. Which one of the following, if any, is never a component of any virus?
  - (a) protein
  - (b) double-stranded (ds) DNA
  - (c) phospholipid bilayer
  - (d) All of the above can be components.
28. Viruses that infect bacteria are called \_\_\_\_\_.
  - (a) bacterioviruses
  - (b) bacteriophages
  - (c) capsomeres
  - (d) proviruses
29. HIV, the virus that causes AIDS, only infects certain cells within the immune system. This is because \_\_\_\_\_.
  - (a) the virus is not very mobile within the body and only comes into contact with a limited number of cells

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- (b) other cells produce toxins that destroy the virus before infection can take place  
 (c) the virus binds to specific receptors that are only present on certain immune cells  
 (d) the virus gets into all cells, but the viral RNA is immediately destroyed in all but a small number of immune system cells
30. When a virus infects an *E. coli* cell, what part of the virus enters the bacterial cytoplasm?  
 (a) the entire virus  
 (b) only the nucleic acid  
 (c) the protein capsid and enclosed nucleic acid  
 (d) the tail fibers
31. The phage reproductive cycle that kills the bacterial host cell is a \_\_\_\_\_ cycle, and a phage that always reproduces this way is a \_\_\_\_\_ phage.  
 (a) lytic... virulent  
 (b) lytic... lysogenic  
 (c) lysogenic... temperate  
 (d) virulent... lytic
32. In the lytic life cycle of phages \_\_\_\_\_.  
 (a) the cell typically dies, releasing many copies of the virus  
 (b) the viral capsid is assembled according to the genetic information of the bacterium  
 (c) the entire phage is taken into the bacterium  
 (d) DNA replication is not part of the life cycle
33. Restriction enzymes help defend bacteria against viral infections by \_\_\_\_\_.  
 (a) preventing the binding of the virus to the cell surface  
 (b) preventing entry of the viral DNA into the cell  
 (c) cutting viral DNA once it has entered the cell  
 (d) preventing the synthesis of viral capsomeres in the cell
34. A phage that inserts itself into the host DNA is called \_\_\_\_\_.  
 (a) a bud (b) lysogenic  
 (c) a bacteriophage (d) semipermeable
35. A prophage is a(n) \_\_\_\_\_.  
 (a) viral genome that has been incorporated into a bacterial cell's chromosome  
 (b) virus that infects bacteria  
 (c) type of retrovirus  
 (d) prion that has been integrated into a bacterial cell's chromosome
36. In the lysogenic cycle of phages \_\_\_\_\_.  
 (a) the nucleic acid core of the phage is all that enters the host cell
37. How do retroviruses, such as HIV, differ from other viruses?  
 (a) They have much simpler reproductive cycles than other RNA viruses.  
 (b) They contain DNA that is used as a template to make RNA.  
 (c) They can reproduce only inside living cells.  
 (d) They contain the enzyme reverse transcriptase.
38. Reverse transcription, carried out by retroviruses, is the process by which \_\_\_\_\_.  
 (a) DNA information is copied into RNA  
 (b) RNA information is copied into DNA  
 (c) RNA information is "read" to form a protein molecule  
 (d) DNA is duplicated
39. Which statement below is a correct comparison of a "regular" RNA virus and a RNA retrovirus?  
 (a) Only the regular RNA virus performs transcription.  
 (b) Only the RNA retrovirus performs translation.  
 (c) Only the regular RNA virus produces DNA from an RNA template.  
 (d) Both produce protein coats via translation of mRNA.
40. The symptoms of a viral infection in a person can be caused by \_\_\_\_\_.  
 (a) the death of infected cells  
 (b) the reaction of the individual's immune system to the infection  
 (c) the production of toxins by infected cells  
 (d) all of the above
41. Vaccines for viral diseases are \_\_\_\_\_. and help prevent infection by \_\_\_\_\_.  
 (a) harmless derivatives of pathogenic viruses... stimulating the immune system to mount a defense against the actual pathogen  
 (b) nucleoside inhibitors... inhibiting the replication of the viral genome  
 (c) protease inhibitors... preventing synthesis of envelope proteins  
 (d) antibiotic formulations... specifically killing infected cells
42. Emerging viruses can originate from all of the following sources except \_\_\_\_\_.  
 (a) animal viruses

- (b) only a small number of the viral genes are expressed  
 (c) the viral nucleic acid inserts itself into the host chromosome  
 (d) all of the above
43. Which of the following is an example of vertical transmission of a virus in plants?  
 (a) Viral particles are carried by the wind from one plant to another.  
 (b) Viral particles are carried from one plant to another by a pair of pruning shears.  
 (c) Two neighboring plants touch each other, allowing viruses present in one plant to infect the other plant.  
 (d) An infected plant produces seeds that contain the virus, giving rise to infected progeny.
44. Circular RNA molecules that function like a virus in plants are termed \_\_\_\_\_.  
 (a) rhabdovirus (b) viroid  
 (c) retrovirus (d) prion
45. Prions are \_\_\_\_\_. that are thought to cause disease by \_\_\_\_\_.  
 (a) abnormally shaped proteins... inducing similar but normally shaped proteins in the brain to adopt the abnormal form  
 (b) RNA molecules... encoding toxic proteins  
 (c) mutant DNA molecules... encoding toxic proteins  
 (d) an abnormal type of capsid... dramatically enhancing the rate of viral infection
46. In an inducible operon, the inducer is often the \_\_\_\_\_ in the pathway being regulated; the inducer binds to the \_\_\_\_\_, thus rendering it \_\_\_\_\_.  
 (a) end product... corepressor... inactive  
 (b) substrate... repressor... inactive  
 (c) substrate... corepressor... inactive  
 (d) substrate... repressor... active
47. If you observe that a cell contains \_\_\_\_\_. you can conclude that it is a eukaryote, rather than a prokaryote.  
 (a) ribosomes  
 (b) several complex chromosomes  
 (c) a true cell membrane  
 (d) a single circular chromosome
48. In prokaryotic DNA replication \_\_\_\_\_.  
 (a) the new DNA molecule is formed when plasmids collect around the chromosome, depolymerize, and then polymerize again in a complementary base sequence
- (b) the chromosomes condense and gather on the equatorial plate and then move to the spindle poles without using any microtubules  
 (c) a single replication fork opens and proceeds around the molecule in both directions. Then the cell elongates to pull the two pieces of DNA apart.  
 (d) the cell divides before DNA replicates, and then replication occurs separately in each daughter cell
49. Which of the following is not a way that a bacterial population can acquire increased genetic variation?  
 (a) transduction (b) conjugation  
 (c) binary fission (d) mutation
50. A microbiologist found that a clone of bacteria infected by a phage had developed the ability to make a particular amino acid that the bacteria could not make before the infection. This new ability was probably a result of \_\_\_\_\_.  
 (a) transformation (b) natural selection  
 (c) conjugation (d) transduction
51. Sometimes genes are transferred between bacteria when a bacteriophage packages bacterial DNA into the capsid instead of viral DNA. This process is called \_\_\_\_\_.  
 (a) generalized transduction  
 (b) conjugation  
 (c) specialized transduction  
 (d) binary fission
52. The primary difference between bacterial "sex" (conjugation) and sexual reproduction in plants and animals is that \_\_\_\_\_.  
 (a) bacterial sex involves more than two individuals  
 (b) bacterial sex involves the transfer of genetic material from an *F*<sup>+</sup> or *Hfr* cell to an *F* cell and a reciprocal transfer from the *F'* cell  
 (c) bacteria exchange RNA, not DNA  
 (d) bacterial sex does not produce offspring
53. A microbiologist analyzed the DNA of two *E. coli* cells, an *Hfr* cell and an *F* cell, before and immediately after their conjugation. He found that \_\_\_\_\_.  
 (a) both cells lost some genes and gained others  
 (b) both cells gained genes but lost none of their original genes  
 (c) one cell lost genes and the other gained genes  
 (d) one cell gained genes and the genes of the other were unchanged

54. Which of the following is true with regard to antibiotic resistance?  
 (a) If individual bacterial cells are killed quickly enough, they don't have time to become resistant to the antibiotic.  
 (b) The resistant cells can be resistant to only one antibiotic.  
 (c) Indiscriminate use of antibiotics is prohibited by federal laws.  
 (d) The resistance can be transferred from one bacterial species to another.
55. R plasmids can cause medical problems because they \_\_\_\_\_.  
 (a) control conjugation in bacteria  
 (b) are used as vectors to transfer genes to plants  
 (c) make bacteria resistant to antibiotics  
 (d) code for DNA polymerase
- The simplest bacterial transposons are \_\_\_\_\_.  
 (a) insertion sequences  
 (b) composite transposons  
 (c) F plasmids  
 (d) prophages
- A bacterium can make the amino acid glycine or absorb it from its surroundings. A biochemist finds that glycine binds to a repressor protein and causes the repressor to bind to the bacterial chromosome, turning off the operon. If it is like other operons, the absence of glycine will result in the \_\_\_\_\_.  
 inhibition of bacterial cell division  
 breakdown of glycine  
 cessation of the synthesis of glycine  
 formation of sex pili  
 "back inhibition" refers to the \_\_\_\_\_.  
 inhibition of enzymes involved in a metabolic pathway by the pathway's end product  
 expression of an operon in the absence of inducer  
 expression of an operon in the absence of repressor  
 switching of viral genes in a prophage  
 function in prokaryotes to \_\_\_\_\_.  
 initiate the catalytic activities of specific proteins  
 increase the rate of transcription  
 synthesize specific polypeptide chains
- (c) is exemplified by the lac operon  
 (d) The first and second choices are correct.
61. In general, operons that encode the enzymes of a biosynthetic (anabolic) pathway (such as the trp operon) are \_\_\_\_\_, and those encoding the enzymes of a catabolic pathway (such as the lac operon) are \_\_\_\_\_.  
 (a) repressible... inducible  
 (b) inducible... repressible  
 (c) permanently on... permanently off  
 (d) permanently off... permanently on
62. An inducible system \_\_\_\_\_.  
 (a) is usually turned off  
 (b) requires an inducer molecule to inactivate its repressor  
 (c) is exemplified by genes that are always expressed  
 (d) The first two choices are correct.
63. You have inserted the gene for human growth factor into the *E. coli* lactose operon, replacing the structural genes with the gene for human growth factor. What substance must you add to your culture of bacteria to cause them to produce human growth factor for you?  
 (a) repressor protein  
 (b) operator protein  
 (c) human growth factor  
 (d) allolactose

## ANSWERS

1. c      2. d      3. b      4. c
5. b      6. d      7. d      8. b
9. d      10. c     11. a     12. b
13. d     14. b     15. b     16. a
17. b     18. b     19. c     20. d
21. b     22. c     23. c     24. d
25. d     26. a     27. d     28. b
29. c     30. b     31. a     32. a
33. c     34. b     35. a     36. d
37. d     38. b     39. d     40. d
41. a     42. c     43. d     44. b
45. a     46. b     47. b     48. c
49. c     50. d     51. a     52. d
53. d     54. d     55. c     56. a
57. c     58. a     59. b     60. d
61. a     62. d     63. d

## 3.6: EUKARYOTIC GENOMES: ORGANIZATION, REGULATION, AND EVOLUTION

1. Rearrangement of the genome plays an important role in the \_\_\_\_\_ system.  
 (a) endocrine      (b) reproductive  
 (c) nervous      (d) immune
2. \_\_\_\_\_ bind(s) to DNA enhancer regions.  
 (a) RNA polymerase  
 (b) Promoters  
 (c) Introns  
 (d) Activators
3. How can a single RNA transcript lead to the translation of different proteins?  
 (a) The same RNA transcript may contain one of several different 5' untranslated regions.  
 (b) The same RNA transcript may contain one of several different caps.  
 (c) The same RNA transcript may be spliced in several different ways.  
 (d) The same RNA transcript may contain one of several different promoters.
4. In the cytoplasm, the mRNA degradation begins at its \_\_\_\_\_.  
 (a) introns      (b) cap  
 (c) 5' end      (d) poly-A tail
5. A poly-A tail's resistance to degradation is affected by the characteristics of the \_\_\_\_\_.  
 (a) 3' untranslated region  
 (b) promoter  
 (c) stop codon  
 (d) enhancer
6. Enzyme complexes that break down protein are called \_\_\_\_\_.  
 (a) lipases      (b) ubiquitins  
 (c) amylase      (d) proteasomes
7. The nuclear membrane's role in the regulation of gene expression involves \_\_\_\_\_.  
 (a) protein activation  
 (b) translation
8. Protein phosphorylation's role in the regulation of gene expression involves \_\_\_\_\_.  
 (a) protein degradation  
 (b) RNA processing  
 (c) protein activation  
 (d) regulating the transport of mRNA to the cytoplasm
9. \_\_\_\_\_ is a carcinogen that promotes colon cancer.  
 (a) fat      (b) UV light  
 (c) estrogen      (d) a virus
10. Histones are \_\_\_\_\_.  
 (a) master genes that affect development  
 (b) groups of genes that respond to environmental changes  
 (c) proteins around which DNA is coiled  
 (d) portions of genes that are transcribed
11. Your muscle and skin cells are different because \_\_\_\_\_.  
 (a) they contain different sets of genes  
 (b) they contain different chromosome sets  
 (c) they contain different operons  
 (d) different genes are switched on and off in each type of cell
12. DNA methylation is a mechanism used by eukaryotes to \_\_\_\_\_.  
 (a) inactivate genes  
 (b) increase the rate of transcription  
 (c) terminate transcription  
 (d) facilitate the binding of DNA to intermediate filaments
13. In humans, the hormone testosterone enters cells and binds to specific proteins, which in turn bind to specific sites on the cells' DNA. These proteins probably act to \_\_\_\_\_.  
 (a) activate genes  
 (b) increase the rate of transcription  
 (c) terminate transcription  
 (d) facilitate the binding of DNA to intermediate filaments

15. It is possible for a cell to make proteins that last for months; hemoglobin in red blood cells is a good example. However, many proteins are not this long-lasting; they may be degraded in days, hours, or even minutes. What is the advantage of short-lived proteins?  
 (a) Most proteins are used only once.  
 (b) Most cells have a short life span.  
 (c) Cells lack the raw materials to make most of the proteins they need.  
 (d) Short-lived proteins enable the cells to control their activities precisely and efficiently.
16. Which of the following would be most likely to lead to cancer?  
 (a) amplification of a proto-oncogene and inactivation of a tumor-suppressor gene  
 (b) hyperactivity of a proto-oncogene and activation of a tumor-suppressor gene  
 (c) failure of a proto-oncogene to produce a protein and amplification of a tumor-suppressor gene  
 (d) failure of both a proto-oncogene and a tumor-suppressor gene to produce proteins
17. In normal cells, the genes that malfunction in cancer usually \_\_\_\_\_.  
 (a) control RNA transcription  
 (b) are responsible for sex determination  
 (c) regulate cell division  
 (d) are not present
18. All your cells contain proto-oncogenes, which can change into cancer-causing genes. Why do cells possess such potential time bombs?  
 (a) Proto-oncogenes are necessary for the normal control of cell growth and division.  
 (b) Proto-oncogenes are genetic junk that has not yet been eliminated by natural selection.  
 (c) Proto-oncogenes are unavoidable environmental carcinogens.  
 (d) Cells produce proto-oncogenes as a by-product of mitosis

## ANSWERS

- |       |       |        |       |
|-------|-------|--------|-------|
| 1. d  | 2. d  | 3. c   | 4. d  |
| 5. a  | 6. a  | 7. d   | 8. d  |
| 9. a  | 10. a | 11. c* | 12. d |
| 13. a | 14. d | 15. d  | 16. a |
| 17. c | 18. a | 19. d  | 20. a |

## 3.7: DNA TECHNOLOGY AND GENOMICS

19. Retrotransposons differ from other transposons in that \_\_\_\_\_.  
 (a) retrotransposons have lost the ability to move about a genome  
 (b) retrotransposons are likely to be the remains of a viral infection  
 (c) retrotransposons have retained the ability to move about a genome, an ability that has been lost by other transposons  
 (d) retrotransposons move via an RNA transcript, whereas other transposons do not
20. Gene duplication has played a critical role in evolution because it \_\_\_\_\_.  
 (a) produces redundant copies of existing genes, which are then free to mutate and adopt new functions  
 (b) increases the number of pseudogenes in the genome  
 (c) increases the likelihood of viral infection in cells  
 (d) increases the amount of DNA in the genome
1. The unpaired nucleotides produced by the action of restriction enzymes are referred to as \_\_\_\_\_.  
 (a) sticky ends  
 (b) base sequences  
 (c) single strands  
 (d) restriction fragments
2. In order to insert a human gene into a plasmid, both must \_\_\_\_\_.  
 (a) have identical DNA sequences  
 (b) originate from the same type of cell  
 (c) code for the same gene product  
 (d) be cut by the same restriction enzyme
3. What enzyme forms covalent bonds between restriction fragments?  
 (a) DNA primase  
 (b) DNA helicase  
 (c) single-stranded binding protein  
 (d) DNA ligase
4. In gel electrophoresis DNA molecules migrate from \_\_\_\_\_ to \_\_\_\_\_ ends of the gel.  
 (a) acidic... basic (b) negative... positive  
 (c) basic... acidic (d) long... short
5. The RP13 gene of chromosome 17 codes for a protein \_\_\_\_\_.  
 (a) involved in glucose transport  
 (b) that is a component of hair and nails  
 (c) in the regulation of blood pressure  
 (d) involved in eye development
6. The TP53 gene of chromosome 17 codes for a protein \_\_\_\_\_.  
 (a) that plays a role in the digestive process  
 (b)\* that, in a particular variant, may play a role in Alzheimer's disease  
 (c) involved in glucose transport  
 (d) involved in the regulation of the cell cycle
7. Which of these genes codes for a protein that plays a role in growth?  
 (a) gastrin (b) GH1  
 (c) SCLC6A4 (d) KRTHA1
8. Which of these genes codes for a protein that plays a role in white blood cell function?  
 (a) DCP1 (b) KRTHA1  
 (c) MPO (d) GLUT4
9. Why is golden rice pale yellow in color?  
 (a) It is rich in chlorophyll a.  
 (b) It is nutrient-poor.  
 (c) It is rich in beta-carotene.  
 (d) It is rich in chlorophyll b.
10. Which of these is a symptom of vitamin A deficiency?  
 (a) osteoporosis  
 (b) impaired taste perception  
 (c) overstimulation of the immune system  
 (d) blindness
11. Which of these is a vitamin A precursor?  
 (a) cobalamin (b) pyridoxine  
 (c) plasmid (d) beta-carotene
12. The transfer of antibiotic-resistant genes from genetically engineered bacteria to disease-causing bacteria \_\_\_\_\_.  
 (a) would, if it occurred, be no cause for concern  
 (b) has occurred  
 (c) seems unlikely  
 (d) can never occur
13. Which of the following is an example of "recombinant DNA technology"?  
 (a) cloning genes from homologous pairs of chromosomes  
 (b) combining alternate alleles of a gene in a single cell  
 (c) introducing a human gene into a bacterial plasmid  
 (d) alternate alleles assorting independently
14. In recombinant DNA experiments, \_\_\_\_\_ is used to cut pieces of DNA and \_\_\_\_\_ joins the resulting fragments to form recombinant DNA.  
 (a) a restriction enzyme... DNA ligase  
 (b) a transposon... a restriction enzyme  
 (c) a plasmid... DNA ligase  
 (d) DNA ligase... a restriction enzyme
15. In which way are sticky ends and nucleic acid probes alike?  
 (a) They are both used as gene vectors in genetic engineering.  
 (b) They both undergo complementary base pairing.  
 (c) They are both parts of RNA molecules.

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- (d) They are both double-stranded nucleic acid molecules.
16. A nucleic acid probe can be used to \_\_\_\_\_.  
 (a) insert genes into a host cell  
 (b) make DNA for gene cloning  
 (c) splice pieces of DNA 8  
 (d) find a particular nucleotide sequence within a mass of DNA
17. A eukaryotic gene was inserted into the DNA of a bacterium. The bacterium then transcribed this gene into mRNA and translated the mRNA into protein. The protein produced was useless; it contained many more amino acids than the protein made by the eukaryote. Why?  
 (a) The mRNA was not spliced as it is in eukaryotes.  
 (b) Eukaryotes and prokaryotes use different genetic codes.  
 (c) Repressor proteins interfered with transcription and translation.  
 (d) The lifetime of the bacterial mRNA was too short.
18. A genomic library is \_\_\_\_\_.  
 (a) where you look to find out how to make recombinant DNA  
 (b) a listing of the known nucleotide sequences for a particular species  
 (c) all the genes contained in one kind of organism  
 (d) a collection of cloned DNA pieces from a genome
19. Archaeologists unearthed a human skull with a small dried fragment of the scalp still attached. They extracted a tiny amount of DNA from the scalp tissue. How could they obtain sufficient DNA for an analysis of the ancient human's genes?  
 (a) Subject the DNA to electrophoresis.  
 (b) Use a nucleic acid probe.  
 (c) Subject the specimen to amniocentesis.  
 (d) Use the polymerase chain reaction.
20. The term "RFLP" stands for \_\_\_\_\_.  
 (a) restriction fragment length polymorphism  
 (b) reverse fragment ligated polymerization  
 (c) really fast ligation protocol  
 (d) restriction fragment ligation procedure
21. The main goal of the Human Genome Project (HGP) was to \_\_\_\_\_.  
 (a) map all the human genes and determine the nucleotide sequence of the entire human genome  
 (b) map and sequence the genomes of important research organisms such as *Drosophila melanogaster*  
 (c) compare the genomes of a large number of individuals from different parts of the world  
 (d) find cures for human genetic disorders
22. Currently available and widespread applications of DNA technology include all of the following except \_\_\_\_\_.  
 (a) gene therapy  
 (b) producing therapeutically important human proteins in bacterial cells  
 (c) producing transgenic plants that are resistant to insects  
 (d) comparing DNA from a blood sample found at a crime scene with DNA taken from a suspect in the crime

**ANSWERS**

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. a  | 2. d  | 3. d  | 4. b  |
| 5. d  | 6. d  | 7. b  | 8. c  |
| 9. c  | 10. d | 11. d | 12. c |
| 13. c | 14. a | 15. b | 16. d |
| 17. a | 18. d | 19. d | 20. a |
| 21. a | 22. A |       |       |

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## Part IV

# Evolution

## 4.1: DESCENT WITH MODIFICATION: A DARWINIAN VIEW OF LIFE

1. The Galápagos Islands are cooled by the \_\_\_\_\_.
  - (a) Equatorial Countercurrent
  - (b) Humboldt Current
  - (c) Monsoon Drift
  - (d) Gulf Stream
2. How many finch species did Darwin send to the British Museum?
  - (a) 13
  - (b) 15
  - (c) 17
  - (d) 21
3. Darwin's thinking while on the Beagle was greatly influenced by his reading of a book written by \_\_\_\_\_.
  - (a) Bishop Ussher
  - (b) Lyell
  - (c) Chaucer
  - (d) Wallace
4. A challenge to traditional (pre-1860) ideas about species came from embryology, when it was discovered that \_\_\_\_\_.
  - (a) the more advanced the animal, the more slowly it develops
  - (b) embryos of dissimilar organisms, such as sharks and humans, resemble each other
  - (c) mutations have a far more dramatic effect on embryos than on adult organisms
  - (d) the embryological development of many plants and animals is almost identical
5. Which of these is a consequence of uniformitarianism?
  - (a) Earth is round, not flat.
  - (b) Populations evolve.
  - (c) Populations reproduce faster than their food supply.
  - (d) Earth is old.
6. The Argentinean pampas are a type of \_\_\_\_\_.
  - (a) chaparral
  - (b) grassland
  - (c) temperate deciduous forest
  - (d) tropical forest
7. At the fossil site at Punta Alta, Darwin found evidence \_\_\_\_\_.
  - (a) that the pampas could support large mammals
  - (b) extinction does not happen
  - (c) of extinction
  - (d) that Brazilian flatworms were a type of slug
8. Patagonia is a \_\_\_\_\_.
  - (a) grassland
  - (b) savanna
  - (c) tropical forest
  - (d) desert
9. His experiences with Fuegians and slavery convinced Darwin that differences among all peoples are primarily \_\_\_\_\_ differences.
  - (a) cultural
  - (b) genetic
  - (c) cultural and genetic
  - (d) height
10. Species in hot climates tend to \_\_\_\_\_ compared to species in cold climates.
  - (a) experience less interspecific competition
  - (b) have larger surface-to-volume ratios
  - (c) have smaller surface-to-volume ratios
  - (d) be less colorful
11. In the Andes, at elevations of 12,000 feet, Darwin collected fossilized marine shells. The existence of marine shells at this altitude provided evidence that \_\_\_\_\_.
  - (a) marine organisms can survive at great elevation
  - (b) Earth's surface changes
  - (c) geologic processes occur at a rapid rate
  - (d) someone carried them from the oceans and left them on the mountains
12. The Galápagos Islands are located \_\_\_\_\_.
  - (a) in the Arctic
  - (b) in the Antarctic
  - (c) off the coast of California
  - (d) on the equator
13. Why were the Galápagos Islands so important to Darwin's formulation of natural selection?
  - (a) They provided evidence in support of uniformitarianism
  - (b) They are where Darwin did most of his writing.
  - (c) The Galápagos Islands are the only place in the world where finches are found.
  - (d) The Galápagos Islands are home to many unique species.
14. The wing of a bat is homologous to the \_\_\_\_\_ of a whale.
  - (a) tail
  - (b) blowhole
  - (c) flipper
  - (d) rib cage
15. An adaptation is \_\_\_\_\_.
  - (a) an individual's attempt to conform to its environment

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- (b) a trait that confers a reproductive advantage on the individual possessing it  
 (c) the cause of natural selection  
 (d) a trait that is quickly integrated into a population
16. Charles Darwin \_\_\_\_\_  
 (a) was the first person to conclude that organisms evolve  
 (b) proposed that unused parts of the body deteriorate  
 (c) eagerly published his theory before it was well-developed  
 (d) proposed natural selection as the mechanism of evolution
17. Which researcher proposed the idea that unused parts of the body will deteriorate?  
 (a) Darwin (b) Larmack  
 (c) Lyell (d) Cuvier
18. Which of these is the best example of evolution in humans?  
 (a) pupils of the eyes becoming dilated in low-light conditions  
 (b) skin becoming tanned in response to increased UV exposure  
 (c) skin color becoming lighter in populations adapting to higher latitudes  
 (d) living bones becoming more massive when exposed to regular stress and strain
19. Which of the following is not a key point of evolution through natural selection?  
 (a) interactions occur between individuals and the environment; therefore, the individual is the smallest unit that can evolve.  
 (b) Acquired characteristics cannot be passed on to offspring.  
 (c) An adaptation that is useful in one environment may be detrimental in another.  
 (d) All of the above are key points of evolution through natural selection.
20. Which one of the following researchers developed a theory of evolution that was very similar to Charles Darwin's?  
 (a) Lyell (b) Wallace  
 (c) Cuvier (d) Lamarck
21. Which of the following assumptions was not part of Charles Darwin's theory of natural selection?  
 (a) Traits are inherited as discrete particles.  
 (b) Earth is very old.  
 (c) Populations produce more offspring than their environment can support.  
 (d) Organisms compete for limited resources.
22. A group of small fish live in a lake with a uniformly light-brown sandy bottom. Most of the fish are light brown, but about 10% are mottled. This fish species is often prey for large birds that live on the shore. A construction company dumps a load of gravel in the bottom of the lake, giving it a mottled appearance. Which of these statements presents the most accurate prediction of what will happen to this fish population?  
 (a) The proportion of mottled fish will increase over time.  
 (b) In two generations, all the fish will be mottled.  
 (c) There is no way to predict the result.  
 (d) As the mottled fish are eaten, more will be produced to fill the gap.
23. Which observation does not contribute to the idea that populations evolve?  
 (a) comparisons of the body structure and patterning among major groups of animals and plants  
 (b) the world distribution of plants and animals  
 (c) observations of fossils of different types of organisms buried in distinct layers of Earth  
 (d) All of the above observations contributed to the idea that populations evolve.
24. The modern idea of extinction as a common occurrence in Earth's history was first proposed in the early 19th century writings of \_\_\_\_\_  
 (a) Cuvier (b) Lamarck  
 (c) Aristotle (d) Wallace
25. Natural selection primarily favors \_\_\_\_\_  
 (a) phenotypes (b) genotypes  
 (c) mutations (d) heterozygotes
26. The smallest unit that can evolve is a(n) \_\_\_\_\_  
 (a) species (b) genotype  
 (c) individual (d) population
27. The breeding of plants and animals for particular traits by humans is called \_\_\_\_\_.  
 (a) natural selection (b) sexual recombination  
 (c) founder effect (d) artificial selection
28. To describe evolution as a "theory" means that \_\_\_\_\_.  
 (a) it is an untested idea  
 (b) it is not factual  
 (c) it is a matter of opinion  
 (d) it is a model that is supported by many observations and much experimental evidence

## ANSWERS

1. b 2. a 3. b 4. b  
 5. d 6. b 7. c 8. d  
 9. a 10. b 11. b 12. d  
 13. d 14. c 15. b 16. d  
 17. b 18. c 19. a 20. b  
 21. a 22. d 23. d 24. a  
 25. a 26. d 27. d 28. d

## 4.2: THE EVOLUTION OF POPULATIONS

1. Generation-to-generation change in the allele frequencies in a population is \_\_\_\_\_.  
 (a) microevolution (b) genetic drift  
 (c) natural selection (d) mutation
2. Which of these individuals is a homozygous genotype?  
 (a) AA (b) Aa  
 (c) Gg (d) AG
3. All the genes in a population are that population's \_\_\_\_\_.  
 (a) gene pool (b) fitness  
 (c) genotype (d) Hardy-Weinberg
4. Genetic drift is a process based on \_\_\_\_\_.  
 (a) differential reproductive success correlated to the relationship between a phenotype and the environment  
 (b) immigration  
 (c) mutation  
 (d) the role of chance
5. A mutation occurs when \_\_\_\_\_.  
 (a) individuals leave a population  
 (b) individuals enter a population  
 (c) some individuals leave more offspring than other individuals  
 (d) there is a change in the DNA sequence of a gene
6. Every few years a giant axe chops off the head of every person who is over 6 feet tall. How will this affect the human population?  
 (a) Gene flow will increase.  
 (b) Alleles that promote "tallness" will decrease in frequency.  
 (c) Genetic drift will play less of a role in the evolution of humans.  
 (d) It will increase in number since shorter people use fewer resources than taller people.
7. Modern travel along with migration reduces the probability of \_\_\_\_\_ having an effect on the evolution of humans.  
 (a) gene flow (b) mutation  
 (c) disease (d) genetic drift
8. The ease with which humans travel across the globe is likely to increase \_\_\_\_\_.  
 (a) natural selection (b) gene flow  
 (c) mutation (d) genetic drift
9. Homologous pairs of chromosomes are lined up independently of other such pairs during \_\_\_\_\_.  
 (a) metaphase I (b) anaphase I  
 (c) prophase II (d) metaphase II
10. Crossing over, resulting in an increase in genetic variation, occurs between \_\_\_\_\_.  
 (a) sex cells and somatic cells  
 (b) sister chromatids of homologous chromosomes  
 (c) nonsister chromatids of homologous chromosomes  
 (d) sister chromatids of nonhomologous chromosomes
11. In human gamete production there is an average of \_\_\_\_ crossover events per chromosome pair.  
 (a) 0–1 (b) 2–3  
 (c) 5–6 (d) 9–10
12. What is the term for a change in the relative frequencies of alleles in a population from generation to generation?  
 (a) gene pool  
 (b) independent assortment  
 (c) macroevolution  
 (d) microevolution
13. Darwin's and Mendel's ideas of inheritance \_\_\_\_\_.  
 (a) were amazingly similar  
 (b) contradict each other too much to be compared  
 (c) were eventually reconciled by geneticists when it was discovered that quantitative characters are influenced by multiple genetic loci  
 (d) both contributed to the blending hypothesis
14. The relationship of genome to organism is the same as that of \_\_\_\_\_ to population.  
 (a) species (b) gene  
 (c) gene pool (d) mutation
15. According to the Hardy-Weinberg theorem, the frequencies of alleles in a population will remain constant if \_\_\_\_\_ is the only process that affects the gene pool.  
 (a) mutation  
 (b) genetic drift

16. The original source of all genetic variation is \_\_\_\_\_  
 (a) mutation  
 (b) meiosis  
 (c) sexual reproduction  
 (d) natural selection
17. The evolutionary effects of genetic drift are greatest when \_\_\_\_\_  
 (a) the population size is large  
 (b) intraspecific competition is intense  
 (c) the population size is small  
 (d) intraspecific competition is weak
18. What situation most likely explains the occasional high frequency of certain inherited disorders among human populations established by a small population?  
 (a) bottleneck effect  
 (b) founder effect  
 (c) gene flow  
 (d) mutation
19. Rabbits living farther north tend to have smaller ears. This is an example of \_\_\_\_\_  
 (a) a cline  
 (b) polymorphism  
 (c) artificial selection  
 (d) heterozygote advantage
20. In evolutionary terms, an organism's fitness is measured by its \_\_\_\_\_  
 (a) health  
 (b) contribution to the gene pool of the next generation  
 (c) mutation rate  
 (d) genetic variability
21. Blue poppies native to China were grown at a plant-breeding center in California. The plants with the thickest leaves were most likely to survive and reproduce in the drier climate. This adaptation of the poppies to their new environment is due to \_\_\_\_\_.  
 (a) genetic drift  
 (b) stabilizing selection  
 (c) directional selection  
 (d) neutral variation
22. Adaptation of a species is its  
 (a) acquired characters  
 (b) metamorphosis  
 (c) hereditary characters  
 (d) all a, b, c
23. If a population of organisms is introduced into a new territory where environmental conditions are favorable to it, the population grows rapidly because of  
 (a) increased rate of reproduction  
 (b) absence of predators  
 (c) unlimited food supply available  
 (d) more survival of offspring
24. In a population that is in Hardy-Weinberg equilibrium, 16% of the individuals show the recessive trait. What is the frequency of the dominant allele in the population?  
 (a) 0.84      (b) 0.36  
 (c) 0.6      (d) 0.32
25. Which of the following is an example of polymorphism in humans?  
 (a) variation in intelligence  
 (b) variation in height  
 (c) presence or absence of a widow's peak  
 (d) presence of variation in fingerprints
26. In a population with two alleles for a particular locus, B and b, the allele's frequency of B is 0.7. What would be the frequency of heterozygotes if the population is in Hardy-Weinberg equilibrium?  
 (a) 0.7      (b) 0.49  
 (c) 0.42      (d) 0.21
27. Closely related species may attempt to mate but fail to consummate the act because they are anatomically incompatible. This type of isolation is called  
 (a) Temporal Isolation  
 (b) Behavioral Isolation  
 (c) Genetic Isolation  
 (d) Mechanical Isolation
28. The biological species cannot be applied to two putative species that are  
 (a) symmetric  
 (b) reproductively isolated  
 (c) capable of forming viable hybrids  
 (d) exclusively asexual
29. There would have been no organic evolution if  
 (a) the individuals did not transmit acquired characters to their offspring  
 (b) individuals in a population did not show gene variation  
 (c) somatic variations did not get inherited  
 (d) somatic variations did not get transformed into genetic variations
30. A new species is formed when  
 (a) an individual with new genotype is formed due to exchange of chromosomal

- segments during crossing over in gametogenesis.  
 (b) genotypic changes accumulated in a population which result in its reproductive isolation  
 (c) variants with new phenotypes are produced owing to new genetic combinations occurring during reproduction  
 (d) homologous chromosomes exchange segments during crossing over in gametogenesis
31. A founder event favors microevolution in the founding population mainly because  
 (a) a small founding population is subject to extensive sampling error in the composition of its gene pool  
 (b) mutations are more common in a new environment  
 (c) members of a small population tend to migrate  
 (d) all of above
32. In a population in Hardy-Weinberg equilibrium, 1% of the individuals in a population show the recessive trait of a certain characteristic. In this situation, what is the value of p?  
 (a) 99%      (b) 0.81  
 (c) 0.9      (d) 0.18
33. New alleles originate from \_\_\_\_\_  
 (a) natural selection  
 (b) genetic drift  
 (c) sexual recombination  
 (d) mutation
34. Which type of mutation plays the most important role in increasing the number of genes in the gene pool?  
 (a) Mutations are so rare that there are no mutations that can have such an important effect.  
 (b) duplication  
 (c) point mutation  
 (d) rearrangement of gene loci
35. Sexual recombination includes the shuffling of chromosomes in \_\_\_\_\_ and fertilization.  
 (a) mitosis      (b) genetic drift  
 (c) natural selection      (d) meiosis
36. Antibiotic resistance in bacteria is an example of which of the following?  
 (a) stabilizing selection  
 (b) directional selection  
 (c) disruptive selection
37. Generation-to-generation change in the allele frequencies in a population is \_\_\_\_\_  
 (a) microevolution  
 (b) genetic drift  
 (c) natural selection  
 (d) mutation
38. Genetic drift is a process based on \_\_\_\_\_  
 (a) differential reproductive success correlated to the relationship between a phenotype and the environment  
 (b) immigration  
 (c) mutation  
 (d) the role of chance
39. A mutation occurs when \_\_\_\_\_  
 (a) individuals leave a population  
 (b) individuals enter a population  
 (c) Some individuals leave more offspring than other individuals  
 (d) there is a change in the DNA sequence of a gene
40. What is the term for a change in the relative frequencies of alleles in a population from generation to generation?  
 (a) gene pool  
 (b) independent assortment  
 (c) macroevolution  
 (d) microevolution
41. The relationship of genome to organism is the same as that of \_\_\_\_\_ to population.  
 (a) species      (b) gene  
 (c) gene pool      (d) mutation
42. The original source of all genetic variation is \_\_\_\_\_  
 (a) mutation  
 (b) meiosis  
 (c) sexual reproduction  
 (d) natural selection
43. In human gamete production there is an average of \_\_\_\_\_ crossover events per chromosome pair.  
 (a) 0-1      (b) 2-3  
 (c) 5-6      (d) 9-10
44. Which of the following conditions is not required for Hardy-Weinberg equilibrium?  
 (a) a large population  
 (b) no migration of alleles in or out of the population  
 (c) no mutations altering the gene pool  
 (d) sexual selection

45. In a population in Hardy-Weinberg equilibrium, 1% of the individuals in a certain characteristic. In this situation, what is the value of  $p$ ?  
 (a) 99% (b) 0.81  
 (c) 0.9 (d) 0.18
46. Which type of mutation plays the most important role in increasing the number of genes in the gene pool?  
 (A) Mutations are so rare that there are no mutations that can have such an important effect.  
 (B) Duplication  
 (C) Point mutation  
 (D) Rearrangement of gene loci
47. As a mechanism of microevolution, natural selection can be most closely equated with  
 (a) assortative mating  
 (b) genetic drift  
 (c) differential reproductive success  
 (d) mutation
48. Most of biological diversity has probably arisen by  
 (a) anagenesis  
 (b) cladogenesis  
 (c) phyletic evolution  
 (d) hybridization
49. Selection acts directly on  
 (a) phenotype  
 (b) genotype  
 (c) the entire genome  
 (d) Each allele
50. The largest unit in which gene flow is possible is a  
 (a) population (b) species  
 (c) genus (d) subspecies
51. Plant species A has a diploid number of 12. Plant species B has a diploid number of 16. A new species, C, arises as an allopolyploid from hybridization of A and B. The diploid number of C would probably be  
 (a) 12 (b) 14  
 (c) 16 (d) 28

## ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. a  | 2. a  | 3. a  | 4. d  |
| 5. d  | 6. b  | 7. d  | 8. b  |
| 9. a  | 10. c | 11. b | 12. d |
| 13. c | 14. c | 15. c | 16. a |
| 17. c | 18. b | 19. a | 20. b |
| 21. c | 22. a | 23. d | 24. c |
| 25. c | 26. c | 27. d | 28. d |
| 29. b | 30. b | 31. a | 32. c |
| 33. d | 34. b | 35. d | 36. b |
| 37. a | 38. d | 39. d | 40. d |
| 41. c | 42. a | 43. b | 44. d |
| 45. c | 46. b | 47. c | 48. b |
| 49. a | 50. b | 51. d | 52. d |
| 53. c | 54. C |       |       |

## 4.3: THE ORIGIN OF SPECIES

1. Feathers either play a role, or may have played a role, in \_\_\_\_\_.  
 (a) courtship (b) gliding  
 (c) flight (d) all of these
2. \_\_\_\_\_ is rapid speciation under conditions in which there is little competition.  
 (a) Microevolution  
 (b) Paedomorphosis  
 (c) Adaptive radiation  
 (d) Genetic drift
3. Mass extinctions create conditions that promote \_\_\_\_\_.  
 (a) adaptive radiation  
 (b) paedomorphosis  
 (c) gene flow  
 (d) genetic drift
4. The appearance of an evolutionary novelty promotes \_\_\_\_\_.  
 (a) gene flow  
 (b) mutation  
 (c) mass extinction  
 (d) adaptive radiation
5. The different finch species found on the Galápagos Islands probably arose as a result of \_\_\_\_\_.  
 (a) artificial selection  
 (b) adaptive radiation  
 (c) mass extinction  
 (d) gene flow
6. How do the skulls of adult chimpanzees and humans differ?  
 (a) Adult chimpanzees have a less angled skull.  
 (b) Adult chimpanzees have less massive jaws.  
 (c) Adult chimpanzees have heavier brow ridges.  
 (d) Adult chimpanzees have flatter faces.
7. In which of the following groups has sympatric speciation been most important?  
 (a) animals (b) plants  
 (c) bacteria (d) fungi
8. What accounts for human infants having large heads on small bodies?
- (a) formation of the head before the rest of the body during fetal development  
 (b) allometric growth  
 (c) the need to get the infant out through the birth canal  
 (d) head cells having a different genotype than the cells of the rest of the body
9. Variations in allometric growth patterns demonstrate how \_\_\_\_\_.  
 (a) relatively large genetic changes can have a minor impact on phenotype  
 (b) relatively small genetic changes can have a major impact on phenotype  
 (c) chimpanzees and humans could not have a common ancestor  
 (d) adult chimpanzees are basically juvenile humans that have gained the ability to reproduce
10. Which of these is a difference between the skull of an adult chimpanzee and the skull of an adult human?  
 (a) The chimpanzee skull is sharper and more angular.  
 (b) The chimpanzee skull has heavier brow ridges.  
 (c) The chimpanzee skull has more massive joints.  
 (d) All of these are differences between adult chimpanzee and adult human skulls.
11. Change over time within an evolutionary lineage (anagenesis) \_\_\_\_\_.  
 (a) is the only important evolutionary process  
 (b) is the main means by which new species arise  
 (c) cannot account for the proliferation of species  
 (d) rarely occurs without the geographic separation of populations
12. Two animals are considered members of different species if they \_\_\_\_\_.  
 (a) look different  
 (b) cannot mate and produce viable, fertile offspring  
 (c) live in different habitats  
 (d) are members of different populations

13. Often, species are identified by their appearance. Why?  
 (a) If two organisms look alike, they must be the same species.  
 (b) This is the criterion used to define a biological species  
 (c) If two organisms look different, they must be different species  
 (d) This is the most convenient way of identifying species.
14. According to the phylogenetic species concept, what is a species?  
 (a) a population that interbreeds and produces fertile offspring  
 (b) a population that is physically able to mate even if there are no offspring or the offspring are infertile  
 (c) a population with a distinct fossil record  
 (d) a set of organisms with a unique genetic history
15. Which of these is an example of temporal isolation?  
 (a) The average weight of the individuals in one species is 45 kg; in the other species the average is 290 kg.  
 (b) One species is found only in New York, the other only in London.  
 (c) One species performs a specific courtship dance; the other species does not.  
 (d) One species is nocturnal, and the other species is not.
16. Which of the following is the first step in allopatric speciation?  
 (a) genetic drift  
 (b) geographic isolation  
 (c) polyploidy  
 (d) hybridization
17. The evolution of numerous species, such as Darwin's finches, from a single ancestor is called \_\_\_\_\_.  
 (a) adaptive radiation  
 (b) sympatric speciation  
 (c) gradualism  
 (d) nondisjunction
18. Sympatric speciation is \_\_\_\_\_.  
 (a) the appearance of a new species in the same area as the parent population  
 (b) the process by which most animal species have evolved  
 (c) initiated by the appearance of a geographic barrier  
 (d) the emergence of many species from a single ancestor
19. According to the \_\_\_\_\_ model, evolution occurs in spurts, species evolve relatively rapidly then remain unchanged for long periods.  
 (a) nondisjunction  
 (b) gradualist  
 (c) adaptive radiation  
 (d) punctuated equilibrium
20. If the wings of extant flying birds originally arose as thermoregulatory devices in ancestral reptiles, then the bird wings could be accurately described as \_\_\_\_\_.  
 (a) vestigial organs  
 (b) analogous organs  
 (c) degenerate organs  
 (d) exaptations
21. The biological species concept cannot be applied to organisms that \_\_\_\_\_.  
 (a) have similar phenotypes  
 (b) breed in different habitats  
 (c) reproduce only asexually  
 (d) reproduce only sexually
22. Which species concept defines a species as a set of organisms with a unique genetic history?  
 (a) morphological species concept  
 (b) paleontological species concept  
 (c) ecological species concept  
 (d) phylogenetic species concept
23. The products of Hox genes \_\_\_\_\_.  
 (a) provide positional information in animal embryos  
 (b) may cause polyploidy in some plants  
 (c) control the rate of timing and developmental events  
 (d) can cause paedomorphosis
24. What is a term for structures that evolve in one context but become co-opted for another function, such as honeycombed bones in earthbound and flying birds?  
 (a) vestigial organs  
 (b) exaptations  
 (c) sibling traits  
 (d) allometric traits
25. If a new species of plant is to be produced by means of allopolyploidy from two parental species that are  $2n = 4$  and  $2n = 8$ , how many chromosomes would you expect in the somatic cells of the new species?  
 (a) 6  
 (b) 12  
 (c) 24  
 (d) 48
26. Which of the following organisms are most likely to be subject to allopatric speciation?  
 (a) whale populations of the same species located on opposite sides of the Atlantic Ocean

- (b) pine trees in Alaska and pine trees on the island of Madagascar  
 (c) mountain lions in the canyons of Wyoming and in the canyons of Utah  
 (d) fruit flies on bananas and fruit flies on oranges
27. Which one of the following conditions is necessary for speciation to occur?  
 (a) reproductive isolation  
 (b) sympatric speciation  
 (c) adaptive radiation  
 (d) mass extinction
28. Which one of the following conditions is necessary for speciation to occur?  
 (a) reproductive isolation  
 (b) sympatric speciation  
 (c) adaptive radiation  
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29. The biological species concept cannot be applied to organisms that \_\_\_\_\_.  
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30. In which of the following groups has sympatric speciation been most important?  
 (a) animals  
 (b) plants  
 (c) bacteria  
 (d) fungi
31. If a new species of plant is to be produced by means of allopolyploidy from two parental species that are  $2n = 4$  and  $2n = 8$ , how many chromosomes would you expect in the somatic cells of the new species?  
 (a) 6  
 (b) 12  
 (c) 24  
 (d) 48
32. Two species of water lilies in the same pond do not interbreed because one blooms at night and the other during the day. The reproductive barrier between them is an example of \_\_\_\_\_.  
 (a) temporal isolation  
 (b) gametic isolation  
 (c) mechanical isolation  
 (d) hybrid breakdown

## ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. d  | 2. c  | 3. a  | 4. d  |
| 5. b  | 6. c  | 7. b  | 8. b  |
| 9. b  | 10. d | 11. c | 12. b |
| 13. d | 14. d | 15. d | 16. b |
| 17. a | 18. a | 19. d | 20. d |
| 21. c | 22. d | 23. a | 24. b |
| 25. b | 26. b | 27. a | 28. a |
| 29. c | 30. b | 31. b | 32. a |
| 33. d | 34. c | 35. b |       |

## 4.4: EVOLUTION-AN OVERVIEW

1. The idea of Hutton and Lyell that Darwin incorporated into his theory concerned
  - the age of Earth and gradual change
  - extinctions evident in the fossil record
  - adaptation of species to the environment
  - a hierarchical classification of organisms
2. Which of the following is not an observation or inference upon which natural selection is based?
  - there is heritable variation among individuals
  - poorly adapted individuals never leave offspring
  - since only a fraction of offspring survive, there is a struggle for limited resources
  - unequal reproductive success leads to adaptations
3. The gill pouches of mammal and bird embryos are
  - vestigial structures
  - support for "ontogeny recapitulates phylogeny"
  - homologous structures
  - used by the embryos to breathe
4. The best evidence for a common origin of all life is
  - comparative anatomy
  - comparative embryology
  - biogeography
  - molecular biology
5. Darwin's theory, as presented in The Origin of Species, mainly concerned
  - how new species arise
  - the origin of life
  - how adaptations evolve
  - how extinctions occur
6. In science the term theory generally applies to an idea that
  - is a speculation lacking supportive observations or experiments.
  - attempts to explain many related phenomena
  - is synonymous with what biologists mean by a hypothesis
  - is so widely accepted that it is considered a fact
7. Which person is incorrectly matched with a term or idea?
  - Plato—essentialism
  - Linnaeus—acquired characteristics
  - Malthus — overpopulation
  - Lyell — uniformitarianism
8. The smallest biological unit that can evolve over time is
  - a particular cell
  - an individual organism
  - a population
  - a species
9. Which of the following ideas is common to both Darwin's and Lamarck's theories of evolution
  - adaptation results from differential reproductive success
  - evolution drives organisms to greater and greater complexity
  - evolutionary adaptation results from interactions between organisms and their environments
  - adaptation results from the use and disuse of anatomical structures
10. Which pair of structures is least likely to represent homology?
  - the wings of a bat and the forelimbs of a human
  - the cytochrome c protein of a bacterium and cytochrome c of a cat
  - the mitochondria of a plant and those of an animal
  - the bark of a tree and the protective covering of lobster
11. A gene pool consists of
  - all the alleles exposed to natural selection
  - the total of all alleles present in a population
  - the entire genome of a reproducing individual
  - the frequencies of the alleles for a gene locus within a population
12. In a population with two alleles for a particular locus, B and b, the allele frequency of B is 0.7. What would be the frequency of

heterozygotes if the population is in Hardy-Weinberg equilibrium?

- 0.7
  - 0.42
  - 0.49
  - 0.09
13. In a population that is in Hardy-Weinberg equilibrium, 16% of the individuals show the recessive trait. What is the frequency of the dominant allele in the population?
- 0.84
  - 0.4
  - 0.36
  - 0.48
14. The average length of jackrabbit ears decreases the farther north the rabbits live. This variation is an example of
  - a cline
  - genetic drift
  - discrete variation
  - diversifying selection
15. Which of the following is an example of a polymorphism in humans?
- variation in height
  - variation in intelligence
  - the presence or absence of a widow's peak
  - variation in the number of fingers
16. The variation acts directly on
  - phenotype
  - genotype
  - the entire genome
  - each allele
17. As a mechanism of microevolution, natural selection can be most closely equated with
  - assortative mating
  - genetic drift
  - differential reproductive success
  - mutation
18. Most the variation we see in coat coloration and pattern is a population of wild mustangs in any generation is probably due to
  - new mutations that occurred in the preceding generation
  - sexual recombination of alleles
  - genetic drift due to the small size of the population
  - geographical variation within the population
19. In terms of the algebraic symbols used in the Hardy-Weinberg equation ( $p$  and  $q$ ), the most likely effect of assortative mating on the frequencies of alleles and genotypes for a gene locus would be
  - a decrease in  $p^2$  compared to  $q^2$
  - a trend towards zero for  $q^2$
  - convergence of  $p$  and  $q$ , the relative frequencies of the two alleles in the gene pool
  - a decrease in  $2pq$  below the value expected by the Hardy-Weinberg Theorem.
20. A founder event favors microevolution in the founding population mainly because
  - mutations are more common in a new environment
  - a small founding population is subject to extensive sampling error in the composition of its gene pool
  - the new environment is like to be patchy, favoring diversifying selection
  - gene flow increases
21. Most of biological diversity has probably arisen by
  - anagenesis
  - cladogenesis
  - phylogenetic evolution
  - hybridization
22. The largest unit in which gene flow is possible is a
  - population
  - species
  - genus
  - subspecies
23. Bird guides once listed the myrtle warbler and Audubon's warbler as distinct species, but recent books show them as eastern and western forms of a single species, the yellow-rumped warbler. Experts must have found that the tow kinds of warblers.
  - live in the same areas
  - successfully interbreed in nature
  - look enough alike to be considered one species
  - are reproductively isolated from each other
24. Among allopatric species of Anopheles mosquito, some live in brackish water, some in running fresh water, and others in stagnant water. What type of reproductive barrier is most obviously separating these different species?
  - habitat isolation
  - temporal isolation
  - behavioral isolation
  - gametic isolation
25. An eight-lane superhighway is constructed across a grass-land. For the next ten years, a researcher compares the genetic structure of several populations of organisms on the two

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- sides of the highway. The most likely organisms show evolutionary divergence are
- crows
  - mice
  - grasses with windblown pollen
  - snails
26. According to advocates of the punctuated equilibrium theory
- natural selection is unimportant as a mechanism of evolution
  - given enough time, most existing species will branch gradually into new species
  - a new species accumulates most of its unique feature it comes into existence and changes little for the rest of its duration as a species
  - most evolution is anagenic
27. The biological species concept cannot be applied to two putative species that are
- sympatric
  - nearly indistinguishable in morphology
  - reproductively isolated
  - exclusively asexual
28. Plant species A has diploid number of 12. Plant species B has a diploid number of 16. A new species, C arises as an allotetraploid from the hybridization of A and B. The diploid number of C would probably be
- 12
  - 14
  - 16
  - 28
29. The speciation episode described in preceding question is most likely a case of
- allopatric speciation
  - symmetric speciation
  - speciation based on sexual selection
  - adaptive radiation
30. A paleontologist estimates that when a particular rock formed, it contained 12 mg of the radioactive isotope potassium-40. The rock now contains 3 mg of potassium-40. The half-life of potassium-40 is 1.3 billion years. About how old is the rock?
- 0.4 billion years
  - 0.3 billion years
  - 1.3 billion years
  - 2.6 billion years
- If humans and pandas belong to the same class, they must also belong to the same
- order
  - phylum
  - family
  - genus
- In the case of comparing birds to other vertebrates, having four appendages is  
(explain your answer)
- a shared primitive character

- (b) a synapomorphy
- (c) a character useful for distinguishing the birds from other vertebrates
- (d) an example of analogy rather than homology
33. Advocates of the theory known as species selection propose that most evolutionary trends results from
- the tendency for natural selection to perfect adaptations
  - stepwise progression of an unbranched lineage, with each step furthering the evolutionary trend
  - phylogenetic transformation of a single species (Anagenesis)
  - differences between species in their longevity and/or rates of speciation
34. The greatest adaptive radiation of the animal kingdom occurred during the
- early Precambrian era
  - late Precambrian era
  - early Paleozoic era
  - early Mesozoic era
35. The DNA from two species is compared by the method of restriction mapping. Extensive similarity between the species in the collection of DNA fragments from treatment with a restriction enzyme indicates that
- the genes being compared have the same functions
  - most sites recognized by the restriction enzyme have equivalent locations in the DNA samples from the two species
  - the two species normally possess the same restriction enzyme
  - the DNA fragment that match in size between the two species have identical base sequences
36. Extensive adaptive radiations have usually followed in the wake of mass extinctions mainly because
- many adaptive zones are vacated
  - conditions of the physical environment are usually at their most favorable after some crisis has passed
  - the survivors have superior adaptations that enable them to move into many environments when conditions improve after the extinction episode.
  - preadaptation assures that survivors will radiate to give rise to many new species
37. Which of the following would be most useful for constructing a cladogram showing the

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- taxonomic relationships among several fish species?
- several analogous characteristics shared by all the fishes
  - a single homologous characteristic shared by all the fishes
  - the total degree of morphological similarity among various fish species
  - several characteristics thought to have evolved after different fish diverged from one another
38. The evolutionary transformation of a primitive lung into a swim bladder is an example of
- convergent evolution
  - divergent evolution
  - preadaptation
  - adaptive radiation
39. The differences between the modern synthesis and more hierarchical view of evolution include all the following except
- gradualism versus punctuated equilibrium
  - natural selection versus chance as central to adaptation
  - the relative importance of microevolution in macroevolution
  - phylogenetic transitions (Anagenesis) versus species selection
40. A change in the frequency of alleles in a population is the definition of
- natural selection
  - genetic drift
  - evolution
  - gene flow
41. The study of genetic events that occur in gene pools is called
- evolutionary genetics
  - population genetics
  - gene pool biology
  - allopatry
42. If the requirements of the Hardy-Weinberg theorem are all met, then
- evolution is occurring rapidly
  - evolution is occurring slowly
  - evolution is not occurring
  - gene frequencies are changing
43. Two male deer are equally adapted to their environment. One of these bucks is in the wrong place at the wrong time and is shot by a hunter. The other buck reproduces, passing its genes on to following generations. This account is an example of
- natural selection
  - gene migration
- (c) bottleneck effect
- (d) genetic drift
44. Which of the following statements is most accurate?
- evolution is always occurring in all populations
  - evolution occurs in virtually all populations at some point in their history
  - evolution rarely occurs in any population
  - evolution never occurs
45. Two tortoises are caught on a mat of floating vegetation and get carried out to sea. Their mat happens to land on a volcanic island that is inhabited by a small population of the same species. Breeding with the island tortoise population introduces new alleles that add to the genetic diversity of tortoises on the island. This account is an example of
- genetic drift
  - gene flow
  - natural selection
  - neutral selection
46. After a bottleneck event has occurred the
- genetic diversity of a population is greater
  - genetic diversity of a population is decreased
  - size of the population always increases
  - size of the population always decreases
47. When chance events increase or decrease the frequencies of genes in a population, \_\_\_\_\_ has occurred
- genetic drift
  - natural selection
  - random mating
  - gene flow
48. From the perspective of a population, mutations are positive events because
- they weed out less fit individuals
  - they provide new genetic variations that can help ensure the survival of the species
  - most mutations make individuals stronger
  - they are always expressed when they occur
49. When a geographical barrier divides members of a population, \_\_\_\_\_ speciation may occur
- sympatric
  - allopathic
  - stabilizing
  - directional
50. A mutation that caused a change in courtship behavior occurred in, and spread among, a few members of a population of cranes. This

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change in courtship behavior prevents those that have the mutation from mating with those that do not have the mutation, even though the two groups share the same breeding territory. This mutation may cause \_\_\_\_\_ speciation.

- (a) sympatric (b) allopathic  
 (c) stabilizing (d) directional
51. The punctuated equilibrium model of evolution describes the theory that evolution (a) occurs very slowly and steadily over long periods  
 (b) occurs at a constant, rapid rate  
 (c) occurs rapidly for short periods of time and then a population undergoes very little change for long periods  
 (d) does not occur

52. Natural selection that narrows the phenotypic range by selecting against phenotypic extremes is called

- (a) disruptive selection  
 (b) stabilizing selection  
 (c) directional selection  
 (d) neutral selection

53. Sickle cell anemia was maintained in African populations because the heterozygote was resistant to malaria. Both homozygotes were selected against by severe suckling or susceptibility to malaria. This example illustrates

- (a) directional selection  
 (b) disruptive selection  
 (c) neutral selection  
 (d) heterozygote superiority

**ANSWERS**

1. a	2. b	3. c	4. d
5. c	6. b	7. b	8. c
9. c	10. d	11. b	12. d
13. c	14. a	15. c	16. a
17. c	18. b	19. d	20. b
21. b	22. b	23. b	24. a
25. d	26. c	27. d	28. d
29. d	30. d	31. b	32. a
33. d	34. c	35. b	36. a
37. d	38. c	39. b	40. d
41. b	42. c	43. d	44. b
45. b	46. b	47. a	48. b
49. b	50. a	51. c	52. b
53. d			

## Part V

# Phylogeny and Systematics

## 5.1: PHYLOGENY AND SYSTEMATICS

1. Reptiles first appeared during the \_\_\_\_ era.  
 (a) Paleozoic      (b) Triassic  
 (c) Mesozoic      (d) Cenozoic
2. We are living during the \_\_\_\_ era.  
 (a) Neogene      (b) Cenozoic  
 (c) Paleozoic      (d) Paleogene
3. Dinosaurs went extinct during the \_\_\_\_.  
 (a) Devonian      (b) Precambrian  
 (c) Mesozoic      (d) Cenozoic
4. \_\_\_\_ were the dominant vertebrate life form during the Paleozoic era.  
 (a) Amphibians      (b) Reptiles  
 (c) Sponges      (d) Dinosaurs
5. Life arose during the \_\_\_\_.  
 (a) Precambrian      (b) Cenozoic  
 (c) Triassic      (d) Paleozoic
6. Flowering plants first appeared during the \_\_\_\_.  
 (a) Devonian      (b) Precambrian  
 (c) Mesozoic      (d) Cenozoic
7. The Mesozoic era began approximately \_\_\_\_ million years ago.  
 (a) 4,600      (b) 570  
 (c) 251      (d) 65
8. The Precambrian time began at least \_\_\_\_ million years ago.  
 (a) 4,600      (b) 570  
 (c) 245      (d) 65
9. A mushroom is classified in domain \_\_\_\_ and kingdom \_\_\_\_.  
 (a) Eukarya... Fungi  
 (b) Eukarya... Protista  
 (c) Eukarya... Plantae  
 (d) Eukarya... Animalia
10. An amoeba is classified in domain \_\_\_\_.  
 (a) Fungi      (b) Eukarya  
 (c) Plantae      (d) Bacteria
11. In the five-kingdom scheme, prokaryotes are classified in the kingdom \_\_\_\_.  
 (a) Fungi      (b) Protista  
 (c) Plantae      (d) Monera
12. In the two-kingdom system, what was the basis of the recognition of the kingdom Animalia?  
 (a) photosynthesis
13. There is(are) \_\_\_\_ prokaryotic domain(s).  
 (a) one      (b) two  
 (c) three      (d) four
14. In the two-kingdom system, why were prokaryotes classified in the kingdom Plantae?  
 (a) They are sedentary.  
 (b) They are heterotrophs.  
 (c) They have cell walls.  
 (d) They are unicellular.
15. Animals that possess homologous structures probably \_\_\_\_.  
 (a) are headed for extinction  
 (b) evolved from the same ancestor  
 (c) have increased genetic diversity  
 (d) by chance had similar mutations in the past
16. The phenomenon whereby different species that occupy similar niches in isolated areas develop morphological similarities is called \_\_\_\_.  
 (a) artificial selection  
 (b) the founder effect  
 (c) convergent evolution  
 (d) adaptive radiation
17. The oldest fossils usually \_\_\_\_.  
 (a) contain more radioactive isotopes than younger fossils  
 (b) are found in the deepest strata  
 (c) have the longest half-lives  
 (d) are found above younger fossils
18. We know a lot about fossil crabs, snails, and corals, but not much about ancient seaweeds. Why do you suppose this is the case?  
 (a) There were no seaweeds in the oceans until very recently.  
 (b) Seaweeds were too soft to fossilize well.  
 (c) Animal life was much more abundant than seaweeds in ancient times.  
 (d) Autotrophs moved onto land, leaving only animals in the sea.
19. Which of the following taxonomic categories contains all the others listed here?  
 (a) genus      (b) class  
 (c) phylum      (d) species

20. The naming and classifying of organisms is called \_\_\_\_.  
 (a) biology      (b) polyploidy  
 (c) genetics      (d) taxonomy
21. \_\_\_\_ introduced phylogenetic systematics when he wrote "Our classifications will come to be, as far as they can be so made, genealogies."  
 (a) Darwin      (b) Linneaus  
 (c) Wallace      (d) Cuvier
22. Systematists have used a wide variety of traits to reconstruct the phylogenies of particular groups of organisms. Which one of the following traits produces the best estimate of the true phylogeny?  
 (a) gross morphological traits  
 (b) behavioral traits  
 (c) embryological traits  
 (d) all of the above traits combined
23. Why do researchers use rRNA in investigations of relationships between taxa that diverged hundreds of millions of years ago?  
 (a) rRNA cannot mutate.  
 (b) rRNA mutates rapidly.  
 (c) DNA coding for rRNA changes relatively slowly.  
 (d) rRNA is traditionally the nucleic acid chosen for recent comparisons.
24. The domains of life are \_\_\_\_.  
 (a) Animalia, Plantae, Protista  
 (b) Bacteria, Protista, Eukarya  
 (c) Archaea, Protista, Eukarya  
 (d) Archaea, Bacteria, Eukarya
25. Which of the following would be the least useful in determining the relationships among various species?  
 (a) a comparison of DNA base sequences  
 (b) homologous structures  
 (c) fossils  
 (d) analogous structures
26. Researchers can use molecular homologies to \_\_\_\_.  
 (a) estimate how long ago the common ancestor lived  
 (b) reveal the amount of mutations in a particular sequence that have occurred between the species since they diverged from a common ancestor  
 (c) hypothesize about the morphological structures of a common ancestor
27. What is the focus of the branch of biology called taxonomy?  
 (a) evolution  
 (b) the classification of life-forms by their similarities and differences  
 (c) genetics  
 (d) the history of the field of biology
28. The binomial system assigns to each organism a unique name that describes its \_\_\_\_.  
 (a) order and family  
 (b) body plan and habitat  
 (c) species and genus  
 (d) family and species
29. The two-part format of the scientific name, referred to as binomial, ensures that \_\_\_\_.  
 (a) each species is assigned a unique name  
 (b) each species has a name that is understandable regardless of language barriers among scientists  
 (c) systematists can easily specify the closest relatives of any species  
 (d) all of the above
30. All the members of which one of the following groups have the greatest number of characteristics in common?  
 (a) class      (b) genus  
 (c) kingdom      (d) species
31. A taxon \_\_\_\_.  
 (a) is a formal grouping at any given level  
 (b) is a formal grouping in any level from phylum to species  
 (c) is a clade  
 (d) is a species
32. Two worms in the same class must also be grouped in the same \_\_\_\_.  
 (a) order      (b) phylum  
 (c) genus      (d) family
33. A phylogenetic tree of bird families constructed by cladistic analysis would be a hypothesis about which of the following?  
 (a) characteristics shared by all bird families  
 (b) evolutionary relationships among bird families  
 (c) families that look most alike  
 (d) analogous structures shared by various species
34. The wings of a hummingbird and a bee are \_\_\_\_.  
 (a) homologous      (b) phylogenetic

35. What information **cannot** be inferred from studying a cladogram?  
 (a) patterns of shared characteristics  
 (b) absolute dates of branch points  
 (c) whether the clade is valid  
 (d) if the shared characteristics are explained by common ancestry
36. Many researchers who study the kingdom Protista argue that all of these organisms should **not** be placed in the same kingdom, because these organisms could not have evolved from a common ancestor. In other words, they argue that the kingdom Protista is \_\_\_\_\_.  
 (a) polyphyletic (b) paraphyletic  
 (c) monophyletic (d) heterophasic
37. Using cladistic analysis, a taxonomist wishes to construct a phylogenetic tree showing the relationships among various species of mammals. Which of the following would be the **least** useful for this purpose?  
 (a) descriptions of various types of limbs (wings, legs, flippers, etc.)  
 (b) the fact that all mammals have hair  
 (c) data about skull bones  
 (d), the fact that teeth vary among types of mammals
38. Which statement below is true about an outgroup?  
 (a) Outgroup comparison is based on the assumption that homologies present in both the outgroup and ingroup must be derived characters.  
 (b) The outgroup would be found at one of the highest branches of a phylogenetic tree.  
 (c) The outgroup and ingroup display a mixture of shared and derived characters.  
 (d) The outgroup should be less closely related to any members of the ingroup than they are to each other.
39. Which statement about cladogram branches is true?  
 (a) The lengths of the branches that connect the taxa and the order of the branch points are both arbitrary.  
 (b) The order of the branch points is arbitrary, but the lengths of the branches that connect the taxa are not.  
 (c) Neither the lengths of the branches that connect the taxa nor the order of the branch points is arbitrary.
40. "Distance" methods and "character-state" methods are \_\_\_\_\_.  
 (a) used to construct trees that are the most parsimonious  
 (b) used to construct trees that are the most likely  
 (c) used to minimize the total of all the percent differences among all the DNA sequences being compared  
 (d) used to construct DNA trees that are both parsimonious and likely
41. Birds and mammals have a four-chambered heart, but reptiles have a three-chambered heart. How does this fact affect the construction of phylogenetic trees for these groups?  
 (a) It shows that the common ancestor of birds and mammals must have had a four-chambered heart.  
 (b) This represents a problem with the principle of parsimony, rather than a problem with the analogy-homology issue.  
 (c) The most likely tree is always the most parsimonious.  
 (d) The most likely tree is not always the most parsimonious..
42. If you wanted to determine the lineage of plants that have evolved on a relatively young archipelago—approximately 15,000 years—what type of nucleic acid should you compare?  
 (a) mRNA (b) rRNA  
 (c) mtDNA (d) tRNA
43. Paralogous genes \_\_\_\_\_.  
 (a) are passed from generation to generation in a straight line  
 (b) result from gene duplication  
 (c) can only diverge after speciation has taken place  
 (d) are responsible for the differences in beta hemoglobin in humans and mice
44. Which is **not** an assumption of the neutral theory?  
 (a) Much evolutionary change in genes and proteins has no effect on fitness and therefore is not influenced by Darwinian selection.  
 (b) Most harmful mutations are removed from a population quickly.

- (c) Differences in the rate of the clock in different genes are a function of how important each gene is.  
 (d) If a particular sequence of amino acids is less critical for survival, fewer new mutations will be harmful and more will be neutral. These genes will change slowly over time.
45. The analytical approach to understanding the diversity and relatedness of both extant and extinct organisms is called \_\_\_\_\_.  
 (a) systematics  
 (b) evolution  
 (c) taxonomy  
 (d) binomial nomenclature
46. Which one of the following methods to establish phylogenetic relationships among organisms has been developed most recently?  
 (a) comparing morphology (shape and structure)  
 (b) comparing physiology (the functioning of structures and systems)  
 (c) comparing the component sequences of proteins and nucleic acids  
 (d) comparing behavioral patterns
47. Which example below is **not** a weakness of the fossil record?  
 (a) It is biased in favor of species with hard shells or skeletons.  
 (b) It is biased in favor of species that were widespread and abundant.  
 (c) A large number of Earth's species may not have died in the right place or time to be fossilized.  
 (d) Only animals can be fossilized; thus, the fossil record cannot be used to study the evolutionary history of plants.

**ANSWERS**

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. a  | 2. b  | 3. c  | 4. a  |
| 5. a  | 6. c  | 7. c  | 8. a  |
| 9. a  | 10. b | 11. d | 12. a |
| 13. b | 14. c | 15. b | 16. c |
| 17. b | 18. b | 19. b | 20. d |
| 21. a | 22. d | 23. c | 24. d |
| 25. d | 26. b | 27. b | 28. c |
| 29. d | 30. d | 31. b | 32. b |
| 33. b | 34. c | 35. b | 36. a |
| 37. b | 38. d | 39. d | 40. d |
| 41. d | 42. c | 43. b | 44. d |
| 45. a | 46. c | 47. d |       |

## 5.2: THE TREE OF LIFE: AN OVERVIEW OF BIOLOGICAL DIVERSITY

1. Seed plants first appeared during the \_\_\_\_\_.
    - (a) Paleozoic
    - (b) Triassic
    - (c) Mesozoic
    - (d) Cenozoic
  2. The first prokaryotic cells appeared during the \_\_\_\_\_.
    - (a) Jurassic
    - (b) Cretaceous
    - (c) Paleozoic
    - (d) Precambrian
  3. Animals first appeared during the \_\_\_\_\_.
    - (a) Mesozoic
    - (b) Paleozoic
    - (c) Precambrian
    - (d) Silurian
  4. The Cenozoic era began approximately \_\_\_\_\_ million years ago.
    - (a) 4,600
    - (b) 570
    - (c) 245
    - (d) 65
  5. \_\_\_\_\_ were the dominant vertebrate life form during the Mesozoic era.
    - (a) Dinosaurs
    - (b) Mammals
    - (c) Fish
    - (d) Birds
  6. Most modern animal phyla evolved during the \_\_\_\_\_ era.
    - (a) Paleozoic
    - (b) Permian
    - (c) Cenozoic
    - (d) Mesozoic
  7. Bony fish first evolved during the \_\_\_\_\_.
    - (a) Mesozoic
    - (b) Paleozoic
    - (c) Cenozoic
    - (d) Precambrian
  8. Which of these events occurred earliest in the history of Earth?
    - (a) formation of oxygen
    - (b) first humans
    - (c) evolution of land plants, fungi, and land animals
    - (d) origin of eukaryotes
  - Which of these events occurred most recently in the history of Earth?
    - (a) formation of oxygen
    - (b) first humans
    - (c) evolution of land plants, fungi, and land animals
    - (d) origin of eukaryotes
  - Which of these events occurred during the Paleozoic?
    - (a) origin of Earth
    - (b) colonization of land by plants
    - (c) origin of eukaryotes
    - (d) origin of multicellularity
11. A human is classified in domain \_\_\_\_\_ and kingdom \_\_\_\_\_.
- (a) Eukarya... Fungi
  - (b) Eukarya... Protista
  - (c) Eukarya... Plantae
  - (d) Eukarya... Animalia
12. A rose bush is classified in domain \_\_\_\_\_ and kingdom \_\_\_\_\_.
- (a) Eukarya... Fungi
  - (b) Eukarya... Protista
  - (c) Eukarya... Plantae
  - (d) Eukarya... Animalia
13. In the five-kingdom system, which kingdom consists primarily of unicellular eukaryotes?
- (a) Fungi
  - (b) Protista
  - (c) Plantae
  - (d) Animalia
14. In the two-kingdom system, why were fungi classified in the kingdom Plantae?
- (a) They are sedentary.
  - (b) They are heterotrophs.
  - (c) They lack cell walls.
  - (d) They are unicellular.
15. There is(are) \_\_\_\_\_ eukaryotic domain(s).
- (a) one
  - (b) two
  - (c) three
  - (d) four
16. Experiments in which electricity was discharged into a vessel containing hydrogen gas, water vapor, methane, and ammonia were conducted by \_\_\_\_\_. Their results support Haldane and Oparin's speculations on the origin of life.
- (a) Miller and Urey
  - (b) Watson and Crick
  - (c) Darwin and Wallace
  - (d) Meselson and Stahl
17. Clay particles may have played an important role in the origin of life because \_\_\_\_\_.
- (a) growing bacterial colonies can leave clay deposits
  - (b) early life-forms probably ate clay
  - (c) clay particles are a suitable template for the polymerization of simple organic molecules
  - (d) clay is an important abiotic nutrient reservoir

- (a) contain more radioactive isotopes than younger fossils
- (b) are found in the deepest strata
- (c) have the longest half-lives
- (d) are found above younger fossils
19. Earth probably formed \_\_\_\_\_ years ago, and the first life evolved as early as \_\_\_\_\_ years ago.
- (a) 4.5 billion years ago... 3.9 billion years ago
  - (b) 3.9 million years ago... 2.0 billion years ago
  - (c) 6,000 years ago... 6,000 years ago
  - (d) 10 billion years ago... 4.5 billion years ago
20. The earliest organisms were most likely
- (a) eukaryotic
  - (b) prokaryotic
  - (c) probiotics
  - (d) multicellular
21. Which of the following was probably not present in large amounts in the atmosphere at the time life is thought to have originated?
- (a) water
  - (b) nitrogen gas
  - (c) carbon monoxide
  - (d) oxygen gas
22. The atmosphere of early Earth probably contained no O<sub>2</sub> until the emergence of organisms that \_\_\_\_\_.
- (a) used hydrogen sulfide as an energy source
  - (b) were chemoautotrophic
  - (c) used water as an electron source for photosynthesis
  - (d) were oxygen respiring
23. Eukaryotic cells probably arose through \_\_\_\_\_.
- (a) colonial aggregations of bacteria
  - (b) associations between different prokaryotes
  - (c) colonial aggregations of protists
  - (d) direct descent from probiotics
24. Until about 500 million years ago, all living things were \_\_\_\_\_.
- (a) asexual
  - (b) autotrophic
  - (c) aquatic
  - (d) prokaryotic
25. Pangaea \_\_\_\_\_.
- (a) was a land mass that broke up, forming the present-day continents
  - (b) is the idea that all life on Earth is related
- (c) was an animal common in ancient seas but is now extinct
- (d) is the evolutionary history of a species, family, or phylum
26. The early atmosphere on Earth is thought to have lacked which one of the following gases?
- (a) methane
  - (b) carbon dioxide
  - (c) oxygen
  - (d) water
27. The oldest evidence of life on Earth, although controversial, is \_\_\_\_\_.
- (a) the fossilized remains of simple plants that are over 5 billion years old
  - (b) 3.8-billion-year-old rocks with isotopes of carbon that seem to represent the metabolic activity of organisms
  - (c) the mineralized remains of tiny animals
  - (d) the fossilized remains of cellular colonies dating from about 3 million years ago
28. In their experiment on the abiotic synthesis of organic compounds, which of the following gases did Miller and Urey use to simulate Earth's early atmosphere?
- (a) H<sub>2</sub>O only
  - (b) H<sub>2</sub>O and CH<sub>4</sub> only
  - (c) H<sub>2</sub>O, CH<sub>4</sub>, and H<sub>2</sub> only
  - (d) H<sub>2</sub>O, CH<sub>4</sub>, H<sub>2</sub>, and NH<sub>3</sub>
29. The Miller and Urey abiotic synthesis experiment (and subsequent, similar experiments) showed that \_\_\_\_\_.
- (a) life can be created in a test tube
  - (b) long chains of DNA can form under abiotic conditions
  - (c) simple organic molecules can form spontaneously under conditions like those thought to prevail early in Earth's history
  - (d) the earliest life forms introduced large amounts of oxygen into the atmosphere
30. Which statement below is not an explanation of how deep-sea vents may have been important factors in the origin of life?
- (a) They may have been the source of some of the carbon-containing compounds that cells use in energy metabolism.
  - (b) Sulfides of iron and nickel common in deep-sea vents are excellent catalysts.
  - (c) The high temperatures associated with deep-sea vents were a source of energy for the reactions necessary for the formation of probiotics.
  - (d) Oxygen was abundant near deep-sea vents and encouraged the formation of polymers.

- aggregates—display all but one of the following properties of living cells. The one property they lack is a(n) \_\_\_\_\_.  
 (a) ability to absorb substances from their surroundings  
 (b) genetic library  
 (c) selectively permeable membrane  
 (d) transmembrane voltage potential
32. Biologists are interested in the role of liposomes in the origin of life. They think that liposomes might show how \_\_\_\_\_.  
 (a) raw materials for organic compounds formed  
 (b) the formation of organic polymers, such as carbohydrates and RNA, were catalyzed  
 (c) primitive cell membranes could form, grow, and divide  
 (d) energy was supplied for the metabolism of the first simple cells
33. Cech and Altman suggested that the first self-replicating molecules were \_\_\_\_\_.  
 (a) DNA      (b) phospholipids  
 (c) viruses    (d) RNA
34. The correct order of the geologic eras, from most ancient to most recent, is \_\_\_\_\_.  
 (a) Paleozoic, Cenozoic, Mesozoic  
 (b) Proterozoic, Mesozoic, Cenozoic, Paleozoic  
 (c) Paleozoic, Mesozoic, Cenozoic  
 (d) Paleozoic, Mesozoic, Cenozoic, Proterozoic
35. A radioactive isotope has a half-life of 1.2 billion years. As measured by the presence of the isotope and its stable decay product, a rock originally contained 10 grams of the radioactive isotope, and now contains 1.25 grams. Approximately how many years old is the rock?  
 (a) 10,000 years  
 (b) 12 billion years  
 (c) 3.6 billion years  
 (d) 0.3 billion years
36. Fossils that can be used to establish relative dates are most likely to be found in \_\_\_\_\_.  
 (a) the continental shelves  
 (b) glacial till (i.e., rubble)  
 (c) sedimentary rock  
 (d) igneous rock
- (a) Fossils show that dinosaurs suffered from cold and starvation.  
 (b) Sedimentary rocks contain a layer of iridium, a mineral uncommon on Earth.  
 (c) There have been several near misses in recent years.  
 (d) The dinosaurs disappeared rather abruptly, virtually overnight.
38. Three or four of the following statements correctly apply to the event that paleontologists regard as the most catastrophic mass extinction of all time. Which one, if any, of these statements is not correct?  
 (a) This mass extinction occurred about 245 million years ago.  
 (b) This mass extinction occurred at the end of the Permian period.  
 (c) This mass extinction occurred at the end of the Paleozoic era.  
 (d) All of the above statements correctly describe the most catastrophic mass extinction of all time.
39. Ancient cyanobacteria were very important in the history of life because they \_\_\_\_\_.  
 (a) were probably the first organisms to live on Earth  
 (b) produced atmospheric oxygen  
 (c) are the oldest known archaea  
 (d) were the first truly multicellular organisms
40. What prokaryotic adaptation occurred during the oxygen revolution and opened up the possibility for energy-demanding multicellular life-forms?  
 (a) electron transport systems  
 (b) anaerobic fermentation  
 (c) aerobic respiration  
 (d) photosynthesis
41. What ability did early eukaryotic cells have to survive without?  
 (a) the ability to engulf other cells  
 (b) the ability to undergo mitosis  
 (c) anaerobic fermentation  
 (d) electron transport
42. Which statement below is not an argument for the endosymbiotic origin of plastids and mitochondria?

- (a) Mitochondria and plastids reproduce by a method that is very similar to binary fission.  
 (b) The inner membrane of both types of organelles have enzymes and transport systems that are homologous to those on the plasma membrane of prokaryotes.  
 (c) Each type of organelle contains a single circular DNA.  
 (d) The ribosomes of each type of organelle are more similar to cytoplasmic ribosomes of eukaryotic cells than to ribosomes of prokaryotic cells.
43. Genetic annealing is the \_\_\_\_\_.  
 (a) term used to describe the horizontal transfer of genetic material between bacterial and archaeal lineages  
 (b) process by which the first eukaryotic cells performed meiosis  
 (c) process by which the first eukaryotic cells performed mitosis  
 (d) method by which archaea reproduce
44. What does the snowball Earth hypothesis propose?  
 (a) Once the first multicellular eukaryotes appeared, their sizes and populations grew exponentially, like a snowball rolling down a hill.  
 (b) Multicellular eukaryotes had an advantage over single-celled organisms in extremely cold conditions.  
 (c) The first multicellular eukaryotes formed colonies on the surface of glaciers.  
 (d) Larger multicellular eukaryotes are scarce in the fossil record until the late Proterozoic because an ice age limited life to deep-sea vents and hot springs.
45. Which one of the following best describes how the breakup of Pangaea affected evolution?  
 (a) Mammals had an opportunity to become dominant.  
 (b) Shallow marine habitat became scarcer.  
 (c) Extensive glaciation caused mass extinctions.  
 (d) The geographic isolation of populations that had previously coexisted led to speciation.
46. Plants colonized land in the company of \_\_\_\_\_. Their symbiotic relationships still exist today.  
 (a) fungi      (b) animals  
 (c) insects    (d) cyanobacteria
47. The fauna and flora of Australia are very different from those of the rest of the world. Why might this be true?  
 (a) They have become different by convergent evolution.  
 (b) The climate of Australia is unlike that of any other place in the world.  
 (c) Australia was never in close proximity to the other continents.  
 (d) Australia has been isolated for about 50 million years.
48. Bacteria were classified as plants for many years because \_\_\_\_\_.  
 (a) most species are photosynthetic  
 (b) of their rigid cell walls  
 (c) their metabolism was identical to that of plants  
 (d) bacteria and plants both have flagellated gametes
49. In the five-kingdom system of classification, eukaryotic organisms that absorb their nutrients (many are decomposers of organic material) are members of kingdom \_\_\_\_\_.  
 (a) Monera      (b) Protista  
 (c) Fungi    (d) Plantae
50. Multicellular organisms that ingest their nutrients are classified in kingdom \_\_\_\_\_.  
 (a) Monera      (b) Protista  
 (c) Fungi    (d) Animalia

**ANSWERS**

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. a  | 2. d  | 3. c  | 4. d  |
| 5. a  | 6. a  | 7. b  | 8. a  |
| 9. b  | 10. b | 11. d | 12. c |
| 13. b | 14. a | 15. a | 16. a |
| 17. c | 18. b | 19. a | 20. b |
| 21. d | 22. c | 23. c | 24. c |
| 25. a | 26. c | 27. b | 28. d |
| 29. c | 30. d | 31. b | 32. c |
| 33. d | 34. c | 35. c | 36. c |
| 37. b | 38. d | 39. b | 40. c |
| 41. d | 42. d | 43. a | 44. d |
| 45. d | 46. a | 47. d | 48. b |
| 49. c | 50. D |       |       |

### 5.3: PROKARYOTES

1. Which statement about endotoxins is true?
  - (a) Endotoxins are components of the cell wall of gram-positive bacteria.
  - (c) Endotoxins are released only when bacteria die and their cell walls break down.
  - (c) An example of a prokaryote that produces endotoxins is *Vibrio cholerae*.
  - (d) None of the above are true.
  
2. \_\_\_\_\_ are surface appendages that allow a bacterium to stick to a surface.
  - (a) Cell walls
  - (b) Flagella
  - (c) Ribosomes
  - (d) Pili
  
3. What is the function of a bacterium's capsule?
  - (a) protection
  - (b) adhesion
  - (c) protein synthesis
  - (d) DNA containment
  
4. Where is a bacterial cell's DNA found?
  - (a) ribosomes
  - (b) nucleus
  - (c) peroxisome
  - (d) nucleoid region

In a bacterium, where are proteins synthesized?

  - (a) ribosomes
  - (b) nucleus
  - (c) peroxisome
  - (d) nucleoid region

What name is given to the rigid structure, found outside the plasma membrane, that surrounds and supports the bacterial cell?

  - (a) capsule
  - (b) pili
  - (c) cell wall
  - (d) flagella

The \_\_\_\_\_ is the bacterial structure that acts as a selective barrier, allowing nutrients to enter the cell and wastes to leave the cell.

  - (a) plasma membrane
  - (b) nucleoid region
  - (c) ribosome
  - (d) pili

Which statement below about bacteria and humans is not true?

In a human body, bacterial cells outnumber human cells by as much as 10 times.

Some bacteria can cause human cells to release antimicrobial agents that kill

  - (a) peptidoglycan
  
5. Many of the relationships between bacterial cells and the humans they live within can be described as commensal.
  - (c) Prokaryotes are at the root of all human diseases.
  
6. The prokaryotic cells that built stromatolites are classified as \_\_\_\_\_.
  - (a) proteobacteria
  - (b) chlamydias
  - (c) spirochetes
  - (d) cyanobacteria
  
7. The prokaryotic cells that were the first to add significant quantities of oxygen to Earth's atmosphere are classified as \_\_\_\_\_.
  - (a) proteobacteria
  - (b) cyanobacteria
  - (c) spirochetes
  - (d) gram-positive bacteria
  
8. Streptococcus aureus is classified with \_\_\_\_\_.
  - (a) proteobacteria
  - (b) chlamydias
  - (c) spirochetes
  - (d) gram-positive bacteria
  
9. Organisms that can cause nongonococcal urethritis are classified with \_\_\_\_\_.
  - (a) proteobacteria
  - (b) chlamydias
  - (c) spirochetes
  - (d) gram-positive bacteria
  
10. The chemoheterotroph *Proteus vulgaris* is a rod-shaped bacterium classified with \_\_\_\_\_.
  - (a) proteobacteria
  - (b) chlamydias
  - (c) spirochetes
  - (d) gram-positive bacteria
  
11. Spiral-shaped bacteria are likely to be placed with \_\_\_\_\_.
  - (a) proteobacteria
  - (b) chlamydias
  - (c) spirochetes
  - (d) gram-positive bacteria
  
12. Which choice below can be found in gram-negative bacteria, but not in gram-positive bacteria?
  - (a) peptidoglycan

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13. Genes for the resistance of antibiotics are usually located \_\_\_\_\_.
    - (a) on the main chromosome
    - (b) in mitochondria
    - (c) in the cell wall
    - (d) on plasmids
  
  14. The bacterium *Bacillus thuringiensis* can withstand heat, dryness, and toxic chemicals that would kill most other bacteria. This indicates that it is probably able to form \_\_\_\_\_.
    - (a) pseudopodia
    - (b) endotoxins
    - (c) endospores
    - (d) pili
  
  15. Bacteria that live around deep-sea, hot-water vents obtain energy by oxidizing inorganic hydrogen sulfide belched out by the vents. They use this energy to build organic molecules from carbon obtained from the carbon dioxide in seawater. These bacteria are \_\_\_\_\_.
    - (a) photoheterotrophs
    - (b) chemoautotrophs
    - (c) photoautotrophs
    - (d) chemoheterotrophs
  
  16. Which statement is true about obligate anaerobes?
    - (a) They use O<sub>2</sub> for cellular respiration and cannot grow without it.
  
  17. They obtain energy by oxidizing ferrous ions.
    - (b) They will use O<sub>2</sub> if it is present, but can obtain energy by fermentation if needed.
    - (c) They are poisoned by O<sub>2</sub>.
    - (d) They are poisoned by O<sub>2</sub>.
  
  18. The prokaryotic organisms most likely to be found living in salt ponds are the \_\_\_\_\_.
    - (a) methanogens
    - (b) extremophiles
    - (c) halophiles
    - (d) thermophiles
  
  19. Which clade of archaea contains the extreme halophiles and methanogens?
    - (a) Euryarchaeota
    - (b) Crenarchaeota
    - (c) Korarchaeota
    - (d) Nanoarchaeota
  
  20. An ecological relationship between organisms of different species that are in direct contact can best be described as \_\_\_\_\_.
    - (a) symbiotic
    - (b) parasitic
    - (c) mutualistic
    - (d) commensal

### ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. c  | 2. d  | 3. a  | 4. d  |
| 5. a  | 6. c  | 7. a  | 8. d  |
| 9. d  | 10. b | 11. d | 12. b |
| 13. a | 14. c | 15. c | 16. d |
| 17. c | 18. b | 19. d | 20. c |
| 21. a | 22. a |       |       |

## 5.4: PROTISTS

1. The cells of \_\_\_\_\_ and \_\_\_\_\_ have modified mitochondria.  
 (a) euglenozoans... alveolates  
 (b) chlorophytes... ciliates  
 (c) dinoflagellates... metazoans  
 (d) parabasalids... diplomonads
2. The members of \_\_\_\_\_ are characterized by cells with small membrane-bound cavities under their cell membranes.  
 (a) Stramenopila (b) Chlorophyta  
 (c) Alveolata (d) Mycetozoa
3. Golden algae, brown algae, red algae, chlorophytes, and charophyceans are some examples of protists that are \_\_\_\_\_.  
 (a) photoheterotrophic  
 (b) chemoautotrophic  
 (c) decomposers  
 (d) photosynthetic
4. Which of these groups consist of parasitic flagellated cells, such as *Trypanosoma*, the organism that causes sleeping sickness?  
 (a) metazoans (b) kinetoplastids  
 (c) diatoms (d) brown algae
5. Which three groups contain large algae known as seaweeds?  
 (a) dinoflagellates, apicomplexans, and green algae  
 (b) brown algae, red algae, and green algae  
 (c) plants, fungi, and choanoflagellates  
 (d) diatoms, golden algae, and brown algae  
 Stramenopiles include all of the following groups EXCEPT \_\_\_\_\_.  
 (a) golden algae  
 (b) brown algae  
 (c) cellular slime molds  
 (d) water molds
7. Which of these groups is characterized by glasslike walls containing silica?  
 (a) plants (b) diatoms  
 (c) plasmodial slime molds  
 (d) diplomonads
8. Plasmodium, the parasitic organism that causes malaria, is a \_\_\_\_\_.  
 (a) ciliate (b) diatom  
 (c) entamoeba (d) apicomplexan
9. A paramecium is a(n) \_\_\_\_\_.  
 (a) diatom (b) apicomplexan  
 (c) ciliate (d) metazoan
10. The largest seaweeds are \_\_\_\_\_.  
 (a) brown algae (b) dinoflagellates  
 (c) red algae (d) green algae
11. All of the organisms classified as \_\_\_\_\_ move and feed using cilia.  
 (a) diplomonads (b) apicomplexans  
 (c) diatoms (d) ciliates
12. Which group is characterized by cells with fine hairlike projections on their flagella?  
 (a) Alveolata (b) Euglenozoa  
 (c) Metazoa (d) Stramenopila
13. Which of these algal groups possess a photosynthetic pigment that allows them to live in deep water?  
 (a) brown algae (b) green algae  
 (c) metazoans (d) red algae
14. Which of these groups includes both aquatic decomposers and the parasites responsible for the powdery mildew of grapes and late potato blight?  
 (a) red algae (b) diatoms  
 (c) water molds (d) plants
15. Which algal group has chloroplasts much like those of green plants in structure and pigment makeup?  
 (a) golden algae (b) chlorophytes  
 (c) diatoms (d) red algae
16. In general, how do algae and protozoans differ?  
 (a) Protozoans can move and algae cannot.  
 (b) Algae are free-living, and protozoans are parasitic.  
 (c) Protozoans are autotrophic, and algae are heterotrophic.  
 (d) Algae are photosynthetic, and almost all protozoans are heterotrophic.
17. \_\_\_\_\_ are eukaryotic autotrophs that float near the surface of water and are the basis of the food chain.  
 (a) Zooplankton  
 (b) Slime molds  
 (c) Phytoplankton  
 (d) Cyanobacteria

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18. Most protozoologists now regard the protozoa as a subkingdom consisting of  
 (a) 5 phyla (b) 7 phyla  
 (c) 8 phyla (d) 10 phyla
  19. What will happen if a marine protozoan is transferred to fresh water  
 (a) it bursts  
 (b) it enlarges but shrinks again  
 (c) it shrinks  
 (d) does not have any effect
  20. Mode of nutrition in *Engleina* is  
 (a) holozoic  
 (b) holophytic  
 (c) holophytic and saprozoic  
 (d) none of these
  21. Secondary host for sleeping sickness parasite is  
 (a) sand-fly (b) house-fly  
 (c) tse-tse fly (d) fruit-fly
  22. Contractile vacuole in protozoans is similar in function to  
 (a) vertebrate kidney  
 (b) vertebrate heart  
 (c) vertebrate lungs  
 (d) all of these
  23. "Sleeping sickness" is caused by  
 (a) *T.b.brucei* (b) *T.b.gambiense*  
 (c) *T.b.rhodesiense* (d) both b and c
  24. *Entamoeba histolytica* differs from amoeba in not having a  
 (a) nucleus  
 (b) food vacuole  
 (c) contractile vacuole  
 (d) none
  25. Which one parasitizes silk worms?  
 (a) *Nosema bombicus*  
 (b) *Nosema apis*  
 (c) *Giardia*  
 (d) *Cryptosporidium*
  26. That causes malaria in which the paroxysms reoccur every 48 hours  
 (a) *Plasmodium vivax*  
 (b) *P.falciparum*  
 (c) *P.malariae*  
 (d) *P.ovale*
  27. The disease pebrine that occurs in silk worms is caused by members of the phylum  
 (a) Myxozoa (b) Acetospora  
 (c) Microspora (d) Ciliophora
  28. The specialized region in protozoa that is analogous to a mouth is the  
 (a) vacuole (b) cytophyge  
 (c) food vacuole (d) cytopharynx
  29. Conjugation in *Paramecium* occurs for  
 (a) sexual reproduction  
 (b) asexual reproduction  
 (c) rejuvenation  
 (d) fragmentation of the body
  30. Schizont stage of life cycle of malarial parasite occurs in  
 (a) RBC of man  
 (b) stomach of mosquito  
 (c) blood of mosquito  
 (d) none of these
  31. *Entamoeba histolytica* cause  
 (a) dysentery (b) typhoid  
 (c) malaria (d) filaria
  32. *Plasmodium* is a  
 (a) digenetic parasite  
 (b) monogenetic parasite  
 (c) polygenetic parasite  
 (d) none of these
  33. Multinucleate amoeba is  
 (a) Amoeba verrucosa  
 (b) *Pelomyxa palustris*  
 (c) Amoeba radiosa  
 (d) Amoeba discoides
  34. *Entamoeba* is a  
 (a) monogenetic parasite  
 (b) digenetic parasite  
 (c) polygenetic parasite  
 (d) none of these
  35. Nutrition in Amoeba is  
 (a) holozoic (b) holophytic  
 (c) saprozoic (d) none of these
- ANSWERS**
- |       |       |       |       |
|-------|-------|-------|-------|
| 1. d  | 2. c  | 3. d  | 4. b  |
| 5. b  | 6. c  | 7. b  | 8. d  |
| 9. c  | 10. a | 11. d | 12. d |
| 13. d | 14. c | 15. b | 16. d |
| 17. c | 18. b | 19. b | 20. c |
| 21. c | 22. a | 23. d | 24. c |
| 25. a | 26. a | 27. c | 28. d |
| 29. a | 30. a | 31. a | 32. a |
| 33. b | 34. a | 35. a |       |

## 5.5: PLANT DIVERSITY I: HOW PLANTS COLONIZED LAND

1. Angiosperms are most closely related to \_\_\_\_\_.
  - green algae
  - charophyceans
  - bryophytes
  - gymnosperms
2. Which of these was the dominant plant group at the time that dinosaurs were the dominant animals?
  - seedless vascular plants
  - charophyceans
  - gymnosperms
  - angiosperms
3. Sori can be found in which of the following?
  - mosses
  - liverworts
  - hornworts
  - pterophytes
4. Plants evolved from green algae approximately \_\_\_\_\_ million years ago.
  - 130
  - 400
  - 475
  - 2,200
5. \_\_\_\_\_ are an example of seedless vascular plants.
  - Mosses
  - Lilacs
  - Charophyceans
  - Ferns
6. The living plants that are most similar to the first plants to bear gametangia are the \_\_\_\_\_.
  - bryophytes
  - charophyceans
  - seedless vascular plants
  - gymnosperms
7. Which of these characteristics is shared by algae and seed plants?
  - embryo development within gametangia
  - roots and shoots
  - vascular tissue
  - chloroplasts
8. During the Carboniferous period, forests consisting mainly of \_\_\_\_\_ produced vast quantities of organic matter, which was buried and later became coal.
  - early angiosperms
  - ferns and other seedless plants
  - giant mosses
  - gymnosperms
9. In moss, \_\_\_\_\_ produce sperm.
  - sporangia
  - antheridia
  - embryos
  - archegonia
10. The sperm produced by mosses require \_\_\_\_\_ to reach an archegonium.
  - wind
  - light
  - moisture
  - the development of a flower
11. In the moss life cycle \_\_\_\_\_ cells within a sporangium undergo \_\_\_\_\_ to produce spores.
  - diploid... meiosis... haploid
  - haploid... mitosis... haploid
  - diploid... mitosis... diploid
  - diploid... mitosis... haploid
12. In mosses gametes are produced by \_\_\_\_\_. In ferns gametes are produced by \_\_\_\_\_.
  - binary fission... mitosis
  - meiosis... meiosis
  - mitosis... mitosis
  - mitosis... meiosis
13. In contrast to bryophytes, in vascular plants the dominant stage of the life cycle is the \_\_\_\_\_.
  - archegonium
  - sporophyte
  - antheridium
  - gametophyte
14. Where do fern antheridia develop?
  - on the underside of the gametophyte
  - on the tip of the gametophyte
  - on the tip of the sporophyte
  - on the tip of the haploid protonema
15. The conspicuous part of a fern plant is a \_\_\_\_\_.
  - haploid gametophyte
  - diploid gametophyte
  - diploid sorus
  - diploid sporophyte
16. Which term below is the proposed kingdom that would include embryophytes and charophyceans?
  - Bryophyta
  - Plantae
  - Streptophyta
  - Viridiplantae
17. Seedless plants include \_\_\_\_\_.
  - bryophytes, ferns, and horsetails
  - only nonvascular plants
  - bryophytes and gymnosperms
  - mosses and angiosperms
18. The closest algal relatives of land plants are \_\_\_\_\_.
  - chrysophytes
  - psilophytes
  - charophyceans
  - rhodophytes

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19. In seedless plants, a fertilized egg will develop into \_\_\_\_\_.
    - spores
    - gametes
    - a gametophyte
    - a sporophyte
  20. The diploid generation of the plant life cycle always \_\_\_\_\_.
    - produces spores
    - is called the gametophyte
    - is larger and more conspicuous than the haploid stage
    - develops from a spore
  21. All of the following structures may be a part of a bryophyte's life cycle except \_\_\_\_\_.
    - rhizoids
    - megaphylls
    - archegonia
    - sporangia
  22. Most bryophytes, such as mosses, differ from all other plants in that they \_\_\_\_\_.
    - do not produce flowers
    - have cones but no seeds
    - have flagellated sperm
    - lack vascular tissue
  23. Alternation of generations \_\_\_\_\_.
    - is unique to plants
    - is distinguished by a unicellular haploid stage and a multicellular diploid generation
    - consists of a diploid gametophyte stage alternating with a haploid sporophyte stage
    - is distinguished by haploid and diploid stages that are both multicellular
  24. Plants undergo alternation of generations in which \_\_\_\_\_.
    - the sporophyte generation alternates with the gametophyte generation
    - the vascular generation alternates with the nonvascular generation
    - male plants alternate with female plants
    - antheridia alternate with archegonia
  25. The development of the \_\_\_\_\_ prevents plants from drying out and protects them from microbes.
    - cuticle
    - apical meristem
    - gametangia
    - terpene
  26. Rhizoids \_\_\_\_\_.
    - are found in liverworts and hornworts, but not in mosses
  27. Which structure of a bryophyte sporophyte is specialized for gradual spore discharge?
    - seta
    - calyptra
    - peristome
    - stomata
  28. In the life cycle of a fern, the multicellular male gametangium (the sex organ that produces sperm cells) is called a(n) \_\_\_\_\_.
    - antheridium
    - archegonium
    - frond
    - rhizome
  29. Fern gametophytes are \_\_\_\_\_.
    - photosynthetic diploid organisms
    - produced from haploid gametes
    - part of the asexual life cycle
    - free-living, multicellular organisms
  30. Which of the following produce eggs and sperm?
    - megaphylls
    - fern sporophytes
    - moss gametophytes
    - megaspores
  31. Fertilization in moss occurs when sperm swim from a(n) \_\_\_\_\_ and down the neck of a(n) \_\_\_\_\_.
    - antheridium ... sporangium
    - sporangium ... antheridium
    - antheridium ... archegonium
    - archegonium ... antheridium
  32. What structures allow plants to readily take up carbon dioxide from the atmosphere?
    - stomata
    - cuticles
    - gametangia
    - mitochondria

### ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. d  | 2. c  | 3. d  | 4. c  |
| 5. d  | 6. a  | 7. d  | 8. b  |
| 9. b  | 10. c | 11. a | 12. c |
| 13. b | 14. a | 15. d | 16. c |
| 17. a | 18. c | 19. d | 20. a |
| 21. b | 22. d | 23. d | 24. a |
| 25. a | 26. d | 27. c | 28. a |
| 29. d | 30. c | 31. c | 32. A |

## 5.6: PLANT DIVERSITY II: THE EVOLUTION OF SEED PLANTS

1. Human survival literally depends on the produce of \_\_\_\_\_.
  - (a) angiosperms
  - (b) gymnosperms
  - (c) ginkgoes
  - (d) cycads
  
2. In pines, the female gametophyte contains \_\_\_\_\_, each of which contains a(n) \_\_\_\_\_.
  - (a) archegonia... egg
  - (b) archegonia... sperm cell
  - (c) antheridia... egg
  - (d) antheridia... sperm cell
  
3. In pines, an embryo is a(n) \_\_\_\_\_.
  - (a) seed
  - (b) immature sporophyte
  - (c) food reserve for the immature sporophyte
  - (d) immature male gametophyte
  
4. In pine trees, pollen grains get to the ovule via the \_\_\_\_\_.
  - (a) micropyle
  - (b) eggs
  - (c) megasporangium
  - (d) pollen cone
  
5. Which of these statements is true about the gametophyte tissue that surrounds the pine embryo?
  - (a) It functions as a haploid food reserve.
  - (b) It functions as a diploid food reserve.
  - (c) It functions as a triploid food reserve.
  - (d) It develops from the fusion of a microspore and a megasporangium.
  
6. Of the four haploid cells produced by a pine cone's megasporangium (megaspore mother cell), \_\_\_\_\_ survive(s).
  - (a) one
  - (b) two
  - (c) three
  - (d) four
  
7. In the pine, microsporangia form \_\_\_\_\_ microspores by \_\_\_\_\_.
  - (a) triploid, fertilization
  - (b) diploid, mitosis
  - (c) diploid, meiosis
  - (d) haploid, meiosis
  
8. Unlike most angiosperms, grasses are pollinated by wind. As a consequence, some unnecessary parts of grass flowers have almost disappeared. Which of the following parts would you expect to be most reduced in a grass flower?
  - (a) ovaries
  - (b) petals
  - (c) anthers
  - (d) carpels
  
9. Which of these is unique to flowering plants?
  - (a) a dominant sporophyte generation
  - (b) an embryo surrounded by nutritive tissue
  - (c) haploid gametophytes
  - (d) double fertilization
  
10. The male gametophytes of flowering plants are also referred to as \_\_\_\_\_.
  - (a) endosperm
  - (b) male sporophytes
  - (c) megasporangium
  - (d) pollen grains
  
11. In flowering plants the integuments of the ovule develop into a(n) \_\_\_\_\_.
  - (a) endosperm
  - (b) cotyledon
  - (c) seed coat
  - (d) sporophyte
  
12. A carpel is composed of \_\_\_\_\_.
  - (a) ovary, ovule, and anther
  - (b) ovule, megasporocyte, and anther
  - (c) zygote, anther, and endosperm
  - (d) stigma, style, and ovary
  
13. In flowering plants one megasporangium gives rise to \_\_\_\_\_ nuclei.
  - (a) four diploid
  - (b) four haploid
  - (c) eight haploid
  - (d) eight diploid
  
14. A stamen consists of \_\_\_\_\_.
  - (a) anther and filament
  - (b) stigma and style
  - (c) stigma and anther
  - (d) stigma and filament
  
15. In angiosperms, pollination is the transfer of pollen grain to the \_\_\_\_\_ of a flower on the same plant or another plant of the same species.
  - (a) style
  - (b) anther
  - (c) ovulate cone
  - (d) stigma
  
16. Which one of the following organisms has both gametophyte and sporophyte stages in its life cycle but spends the largest fraction of that life cycle in the gametophyte stage?
  - (a) moss
  - (b) green alga (*Ulva*)
  - (c) gymnosperms
  - (d) angiosperms

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17. When you look at a pine or maple tree, the plant you see is \_\_\_\_\_.
    - (a) haploid sporophyte
    - (b) diploid sporophyte
    - (c) haploid gametophyte
    - (d) diploid gametophyte
  
  18. All seed plants \_\_\_\_\_.
    - (a) produce flowers
    - (b) are heterosporous
    - (c) produce antheridia and archegonia on the same gametophyte
    - (d) exhibit a dominant gametophyte
  
  19. The adaptation that made possible the colonization of dry environments by seed plants is most likely the result of the evolution of \_\_\_\_\_.
    - (a) ovules
    - (b) pollen
    - (c) heterospory
    - (d) sporophylls
  
  20. Gymnosperms were most abundant during the \_\_\_\_\_.
    - (a) Paleozoic
    - (b) Precambrian
    - (c) Cenozoic
    - (d) Mesozoic
  
  21. In pine, the embryo develops within the \_\_\_\_\_.
    - (a) female gametophyte
    - (b) male gametophyte
    - (c) megasporangium
    - (d) microsporophyll
  
  22. The major difference between angiosperms and gymnosperms comes from the \_\_\_\_\_ covering over the ovule.
    - (a) presence or absence of a protective covering over the ovule
    - (b) presence or absence of vascular structures
    - (c) presence or absence of alternation of generations
    - (d) dominance or lack of dominance of the sporophyte generation
  
  23. Angiosperms are different from all other plants because they have \_\_\_\_\_.
    - (a) a vascular system
    - (b) flowers
    - (c) a life cycle that involves alternation of generations
    - (d) seeds
  
  24. A bright pink flower with deep floral tubes will most likely be pollinated by which mechanism?
    - (a) birds with long beaks
    - (b) bats
    - (c) honeybees
    - (d) wind
  
  25. During pollination, pollen grains are transferred from the \_\_\_\_\_ to the \_\_\_\_\_.
    - (a) ovary... anther
    - (b) stigma... ovary
    - (c) anther... sepal
    - (d) anther... stigma
- ANSWERS**
- |       |       |       |       |
|-------|-------|-------|-------|
| 1. a  | 2. a  | 3. b  | 4. a  |
| 5. a  | 6. a  | 7. d  | 8. b  |
| 9. d  | 10. d | 11. c | 12. d |
| 13. c | 14. a | 15. d | 16. a |
| 17. b | 18. b | 19. b | 20. d |
| 21. a | 22. a | 23. b | 24. a |
| 25. d | 26. d | 27. d | 28. d |
| 29. a | 30. c | 31. a | 32. b |
| 33. d |       |       |       |

## 5. 7: FUNGI

1. As a group, fungi are \_\_\_\_\_.
  - photoautotrophs
  - decomposers
  - herbivores
  - carnivores
2. Fungi release digestive enzymes into their \_\_\_\_\_.
  - surroundings
  - gastrovascular cavity
  - stomach
  - hyphae
3. Basidia produce spores by a process known as \_\_\_\_\_.
  - decomposition
  - mitosis
  - meiosis
  - hyphae
4. Fungi produce \_\_\_\_\_ spores.
  - dikaryotic
  - heterokaryotic
  - haploid
  - diploid
5. Karyogamy produces a \_\_\_\_\_.
  - diploid zygote
  - haploid zygote
  - spores
  - mycelium
6. The asexual spores produced by members of the phylum Ascomycota are called \_\_\_\_\_.
  - conidia
  - lichens
  - mushrooms
  - mycorrhizae
7. Which of these contains two haploid nuclei?
  - the heterokaryotic stage of the fungal life cycle
  - zygote
  - spore-producing structures
  - mycelium
8. Zygosporangia are \_\_\_\_\_.
  - diploid
  - haploid
  - heterokaryotic
  - haplodiploid
9. Lichens are \_\_\_\_\_.
  - mutualistic associations of fungi and plant roots
  - predatory fungi
  - the sexual stage of deuteromycetes
  - symbiotic associations of photosynthesizers and fungi
10. Cup fungi are in the phylum \_\_\_\_\_.
  - Zygomycota
  - Chytridiomycota
  - Ascomycota
  - Chordata
11. A dramatic example of the pathogenicity of certain fungi is the virtual elimination of the American elm by \_\_\_\_\_.
  - ergots
  - truffles
  - an ascomycete
  - a shelf fungus
12. In sac fungi, karyogamy and meiosis occur in \_\_\_\_\_.
  - ascospores
  - antheridia
  - asci
  - ascogonia
13. A nucleus within an ascus undergoes meiosis, producing four haploid spores, which then undergo mitosis, producing eight haploid ascospores. These haploid ascospores contain a maximum of \_\_\_\_\_ different genetic types.
  - one
  - two
  - three
  - four
14. In contrast to plants, the cell walls of fungi are composed of \_\_\_\_\_.
  - lignin
  - cellulose
  - peptidoglycan
  - chitin
15. In club fungi, karyogamy and meiosis occur in \_\_\_\_\_.
  - basidiospores
  - basidia
  - ovule
  - asci
16. Which of the following is a difference between plants and fungi?
  - Plants have diploid and haploid phases, and fungi have only haploid stages.
  - Fungi have cell walls.
  - Fungi are heterotrophic, and plants are autotrophic.
  - Plants produce spores.
17. Hyphae with two nuclei per cell are called \_\_\_\_\_.
  - diploid
  - multicellular
  - dikaryotic
  - asci (plural of ascus)
18. Fungi obtain nutrients through \_\_\_\_\_.
  - endocytosis
  - chemosynthesis
  - photosynthesis
  - absorption

19. The body of most fungi consists of threadlike \_\_\_\_\_, which form a network called a \_\_\_\_\_.
  - mycelia, dikaryon
  - hyphae, chytrid
  - mycelia, hypha
  - hyphae, mycelium
20. Fungi have cell walls made of \_\_\_\_\_.
  - chitin
  - cellulose
  - peptidoglycan
  - hyphae
21. Fungi cannot make their own food, and they cannot move. How do they obtain nutrition once they have exhausted their food source?
  - They produce huge numbers of tiny spores.
  - They grow rapidly.
  - They poison anything nearby.
  - They produce huge numbers of spores, and they grow rapidly.
22. The diploid phase of the life cycle is shortest in which of the following?
  - moss
  - angiosperm
  - fungus
  - fern
23. Fungi are classified on the basis of \_\_\_\_\_.
  - their source of food
  - whether they form molds
  - their sexual stage
  - their commercial use
24. An important example of interaction between fungi and certain other organisms is mycorrhizae, in which the fungal partners
  - help plants take up nutrients and water
  - cause the decay of cellulose and lignin
  - control soil nematodes
  - sicken herbivores that attempt to feed on plants

### ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. b  | 2. a  | 3. c  | 4. c  |
| 5. a  | 6. a  | 7. a  | 8. c  |
| 9. d  | 10. c | 11. c | 12. c |
| 13. d | 14. d | 15. b | 16. c |
| 17. c | 18. d | 19. d | 20. a |
| 21. d | 22. c | 23. c | 24. a |
| 25. a | 26. c | 27. a |       |

## 5.8: AN INTRODUCTION TO ANIMAL DIVERSITY

1. Which of the following is not a difference between protostomes and deuterostomes?
  - the presence of a body cavity
  - generally, protostomes are schizocoelous and deuterostomes are enterocoelous
  - the fate of the blastopore
  - the cleavage plane of the embryo
2. Protostomous animals are those in which the \_\_\_\_\_.
  - blastopore forms the anus
  - ectoderm forms the muscles
  - digestive tract is incomplete
  - cell fate is determined early during embryonic development
3. Protostomous animals are those in which the \_\_\_\_\_.
  - blastopore forms the anus
  - ectoderm forms the muscles
  - digestive tract is incomplete
  - cell fate is determined early during embryonic development
4. One of the two taxa that molecular studies divide the protostomes into is called Ecdysozoa. What characteristic is this taxon named for?
  - a horseshoe-shaped crown of ciliated tentacles
  - a trochophore larva
  - the secretion of stiff external skeletons that must be shed to allow for growth
  - segmented bodies
5. Cnidarians are in the \_\_\_\_\_ clade.
  - parazoan
  - protostome
  - radiate
  - coelomate
6. Echinoderms are \_\_\_\_\_.
  - deuterostomes
  - parazoans
  - protostomes
  - radiata
7. Molluscs are \_\_\_\_\_.
  - protostomes
  - acoelomates
  - parazoans
  - deuterostomes
8. Why are annelids, arthropods, and mollusks placed in the same clade?
  - They are triploblastic.
  - They are protostomes.
  - They are bilaterally symmetrical.
9. Roundworms are classified in the phylum \_\_\_\_\_.
  - Cnidaria
  - Nematoda
  - Arthropoda
  - Porifera
10. At the phylum level, you are most closely related to a(n) \_\_\_\_\_.
  - clam
  - sea star
  - earthworm
  - jelly
11. A graduate student finds an organism in a pond and thinks it is a freshwater sponge. A postdoctoral student thinks it looks more like an aquatic fungus. How can they decide whether it is an animal or a fungus?
  - See if it reproduces sexually.
  - Figure out whether it is autotrophic or heterotrophic.
  - See if it is a eukaryote or prokaryote.
  - Look for cell walls under a microscope.
12. All animals can trace their lineage to a common ancestor that lived in the \_\_\_\_\_.
  - Neoproterozoic era
  - Jurassic
  - Pliocene
  - Devonian
13. Most animal body plans first appeared during the \_\_\_\_\_.
  - Carboniferous
  - Devonian
  - Pleistocene
  - Cambrian
14. Which of the following is radially symmetrical?
  - a doughnut
  - an automobile
  - a spoon
  - a dog
15. Gastrulation is the process that directly forms the \_\_\_\_\_.
  - central nervous system
  - blastula
  - organs
  - primary germ layers
16. Which of the following is not a characteristic of all animals?
  - They are all multicellular.
  - They have tissues, organs, and organ systems.
  - They are eukaryotes.
  - They ingest their food.

17. An important trend in animal evolution was cephalization. An animal is said to have advanced cephalization when it \_\_\_\_\_.
  - is large
  - has bilateral symmetry
  - has an aggregation of sensory neurons at the anterior end
  - has tissue specialization
18. Which of the following animals does not have a body cavity?
  - flatworm
  - ant
  - mouse
  - clam
19. During embryological development, the anus forms before the mouth in \_\_\_\_\_.
  - flatworms
  - arthropods
  - slugs
  - humans
20. An animal is called a protostome or a deuterostome based on \_\_\_\_\_.
  - whether it has a blastocoel
  - the number of germ layers it has
  - the fate of its blastopore
  - the symmetry of its gastrula
21. Which characteristic below is shared by plants, fungi, and animals?
  - They all have cell walls.
  - All are multicellular eukaryotes.
  - All are held together by structural proteins.
  - All have intracellular junctions known as desmosomes.
22. Animals probably evolved from colonial protists. How do animals differ from these protists?
  - The protists were prokaryotic.
  - Animals have more specialized cells.
  - The protists were heterotrophic.
  - The protists were autotrophic.
23. During the development of most animals, cleavage leads to \_\_\_\_\_.
  - the formation of a zygote
  - the formation of a blastula
  - the formation of a gastrula
  - fertilization
24. Which example below is a common feature of all animals?
  - a homeobox-containing family of genes called Hox genes
  - bilateral symmetry
  - true tissues
  - a true coelom
25. Which example below is not a current hypothesis regarding the Cambrian explosion?
  - An increase in atmospheric CO<sub>2</sub> led to an explosion of plants and life-forms that fed on them.
  - Predator-prey relationships led to diversity through natural selection.
  - A rise in atmospheric oxygen led to success of large animals with high metabolic rates.
  - Evolution of the Hox gene complex provided developmental flexibility.
26. Which of the following occurred during the Mesozoic era?
  - Marine reptiles disappeared.
  - Large mammalian herbivores and carnivores arose.
  - The tetrapod body plan became modified for powered flight in birds.
  - Fishes emerged as top predators in marine food webs.
27. Symmetry is one of the most basic characteristics of animals. The group that has a different symmetry from the other four groups listed here is the \_\_\_\_\_.
  - arthropods
  - chordates
  - mollusks
  - jellies
28. Which of the following is associated with bilateral symmetry?
  - a sessile lifestyle
  - a lack of true tissues
  - parazoans
  - cephalization
29. "Cephalization" refers to having \_\_\_\_\_.
  - radial symmetry
  - a right and a left side
  - a head
  - a dorsal and a ventral surface
30. Unlike other animals, sponges \_\_\_\_\_.
  - are unicellular
  - possess cell walls
  - lack true tissues
  - exhibit bilateral symmetry
31. Which of the following is not a characteristic of cnidarians?
  - gastrovascular cavity
  - ectoderm
  - mesoderm
  - a lack of true tissues

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32. Ectoderm can give rise to \_\_\_\_; mesoderm can give rise to \_\_\_\_; endoderm can give rise to \_\_\_\_.  
 (a) muscle... the outer covering of the animal... the central nervous system  
 (b) the lining of the digestive tract... muscle... the outer covering of the animal  
 (c) the central nervous system... the outer covering of the animal... the lining of the digestive tube  
 (d) the central nervous system... muscle... the lining of the digestive tube
33. All animals with bilateral symmetry have \_\_\_\_ germ tissue layer(s).  
 (a) one  
 (b) two  
 (c) three  
 (d) four
34. A true coelom is \_\_\_\_.  
 (a) a body cavity lined with tissues derived from the endoderm  
 (b) a body cavity lined with endoderm and mesoderm  
 (c) a body cavity lined with mesoderm  
 (d) a thoracic body cavity
35. One of the primary developmental/anatomical characteristics distinguishing the major animal phyla is the condition of the body cavity. A pseudocoelomate animal is one in which the body cavity is \_\_\_\_.  
 (a) bounded completely by mesoderm  
 (b) filled by a solid mass of mesoderm  
 (c) bounded completely by endoderm  
 (d) bounded partly by mesoderm
36. The difference between pseudocoelomates and coelomates is that pseudocoelomates \_\_\_\_; whereas coelomates \_\_\_\_.  
 (a) do not have a body cavity... have a body cavity  
 (b) exhibit radial symmetry... exhibit bilateral symmetry  
 (c) are parazoans... are eumetazoans  
 (d) have a body cavity partially lined with tissue derived from mesoderm... have a body cavity completely lined with tissue derived from mesoderm
37. The presence of a coelom is advantageous because \_\_\_\_.  
 (a) it allows for a third embryonic germ layer  
 (b) it permits the development of an open circulatory system  
 (c) it allows room for the development and movement of internal organs  
 (d) it is necessary for a complete digestive
38. Which example below is **not** a major feature of animal body plans?  
 (a) symmetry  
 (b) type of eye  
 (c) tissues  
 (d) body cavities
39. The zygotes of many protostomes undergo \_\_\_\_ development and \_\_\_\_ cleavage.  
 (a) spiral... radial  
 (b) determinate... indeterminate  
 (c) radial... indeterminate  
 (d) determinate... spiral
40. An animal with a true coelom that has cleavage must be a \_\_\_\_.  
 (a) radial... protostome  
 (b) radial... deuterostome  
 (c) spiral... deuterostome  
 (d) spiral... cyclostome
41. An animal with a true coelom that has cleavage must be a \_\_\_\_.  
 (a) radial... protostome  
 (b) radial... deuterostome  
 (c) spiral... deuterostome  
 (d) spiral... cyclostome
42. Animals probably evolved from colonial protists. How do animals differ from these protist ancestors?  
 (a) The protists were prokaryotic.  
 (b) Animals have more specialized cells.  
 (c) The protists were heterotrophic.  
 (d) The protists were autotrophic.
43. During the development of most animals, cleavage leads to \_\_\_\_.  
 (a) the formation of a zygote  
 (b) the formation of a blastula  
 (c) the formation of a gastrula  
 (d) fertilization
44. Which of the following is associated with bilateral symmetry?  
 (a) a sessile lifestyle  
 (b) a lack of true tissues  
 (c) parazoans  
 (d) cephalization
45. "Cephalization" refers to having \_\_\_\_.  
 (a) radial symmetry  
 (b) a right and a left side  
 (c) a head  
 (d) a dorsal and a ventral surface
46. Unlike other animals, sponges \_\_\_\_.  
 (a) are unicellular  
 (b) possess cell walls  
 (c) lack true tissues  
 (d) exhibit bilateral symmetry

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## ANSWERS

47. Which of the following is **not** a characteristic of cnidarians?  
 (a) gastrovascular cavity  
 (b) ectoderm  
 (c) mesoderm  
 (d) a lack of true tissues
48. The difference between pseudocoelomates and coelomates is that pseudocoelomates \_\_\_\_; whereas coelomates \_\_\_\_.  
 (a) do not have a body cavity... have a body cavity  
 (b) exhibit radial symmetry... exhibit bilateral symmetry  
 (c) are parazoans... are eumetazoans  
 (d) have a body cavity partially lined with tissue derived from mesoderm... have a body cavity completely lined with tissue derived from mesoderm
1. a      2. d      3. d      4. c  
 5. c      6. a      7. a      8. b  
 9. b      10. b      11. d      12. a  
 13. d      14. a      15. d      16. b  
 17. c      18. a      19. d      20. c  
 21. b      22. b      23. b      24. a  
 25. a      26. c      27. d      28. d  
 29. c      30. c      31. c      32. d  
 33. c      34. c      35. d      36. d  
 37. c      38. b      39. d      40. b  
 41. b      42. b      43. b      44. d  
 45. c      46. c      47. c      48. D

## 5.9: INVERTEBRATES

1. Which of these statements is true of sponges?
  - (a) They have an open circulatory system.
  - (b) They are segmented animals.
  - (c) They have no true tissues.
  - (d) Food is digested within a gastrovascular cavity.
2. Which of these statements is true of cnidarians?
  - (a) They have three tissue layers (they are triploblastic)
  - (b) They respire via book lungs.
  - (c) They have a nerve net.
  - (d) They are segmented.
3. Of the phyla studied in this exercise, the simplest (most primitive) one to have three tissue layers is the phylum \_\_\_\_.
  - (a) Cnidaria
  - (b) Arthropoda
  - (c) Platyhelminthes
  - (d) Chordata
4. Which of these statements is true of nematodes?
  - (a) They lack a nervous system.
  - (b) They lack a body cavity.
  - (c) They have a digestive system with two openings.
  - (d) Their body plan has two main tissue layers.
5. Nematodes are most closely related to \_\_\_\_.
  - (a) flatworms
  - (b) arthropods
  - (c) rotifers
  - (d) annelids
6. Earthworms are in the phylum \_\_\_\_.
  - (a) Nematoda
  - (b) Annelida
  - (c) Chordata
  - (d) Platyhelminthes
7. Which of these statements is true of earthworms?
  - (a) They lack an excretory system.
  - (b) They have a body cavity.
  - (c) They have a bony endoskeleton.
  - (d) Their digestive system consists of a gastrovascular cavity.
8. Snails are classified in the phylum \_\_\_\_.
  - (a) Chordata
  - (b) Mollusca
  - (c) Cnidaria
  - (d) Arthropoda
9. Which of these characteristics is common to both snails and earthworms?
  - (a) a closed circulatory system
10. Grasshoppers respire via \_\_\_\_.
  - (a) their skin
  - (b) nephridia
  - (c) book lungs
  - (d) spiracles and tracheae
11. Grasshoppers are classified in the phylum \_\_\_\_.
  - (a) Annelida
  - (b) Mollusca
  - (c) Nematoda
  - (d) Arthropoda
12. As adults, sea stars \_\_\_\_.
  - (a) exhibit bilateral symmetry
  - (b) exhibit radial symmetry
  - (c) are asymmetrical
  - (d) exhibit no symmetry
13. Which of these is a characteristic of sea stars?
  - (a) a closed circulatory system
  - (b) nephridia
  - (c) a brain
  - (d) tube feet
14. Which of these characteristics is shared by both dogs and sea stars?
  - (a) an endoskeleton
  - (b) a closed circulatory system
  - (c) no excretory system
  - (d) a brain
15. Dogs are classified in the phylum \_\_\_\_.
  - (a) Echinodermata
  - (b) Cnidaria
  - (c) Arthropoda
  - (d) Chordata
16. The animal phylum most like the protists that gave rise to the animal kingdom is \_\_\_\_.
  - (a) Echinodermata
  - (b) Cnidaria
  - (c) Ctenophora
  - (d) Porifera
17. Which of the following is not a characteristic of cnidarians?
  - (a) gastrovascular cavity
  - (b) cnidocytes
  - (c) mesoderm
  - (d) nematocysts
18. All of the following are true of the phylum Platyhelminthes except \_\_\_\_.
  - (a) they are dorsoventrally flattened
  - (b) they are triploblastic
  - (c) they are all parasitic
  - (d) they are bilaterally symmetrical

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19. Some species of rotifers consist solely of females. Their method of reproduction is described as \_\_\_\_.
    - (a) budding
    - (b) binary fission
    - (c) sperm-stealing
    - (d) parthenogenesis
  20. Bryozoans, phoronids, and brachiopods are collectively referred to as \_\_\_\_.
    - (a) flatworms
    - (b) trochophorates
    - (c) eumetazoans
    - (d) lophophorates
  21. Sponges feed by \_\_\_\_.
    - (a) filtering small particles from water
    - (b) scraping bacteria and algae from hard substrates
    - (c) paralyzing small crustaceans with stinging cells
    - (d) absorbing nutrients from the guts of their hosts
  22. Sponges lack \_\_\_\_.
    - (a) a complete digestive tract
    - (b) a nervous system
    - (c) the ability to make organic compounds from CO<sub>2</sub> and water
    - (d) all of the above
  23. Some digestion in sponges takes place in the \_\_\_\_.
    - (a) amoebocytes
    - (b) osculum
    - (c) gastrovascular cavity
    - (d) spongocoel
  24. Which characteristic is **Not** true of sponges?
    - (a) They have collar cells.
    - (b) They basically consist of two layers of cells with a noncellular gelatinous layer between them.
    - (c) They have holes, or pores, in specialized cells, through which water enters.
    - (d) All of the above are characteristics of sponges.
  25. Which one of following features is characteristic of the poriferan (sponge) body plan or life history?
    - (a) closed circulatory system
    - (b) ventral nerve chord
    - (c) motile larvae
    - (d) extracellular digestion
  26. Some cnidarians go through both a motile and a sessile (attached) stage during their life cycle. The attached stage is called a(n) \_\_\_\_.
    - (a) embryo
    - (b) medusa
    - (c) larva
    - (d) polyp
  27. Through what means do coral animals capture their food?
    - (a) photosynthesis
    - (b) tentacles that trap food particles
  28. \_\_\_\_\_ are members of the phylum \_\_\_\_\_ and feed by \_\_\_\_\_.
    - (a) Sponges... Urochordata... scraping away organic films covering the rocks on which they grow
    - (b) Leeches... Porifera... filtering tiny particles from water passing through their bodies
    - (c) Corals... Cnidaria... using stinging cells to capture small animals that venture too close to them
    - (d) Bivalves... Annelida... killing small animals with electric shock
  29. Jellies and corals are members of the same \_\_\_\_ all members of which \_\_\_\_.
    - (a) family... have a complete circulatory system
    - (b) phylum... have a colonial lifestyle
    - (c) order... are herbivorous
    - (d) phylum... have special stinging cells on their tentacles
  30. The choanocyte of a sponge and the nematocyst of a cnidarian both function in \_\_\_\_.
    - (a) reproduction
    - (b) locomotion
    - (c) obtaining food
    - (d) locating mates
  31. Which of the following statements does not describe the phylum Cnidaria?
    - (a) The bodies of its members are organized around a gastrovascular cavity.
    - (b) This phylum has more species than any other phylum.
    - (c) The life cycles of many of its members alternate between a feeding polyp and a reproductive medusa.
    - (d) The bodies of its members are radially symmetrical and show no cephalization.
  32. Tapeworms are highly specialized worms that make their living as endoparasites. To which of the following phyla and classes do the tapeworms belong?
    - (a) phylum Annelida, class Oligochaeta
    - (b) phylum Annelida, class Hirudinoidea
    - (c) phylum Nematoda, class Polychaeta
    - (d) phylum Platyhelminthes, class Cestoidea
  33. Which of the following classes is (are) totally parasitic?
    - (a) Cestoidea
    - (b) Turbellaria
    - (c) Trematoda
    - (d) Cestoidea and Trematoda

34. The proglottids of a tapeworm contain an elaborate \_\_\_\_\_ system.  
 (a) sensory (b) digestive  
 (c) circulatory (d) reproductive
35. Some species of rotifers undergo parthenogenesis, which means that \_\_\_\_\_.  
 (a) their larval stage of development looks completely different from the adult stage  
 (b) they shed their exoskeleton as they grow  
 (c) each individual functions as both male and female in sexual reproduction by producing sperm and eggs  
 (d) the species consists of only females that produce more females from unfertilized eggs
36. Consider the following list of animals: giant squid, earthworm, largemouth bass, snail, and starfish. The two that belong to the same phylum are the \_\_\_\_\_.  
 (a) bass and giant squid... Mollusca  
 (b) earthworm and tapeworm... Annelida  
 (c) coral and starfish... Echinodermata  
 (d) giant squid and snail... Mollusca
37. An active marine predator is found possessing these characteristics: a series of tentacles (modified from the foot), a highly developed nervous system, and elaborate eyes. To which of the following animal classes does this organism most likely belong?  
 (a) Chelicerata (b) Cephalopoda  
 (c) Polyplacophora (d) Polychaeta
38. Cephalopods are the only molluscs \_\_\_\_\_.  
 (a) without a mantle  
 (b) with a closed circulatory system  
 (c) that reproduce sexually  
 (d) with segmented bodies
39. Annelids \_\_\_\_\_.  
 (a) include leeches, earthworms, and polychaete worms  
 (b) have characteristically long bodies with both internal and external segmentation  
 (c) use their coeloms as hydrostatic skeletons  
 (d) all of the above
40. Earthworms are most closely related to \_\_\_\_\_.  
 (a) roundworms (b) sea urchins  
 (c) tapeworms (d) leeches
41. The excretory organs of earthworms are called \_\_\_\_\_.  
 (a) Malpighian tubules (b) contractile vacuoles  
 (c) metanephridia (d) flame cells
42. During reproduction by the oligochaete earthworm *Lumbricus* \_\_\_\_\_.  
 (a) each individual fertilizes its own eggs with its own sperm (in self-fertilization)  
 (b) fertilization takes place during copulation between males and females  
 (c) hermaphroditic individuals exchange sperm  
 (d) hermaphroditic individuals exchange eggs
43. Which one of the following is not a feature of polychaete worms (phylum Annelida, class Polychaeta)?  
 (a) the use of a mucous net for feeding  
 (b) a protostome pattern of embryonic development  
 (c) a marine environment  
 (d) a water vascular system
44. Leeches are members of the phylum \_\_\_\_\_.  
 (a) Nematoda (b) Cnidaria  
 (c) Platyhelminthes (d) Annelida
45. Which choice includes three different phyla of organisms commonly known as "worms"?  
 (a) Nematoda, Trematoda, Echinodermata  
 (b) Cnidaria, Arthropoda, Anthozoa  
 (c) Platyhelminthes, Annelida, Nematoda  
 (d) Nematoda, Anthozoa, Oligochaeta
46. Animals such as \_\_\_\_\_ are the simplest animals to have \_\_\_\_\_.  
 (a) sponges... bilateral symmetry  
 (b) flatworms... a body cavity  
 (c) roundworms... a complete digestive tract  
 (d) jellies... a complete digestive tract
47. An unidentified species of animal displays the following characteristics: bilateral symmetry, determinate embryonic cleavage, a complete digestive system, an open circulatory system, and distinct body segmentation. To which one of the following animal phyla does this species most likely belong?  
 (a) Cnidaria (b) Platyhelminthes  
 (c) Porifera (d) Arthropoda
48. The arthropods superficially resemble earthworms in that both groups \_\_\_\_\_ yet the two are distinctly different because arthropods, but not earthworms, \_\_\_\_\_.  
 (a) have prominently segmented bodies... have jointed appendages  
 (b) have closed circulatory systems... have bristles  
 (c) are cephalized and bilaterally symmetrical... have true organs  
 (d) have a true coelom... are protostomes

49. A major characteristic of arthropods is \_\_\_\_\_.  
 (a) flame cells  
 (b) radial symmetry  
 (c) a dorsal nerve cord  
 (d) a chitinous exoskeleton
50. In insects, gas exchange is accomplished by \_\_\_\_\_.  
 (a) Malpighian tubules (b) book lungs  
 (c) lungs (d) a tracheal system
51. Sowbugs are really crustaceans, not insects. Therefore, a sowbug does not have \_\_\_\_\_.  
 (a) an exoskeleton  
 (b) an open circulatory system  
 (c) three pairs of legs  
 (d) antennae
52. The majority of animal species are \_\_\_\_\_.  
 (a) insects (b) deuterostomes  
 (c) marine (d) acelomates
53. In arthropods, molting is necessary because \_\_\_\_\_.  
 (a) the chitinous exoskeleton cannot grow  
 (b) arthropod appendages generally increase in number as the animal ages  
 (c) the environment degrades the exoskeleton, which therefore must be shed and replaced  
 (d) worn exoskeletons make arthropods more susceptible to predators
54. Complete metamorphosis \_\_\_\_\_.  
 (a) features a larval stage that looks different from the adult  
 (b) is a feature in the life history of a minority of insect species  
 (c) features larval stages with antennae and compound eyes  
 (d) is accompanied by a complete rearrangement of the genome
55. Which of the following animals are most closely related to spiders?  
 (a) scorpions (b) grasshoppers  
 (c) pill bugs (d) mosquitoes
56. The water vascular system of a sea star functions in \_\_\_\_\_.  
 (a) movement of the tube feet  
 (b) digestion  
 (c) pumping water for swimming movements  
 (d) vision
57. Which one of the following statements about the phylum Echinodermata is false?  
 (a) Echinoderms have true radial symmetry as adults.  
 (b) Larval forms show evidence of bilateral symmetry, which is mostly lost in the adult form.  
 (c) One of the classes in this phylum is *Astroioidea*—the sea stars.

## ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. c  | 2. c  | 3. c  | 4. c  |
| 5. c  | 6. b  | 7. b  | 8. b  |
| 9. d  | 10. d | 11. d | 12. b |
| 13. d | 14. a | 15. d | 16. d |
| 17. c | 18. c | 19. d | 20. d |
| 21. a | 22. d | 23. d | 24. d |
| 25. c | 26. d | 27. b | 28. c |
| 29. d | 30. c | 31. b | 32. d |
| 33. d | 34. d | 35. d | 36. d |
| 37. b | 38. b | 39. d | 40. d |
| 41. c | 42. c | 43. d | 44. d |
| 45. c | 46. c | 47. d | 48. a |
| 49. d | 50. d | 51. c | 52. a |
| 53. a | 54. a | 55. a | 56. a |
| 57. a | 58. c | 59. a | 60. a |
| 61. d | 62. b |       |       |

## 5.10: VERTEBRATES

1. Which one of these chordate groups lacks a post-anal tail and a notochord as adults?  
 (a) lancelets      (b) tunicates  
 (c) amphibians      (d) mammals
  2. The common ancestor of all these chordate groups except the \_\_\_\_\_ probably had paired appendages.  
 (a) mammals      (b) amphibians  
 (c) lampreys      (d) ray-finned fishes
  3. Which of these is the only chordate group that has hair?  
 (a) tunicates      (b) ray-finned fishes  
 (c) mammals      (d) amphibians
  4. Which of these primate groups is most closely related to hominids?  
 (a) apes      (b) Old World monkeys  
 (c) lorises      (d) prosimians
  5. \_\_\_\_\_ are the oldest known primate group.  
 (a) Apes      (b) Prosimians  
 (c) Anthropoids      (d) Hominids
  6. The primates that spend the most time walking upright are the \_\_\_\_\_.  
 (a) apes  
 (b) prosimians  
 (c) New World monkeys  
 (d) hominids
  7. Which of these anthropoid groups consists of primates who are mostly tree dwellers and whose forelimbs and hind limbs are about equal in length?  
 (a) monkeys      (b) hominids  
 (c) prosimians      (d) primates
  8. Which of these primate groups lives in trees in Central and South America and have nostrils that are wide open and far apart?  
 (a) hominids  
 (b) apes  
 (c) New World monkeys  
 (d) anthropoids
  9. Humans are \_\_\_\_\_.  
 (a) Australopithecus      (b) Homo erectus  
 (c) Ardipithecus      (d) Homo sapiens
  10. Which of the following is not a diagnostic feature of the phylum Chordata?  
 (a) pharyngeal clefts
11. Which of the following chordates is most likely to look least like other chordates?  
 (a) embryonic human  
 (b) adult tunicate  
 (c) lancelet  
 (d) adult human
  12. A unique feature of craniates is \_\_\_\_\_.  
 (a) a four-chambered heart  
 (b) segmentation  
 (c) a vertebral column composed of bone  
 (d) the neural crest
  13. Analysis of mitochondrial DNA and chromosomes of modern humans has led most researchers to agree that \_\_\_\_\_.  
 (a) the common ancestor of Homo sapiens was a Neanderthal  
 (b) modern humans emerged from Africa  
 (c) Homo sapiens evolved from H. erectus in several parts of the world  
 (d) Homo sapiens have many common ancestors
  14. Jaws developed \_\_\_\_\_.  
 (a) from the bony armor of ostracoderms  
 (b) from arthropod jaws  
 (c) by modification of middle ear bones  
 (d) by modification of the skeletal rods that previously supported the anterior pharyngeal gill slits
  15. The diagnostic feature of class Chondrichthyes is \_\_\_\_\_.  
 (a) a swim bladder  
 (b) an endoskeleton of calcified cartilage  
 (c) a streamlined, torpedo-shaped body  
 (d) jaws
  16. Imagine that you are a paleontologist (a scientist who studies fossils of ancient life forms). In a recent dig, you unearthed bones of all of the following. Which could you have found in the oldest sediments?  
 (a) amphibians      (b) mammals  
 (c) parareptiles      (d) dinosaurs

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17. Listed below are four adaptations of terrestrial vertebrates. Which one is a characteristic only of truly terrestrial animals that have no need to return to bodies of water at any stage of the life cycle?  
 (a) tetrapod locomotion  
 (b) nephron tube systems for osmoregulation  
 (c) lungs  
 (d) amniotic eggs
  18. Which of the following is not thought to be in the lineage that led to human beings?  
 (a) amphibian  
 (b) birds  
 (c) jawless vertebrate  
 (d) colonial choanoflagellate protist
  19. There are three major groups of mammals categorized on the basis of their \_\_\_\_\_.  
 (a) size  
 (b) habitat  
 (c) method of locomotion  
 (d) method of reproduction
  20. Which hominid branch marks an important shift in the relative size of the sexes?  
 (a) Homo sapiens      (b) Homo ergaster  
 (c) Australopithecus      (d) Homo habilis
  21. If an animal has segments, bilateral symmetry, pharyngeal clefts, a post-anal tail, and deuterostomic development, it must be a member of the phylum \_\_\_\_\_.  
 (a) Annelida      (b) Arthropoda  
 (c) Chordata      (d) Mollusca
  22. A \_\_\_\_\_ is a chordate but not a vertebrate.  
 (a) lamprey      (b) shark  
 (c) lancelet      (d) sea star
  23. Which of the following pairs is not matched correctly?  
 (a) Gnathostomata... hagfish  
 (b) Mammalia... kangaroo  
 (c) Osteichthyes... perch  
 (d) Chondrichthyes... great white shark
  24. A lamprey, a shark, a lizard, and a rabbit share all the following characteristics except \_\_\_\_\_.  
 (a) pharyngeal clefts in the embryo  
 (b) vertebrae  
 (c) hinged jaws  
 (d) a hollow dorsal nerve cord
  25. Some sharks are viviparous, which means that \_\_\_\_\_.  
 (a) the young develop within the female's body
  26. They lay eggs  
 (c) they have a tendency toward multiple births  
 (d) they have a tendency toward single births
  27. The gill flap, or operculum, was an important adaptation for fish because it helps with  
 (a) orientation in currents  
 (b) maintaining a supply of oxygen  
 (c) sensing chemicals in water  
 (d) adjusting buoyancy
  28. A feature of bony fish not found in sharks is \_\_\_\_\_.  
 (a) gills  
 (b) mineralized teeth  
 (c) pelvic and pectoral fins with bony supports  
 (d) a swim bladder
  29. The first vertebrates to live on land were \_\_\_\_\_.  
 (a) agnathans      (b) reptiles  
 (c) amphibians      (d) chondrichthyans
  30. The development that freed vertebrates from water for reproduction and allowed them to radiate into diverse terrestrial environments was the \_\_\_\_\_.  
 (a) operculum  
 (b) placenta  
 (c) lateral line system  
 (d) amniotic egg
  31. Which of the following characteristics is not shared by extant birds and extant reptiles?  
 (a) endothermic metabolism  
 (b) amniotic eggs  
 (c) backbones of vertebrae  
 (d) scales containing keratin
  32. All mammals \_\_\_\_\_.  
 (a) bear live young  
 (b) complete their embryonic development in the uterus  
 (c) nourish their offspring through mammary glands  
 (d) have all the characteristics listed above
  33. The opossum is an example of a(n) \_\_\_\_\_. mammal.  
 (a) marsupial      (b) placental  
 (c) monotreme      (d) oviparous
  34. Primates are distinguished from other mammals by \_\_\_\_\_.  
 (a) opposable thumbs, nails, and good depth perception

- (b) fur, claws, and small litters  
 (c) stereoscopic vision, mammary glands, and single births  
 (d) eutherian reproduction, opposable thumbs, and good depth perception
34. Humans and the slender loris share many traits that probably evolved in our early primate ancestors, including \_\_\_\_\_.
- (a) opposable big toes  
 (b) an arboreal way of life  
 (c) a thumb that is relatively mobile and separate from the fingers  
 (d) culture
35. Humans, apes, and monkeys are classified together as \_\_\_\_\_.  
 (a) hominids      (b) anthropoids  
 (c) hominoids      (d) brachiators
36. If you were to observe a monkey in a zoo, which characteristic would indicate a New World origin for that monkey species?  
 (a) distinct seat pads  
 (b) forward-facing eyes  
 (c) use of the tail to hang from a tree limb  
 (d) a big toe that is widely separated from the other toes
37. Included among the modern genera of apes are \_\_\_\_\_.  
 (a) gibbons, orangutans, gorillas, chimpanzees, and bonobos  
 (b) lemurs and lorises  
 (c) tarsiers and gorillas  
 (d) Old World monkeys and New World monkeys
38. Which of the following traits distinguishes hominids from apes?  
 (a) the use of tools  
 (b) the use of fire  
 (c) an enlarged brain (relative to body size)  
 (d) bipedalism (upright walking)
39. Which of the following correctly lists probable ancestors of modern humans from the oldest to the most recent?  
 (a) *Homo erectus*, *Australopithecus*, *Homo habilis*
- (b) *Australopithecus*, *Homo habilis*, *Homo erectus*  
 (c) *Australopithecus*, *Homo erectus*, *Homo habilis*  
 (d) *Homo erectus*, *Homo habilis*, *Australopithecus*
40. \_\_\_\_\_ arose very early in hominid evolution; \_\_\_\_\_ evolved more recently.  
 (a) Large brains... prominent brow ridges  
 (b) Large brains... upright posture  
 (c) Upright posture... forward-looking eyes  
 (d) Upright posture... large brains
41. The first species in the genus *Homo* known to make tools is (was) \_\_\_\_\_.  
 (a) *Homo neanderthalensis*  
 (b) *Homo sapiens*  
 (c) *Homo habilis*  
 (d) *Homo heidelbergensis*
42. What was the earliest hominid to have an enlarged brain (relative to body size)?  
 (a) *Ardipithecus*    (b) *Australopithecus*  
 (c) *Homo habilis*    (d) *Homo erectus*

## ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. b  | 2. c  | 3. c  | 4. a  |
| 5. b  | 6. d  | 7. a  | 8. c  |
| 9. d  | 10. c | 11. b | 12. d |
| 13. b | 14. d | 15. b | 16. a |
| 17. d | 18. b | 19. d | 20. b |
| 21. c | 22. c | 23. a | 24. c |
| 25. a | 26. b | 27. d | 28. c |
| 29. d | 30. a | 31. c | 32. a |
| 33. a | 34. c | 35. b | 36. c |
| 37. a | 38. d | 39. b | 40. d |
| 41. c | 42. C |       |       |

## Part VI

# Plant Form and Function

### 6.1: PLANT STRUCTURE, GROWTH, AND DEVELOPMENT

1. Root hairs are important to a plant because they \_\_\_\_\_.  
(a) protect the plant from freezing  
(b) protect the plant from soil microbes  
(c) develop into lateral roots  
(d) increase the surface area for absorption
2. Which of the following is correctly matched with its tissue system?  
(a) xylem... ground tissue system  
(b) phloem... epidermis  
(c) cortex... ground tissue system  
(d) pith... vascular tissue system
3. Most of the photosynthesis in a plant occurs in the \_\_\_\_\_ cells of the leaves.  
(a) collenchymas (b) water-conducting  
(c) parenchyma (d) sclerenchyma
4. How do cells in a meristem differ from cells in other types of plant tissue?  
(a) They continue to divide.  
(b) They photosynthesize at a faster rate.  
(c) They are growing.  
(d) They are differentiating.
5. The primary growth of a plant adds \_\_\_\_\_ and secondary growth adds \_\_\_\_\_.  
(a) height... girth  
(b) branching... flowers  
(c) girth... height  
(d) branching... girth
6. Wood is composed primarily of \_\_\_\_\_.  
(a) primary xylem  
(b) primary phloem  
(c) secondary xylem  
(d) secondary phloem
7. Other than the transport of materials, what is another function that vascular tissue performs in a leaf?  
(a) The tissue contains the cells that perform photosynthesis.  
(b) The tissue contains a labyrinth of air spaces that allow for gas exchange.  
(c) The tissue functions as a skeleton that reinforces the shape of the leaf.  
(d) The tissue regulates the opening and closing of pores in stomata complexes.
8. Cell division in the vascular cambium adds to the girth of a tree by adding new \_\_\_\_\_ to the layer's interior and \_\_\_\_\_ to the layer's exterior.  
(a) phloem... xylem  
(b) xylem and phloem... bark  
(c) pith... xylem and phloem  
(d) xylem... phloem
9. Cellular differentiation is responsible for \_\_\_\_\_.  
(a) cell division in the apical meristem  
(b) elongation of cells in the zone of elongation of a root  
(c) one daughter cell becoming a sieve tube while the other becomes a companion cell  
(d) only one daughter cell remaining meristematic when a vascular cambium cell divides
10. At which level in the hierarchy of plant structure is the polarity of a plant determined?  
(a) whole plant body (b) organs  
(c) tissues (d) cells
11. In the hierarchy of biological organization, the shoot is \_\_\_\_\_.  
(a) an organ (b) a system  
(c) a tissue (d) a tissue system
12. A root hair is \_\_\_\_\_.  
(a) a multicellular extension of the root epidermis  
(b) an extension of the endodermis of roots  
(c) an outgrowth of the pericycle  
(d) an extension of an individual cell that absorbs water from soil
13. Leaves occur at intervals along the plant stem. The region where a leaf is attached to the stem is the \_\_\_\_\_.  
(a) internode (b) axil  
(c) node (d) shoot apex
14. Leaves consist of \_\_\_\_\_.  
(a) a blade and a petiole  
(b) a bud and a node  
(c) a node and an internode  
(d) a bud and a blade
15. The shoot system of a beavertail cactus consists of broad paddle-like structures called \_\_\_\_\_.  
(a) rachis (b) cladodes  
(c) areoles (d) spines

- covered with clusters of spines. The spines are modified leaves, so the clusters must be modified \_\_\_\_ and the flat green paddles must be modified \_\_\_\_.  
 (a) buds... leaves (b) buds... stems  
 (c) leaves... stems (d) stems... roots
16. What is the difference between the root epidermis and the shoot epidermis?  
 (a) The root epidermis has chloroplasts.  
 (b) Only the shoot epidermis gives rise to vascular tissues.  
 (c) Only the shoot epidermis is replaced by periderm in woody plants.  
 (d) Only the shoot epidermis produces a waxy cuticle.
17. The plant tissue system most analogous to our circulatory system is the \_\_\_\_.  
 (a) dermal tissue  
 (b) sclerenchyma  
 (c) vascular cambium  
 (d) vascular tissue
18. Ground tissue is composed of undifferentiated cells with thin walls that are usually involved with storage. At the stage in an herbaceous (nonwoody) dicot plant's life when only primary growth has occurred, the inner portion of the ground tissue of a stem is called \_\_\_\_ and the outer portion is called \_\_\_\_.  
 (a) pith, cortex (b) endodermis... pith  
 (c) cork... cortex (d) cambium... cork
19. Which of the following cells are dead at maturity?  
 (a) parenchyma and sclerenchyma cells  
 (b) collenchyma and sclerenchyma cells  
 (c) sieve-tube members and companion cells  
 (d) tracheids and vessel elements
20. Most of the photosynthesis in plants takes place in specialized \_\_\_\_ cells called the \_\_\_\_.  
 (a) parenchyma... mesophyll  
 (b) sclerenchyma... palisades  
 (c) pith... parenchyma  
 (d) dermal... mesophyll
21. Collenchyma cells can be recognized by \_\_\_\_.  
 (a) their unevenly thickened cell walls  
 (b) the presence of chloroplasts  
 (c) lignin in the cell walls  
 (d) the lack of nuclei at maturity
22. Artichoke hearts are tender and have a strong taste. The leaves have a strong taste too, but most of an artichoke leaf is fibrous and too difficult to chew. The leaves must contain lots of \_\_\_\_.  
 (a) collenchyma cells  
 (b) phloem  
 (c) meristematic tissue  
 (d) sclerenchyma cells
23. In most leaves, chloroplast-containing cells are most closely compacted in \_\_\_\_.  
 (a) the vein (vascular bundle)  
 (b) the upper epidermis  
 (c) the lower epidermis  
 (d) the mesophyll
24. Perennials die \_\_\_\_.  
 (a) in a single year, after seed production  
 (b) after flowering in their second spring/summer  
 (c) from old age  
 (d) usually from an infection or some sort of trauma
25. A region of dividing cells in a plant is called a \_\_\_\_.  
 (a) meristem (b) cortex  
 (c) ground tissue (d) cotyledon
26. Which example below is the site of primary growth?  
 (a) apical meristems  
 (b) axillary buds  
 (c) bud scales  
 (d) lateral meristems
27. Some plants grow by primary and secondary mechanisms. Choose the correct description of a mechanism and its result.  
 (a) Primary and secondary growth are required to produce woody plants.  
 (b) Primary growth increases the girth of the plant.  
 (c) Stems that only experience primary growth are called woody plants.  
 (d) Herbaceous plants have stems that exhibit only secondary growth.
28. If you pound a nail into a tree 1 meter off the ground and come back to find it in 20 years, it will be \_\_\_\_.  
 (a) 1 meter off the ground and more deeply embedded in the tree  
 (b) more than 1 meter off the ground and more deeply embedded in the tree  
 (c) 1 meter off the ground and the same depth in the tree  
 (d) more than 1 meter off the ground and the same depth in the tree

29. Which choice below describes the fate of derivatives?  
 (a) They die once they produce a generation of new cells.  
 (b) They remain in vascular tissue as sources of new cells.  
 (c) Once displaced from the meristem, they divide until cells they produce specialize.  
 (d) They remain in the meristematic tissue as a source of new cells.
30. The layer that covers the apical meristem of a root is called the \_\_\_\_.  
 (a) root cap (b) root hair  
 (c) taproot (d) apoplast
31. Root tips are pushed further into the soil mainly by \_\_\_\_.  
 (a) cell division in the meristem  
 (b) elongation of cells  
 (c) cell division in the vascular cambium  
 (d) differentiation (specialization) of root cells
32. A cross section of a plant part exposes epidermis, a thick cortex, and a central cylinder of xylem and phloem. This part is a \_\_\_\_.  
 (a) fruit (b) seed  
 (c) stem (d) root
33. Which of the following is closest to the center of an orchid (monocot) root?  
 (a) the cortex (b) phloem  
 (c) pith (d) epidermis
34. Lateral roots in seed plants are initiated by cell divisions in the \_\_\_\_.  
 (a) vascular cambium  
 (b) endodermis  
 (c) pericycle  
 (d) lateral meristems
35. Which of the following correctly describes a feature unique to monocot stems?  
 (a) Vascular bundles are scattered throughout.  
 (b) Lateral shoots cannot originate near the surface.  
 (c) Vascular tissue is located all in the center.  
 (d) Vascular bundles are arranged in a ring.
36. Guard cells \_\_\_\_.  
 (a) are involved in controlling the evaporative loss of water from a plant  
 (b) are necessary for gas exchange during photosynthesis  
 (c) protect the plant's roots from infection  
 (d) The first and second answers are correct.
37. Which of the following is the correct arrangement of structures from the inside to the outside of a leaf blade?  
 (a) vascular bundle, mesophyll, epidermis  
 (b) mesophyll, vascular bundle, epidermis  
 (c) epidermis, mesophyll, vascular bundle  
 (d) palisade mesophyll, spongy mesophyll, lower epidermis, upper epidermis, vascular bundle
38. Which of the following is closest to the center of a woody stem?  
 (a) vascular cambium (b) young phloem  
 (c) old phloem (d) old xylem
39. A vandal killed a historic oak tree on the village green by girdling it with a chain saw. He cut through the bark and into the sapwood all the way around the tree. Why did the tree die?  
 (a) The leaves could not get carbon dioxide.  
 (b) Oxygen could not get to the roots.  
 (c) The roots could not get food.  
 (d) The leaves could not get food.
40. Which best describes a characteristic of tracheids?  
 (a) They are only found in gymnosperms.  
 (b) They are only produced early in the growing season.  
 (c) They maximize delivery of water to new expanding leaves.  
 (d) They are also called vessel elements.
41. Annual rings in wood are evidence that in climates with a single annual growing season, the \_\_\_\_ divides actively when water is plentiful and temperatures are suitable for growth, and ceases to divide when water is scarce and the weather is cold.  
 (a) apical meristem  
 (b) lateral meristem  
 (c) cork cambium  
 (d) vascular cambium
42. Cell division would occur least frequently in which of these tissues?  
 (a) apical meristem of a root  
 (b) cork cambium  
 (c) epidermis  
 (d) vascular cambium
43. The vascular cambium of a stem does not produce \_\_\_\_.  
 (a) cork  
 (b) wood  
 (c) secondary phloem  
 (d) secondary xylem

44. In what order would you pass through tissues when moving from the pith to the epidermis in a plant possessing secondary vascular tissue?  
 (a) primary phloem, primary xylem, secondary phloem, secondary xylem  
 (b) primary xylem, secondary xylem, vascular cambium, secondary phloem, primary phloem  
 (c) primary phloem, secondary phloem, secondary xylem, primary xylem  
 (d) secondary xylem, primary xylem, primary phloem, secondary phloem
45. What accounts for about 90% of a plant cell's expansion?  
 (a) additional organic material in a plant's cytoplasm  
 (b) water uptake stored in various small vacuoles  
 (c) water uptake that is stored in a large central vacuole  
 (d) additional organic material stored in vacuoles
46. Preprophase bands \_\_\_\_\_.  
 (a) determine the location where the cell plate will form during cell division  
 (b) run parallel to the direction of elongation as a cell matures  
 (c) are present throughout the cell cycle  
 (d) run perpendicular to the cellulose microfibrils in a dividing cell
47. In a young cell just produced by mitosis, the cellulose microfibrils are arranged in horizontal rings. Which of the following accurately explains how the cell will grow longer?  
 (a) The cell will expand horizontally, in the same direction that the microfibrils are oriented.  
 (b) Water will enter the cell only at the ends lacking cellulose microfibrils.  
 (c) Enlargement of the vacuole will force the cell to grow evenly in all directions.  
 (d) The bands of microfibrils will resist expansion, so the cell will enlarge at right angles to the ring of microfibrils.
48. The *gnom* mutant of *Arabidopsis* causes the first cell division of the zygote to be symmetrical. As a result \_\_\_\_\_.  
 (a) no polarity is established in the plant and it remains ball-shaped and lacks leaves and roots  
 (b) the plant develops at the same rate as
49. The homeotic gene *GLABRA-2* controls cellular differentiation in the root epidermis of *Arabidopsis*. Which of the following statements is correct?  
 (a) If *GLABRA-2* is "turned on" the cell produces a root hair.  
 (b) If an epidermal cell borders two cortical cells, *GLABRA-2* is not expressed and the cell produces a root hair.  
 (c) If an epidermal cell borders one cortical cell, *GLABRA-2* is expressed and the cell produces a root hair.  
 (d) If *GLABRA-2* is not expressed, no root hairs are formed.
50. During normal development *Acacia koa* plants first produce compound juvenile leaves and later produce adult sickle-shaped leaves. Which of the following statements is correct?  
 (a) Existing compound leaves will change to sickle-shaped leaves as the plant matures.  
 (b) Sickle-shaped leaves will revert to compound leaves if cuttings are made from them.  
 (c) Existing compound leaves will stay compound as the plant ages.  
 (d) The compound juvenile leaves and the adult sickle-shaped leaves are produced by two different apical meristems.
51. The ABC model of flower formation suggests \_\_\_\_\_.  
 (a) flower development depends on a sequence of three genes turning on in the correct order  
 (b) the A gene turns on sepals, the B gene turns on petals, the C gene turns on stamens, and all three are necessary for carpels to form  
 (c) the A gene initiates the flower bud, the B gene initiates formation of the sterile parts, and the C gene initiates formation of the reproductive parts  
 (d) pairs of genes are required to form petals and stamens, but a single gene can initiate sepals or carpels
52. \_\_\_\_\_ provides cells for secondary growth.  
 (a) Apical meristem  
 (b) Secondary xylem  
 (c) Vascular cambium  
 (d) Secondary phloem

53. Vascular cambium forms wood toward the stem's \_\_\_\_\_ and secondary phloem toward the stem's \_\_\_\_\_.  
 (a) center...center  
 (b) surface...surface  
 (c) surface...center  
 (d) center...surface
54. What is the function of cork?  
 (a) providing a site for photosynthesis  
 (b) providing cells for secondary growth  
 (c) insulation and waterproofing  
 (d) providing cells for primary growth  
 (e) regulating the opening and closing of stomata
55. How is the supply of vascular cambium maintained?  
 (a) by the differentiation of secondary xylem  
 (b) by the differentiation of secondary phloem  
 (c) by the differentiation of cork  
 (d) by the division of its cells
56. Secondary growth never occurs in \_\_\_\_\_.  
 (a) stems  
 (b) roots  
 (c) leaves  
 (d) stems and leaves

**ANSWERS**

1. d	2. c	3. c	4. a
5. a	6. c	7. c	8. d
9. c	10. d	11. b	12. d
13. c	14. a	15. b	16. d
17. d	18. a	19. d	20. a
21. a	22. d	23. d	24. d
25. a	26. a	27. a	28. a
29. c	30. a	31. a	32. d
33. c	34. c	35. a	36. d
37. a	38. d	39. c	40. c
41. d	42. c	43. a	44. b
45. c	46. a	47. d	48. a
49. b	50. c	51. d	52. c
53. d	54. c	55. d	56. c

## 6.2: TRANSPORT IN VASCULAR PLANTS

1. Which aspect of solute transport in the xylem of a plant is most like that of solute transport in the phloem?  
 (a) the upward movement from roots to leaves  
 (b) the development of root pressure  
 (c) movement in conduits composed of nonliving cell walls  
 (d) the development of tension on water to pull it and dissolved solutes through the conduits
2. Which of these are symbiotic associations?  
 (a) root hairs  
 (b) apoplasts  
 (c) Casparyan strips  
 (d) mycorrhizae
3. Companion cells that are specialized for the transport of sugar between apoplast and symplast are \_\_\_\_\_ cells.  
 (a) transfer (b) guard  
 (c) mycorrhizae (d) aquaporin
4. In roots the \_\_\_\_\_ forces water and solutes to pass through the plasma membranes of \_\_\_\_\_ cells before entering the \_\_\_\_\_.  
 (a) Casparyan strip... ectoderm... xylem  
 (b) Casparyan strip... endodermis... xylem  
 (c) Casparyan strip... endodermis... phloem  
 (d) xylem... endodermis... Casparyan strip
5. \_\_\_\_\_ provide(s) the major force for the movement of water and solutes from roots to leaves.  
 (a) Translocation (b) Bulk flow  
 (c) Transpiration (d) Root pressure
6. \_\_\_\_\_ bonds are responsible for the cohesion of water molecules.  
 (a) Ionic  
 (b) Hydrogen  
 (c) Nonpolar covalent  
 (d) Polar covalent
7. \_\_\_\_\_ cells are the cells that regulate the opening and closing of stomata, thus playing a role in regulating transpiration.  
 (a) Tracheid  
 (b) Casparyan strip  
 (c) Sieve-tube member  
 (d) Guard
8. Which of these processes is responsible for leaves being considered sugar sources?  
 (a) catabolism  
 (b) glycolysis  
 (c) citric acid cycle  
 (d) photosynthesis
9. \_\_\_\_\_ transport(s) sugars from leaves to, for example, taproots.  
 (a) Blood vessels (b) Tracheids  
 (c) Phloem (d) Vessel elements
10. Sugar moves from leaves into the \_\_\_\_\_ of \_\_\_\_\_ by \_\_\_\_\_.  
 (a) sieve-tube members... phloem... active transport  
 (b) sieve-tube members... xylem... active transport  
 (c) sieve-tube members... phloem... diffusion  
 (d) tracheids... phloem... active transport
11. The proton pump \_\_\_\_\_.  
 (a) uses the energy stored in ATP to produce a hydrogen ion gradient  
 (b) uses the energy of a proton gradient to generate ATP  
 (c) releases kinetic energy  
 (d) operates by osmosis
12. A plant cell placed in a solution with a lower water potential will \_\_\_\_\_.  
 (a) lose water and burst  
 (b) lose water and become turgid  
 (c) gain water and become turgid  
 (d) lose water and plasmolyze
13. \_\_\_\_\_ is responsible for the movement of sugars from leaves to taproots; \_\_\_\_\_ is responsible for the movements of sugar from taproots to leaves.  
 (a) Transpiration... transpiration  
 (b) Bulk flow... bulk flow  
 (c) Bulk flow... root pressure  
 (d) Bulk flow... transpiration
14. Which of the following is a correct statement about a difference between xylem and phloem transport?  
 (a) Active transport moves xylem sap but not phloem sap.  
 (b) Transpiration moves phloem sap but not xylem sap.

- (c) Phloem carries water and minerals; xylem carries organic molecules.  
 (d) Xylem sap moves up; phloem sap moves up or down.
15. Which one of the following refers to the loss of water through the stomata in a plant's leaves?  
 (a) respiration (b) bulk flow  
 (c) transpiration (d) osmosis
16. The last thing all water and solute molecules pass through before they enter the vascular system of roots and move upward to the leaves is \_\_\_\_\_.  
 (a) a stoma  
 (b) a root hair cell  
 (c) an endodermal cell  
 (d) an epidermal cell
17. The Casparyan strip is \_\_\_\_\_.  
 (a) a band of waterproof suberin impregnated through endodermal cell walls  
 (b) the last segment in the soil-to-xylem pathway  
 (c) a region across central Canada marking the northernmost presence of deciduous trees  
 (d) a vertical band of xylem cells in a woody stem
18. A student is performing a chemical analysis of xylem sap. This student should not expect to find much \_\_\_\_\_.  
 (a) nitrogen (b) sugar  
 (c) phosphorus (d) water
19. Xerophytes minimize water loss by \_\_\_\_\_.  
 (a) using the CAM pathway  
 (b) reducing the thickness of the leaf cuticle  
 (c) developing a Casparyan strip between their leaves and stem  
 (d) having leaves with a large surface-to-volume ratio
20. In a sugar sink, such as a taproot, sugar is converted into \_\_\_\_\_.  
 (a) starch (b) fatty acids  
 (c) cellulose (d) glycogen
21. The proton pump \_\_\_\_\_.  
 (a) pumps H<sup>+</sup> out of the cell  
 (b) pumps H<sup>+</sup> into the cell  
 (c) generates energy by producing ATP  
 (d) provides energy for active transport
22. Which of the following processes is aided by the membrane potential established by the proton pump?  
 (a) uptake of cations such as K<sup>+</sup>  
 (b) cotransport of anions
- (c) Cotransport of neutral solutes  
 (d) All of the above answers are correct.
23. A plant cell placed in a solution with a higher water potential will \_\_\_\_\_.  
 (a) lose water and crenate  
 (b) lose water and become turgid  
 (c) gain water and become turgid  
 (d) lose water and plasmolyze
24. A cell has a pressure potential of 0 and a solute potential of -0.7 MPa. What is its water potential?  
 (a) -0.7 MPa (b) 0 MPa  
 (c) 0.7 MPa (d) > -0.7 MPa
25. If pure water is separated from a 0.1 M solution in a U-shaped tube by a membrane impermeable to the solute, what will happen?  
 (a) Water will move to the 0.1 M solution side until the concentrations are equal on both sides of the membrane  
 (b) Solute in the solution will diffuse to the pure water side until equilibrium is reached.  
 (c) Water will diffuse toward the solution side until a piston pushes it back at an equal rate.  
 (d) Water will diffuse to the solution side until the pressure potential due to a higher water column is equal, but opposite in sign, to the osmotic potential.
26. Which of the following is true for a plant that is wilting?  
 (a) The pressure potential in the xylem will be more negative than in a turgid plant.  
 (b) The pressure potential in guard cells will be high to keep them closed.  
 (c) The pressure potential in endodermal cells will be positive.  
 (d) Root hair cells will have a positive pressure potential.
27. When referring to phloem transport, the "sink" in roots is created by \_\_\_\_\_.  
 (a) the active transport of mineral ions into xylem cells  
 (b) the osmosis of water into xylem cells  
 (c) the absorption of water from the soil through epidermal cells  
 (d) the active transport of sugars from phloem to cortex cells
28. Water molecules cross a plasma membrane of a plant cell due to \_\_\_\_\_.  
 (a) diffusion (b) transport proteins  
 (c) aquaporins (d) all of the above

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29. The cytoplasmic continuum connecting neighboring cells is called the \_\_\_\_\_.  
 (a) tonoplast (b) apoplast  
 (c) aquaporin (d) symplast
30. The continuum of cell walls connecting neighboring cells is defined as the \_\_\_\_\_.  
 (a) tonoplast (b) apoplast  
 (c) aquaporin (d) symplast
31. Which of the cells below are involved with bulk flow?  
 (a) tracheids, vessels, and sieve tubes  
 (b) tracheids, vessels, and guard cells  
 (c) tracheids, tonoplasts, and sieve tubes  
 (d) guard cells, vessels, and sieve tubes
32. The most direct route for water from the soil to the xylem is via the \_\_\_\_\_.  
 (a) apoplast (b) symplast  
 (c) stelle (d) cells of the cortex
33. The greatest increase in surface area for absorption in the root is due to \_\_\_\_\_.  
 (a) branch roots (b) root hairs  
 (c) mycorrhizae (d) root nodules
34. A botanist discovered a mutant plant that is unable to produce the material that forms the Caspary strip. This plant is \_\_\_\_\_.  
 (a) unable to fix nitrogen  
 (b) unable to transport water or solutes to the leaves  
 (c) able to exert greater root pressure than normal plants  
 (d) unable to control the amounts of water and solutes it absorbs
35. In a plant root, the one cell type in which water **cannot** move via the apoplast is the \_\_\_\_\_.  
 (a) epidermis (b) endodermis  
 (c) pericycle (d) cortex
36. A friend of yours has a terrarium on her windowsill containing various houseplants. She wonders why the glass is often fogged with water droplets. What would you tell her is the cause of the droplets?  
 (a) root pressure (b) adhesion  
 (c) transpiration (d) pressure flow
37. Root pressure is attributable to \_\_\_\_\_.  
 (a) transpiration  
 (b) accumulation of minerals in the vascular cylinder  
 (c) the high water potential of the vascular cylinder relative to the root cortex  
 (d) guttation
38. Which of the following conditions will result in the fastest transport through the xylem in a tree, assuming adequate water supply in the roots?  
 (a) negative pressure potential in the leaf mesophyll  
 (b) positive pressure potential in the xylem  
 (c) positive pressure potential in the mesophyll  
 (d) negative pressure potential in the guard cells
39. What keeps the force of gravity from overcoming transpirational pull?  
 (a) upward pressure from the roots  
 (b) high water pressure in the leaves  
 (c) the Caspary strip blocking water molecules from moving out  
 (d) cohesion and adhesion of water molecules
40. Normally when an aphid feeds by puncturing plant tissues, it does not have to suck the sap out. If an aphid, however, inserted its feeding tube in the wrong place, the fluid in the aphid's guts could be sucked out through the feeding tube. What could explain this phenomenon?  
 (a) The aphid pierced the Caspary strip.  
 (b) The aphid punctured a root nodule.  
 (c) The aphid punctured xylem cells.  
 (d) The aphid punctured a sieve tube cell.
41. During winter, tree sap can sometimes freeze and **cavitation** (the formation of an air pocket) may occur. Which one of the following mechanisms of sap transport would you expect to be most immediately affected by cavitation?  
 (a) symplast function  
 (b) pressure flow (mass flow)  
 (c) cohesion transpiration  
 (d) root pressure
42. What is the main source of energy that moves water upward in the trunk of a tree?  
 (a) contraction of xylem cells  
 (b) evaporation of water by the sun  
 (c) pressure exerted by root cells  
 (d) breakdown and release of energy of sugar molecules
43. The rate of transpiration is expected to be greatest on a \_\_\_\_\_ day.  
 (a) cool and moist (b) warm and moist  
 (c) cool and dry (d) warm and dry

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44. What contributes directly to the turgor pressure that opens and closes stomata?  
 (a) respiration  
 (b) transpiration  
 (c) guttation  
 (d) potassium accumulation in guard cells
45. Stomata open during the day in response to \_\_\_\_\_.  
 (a) blue light triggering the efflux of K<sup>+</sup> from guard cells  
 (b) increased temperatures  
 (c) increased CO<sub>2</sub> levels  
 (d) blue light triggering the uptake of K<sup>+</sup> by guard cells
46. Which of the following describes how some plants are adapted to arid environments?  
 (a) They can fix carbon from carbon dioxide even when stomata are closed.  
 (b) They lose more water to transpiration than C<sub>3</sub> plants.  
 (c) They have evolved alternatives to the Calvin cycle.  
 (d) They can leave their stomata open even on very hot, dry days.
47. In an apple tree that is producing sugars, sugar might flow from \_\_\_\_\_ to \_\_\_\_\_.  
 (a) a developing apple... a mature leaf  
 (b) the trunk... a leaf  
 (c) a growing root... a growing shoot tip  
 (d) a leaf... a developing apple
48. The water pressure that pushes water and sugar from sugar source to sugar sink is referred to as \_\_\_\_\_.  
 (a) translocation (b) bulk flow  
 (c) transpiration (d) root pressure

## ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. d  | 2. c  | 3. c  | 4. a  |
| 5. c  | 6. c  | 7. c  | 8. d  |
| 9. c  | 10. d | 11. b | 12. d |
| 13. b | 14. d | 15. c | 16. c |
| 17. a | 18. b | 19. a | 20. a |
| 21. a | 22. d | 23. c | 24. a |
| 25. d | 26. a | 27. d | 28. d |
| 29. d | 30. b | 31. a | 32. a |
| 33. c | 34. d | 35. b | 36. c |
| 37. b | 38. a | 39. d | 40. c |
| 41. c | 42. b | 43. d | 44. d |
| 45. d | 46. a | 47. d | 48. b |
| 49. c | 50. d |       |       |

### 6.3: PLANT NUTRITION

1. By trapping insects, carnivorous plants obtain \_\_\_\_\_, which they need \_\_\_\_\_.  
 (a) water... because they live in dry soil  
 (b) nitrogen... to make sugar  
 (c) phosphorus... to make protein  
 (d) nitrogen... to make protein
2. The release of CO<sub>2</sub> into the soil results in the formation of \_\_\_\_\_.  
 (a) hydrogen ions and oxygen ions  
 (b) sodium ions and chloride ions  
 (c) hydrogen ions and carbonate ions  
 (d) carbonate ions and oxygen ions
3. What process is the source of the CO<sub>2</sub> that root hairs release into the soil?  
 (a) photosynthesis  
 (b) respiration  
 (c) photolysis  
 (d) photosynthesis and respiration
4. The binding of H<sup>+</sup> ions to soil particles \_\_\_\_\_.  
 (a) displaces mineral cations  
 (b) promotes the clumping of soil particles  
 (c) is counteracted by acid precipitation  
 (d) leached from the soil?
5. Which of these ions is most likely to be leached from the soil?  
 (a) potassium ions (b) magnesium ions  
 (c) calcium ions (d) chlorine ions
6. Acid precipitation \_\_\_\_\_.  
 (a) promotes the attachment of anions to soil particles  
 (b) decreases soil fertility  
 (c) has no effect on soil fertility  
 (d) increases soil fertility
7. How do cations enter root hairs?  
 (a) osmosis (b) active transport  
 (c) endocytosis (d) diffusion
8. Legumes (members of the pea family) have roots with swellings called nodules that \_\_\_\_\_.  
 (a) contain nitrogen-fixing bacteria  
 (b) form fungal hyphae  
 (c) provide a steady supply of sugar to the host plant  
 (d) produce antibiotics that protect the plant from soil bacteria
9. What is the role of nod genes in the relationship between plants and Rhizobium?  
 (a) In plants, nod genes cause the secretion of flavonoids.  
 (b) In Rhizobium, nod genes produce enzymes that catalyze production of Nod factors.  
 (c) In plants, nod genes cause the formation of mycorrhizae.  
 (d) In Rhizobium, nod genes cause the secretion of flavonoids.
10. Which of the following is a correct description of endomycorrhizae or ectomycorrhizae?  
 (a) Endomycorrhizae penetrate the cytoplasm of root cells.  
 (b) Ectomycorrhizae are found in many crop plants such as wheat and maize.  
 (c) Endomycorrhizae do not have a dense mantle ensheathing roots.  
 (d) The fungal hyphae of ectomycorrhizae form arbuscules.
11. Denitrifying bacteria convert \_\_\_\_\_ to \_\_\_\_\_.  
 (a) ammonium... nitrogen gas  
 (b) nitrates... nitrogen gas  
 (c) nitrogen gas... ammonium  
 (d) nitrogen gas... nitrates
12. Nitrifying bacteria convert \_\_\_\_\_ to \_\_\_\_\_.  
 (a) nitrogen gas... ammonium  
 (b) nitrogen gas... nitrates  
 (c) ammonium... nitrites  
 (d) nitrates... nitrogen gas
13. \_\_\_\_\_ removes nitrogen from the atmosphere.  
 (a) Denitrification (b) Nitration  
 (c) Mineralization (d) Nitrogen fixation
14. Which one of these is a nitrate?  
 (a) NO<sub>2</sub><sup>-</sup> (b) NH<sub>4</sub><sup>+</sup>  
 (c) NO<sub>3</sub><sup>-</sup> (d) SH
15. Which one of these is a nitrite?  
 (a) NO<sub>2</sub><sup>-</sup> (b) NH<sub>4</sub><sup>+</sup>  
 (c) NH<sub>2</sub> (d) NO<sub>3</sub>
16. Mineral nutrients \_\_\_\_\_.  
 (a) are not essential to plant growth  
 (b) contribute little to a plant's overall mass  
 (c) enter plants via the stomata  
 (d) are organic nutrients

17. For an element to be considered a macronutrient \_\_\_\_\_.  
 (a) it must have a high atomic mass  
 (b) it must be available in large amounts  
 (c) it should consist of three or more subunits  
 (d) it must be required in relatively large amounts
18. Which of the following is a symptom of magnesium deficiency in plants?  
 (a) yellowing of younger leaves prior to yellowing of older leaves  
 (b) plant overgrowth  
 (c) chlorosis  
 (d) anemia
19. Topsoil \_\_\_\_\_.  
 (a) is the relatively inert upper layer of soil  
 (b) does not retain water  
 (c) is a mixture of rock fragments, living organisms, and humus  
 (d) is uniform in texture
20. A major long-term problem resulting from excessive irrigation is the \_\_\_\_\_.  
 (a) drowning of crop plants  
 (b) accumulation of salts in the soil  
 (c) erosion of fine soil particles  
 (d) encroachment of water-consuming weeds
21. The biological process that produces most of the dry weight of a plant is called \_\_\_\_\_.  
 (a) photosynthesis (b) respiration  
 (c) transpiration (d) oxidation
22. A plant does not obtain which of the following substances from soil?  
 (a) magnesium (b) nitrogen  
 (c) carbon (d) potassium
23. Mycorrhizae develop \_\_\_\_\_.  
 (a) when nutrients are required by plants in relatively small amounts  
 (b) in plants such as mistletoe that parasitize other plants  
 (c) when soil is too compact and lacks sufficient air spaces  
 (d) between roots and beneficial fungi
24. If a plant's leaves are yellowing, it may be that the plant is deficient in the elements needed to make chlorophyll, one of which is \_\_\_\_\_.  
 (a) copper (b) molybdenum  
 (c) sulfur (d) magnesium
25. If a plant is deficient in \_\_\_\_\_, it will not be able to make DNA.  
 (a) phosphorus (b) magnesium  
 (c) manganese (d) iron
26. Soil could be deficient in any of the following nutrients. If you had to supply one of them, which would be needed in the smallest amount?  
 (a) iron  
 (b) phosphorus  
 (c) nitrogen  
 (d) potassium
27. Which of the following is least likely to be deficient in soil?  
 (a) oxygen (b) phosphorus  
 (c) carbon (d) iron
28. Which is true regarding mineral deficiency symptoms in plants?  
 (a) Deficiency symptoms of freely moving nutrients will show up first in younger organs.  
 (b) Deficiency symptoms of immobile nutrients will show up first in older organs.  
 (c) Mobile nutrients are drawn to growing tissues; therefore, growing tissues would not show signs of mineral deficiency of mobile nutrients before older tissues.  
 (d) Symptoms of mineral deficiency always show up in older leaves first.
29. When you add "plant food" to your potted geraniums, you are actually providing the plant with \_\_\_\_\_.  
 (a) sugars  
 (b) complex carbohydrates  
 (c) vitamins and amino acids  
 (d) minerals
30. Soil can easily become deficient in \_\_\_\_\_ because these ions are negatively charged and do not stick to negatively charged soil particles.  
 (a) potassium (b) calcium  
 (c) magnesium (d) nitrate
31. The particles in soil are important because they \_\_\_\_\_.  
 (a) are composed of nitrogen needed by plants  
 (b) eliminate spaces for air and facilitate drainage  
 (c) fill spaces and keep oxygen out of the soil  
 (d) are charged and hold ions needed by plants
32. Fertilizers are usually enriched in \_\_\_\_\_.  
 (a) iron, manganese, and zinc  
 (b) calcium and boron  
 (c) nitrogen, phosphorus, and potassium  
 (d) molybdenum, copper, and magnesium

33. What is the goal of phytoremediation?  
 (a) to test whether an element is essential to a certain species of plant  
 (b) to replace lost minerals in soil  
 (c) to clean contaminated sites by using plants that have the ability to extract and store soil pollutants  
 (d) to grow crops such as alfalfa and wheat that provide good ground cover
34. Why do farmers need to be concerned with the pH level of soil?  
 (a) The pH level of soil affects the anion exchange and influences the chemical form of minerals.  
 (b) The pH level of soil affects the cation exchange and influences the chemical form of minerals.  
 (c) The pH level of soil affects water levels.  
 (d) Plants may turn blue if the pH is too high.
35. The most abundant gas in our atmosphere cannot be used by plants directly in its atmospheric form and is, therefore, captured by certain bacteria that live symbiotically in their roots. What is this gas?  
 (a) hydrogen                                 (b) carbon dioxide  
 (c) nitrogen                                   (d) oxygen
36. Nitrogen fixation is \_\_\_\_\_.  
 (a) using nitrogen to build molecules such as proteins and nucleic acids  
 (b) converting nitrogen in the air to a form usable by plants  
 (c) recycling nitrogen from organic matter in the soil  
 (d) absorbing N<sub>2</sub> from the soil
37. The enzyme that catalyzes the conversion of atmospheric nitrogen to ammonia is \_\_\_\_\_.  
 (a) rhizobium                                   (b) nitrogenase  
 (c) nodulase                                   (d) rubisco
38. Nitrogen-fixing bacteria in the soil \_\_\_\_\_.  
 (a) convert nitrates to N<sub>2</sub>  
 (b) convert nitrate to ammonium  
 (c) convert atmospheric nitrogen to ammonia  
 (d) change ammonium into nitrates
39. The relationship between legumes and Rhizobium is \_\_\_\_\_.  
 (a) mutualistic                               (b) parasitic  
 (c) competitive                              (d) commensalistic
40. The initial interaction between Rhizobium and a soybean root is \_\_\_\_\_.  
 (a) activation of nod genes in Rhizobium  
 (b) secretion of flavonoids from soybean that is detected by Rhizobium  
 (c) the production of Nod factors  
 (d) initiation of an infection thread in the root hair of the legume
41. Mutualistic associations between roots and soil fungi are called \_\_\_\_\_.  
 (a) mycorrhizae  
 (b) phytoremediators  
 (c) nitrogen fixations  
 (d) cation exchanges
42. The sundew plant has to digest insects because \_\_\_\_\_.  
 (a) it obtains nitrogen from their bodies that it cannot get from the soil  
 (b) it has lost the ability to perform photosynthesis  
 (c) it lives in a dry environment and uses moisture from the insects' bodies  
 (d) it's a method of self-cleaning to rid the plants of insects that get stuck in the plant

**ANSWERS**

1. d                  2. c                  3. b                  4. a  
 5. d                  6. b                  7. d                  8. a  
 9. b                  10. c                11. b                12. b  
 13. d                14. c                15. a                16. b  
 17. d                18. c                19. c                20. b  
 21. a                22. c                23. d                24. d  
 25. a                26. a                27. d                28. c  
 29. d                30. d                31. d                32. c  
 33. c                34. b                35. c                36. b  
 37. b                38. c                39. a                40. b  
 41. a                42. a

**6.4: ANGIOSPERM REPRODUCTION AND BIOTECHNOLOGY**

1. The transfer of antibiotic-resistant genes from genetically engineered bacteria to disease-causing bacteria \_\_\_\_\_.  
 (a) seems unlikely                       (b) has occurred  
 (c) is likely to occur                   (d) can never occur
2. Which of these is unique to flowering plants?  
 (a) a dominant sporophyte generation  
 (b) an embryo surrounded by nutritive tissue  
 (c) haploid gametophytes  
 (d) double fertilization
3. The male gametophytes of flowering plants are also referred to as \_\_\_\_\_.  
 (a) endosperm                           (b) male sporophytes  
 (c) megasporophores                   (d) pollen grains
4. In flowering plants the integuments of the ovule develop into a(n) \_\_\_\_\_.  
 (a) endosperm                           (b) cotyledon  
 (c) seed coat                           (d) sporophyte
5. A carpel is composed of \_\_\_\_\_.  
 (a) ovary, ovule, and anther  
 (b) ovule, megasporocyte, and anther  
 (c) zygote, anther, and endosperm  
 (d) stigma, style, and ovary
6. In flowering plants one megasporophore gives rise to \_\_\_\_\_. nuclei.  
 (a) four diploid                       (b) four haploid  
 (c) eight haploid                       (d) eight diploid
7. A stamen consists of \_\_\_\_\_.  
 (a) anther and filament  
 (b) stigma and style  
 (c) stigma and anther  
 (d) stigma and filament
8. In angiosperms, pollination is the transfer of pollen grain to the \_\_\_\_\_ of a flower on the same plant or another plant of the same species.  
 (a) style                               (b) anther  
 (c) ovulate cones                      (d) stigma
9. What is endosperm?  
 (a) the male portion of a flowering plant  
 (b) via cotyledons, a source of food for the embryo  
 (c) the leaves that are a part of the embryo  
 (d) the female portion of a flowering plant
10. Which of these is a vitamin A precursor?  
 (a) cobalamin                           (b) pyridoxine  
 (c) plasmid                              (d) beta-carotene
11. The term "alternation of generations" refers to the alternation in a plant's life cycle between \_\_\_\_\_.  
 (a) the production of haploid gametes by meiosis and the production of diploid spores by mitosis  
 (b) a haploid gametophyte generation and a haploid sporophyte generation  
 (c) a haploid gametophyte generation and a diploid sporophyte generation  
 (d) a flower-producing generation and a leaf-producing generation
12. Meiosis will produce microspores in the \_\_\_\_\_.  
 (a) receptacle                           (b) sepal  
 (c) petal                               (d) anther
13. Which association below is correct?  
 (a) anther... egg production  
 (b) bisexual flowers... dioecious  
 (c) unisexual flowers... dioecious  
 (d) dioecious... separate female and male plants
14. Self-incompatibility \_\_\_\_\_.  
 (a) works the same way in all plants  
 (b) does not have potential agricultural applications  
 (c) is based on the same mechanism of transplant rejection seen in animals  
 (d) maintains variation
15. In angiosperms, each pollen grain produces two sperm. What do these sperm do?  
 (a) Each one fertilizes a separate egg cell.  
 (b) One fertilizes an egg, and the other fertilizes the fruit.  
 (c) One fertilizes an egg, and the other combines with a cell that develops into stored food.  
 (d) Both sperm fertilize a single egg cell.
16. The scutellum \_\_\_\_\_.  
 (a) is a specialized cotyledon found in certain monocots

17. The germination of seeds \_\_\_\_\_.  
 (a) depends on the growth of the embryo rupturing the seed  
 (b) depends on imbibition  
 (c) depends on maturation of the embryo  
 (d) occurs after a certain species-specific period of time
18. Which of the following is not a method of vegetative reproduction?  
 (a) apomixis (b) fertilization  
 (c) stump sprouts (d) cuttings
19. In grafting, the plant that provides the root system is the \_\_\_\_\_ and the twig is the \_\_\_\_\_.  
 (a) stock... scion  
 (b) callus... protoplast  
 (c) radicle... scion  
 (d) hypocotyl... epicotyl
20. Which example below is not a concern related to the debate over plant biotechnology?  
 (a) human health issues (such as allergies) associated with transgenic crops  
 (b) novel organisms will be introduced into the biosphere  
 (c) effects on nontarget organisms, such as insects that feed on nearby plants  
 (d) *Bt* maize contains high levels of the cancer-causing toxin fumonisin
21. In alternation of generations in plants \_\_\_\_\_.  
 (a) the gametes are produced by the gametophyte through mitosis and cellular differentiation  
 (b) the gametes are produced by the gametophyte through meiosis and cellular differentiation  
 (c) the spores are produced by the gametophyte by meiosis and cellular differentiation  
 (d) the sporophyte is the haploid generation
22. Which association below is incorrect?  
 (a) petals... attraction of pollinators  
 (b) sepals... containment of sporangia  
 (c) stamens... development of male gametophytes  
 (d) carpels... development of female gametophytes
23. The male structures of angiosperms are \_\_\_\_\_.  
 (a) petals (b) sepals  
 (c) anthers (d) ovaries
24. The female structures of angiosperms are called \_\_\_\_\_, and they produce \_\_\_\_\_.  
 (a) ovaries... ovules  
 (b) anthers... ovaries  
 (c) anthers... pollen  
 (d) sepals... ovules
25. Flowers bear seeds in protective chambers called \_\_\_\_\_.  
 (a) cones (b) anthers  
 (c) sepals (d) ovaries
26. Which two structures of a flower bear sporangia?  
 (a) ovules and stamens  
 (b) ovaries and the receptacle  
 (c) sepal and the filament  
 (d) ovules and anthers
27. A generative cell and a tube cell originate when \_\_\_\_\_.  
 (a) a microsporocyte undergoes meiosis  
 (b) a microsporocyte undergoes mitosis  
 (c) a microspore undergoes meiosis and cytokinesis  
 (d) a microspore undergoes mitosis and cytokinesis
28. How many pollen grains can potentially result from one microsporocyte?  
 (a) 1 (b) 2  
 (c) 4 (d) 8
29. What is the purpose of synergids in an ovule?  
 (a) Synergids divide, producing megasporangia.  
 (b) Synergids divide, producing one large cell with eight haploid nuclei.  
 (c) Synergids function in the guidance of the pollen tube to the embryo sac.  
 (d) The function of synergids is unknown.
30. In the process of pollination, pollen grains are transferred from the \_\_\_\_\_ to the \_\_\_\_\_.  
 (a) ovary... anther (b) stigma... ovary  
 (c) anther... sepal (d) anther... stigma
31. Like gymnosperms, many grasses and angiosperm trees are wind-pollinated. To conserve energy, these angiosperms do not produce complete flowers (complete flowers have all four of the basic parts). Which basic part would most likely be missing from wind-pollinated angiosperm flowers?  
 (a) petals (b) sepals  
 (c) anthers (d) ovaries

32. Which statement below accurately describes the role of S-genes in plants?  
 (a) S-genes are unique to plants and make them more susceptible to manipulation by bioengineers.  
 (b) S-genes are involved in self-recognition plant species.  
 (c) S-genes make plants more resistant to pests.  
 (d) If pollen from another species lands on the stigma of a mustard plant, S-genes block the pollen tube growth.
33. After fertilization, the \_\_\_\_\_ develops into a seed and the \_\_\_\_\_ develops into a fruit.  
 (a) ovule... ovary  
 (b) pollen grain... ovule  
 (c) ovary... ovule  
 (d) egg... ovule
34. A pea pod is formed from \_\_\_\_\_. A pea inside the pod is formed from \_\_\_\_\_.  
 (a) an ovule... a carpel  
 (b) an ovary... an ovule  
 (c) an ovary... a pollen grain  
 (d) an anther... an ovule
35. What are the results of the first mitotic division in a plant zygote?  
 (a) suspensor and endosperm  
 (b) basal cell and suspensor  
 (c) proembryo and terminal cell  
 (d) basal cell and terminal cell
36. Which portion of an embryonic plant consists of the shoot tip with a pair of miniature leaves?  
 (a) seed coat (b) epicotyl  
 (c) radicle (d) scutellum
37. Which one of the following best describes the function of fruits?  
 (a) protection and dispersal of seeds  
 (b) rewards for pollinators  
 (c) protection from pollinators  
 (d) storage of food for the plant to consume through the winter
38. What is the correct definition of an aggregate fruit?  
 (a) a fruit that results from a single flower that has more than one carpel, each forming a small fruit  
 (b) a fruit in which other floral parts in addition to ovaries contribute to what we call a fruit
39. Why do seeds need water to germinate?  
 (a) Water provides energy.  
 (b) Imbibition of water causes the seed coat to swell and allows the cells of the embryo to rehydrate.  
 (c) Water activates the chlorophyll molecules so that photosynthesis can begin.  
 (d) Water dissolves the minerals in the soil so that they become available to the seed.
40. Which example below is not an advantage of sexual reproduction in plants?  
 (a) Sexual reproduction can be an advantage in unstable environments because it generates variations in offspring and populations.  
 (b) The offspring of sexually reproducing plants are not as frail as clones of asexually reproducing plants.  
 (c) Seeds facilitate dispersal of offspring to more distant locations.  
 (d) Seed dormancy allows growth to be suspended until hostile environmental conditions are reversed.
41. In this type of asexual reproduction, seeds are produced even without the joining of sperm and eggs.  
 (a) callus (b) fragmentation  
 (c) apomixis (d) cloning
42. A botanist had an apple tree in his yard that produced eight different varieties of apple. This tree was most likely produced by \_\_\_\_\_.  
 (a) repeated selection of seedlings with desirable qualities  
 (b) inducing mutations in the young seedling  
 (c) grafting scions of different varieties onto the same root stock  
 (d) protoplast fusion of different varieties in the same culture tube
43. Which statement below accurately describes protoplast fusion?  
 (a) It is not possible to fuse two protoplasts from different plant species that are not reproductively compatible.  
 (b) Protoplasts can be screened for

46. Protoplasts are plant cells with their nuclei removed by fungal enzyme treatments.  
 (a) Researchers can culture protoplast fusion with grafting techniques to invent new plant varieties.  
 47. Which of the following can be done by using biotechnology, but cannot be done using traditional agricultural breeding practices?  
 (a) clone production of desirable plants  
 (b) variability loss reduction in a population  
 (c) introduction of genes into a crop from a related species  
 (d) introduction of non-existent genes into a crop
48. What does the "Bt" in Bt maize refer to?  
 (a) a gene that makes the husk of the corn too tough for insects to penetrate  
 (b) a gene that causes the plants to emit a strong toxin  
 (c) a gene that reduces the amount of water the plants need to grow  
 (d) a gene that causes the plants to produce a chemical that becomes toxic within insect guts
49. "Transgene escape" would occur if \_\_\_\_\_  
 (a) a genetically modified crop from one country is transported to another country with a local weed  
 (b) a genetically modified crop is hybridized with a wild relative  
 (c) a genetically modified crop is allowed to freely self-pollinate  
 (d) transgenic genes and are inserted into a genetically modified crop
50. Fruits develop primarily as structures specialized to \_\_\_\_\_  
 (a) spread seeds  
 (b) disperse seeds  
 (c) attract pollinators  
 (d) provide food for humans

**ANSWERS**

1. a	2. d	3. d	4. c
5. d	6. c	7. a	8. d
9. b	10. d	11. c	12. d
13. d	14. d	15. c	16. a
17. b	18. b	19. a	20. *d
21. a	22. b	23. d	24. b
25. d	26. d	27. d	28. c
29. c	30. d	31. a	32. b
33. a	34. b	35. d	36. b
37. a	38. a	39. b	40. b
41. c	42. c	43. b	44. d
45. d	46. b	47. b	48. c
49. a			

**6.5: PLANT RESPONSES TO INTERNAL AND EXTERNAL SIGNALS**

1. Evergreen trees lose their leaves \_\_\_\_\_  
 (a) in the spring (b) in the summer  
 (c) steadily all year (d) every fall
2. Which of the following seedlings will probably bend toward the light?  
 (a) one whose tip is covered with a black plastic cap  
 (b) one whose tip is separated from its base by a gelatin block  
 (c) one whose tip is cut off  
 (d) one whose tip is separated from its base by aluminum foil
3. The breakdown of chlorophyll reveals the \_\_\_\_\_ pigments of a leaf.  
 (a) carotenoid (b) xanthophylls  
 (c) anthocyanin (d) melanin
4. The formation of the abscission layer cuts off transport of substances to and from the leaf. As the concentration of sugar trapped within a leaf increases, \_\_\_\_\_ pigments are produced.  
 (a) carotenoid (b) xanthophylls  
 (c) anthocyanin (d) melanin
5. The protective layer that forms between the abscission layer and the stem consists of \_\_\_\_\_  
 (a) a layer of green palisade cells  
 (b) weak, colorless, thin-walled cells  
 (c) mycorrhizae  
 (d) densely colored cells filled with a waxy layer
6. After leaf abscission, growth will resume from the \_\_\_\_\_  
 (a) petiole (b) protective layer  
 (c) palisade layer (d) axillary bud
7. \_\_\_\_\_ trees lose their leaves in preparation for winter.  
 (a) Fir (b) Spruce  
 (c) Deciduous (d) Cedar
8. For a short-day plant, the \_\_\_\_\_ is critical in determining if flowering will occur.  
 (a) maximum number of hours of light  
 (b) minimum number of hours of darkness  
 (c) minimum number of hours of light  
 (d) maximum number of hours of darkness
9. For a long-day plant, the \_\_\_\_\_ is critical in determining if flowering will occur.  
 (a) maximum number of hours of light  
 (b) minimum number of hours of darkness  
 (c) minimum number of hours of light  
 (d) maximum number of hours of darkness
10. Day-neutral plants flower regardless of \_\_\_\_\_  
 (a) night length  
 (b) day length  
 (c) photoperiod  
 (d) day length, night length, or photoperiod
11. Which of these would inhibit flowering in a short-day plant with a critical night length of 12 hours?  
 (a) 12 hours of light, 6 hours of dark, a flash of red light, a flash of far-red light, a flash of red light, a flash of far-red light, 6 hours of dark  
 (b) 12 hours of light, 6 hours of dark, a flash of red light, a flash of far-red light, 6 hours of dark  
 (c) 12 hours of light followed by 12 hours of dark  
 (d) 12 hours of light, 6 hours of dark, a flash of red light, 6 hours of dark
12. Which of these would stimulate flowering in a long-day plant with a critical night length of 12 hours?  
 (a) 12 hours of light, 6 hours of dark, a flash of red light, a flash of far-red light, a flash of red light, a flash of far-red light, 6 hours of dark  
 (b) 12 hours of light, 6 hours of dark, a flash of red light, a flash of far-red light, 6 hours of dark  
 (c) 12 hours of light followed by 12 hours of dark  
 (d) 12 hours of light, 6 hours of dark, a flash of red light, 6 hours of dark
13. Which of the plant hormones is unusual in that it produces a response opposite that of most other hormones?  
 (a) abscisic acid (b) cytokinin  
 (c) gibberellin (d) ethylene

44. Why is golden rice pale yellow in color?  
 (a) It is rich in chlorophyll a.  
 (b) It is nutrient-poor.  
 (c) It is rich in beta-carotene.  
 (d) It is rich in chlorophyll b.
45. Which of the following can be done by using biotechnology, but cannot be done using traditional agricultural breeding practices?  
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 (b) a genetically modified crop is hybridized with a local weed  
 (c) a genetically modified crop is allowed to freely self-pollinate  
 (d) terminator genes also are inserted into a genetically modified crop
48. Fruits evolved primarily as structures specialized to \_\_\_\_\_.  
 (a) protect seeds  
 (b) disperse seeds  
 (c) protect pollen  
 (d) provide food for humans

## ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. a  | 2. d  | 3. d  | 4. c  |
| 5. d  | 6. c  | 7. a  | 8. d  |
| 9. b  | 10. d | 11. c | 12. d |
| 13. d | 14. d | 15. c | 16. a |
| 17. b | 18. b | 19. a | 20. d |
| 21. a | 22. b | 23. d | 24. b |
| 25. d | 26. d | 27. d | 28. c |
| 29. c | 30. d | 31. a | 32. b |
| 33. a | 34. b | 35. d | 36. b |
| 37. a | 38. a | 39. b | 40. b |
| 41. c | 42. c | 43. b | 44. d |
| 45. d | 46. b | 47. b | 48. c |
| 49. a |       |       |       |

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 (c) minimum number of hours of light  
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9. For a long-day plant, the \_\_\_\_\_ is critical in determining if flowering will occur.  
 (a) maximum number of hours of light  
 (b) minimum number of hours of darkness  
 (c) minimum number of hours of light  
 (d) maximum number of hours of darkness
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 (b) 12 hours of light, 6 hours of dark, a flash of red light, a flash of far-red light, 6 hours of dark  
 (c) 12 hours of light followed by 12 hours of dark  
 (d) 12 hours of light, 6 hours of dark, a flash of red light, 6 hours of dark
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 (b) 12 hours of light, 6 hours of dark, a flash of red light, a flash of far-red light, 6 hours of dark  
 (c) 12 hours of light followed by 12 hours of dark  
 (d) 12 hours of light, 6 hours of dark, a flash of red light, 6 hours of dark
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 (a) abscisic acid (b) cytokinin  
 (c) gibberellin (d) ethylene

14. The P<sub>1</sub> form of the phytochrome pigment has maximum absorption in the \_\_\_\_\_ part of the spectrum.  
 (a) blue (b) red  
 (c) far-red (d) blue and far-red
15. A biological cycle with a period of about 24 hours is called \_\_\_\_\_.  
 (a) thigmotropism  
 (b) a circadian rhythm  
 (c) photoperiodism  
 (d) abscission
16. Most plants flower when \_\_\_\_\_.  
 (a) the soil reaches a certain temperature  
 (b) they deplete soil nutrients  
 (c) the days are the right length  
 (d) the nights are the right length
17. The pigment involved in the flowering process (and other developmental events in plants) is \_\_\_\_\_.  
 (a) chlorophyll (b) beta-carotene  
 (c) phytochrome (d) rhodopsin
18. Thigmotropism is a movement in response to \_\_\_\_\_.  
 (a) light (b) gravity.  
 (c) touch (d) chemicals
19. Which one of the following is seen in plants in response to a water deficit?  
 (a) closing stomata to reduce the rate of transpiration  
 (b) increasing the synthesis and release of abscisic acid  
 (c) inhibiting the growth of young leaves  
 (d) all of the above
20. Strains of pathogens that mildly harm, but do not kill, the host plant are termed \_\_\_\_\_.  
 (a) jasmonic (b) virulent  
 (c) avirulent (d) herbivores
21. A conformational change in a substance called phytochrome \_\_\_\_\_.  
 (a) causes a plant to bend toward light  
 (b) triggers fruit drop  
 (c) leads to de-etiolation  
 (d) is responsible for gravitropism
22. Growth that results in curvatures of whole plant organs toward or away from stimuli is called \_\_\_\_\_.  
 (a) gravitropism (b) phototropism  
 (c) thigmotropism (d) all of the above
23. You are interested in determining what part of a plant is actually sensitive to light for
- phototropism. A good first experiment would be to \_\_\_\_\_.  
 (a) remove the apical meristem and apply auxin before beginning light treatments.  
 (b) shine light from one side only. Then measure the auxin diffusing down the stem on the light and the shaded sides.  
 (c) cover one part (for instance, the tip or base) before beginning light treatments.  
 (d) spray auxin on just one part of the plant at a time to determine which one stimulates flowering.
24. The immediate, direct effect of auxin in cell elongation, according to the acid growth hypothesis, is to \_\_\_\_\_.  
 (a) increase the hydrostatic pressure in cells, stretching their walls  
 (b) activate ATP-driven proton (H<sup>+</sup>) pumps  
 (c) shift the pH and thus activate enzymes that break the hydrogen bonds  
 (d) move water into vacuoles
25. A graduate student growing plant cells in a laboratory dish wants them to therefore, the student treats them with cytokinins.  
 (a) enlarge (b) become dormant  
 (c) grow roots (d) divide
26. A callus will develop roots if you use a auxin concentration and a \_\_\_\_\_ cytokinin concentration in the medium.  
 (a) high... high (b) high... low  
 (c) low... high (d) low... low
27. In shoots, branching is inhibited by \_\_\_\_\_ from the tip of a growing shoot, but this effect is countered by \_\_\_\_\_ from the roots.  
 (a) cytokinins... auxin  
 (b) gibberellins... ethylene  
 (c) auxin... cytokinins  
 (d) gibberellins... abscisic acid
28. Which hormone would a florist most likely spray on cut flowers to keep them fresh?  
 (a) auxin (b) gibberellins  
 (c) cytokinins (d) brassinosteroids
29. As leaf lettuce matures, a tall flowering shoot extends beyond the basal edible leaves. After the plant bolts like this, it no longer produces broad, tasty leaves. Suppose you want to prevent bolting so that you can harvest lettuce longer. You may want to prevent the plant from synthesizing \_\_\_\_\_.  
 (a) abscisic acid (b) gibberellins  
 (c) cytokinins (d) ethylene

30. Seeds of many desert plants will not germinate until a heavy rain washes away their \_\_\_\_\_.  
 (a) phytochrome (b) abscisic acid  
 (c) gibberellins (d) auxin
31. The synthesis and release of abscisic acid in a plant is a response to \_\_\_\_\_.  
 (a) water deficit  
 (b) oxygen deprivation  
 (c) salt stress  
 (d) heat stress
32. The triple response to mechanical stress does not involve \_\_\_\_\_.  
 (a) increased stem elongation  
 (b) stem thickening  
 (c) asymmetric growth  
 (d) the inactivation of kinase
33. The abscission layer \_\_\_\_\_.  
 (a) causes a shoot to bend toward light  
 (b) secretes cytokinin  
 (c) is where a leaf separates from a stem  
 (d) detects light and measures the photoperiod
34. In the autumn, the amount of \_\_\_\_\_ decreases, rendering the cells of the abscission layer more sensitive to \_\_\_\_\_.  
 (a) ethylene... auxin  
 (b) gibberellin... abscisic acid  
 (c) cytokinin... abscisic acid  
 (d) auxin... ethylene
35. Which one, if any, of these features is not characteristic of ethylene?  
 (a) It is an organic compound.  
 (b) It is active in small amounts.  
 (c) Ethylene is involved in one of the rare examples of a positive feedback loop.  
 (d) All of the above statements are true regarding ethylene.
36. Some seeds require light for germination, which is controlled by the phytochrome system. In which one of the following treatments would germination not occur?  
 (a) red light only  
 (b) red light followed by far-red light  
 (c) far-red light followed by red light  
 (d) green light followed by red light
37. Circadian rhythms are \_\_\_\_\_.  
 (a) responses to the number of hours of daylight  
 (b) innate 24-hour cycles of behavior or physiological change
38. Photoperiodism is \_\_\_\_\_.  
 (a) the ability to perceive shortwave ultraviolet light  
 (b) an attraction to light  
 (c) found only in plants  
 (d) a physiological response of an organism to alternating light and dark cycles
39. An Alaskan trapper worried about being attacked by grizzly bears left on the lights in his cabin all the time. Plants just outside the cabin flowered a month early. Which of the following best explains this?  
 (a) It was due to phototropism.  
 (b) They must have been long-night plants.  
 (c) The lights must have emitted far-red light  
 (d) They must have been long-day plants.
40. A certain short-day plant flowers when days are less than 12 hours long. Which of the following will cause it to flower?  
 (a) a 9-hour night and a 15-hour day with 1 minute of darkness after 7 hours  
 (b) an 8-hour day and a 16-hour night with a flash of white light after 8 hours  
 (c) a 13-hour night and an 11-hour day with 1 minute of darkness after 6 hours  
 (d) a 12-hour day and a 12-hour night with a flash of red light after 6 hours
41. A certain plant flowers only if days are shorter than 10 hours. Which of the following will cause it to flower?  
 (a) 8 hours light, 8 hours dark, flash of red light, 8 hours dark  
 (b) 12 hours light, 6 hours dark, flash of red light, 6 hours dark  
 (c) 8 hours light, brief dark period, 8 hours light, 8 hours dark  
 (d) 8 hours light, 8 hours dark, flash of red light, flash of far-red light, 8 hours dark
42. \_\_\_\_\_ appear to be responsible for gravitropism.  
 (a) Statoliths (b) Phytoalexins  
 (c) Gibberellins (d) Cytokinins
43. A rapid loss of water in specialized cells in the sensitive plant *Mimosa pudica* causes \_\_\_\_\_.  
 (a) seed germination  
 (b) the plant to bend toward light  
 (c) stomatal openings, initiating photosynthesis  
 (d) leaves to droop

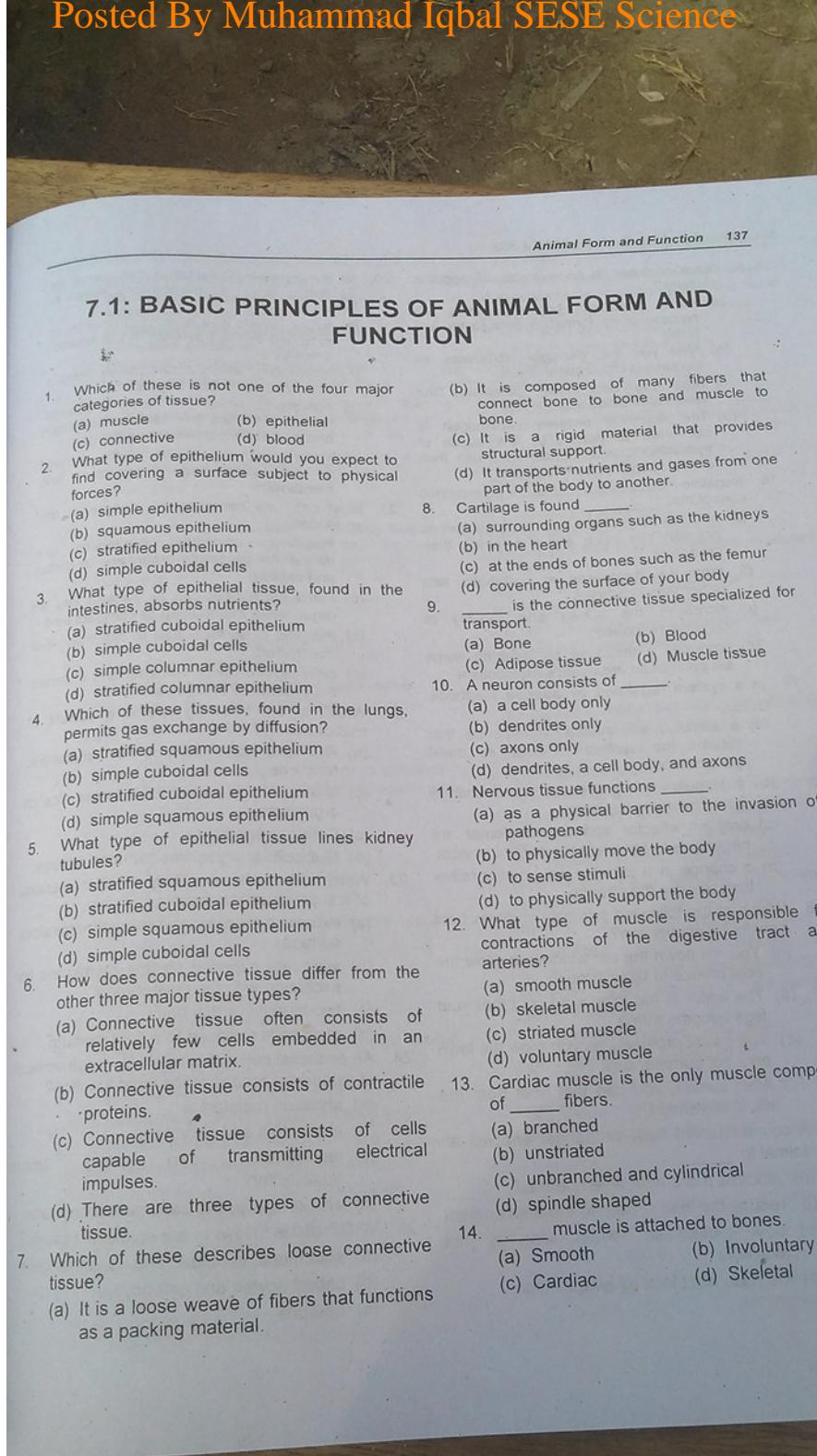
44. Inhibiting the growth of shallow roots is a response of plants to \_\_\_\_\_.  
 (a) water deficit (b) oxygen deprivation  
 (c) salt stress (d) heat stress
45. The formation of air tubes in submerged roots is an adaptation to \_\_\_\_\_.  
 (a) water deficit (b) oxygen deprivation  
 (c) salt stress (d) heat stress
46. When a plant that is not adapted to salty water is exposed to salty water, it will \_\_\_\_\_.  
 (a) lose water rather than absorb it  
 (b) thrive  
 (c) form air tubes  
 (d) synthesize and release abscisic acid
47. The production of organic solutes by plants is a response to \_\_\_\_\_.  
 (a) water deficit (b) oxygen deprivation  
 (c) salt stress (d) heat stress
48. Which one of the following describes a plant's response to heat stress?  
 (a) production of heat-shock proteins  
 (b) closing of stomata  
 (c) production of abscisic acid  
 (d) production of heat-shock proteins and closing of stomata
49. How are heat-shock proteins thought to work?  
 (a) They promote evaporative cooling.  
 (b) They help other proteins retain their functional shapes.  
 (c) They regulate stomatal opening and closing.  
 (d) They facilitate the uptake of water.
50. Increasing the proportion of unsaturated fatty acids in their membranes is a response of plants to \_\_\_\_\_.  
 (a) water deficit (b) oxygen deprivation  
 (c) salt stress (d) cold stress
51. Increasing the cytoplasmic levels of specific well-tolerated solutes, such as sugars, helps a plant to cope with \_\_\_\_\_.  
 (a) water deficit (b) oxygen deprivation  
 (c) heat stress (d) cold stress
52. The production of canavanine is a response of some plants to \_\_\_\_\_.  
 (a) water deficit (b) oxygen deprivation  
 (c) herbivory (d) cold stress
53. In at least some species of plants, a leaf damaged by a caterpillar may \_\_\_\_\_.  
 (a) synthesize and release chemicals that attract wasps that prey on the caterpillar  
 (b) produce large quantities of heat-shock proteins that discourage foraging  
 (c) increase the proportion of unsaturated fatty acids in the membranes  
 (d) respond by producing organic solutes that affect water potential
54. The first line of defense against pathogens is \_\_\_\_\_.  
 (a) gene-for-gene recognition  
 (b) specific plant disease resistance (*R*) genes  
 (c) production of oligosaccharides  
 (d) physical barrier of the epidermis (or periderm)
55. Plant defenses against the herbivores that feed on them include \_\_\_\_\_.  
 (a) poisons such as canavanine  
 (b) physical defenses, such as thorns and spines  
 (c) distasteful compounds  
 (d) all of the above
56. Plant hormones act by affecting the activities of \_\_\_\_\_.  
 (a) genes  
 (b) membranes  
 (c) enzymes  
 (d) genes, membranes, and enzymes

**ANSWERS**

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. c  | 2. b  | 3. a  | 4. c  |
| 5. d  | 6. d  | 7. c  | 8. b  |
| 9. b  | 10. d | 11. d | 12. d |
| 13. a | 14. b | 15. b | 16. d |
| 17. c | 18. c | 19. d | 20. c |
| 21. c | 22. d | 23. c | 24. b |
| 25. d | 26. b | 27. c | 28. c |
| 29. b | 30. b | 31. a | 32. a |
| 33. c | 34. d | 35. d | 36. b |
| 37. b | 38. d | 39. d | 40. a |
| 41. a | 42. a | 43. d | 44. a |
| 45. b | 46. a | 47. c | 48. d |
| 49. b | 50. d | 51. d | 52. a |
| 53. a | 54. d | 55. d | 56. d |

## Part VII

# Animal Form and Function



15. Which of these is an example of negative feedback?  
 (a) As a blood clot begins to form, the process of its formation gets faster and faster.  
 (b) After you eat, glucagon stimulates an increase in blood sugar levels.  
 (c) After you eat, insulin stimulates the lowering of blood sugar levels.  
 (d) The digestive enzyme pepsinogen is converted to pepsin by the action of hydrochloric acid; pepsin itself can then convert pepsinogen into pepsin.
16. Negative feedback is a method of homeostatic control that \_\_\_\_\_.  
 (a) ensures that conditions in an organism do not vary too much above or below their set points  
 (b) promotes decreases in metabolic rate rather than increases  
 (c) increases the speed and rapidity of negative responses  
 (d) produces a response by lowering some set point of an organism's metabolism
17. In a system regulated by positive feedback, \_\_\_\_\_.  
 (a) a stimulus will initiate a response that returns the system to near its initial parameters  
 (b) a stimulus will prevent a small change from becoming too large  
 (c) only an effector and control center are necessary to complete the control system  
 (d) a change in a variable will amplify rather than reverse the change
18. Which of the following primarily involves heat transfer by convection?  
 (a) You roll down the car window to allow the cool breeze to blow through.  
 (b) The water in the lake is so cold that your legs become numb.  
 (c) You sweat profusely as you mow the lawn on a hot summer day.  
 (d) After sunset, you can feel heat from the warm pavement.
19. A countercurrent heat exchanger enables an animal to \_\_\_\_\_.  
 (a) produce more heat when needed  
 (b) reduce the loss of heat to the environment  
 (c) slow metabolism when food is not available  
 (d) increase heat loss by evaporation
20. An energy-saving adaptation that conserves life during times of environmental stress or famine is \_\_\_\_\_.  
 (a) torpor, which is a slowing of motion as exhibited by the tree sloth in the Amazon basin as it \_\_\_\_\_.  
 (b) hibernation, which allows desert animals to survive summer droughts  
 (c) estivation, which is what nocturnal animals do when their temperature drops and metabolism slows during the day  
 (d) slowing respiration and circulation as well as decreasing body temperature and metabolism
21. Most cells are microscopic because at this small size \_\_\_\_\_.  
 (a) free-living unicellular organisms are difficult for predatory organisms to detect and capture  
 (b) many more cells can be packed into an organ while maintaining its compact size  
 (c) the ratio of surface area to cell volume is maximized  
 (d) cells require fewer nutrients and increase the probability of survival
22. Which of the following is not a benefit of multicellularity?  
 (a) All cells can perform all metabolic functions.  
 (b) Multicellularity allows for a larger size of organisms.  
 (c) Cells can specialize.  
 (d) Multicellular organisms can form tissues.
23. Which of these is most likely not characteristic of a small aquatic animal?  
 (a) extensive branching of internal respiratory surfaces  
 (b) adequate exposed plasma membrane to exchange with the environment  
 (c) two-layered or thin body  
 (d) most cells exposed to a fluid medium
24. An epithelial cell with a relatively large amount of cytoplasm probably has what function?  
 (a) abrasion resistance  
 (b) absorption and secretion  
 (c) regeneration and rapid tissue replacement  
 (d) anchorage for the basement membrane
25. Which of the following are epithelial tissues?  
 (a) squamous, cuboidal, and columnar cells  
 (b) chondrocytes and osteocytes  
 (c) neurons

26. Which of the following consist(s) of specialized epithelial cells?  
 (a) pseudostratified ciliated epithelium  
 (b) salivary glands and sweat glands  
 (c) sweat glands and mammary glands  
 (d) all of the above
27. Organs that come into contact with the environment are lined with which one of the following types of tissue?  
 (a) smooth muscle  
 (b) epithelial  
 (c) adipose  
 (d) loose connective
28. Microscopic analysis of an unknown tissue sample reveals the presence of chondrocytes, indicating that the sample is \_\_\_\_\_.  
 (a) bone  
 (b) loose connective tissue  
 (c) cartilage  
 (d) stratified columnar epithelium
29. The matrix of blood tissue is \_\_\_\_\_.  
 (a) the outer covering of the blood vessels  
 (b) the red and white blood cells  
 (c) the blood plasma  
 (d) made of cuboidal epithelium
30. Which of the six major types of connective tissue has a matrix made of rigid collagen and calcium salts?  
 (a) fibrous connective  
 (b) cartilage  
 (c) bone  
 (d) adipose
31. Ligaments are what kind of connective tissue?  
 (a) cartilage  
 (b) adipose  
 (c) loose connective  
 (d) fibrous connective
32. Which of the major tissue types is responsible for elasticity in the heart?  
 (a) epithelial  
 (b) connective  
 (c) muscle  
 (d) nervous
33. Cells that secrete cartilage are called \_\_\_\_\_.  
 (a) fibroblasts  
 (b) osteons  
 (c) chondrocytes  
 (d) adipocytes
34. Ligaments connect \_\_\_\_\_ to \_\_\_\_\_.  
 (a) muscle... tendon  
 (b) tendon... tendon  
 (c) tendon... bone  
 (d) bone... bone
35. Which of the following are connective tissues?  
 (a) adipose tissue, cartilage, bone, and blood  
 (b) bone, blood, and skin  
 (c) red blood cells and neurons  
 (d) cartilage, bone, and epithelium
36. Bone cells are called \_\_\_\_\_.  
 (a) osteocytes  
 (b) chondrocytes  
 (c) neurons  
 (d) osteoblasts
37. "Branched and stratified" is a description that would apply to which kind of animal tissue?  
 (a) stratified squamous epithelium  
 (b) nerve  
 (c) skeletal muscle  
 (d) cardiac muscle
38. Myosin and actin are \_\_\_\_\_.  
 (a) proteins that play a major role in muscle contraction  
 (b) part of a negative feedback loop  
 (c) types of skeletal muscle  
 (d) found localized in intercalated disks
39. Each skeletal muscle fiber \_\_\_\_\_.  
 (a) has striations  
 (b) consists of a single cell  
 (c) contains many parallel contractile units called myofibrils  
 (d) all of the above
40. A neuron consists of \_\_\_\_\_.  
 (a) effectors, actin, and striated muscle fibers  
 (b) sarcomeres, axons, and dendrites  
 (c) a cell body, matrix, and myosin  
 (d) a cell body, dendrites, and axons
41. How many organ systems make up your body?  
 (a) four  
 (b) hundreds  
 (c) eleven  
 (d) millions
42. All but one of the following systems are correctly paired with one of their parts. Which pair is incorrect?  
 (a) excretory system... intestine  
 (b) respiratory system... lung  
 (c) endocrine system... thyroid gland  
 (d) integumentary system... hair
43. An organ such as the heart or liver contains \_\_\_\_\_.  
 (a) muscle tissue  
 (b) nervous tissue  
 (c) connective tissue  
 (d) all of the above
44. An organism is to an albatross as a(n) \_\_\_\_\_ is to an intestine.  
 (a) cell  
 (b)

45. Which one of the following animals would you expect to consume food at the highest rate (kilograms of food per kilogram of body weight per day)?  
 (a) dog (b) hummingbird  
 (c) human (d) elephant
46. Which of these is not true of a food ingested by an animal?  
 (a) It is used as a source of chemical energy  
 (b) Food is broken down in anabolic pathways.  
 (c) It yields high-energy molecules that are absorbed into body cells  
 (d) It is used to generate ATP for biosynthesis.
47. An animal's internal environment is \_\_\_\_\_.  
 (a) the blood  
 (b) the interior of compartments like the heart and stomach  
 (c) any place beneath the skin  
 (d) the interstitial fluid that surrounds the cells
48. Which of the following best illustrates homeostasis?  
 (a) All the cells in the body have much the same chemical composition.  
 (b) Cells of the skin are constantly worn off and replaced.  
 (c) When blood  $\text{CO}_2$  increases, you breathe faster, ridding the body of excess  $\text{CO}_2$ .  
 (d) All organs are composed of the same four kinds of tissues.
49. Negative feedback is a method of homeostatic control that \_\_\_\_\_.  
 (a) increases the speed and rapidity of negative responses  
 (b) counteracts a change in a condition by causing the change to either moderate or stop  
 (c) promotes decreases in metabolism rather than increases  
 (d) produces a response by lowering some set point of an organism's metabolism
50. If hormone A is part of a negative feedback loop with hormone B, then we can expect that \_\_\_\_\_.  
 (a) A and B will tend to have the same concentration  
 (b) their concentrations will rise and fall at the same time, but in a regular cycle  
 (c) A will be highest when B is lowest, and vice versa  
 (d) the concentrations of A and B will have no obvious relation to one another
51. When we talk of feedback systems, the word "stimulus" means \_\_\_\_\_.  
 (a) a signal from the outside environment  
 (b) a difference between the environment and the set point  
 (c) a signal that the effector gives to the sensor  
 (d) any signal passed between the sensor, integrator, and effector
52. The role of an effector in a feedback loop is to \_\_\_\_\_.  
 (a) detect the stimulus  
 (b) influence the stimulus  
 (c) allow the integrator to keep working even though conditions have changed  
 (d) act as a sensor
53. When a jogger starts to run, the rate at which his muscles produce  $\text{CO}_2$  rises sharply. But the  $\text{CO}_2$  in his blood rises only slightly before he starts to breathe faster and his heart starts beating stronger. Soon his increased rate of  $\text{CO}_2$  production is balanced by an increased rate of  $\text{CO}_2$  removal. This would be an example of \_\_\_\_ feedback because the jogger's circulatory and respiratory systems are \_\_\_\_\_.  
 (a) positive... improving the operating conditions in the jogger's body  
 (b) negative... acting to oppose the increase of  $\text{CO}_2$  from the preferred concentration  
 (c) positive... decreasing the  $\text{CO}_2$  concentration  
 (d) positive... restoring the  $\text{CO}_2$  concentration to the set point
54. \_\_\_\_\_ feedback most directly maintains homeostasis because it \_\_\_\_\_.  
 (a) Negative... tends to keep a system at a desirable "set point"  
 (b) Negative... accentuates fluctuations and keeps the system from reaching equilibrium  
 (c) Positive... keeps systems constant despite fluctuations in the external environment  
 (d) Positive... magnifies deviations from the "set point"
55. By definition, an ectotherm \_\_\_\_\_.  
 (a) is cold-blooded  
 (b) is warm-blooded  
 (c) obtains most of its heat from its environment  
 (d) can generate enough metabolic heat to keep its body temperature above that of its surroundings

56. The term "endotherm" refers specifically to \_\_\_\_\_.  
 (a) a warm-blooded animal  
 (b) a cold-blooded animal  
 (c) an animal that gets most of its body heat from its metabolism  
 (d) an animal that temporarily abandons warm-bloodedness.
57. Which statement is true regarding thermoregulation? \_\_\_\_\_  
 (a) An ectotherm such as a lizard does not maintain a fairly constant body temperature.  
 (b) Ectotherms generally do not conserve body heat as effectively as do polar bears.  
 (c) Endotherms must always maintain a fairly constant body temperature to survive.  
 (d) In furry animals, raised hairs keep the animal cooler than lowered hairs.
58. The wolf, his coat glowing in the early spring sunshine, sat atop a cold boulder after unsuccessfully pursuing a plump jackrabbit. He continued to pant while \_\_\_\_\_.  
 (a) his body heat evaporated into the rock  
 (b) heat escaped his gaping jaws by conduction  
 (c) receiving heat by conduction from the sun  
 (d) heat radiated from his tired body.
59. It's a cold day in the lecture hall. When you rest your arm on the cool laminated desktop at your seat, heat is transferred \_\_\_\_\_.  
 (a) from your body to the desk by radiation  
 (b) from your body to the desk by conduction  
 (c) from the desk to your body by radiation  
 (d) from the desk to your body by conduction
60. When body temperature is too \_\_\_\_\_ helps to correct the situation because it \_\_\_\_\_.  
 (a) high... peripheral vasodilation... redirects heat from the body core to the outside  
 (b) high... sweating... lowers the metabolic rate by dumping toxic ions  
 (c) low... peripheral vasodilation... conserves heat in the body core  
 (d) low... shivering... lowers the metabolic rate and conserves blood sugar
61. Humid weather makes you feel warmer because humid air, which is saturated with water molecules \_\_\_\_\_.  
 (a) interferes with heat loss by conduction  
 (b) holds warm water vapor  
 (c) interferes with heat loss by evaporation
62. Sweating \_\_\_\_\_.  
 (a) can be prevented by drinking adequate amounts of water  
 (b) happens only on hot days  
 (c) is common in dogs  
 (d) helps the body thermoregulate
63. Which mode of thermoregulation is both behavioral and warming?  
 (a) An elephant rolls in the mud and sprays dust over its back.  
 (b) A marine iguana dives into the surf after sunning on a rock.  
 (c) A man puts on a wide-brimmed hat while laboring in the sunshine.  
 (d) A falcon migrates from San Francisco to Brazil for the winter.
64. In the late fall, bats hibernate in clusters with many bats pressed together and holding on to one another. Which example below is not an advantage of this behavior?  
 (a) Less surface area is exposed to the environment.  
 (b) In this configuration, less heat is needed for each bat and, therefore, each bat requires less food.  
 (c) Hibernation allows the bats to completely shut down their physiology.  
 (d) Any heat generated by any bat is shared by other bats.
65. On a cold day, blood vessels in the skin \_\_\_\_\_.  
 (a) dilate, allowing blood to keep the skin warm  
 (b) constrict, forcing blood to flow through vessels in the skin  
 (c) constrict, reducing heat loss from blood at the surface  
 (d) dilate, causing blood to pass through the cold skin more quickly
66. Which is a correct statement about an organism and its environment?  
 (a) The gastrovascular cavity provides the nutrient exchange surface in mammals.  
 (b) Interstitial fluid is the go-between for body cells and the circulatory system.  
 (c) An animal is a closed system that is separate and distinct from its environment.  
 (d) Animals are able to live as long as they remain isolated from their environments.

67. The four major categories of tissues are \_\_\_\_\_.
- bone, muscle, blood, and adipose
  - nervous, epithelial, connective, and muscle
  - muscle, epithelial, bone, and cartilage
  - blood, nervous, connective, and muscle
68. Metabolic rate is \_\_\_\_\_.
- the total amount of energy an animal uses in a unit of time
  - the amount of heat lost by an animal in a unit of time
  - typically higher in an ectothermic animal than in an endothermic one
  - determined when the organism is at rest with an empty stomach
69. Which of the following are listed in the correct order based upon an increasing basal metabolic rate (BMR)?
- hummingbird, dog, mouse
  - fish, dog, mouse
  - dog, cat, mouse, salamander
  - frog, rabbit, snake
70. Homeostasis is the \_\_\_\_\_.
- exchange of materials with the surrounding environment
  - idea that all vertebrates are built in a similar way
  - correlation of structure and function
  - maintenance of a relatively constant internal environment

## ANSWERS

1. d	2. c	3. c	4. d
5. d	6. a	7. a	8. c
9. b	10. d	11. c	12. a
13. a	14. d	15. c	16. a
17. d	18. a	19. b	20. d
21. c	22. a	23. a	24. b
25. a	26. d	27. b	28. c
29. c	30. c	31. d	32. b
33. c	34. d	35. a	36. a
37. d	38. a	39. d	40. d
41. d	42. a	43. d	44. c
45. b	46. b	47. d	48. c
49. b	50. c	51. b	52. b
53. b	54. a	55. c	56. c
57. b	58. d	59. b	60. a
61. c	62. d	63. d	64. c
65. c	66. b	67. b	68. a
69. b	70. d		

## 7.2: ANIMAL NUTRITION

1. When digested, proteins are broken down into \_\_\_\_\_.
- glycerol only
  - fatty acids only
  - monosaccharides
  - amino acids
2. When digested, fats are broken down into \_\_\_\_\_.
- glycerol only
  - fatty acids only
  - monosaccharides
  - both glycerol and fatty acids
3. Starch is a type of \_\_\_\_\_.
- disaccharide
  - nucleotide
  - polysaccharide
  - fatty acid
4. Your small intestine can absorb \_\_\_\_\_ without their being further digested.
- |              |               |
|--------------|---------------|
| (a) starches | (b) fats      |
| (c) proteins | (d) fructoses |
5. Which of these enzymes begins the breakdown of starch?
- bile
  - disaccharidases
  - lipase
  - amylase
6. Starch can be broken down into the disaccharide known as \_\_\_\_\_.
- |             |             |
|-------------|-------------|
| (a) lactose | (b) glucose |
| (c) sucrose | (d) maltose |
7. Protein digestion begins in the \_\_\_\_\_.
- mouth
  - esophagus
  - stomach
  - small intestine
8. What is the main component of gastric juice?
- inactive pepsin
  - amylase
  - hydrochloric acid
  - water
9. \_\_\_\_\_ is secreted by the \_\_\_\_\_ and acts to emulsify \_\_\_\_\_ in the \_\_\_\_\_.
- Lipase... small intestine... fats... small intestine
  - Trypsin... pancreas... fats... small intestine

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16. How does a gastrovascular cavity differ from an alimentary canal? The gastrovascular cavity \_\_\_\_\_.
- stores food but does not digest it
  - absorbs food molecules but does not produce hydrolytic enzymes
  - has only a single opening
  - functions in digestion but not absorption
17. Which one of the following correctly represents the order in which food coming into the body passes through the structures of the digestive system?
- pharynx, stomach, esophagus, small intestine
  - esophagus, stomach, pharynx, small intestine
  - pharynx, small intestine, large intestine, stomach
  - pharynx, stomach, small intestine, large intestine
18. Breakdown of carbohydrates first begins in which one of the following organs?
- mouth
  - stomach
  - small intestine
  - pancreas
19. The cardiac sphincter surrounds the cardiac orifice, the upper opening into the stomach. If this sphincter failed to properly constrict, there might be a problem with \_\_\_\_\_.
- regurgitation of food into the esophagus
  - the loss of control of defecation
  - movement of the bolus into the trachea rather than the esophagus
  - rapid emptying from the stomach into the small intestine
20. Which one of the following statements is false?
- The teeth of carnivores tend to be sharper than the teeth of herbivores.
  - The intestines of carnivores tend to be longer than the intestines of herbivores of similar overall body size.
  - Animals do not produce enzymes that hydrolyze cellulose.
  - Many herbivorous vertebrates house large populations of symbiotic bacteria and protists in special fermentation chambers in their alimentary canals.
21. Which one of the following is not something that must be provided in an animal's diet?
- oxygen
  - organic raw materials
  - fuel
  - essential nutrients
22. Which one of the following statements is false?
- Glycogen is a major fuel molecule for cells.
  - ATP powers basal metabolism and, in endotherms, temperature regulation.
  - Obesity is currently a major global health problem.
  - A person's genetic makeup is a major factor in obesity.
23. Leptin, an appetite regulator, is produced in the \_\_\_\_\_ and \_\_\_\_\_.
- adipose tissue... high blood levels of leptin should lead to suppressed appetite
  - brain... it promotes the breakdown of muscle protein during periods of undernourishment
  - stomach... it causes the churning motion you feel when you are hungry.
  - liver... it promotes the breakdown of glycogen stores
24. A breakfast cereal advertises that it contains essential vitamins and minerals. In this context, the word "essential" means \_\_\_\_\_.
- that it contains the essence of vegetables used to extract the nutrients
  - that they can be made in the body but it is important to eat food containing these nutrients so that we do not waste essential energy in making them
  - the nutrients must be supplied in the diet and cannot be made in the body
  - that it is important that you believe the package and buy the product
25. Which of the following are considered essential nutrients? (1) certain carbohydrates, (2) certain fatty acids, (3) certain amino acids, (4) cholesterol
- 1, 2, 3, and 4
  - 1, 2, and 3
  - 2, 3, and 4
  - 2 and 3
26. In general, B vitamins function in your body as \_\_\_\_\_.
- a source of energy
  - structural components of cell membranes
  - a source of minerals
  - coenzymes

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27. Why is it important to consume B vitamins every day, but not A vitamins?
- B vitamins are an essential nutrient, and vitamin A is not.
  - Vitamin A can be stored by the body, but B vitamins cannot.
  - The body needs much larger amounts of B vitamins than vitamin A.
  - A is just an "extra."
28. The fat-soluble vitamins include \_\_\_\_\_.
- vitamins A, D, E, and K
  - vitamin A and the B group
  - the B vitamins and vitamin C
  - vitamins C, D, E, and K
29. \_\_\_\_\_ are needed in the diet as components of teeth and bone, as parts of certain enzymes, for normal muscle and nerve function, and for water balance.
- Starches
  - Fats
  - Minerals
  - Nucleic acids
30. Which one of the following statements about nutrition and digestion is true?
- "Feeding" and "digestion" are synonyms.
  - Chemical digestion precedes physical digestion in wolves.
  - Absorption involves monomers passing through intestinal walls.
  - Elimination rids the body of overly large nutrient molecules.
31. Which one of the following statements is false?
- The last stage of food processing is absorption.
  - Digestion breaks down food into molecules small enough for the body to absorb.
  - Digestion breaks bonds using enzymatic hydrolysis.
  - Ingestion is the act of eating.
32. In vertebrates, food is moved along the length of the digestive system by \_\_\_\_\_.
- active transport across cell membranes
  - peristalsis
  - diffusion and osmosis
  - sequential contraction of bands of skeletal muscles
33. Chemical digestion of carbohydrates begins in the \_\_\_\_\_ with the action of \_\_\_\_\_.
- mouth... salivary amylase
  - stomach... hydrochloric acid
  - small intestine... lipase
34. The tongue does all of the following except \_\_\_\_\_.
- taste food
  - manipulate food within the mouth
  - shape food into a bolus
  - secrete saliva
35. How is the stomach lining protected from the strongly acidic pH of its contents?
- It releases a hormone called gastrin, which stops gastric juice secretion.
  - Mucous cells secrete a protective lubricant into the stomach.
  - Bile neutralizes the acid soon after it enters the stomach.
  - Parietal cells secrete a protective buffer to neutralize hydrochloric acid.
36. Which one of the following statements regarding protein digestion is false?
- Protein digestion begins in the stomach.
  - Protein digestion involves pepsin, which comes from the chief cells in the stomach.
  - Protein digestion is dependent on HCl from parietal cells of the stomach.
  - Protein digestion is initiated when pepsin splits polypeptide chains into smaller polypeptides.
37. Which of the following might make the most effective anti-ulcer medication?
- a chemical that stimulates the parietal cells of the gastric pits
  - a chemical that kills bacteria in the stomach
  - a chemical that inhibits epithelial cells in the stomach that produce mucus
  - a chemical that stimulates the secretion of bile
38. Acid chyme \_\_\_\_\_.
- contains digested fat
  - is a mush made from boluses and hydrolytic enzymes secreted by the pancreas and duodenum
  - contains food and gastric juice and moves through the pyloric sphincter
  - causes gastric ulcers
39. Which of the following is properly matched with its product?
- peristalsis... heartburn
  - acid chyme backflow... heartburn
  - parietal cells... gastrin
  - chief cells... vomiting

CHIEF  
REDY

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40. In humans, most nutrient molecules are absorbed by the \_\_\_\_\_.  
 (a) stomach (b) liver  
 (c) small intestine (d) large intestine
41. The liver and pancreas add their secretions to the partially digested food produced in the stomach, in the \_\_\_\_\_ of the small intestine.  
 (a) sphincter (b) duodenum  
 (c) jejunum (d) ileum
42. The largest variety of digestive enzymes function in the \_\_\_\_\_.  
 (a) large intestine (b) oral cavity  
 (c) stomach (d) small intestine
43. The natural antacid produced to protect the intestines against stomach acid is produced by the \_\_\_\_\_.  
 (a) stomach (b) liver  
 (c) esophagus (d) pancreas
44. Pepsin is an enzyme produced in the stomach that attacks proteins to break them down into smaller peptide molecules. Which one of the following statements about this enzyme is true?  
 (a) The activity of pepsin will speed up in the small intestine because the pH becomes less acidic.  
 (b) Pepsin will continue to work at the same rate as it moves through the intestines until all the protein is broken down.  
 (c) Pepsin will cease to function in the small intestine as basic secretions from the pancreas neutralize the pH.  
 (d) Salivary amylase activates pepsin, converting it to a functioning form in the stomach.
45. Gallstone surgery sometimes requires that the gallbladder be removed. Patients are then advised to avoid ingesting large amounts of fat because \_\_\_\_\_.  
 (a) the gallbladder makes bile, which is necessary for fat emulsification  
 (b) without the bile produced by the gallbladder, fats cannot be enzymatically hydrolyzed  
 (c) the gallbladder produces the hormone enterogastrone, necessary to digest fats  
 (d) the gallbladder stores large quantities of bile, releasing it when fats reach the small intestine
46. digestive system similar in function to these air sacs and capillaries are the \_\_\_\_\_.  
 (a) villi and microvilli  
 (b) esophagus  
 (c) gastric glands  
 (d) high-density lipoproteins
47. Which of the following is the actual absorptive surface within the lumen of the small intestine?  
 (a) microvilli (b) blood capillaries  
 (c) liver (d) fingerlike villi
48. Researchers provided radioactively labeled food to a dog and traced the movement of absorbed molecules. Which type of molecule moved along a path different from all the others?  
 (a) carbohydrates (b) proteins  
 (c) nucleic acids (d) fats
49. The lymphatic vessels in the villi absorb and transport \_\_\_\_\_.  
 (a) chylomicrons  
 (b) nucleotides  
 (c) monosaccharides  
 (d) amino acids
50. Which one of the following organs of the digestive system does not produce any secretions that aid in digestion?  
 (a) large intestine  
 (b) small intestine  
 (c) stomach  
 (d) pancreas
51. During some types of antibiotic treatments, patients often experience diarrhea because \_\_\_\_\_.  
 (a) antibiotics are toxic to the colon's epithelium and to bacteria  
 (b) the bacterial flora of the large intestine normally break down undigested organic material; after the bacteria have been killed by antibiotics, the undigested material increases the osmotic pressure, resulting in decreased water reabsorption  
 (c) antibiotics interfere with the vitamin absorption normally occurring within the large intestine  
 (d) after intestinal bacteria have been killed, an unusually large amount of water is reabsorbed
52. Symbiotic bacteria living in our large intestines

53. What relation do indigestible plant fibers, prokaryotes, and vitamins have with the digestive system?  
 (a) These are washed out of the body in the 7 liters of water that daily pass into the digestive system.  
 (b) In the presence of certain vitamins, prokaryotes are able to digest plant fibers, resulting in constipation, which retains plant fibers and vitamins in the lower intestine.  
 (d) These are the contents of the large intestine.
54. Which one of the following is not an adaptation to an herbivorous diet?  
 (a) sharp, pointed teeth  
 (b) reingestion of feces  
 (c) longer intestines  
 (d) a rumen
55. How would you expect the digestive system of a hawk to compare with that of a seed-eating sparrow?  
 (a) The hawk would have a larger gastrovascular cavity.  
 (b) The sparrow's digestive system would be longer.  
 (c) The hawk would have a gizzard, but the sparrow would not.  
 (d) The hawk's digestive system would be longer.
56. Secretin stimulates the \_\_\_\_\_ to secrete \_\_\_\_\_.  
 (a) pancreas... bicarbonate  
 (b) pancreas... pancreatic enzymes  
 (c) small intestine... disaccharidases  
 (d) stomach... bicarbonate
57. Cholecystokinin (CCK) stimulates the \_\_\_\_\_ to secrete \_\_\_\_\_.  
 (a) pancreas... bicarbonate  
 (b) pancreas... pancreatic enzymes  
 (c) small intestine... disaccharidases  
 (d) stomach... bicarbonate
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58. The acidity of the stomach contents triggers the small intestine to secrete a hormone known as \_\_\_\_\_.  
 (a) cholecystokinin, or CCK  
 (b) histones  
 (c) TSH  
 (d) secretin
59. The presence of fatty acids and amino acids in the stomach contents triggers the small intestine to secrete a hormone known as \_\_\_\_\_.  
 (a) cholecystokinin, or CCK  
 (b) histones  
 (c) insulin  
 (d) secretin
60. Bile is produced by the \_\_\_\_\_ and stored by the \_\_\_\_\_ until it is secreted into the small intestine.  
 (a) liver... gall bladder  
 (b) pancreas... gall bladder  
 (c) liver... pancreas  
 (d) gall bladder... liver

## ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. d  | 2. d  | 3. c  | 4. d  |
| 5. d  | 6. d  | 7. c  | 8. d  |
| 9. d  | 10. a | 11. d | 12. d |
| 13. b | 14. b | 15. a | 16. c |
| 17. d | 18. a | 19. a | 20. b |
| 21. a | 22. a | 23. a | 24. c |
| 25. d | 26. d | 27. b | 28. a |
| 29. c | 30. c | 31. a | 32. b |
| 33. a | 34. d | 35. b | 36. b |
| 37. b | 38. c | 39. b | 40. c |
| 41. b | 42. d | 43. d | 44. c |
| 45. d | 46. a | 47. a | 48. d |
| 49. a | 50. a | 51. b | 52. b |
| 53. d | 54. a | 55. b | 56. a |
| 57. b | 58. d | 59. a | 60. A |

### 7.3: CIRCULATION AND GAS EXCHANGE

1. How does myoglobin aid diving mammals such as the Weddell seal?
  - (a) It allows diving males to store twice as much oxygen in their blood as the average human can.
  - (b) It allows diving males to store a considerable amount of oxygenated blood in their spleens.
  - (c) It allows diving males to store a considerable amount of oxygenated blood in their muscles.
  - (d) It allows seals to switch from cellular respiration to fermentation after the oxygen in muscle cells has been depleted.
  
2. Arteries carry blood \_\_\_\_\_.
  - (a) away from capillaries
  - (b) away from the heart and away from the lungs
  - (c) to the heart and away from the lungs
  - (d) away from the heart only
  
3. Blood returns to the heart via the \_\_\_\_\_ and \_\_\_\_\_.
  - (a) aorta
  - (b) pulmonary arteries
  - (c) pulmonary veins
  - (d) aorta and pulmonary arteries
  
4. From the pulmonary veins, blood flows to the \_\_\_\_\_.
  - (a) right atrium
  - (b) left atrium
  - (c) aorta
  - (d) capillaries of the lungs
  
5. From the anterior vena cava, blood flows to the \_\_\_\_\_.
  - (a) right atrium
  - (b) left atrium
  - (c) aorta
  - (d) capillaries of the lungs
  
6. From the capillaries of the abdominal organs and hind limbs, blood flows to the \_\_\_\_\_.
  - (a) right atrium
  - (b) left atrium
  - (c) aorta
  - (d) posterior vena cava
  
7. Carbon dioxide enters the blood at the \_\_\_\_\_.
  - (a) capillaries of the head, forelimbs, abdominal organs and hind limbs
  
8. The \_\_\_\_\_ has (have) the thinnest walls.
  - (a) aorta
  - (b) capillaries
  - (c) posterior vena cava
  - (d) pulmonary artery
  
9. Blood pressure is highest in the \_\_\_\_\_.
  - (a) aorta
  - (b) posterior vena cava
  - (c) anterior vena cava
  - (d) pulmonary artery
  
10. Voice sounds are produced by the \_\_\_\_\_.
  - (a) trachea
  - (b) diaphragm
  - (c) bronchioles
  - (d) larynx
  
11. In which of the following animals are blood and interstitial fluid considered to be the same body fluid?
  - (a) grasshopper
  - (b) jelly
  - (c) fish
  - (d) dog
  
12. Which statement regarding the mammalian heart is false?
  - (a) Blood arrives at the heart via the atria.
  - (b) Blood is pumped from the heart via the ventricles.
  - (c) Oxygen-loaded blood moves only through the left side of the heart.
  - (d) When the right atrium contracts, it forces blood into the left ventricle.
  
13. Which of the following best describes an artery?
  - (a) Arteries carry blood away from the heart.
  - (b) Arteries carry oxygenated blood.
  - (c) Arteries contain valves.
  - (d) Arteries have thin walls compared with veins.
  
14. Which statement is true about blood vessels?
  - (a) Arteries carry blood toward the atria of the heart.
  - (b) Veins transport blood from the heart to the capillaries.
  - (c) Pulmonary veins carry oxygen-rich blood to the heart.
  - (d) The pulmonary artery carries oxygen-rich blood from the lungs.

(b) a blood clot enters and blocks one of the coronary arteries

(c) a blood clot dislodges from a vein and moves into the lung, where it blocks a pulmonary artery

(d) a blood clot enters the cerebral circulation, blocking an artery and causing the death of brain tissue

23. An open circulatory system \_\_\_\_\_

(a) is less common in crabs and beetles than in mice and snakes

(b) does not rely on muscle contraction

(c) allows interstitial fluid to mix freely with vascular fluid

(d) restricts the backflow of blood by valves in the trachea

24. Which response fails to explain why large animals, like a horse, require a circulatory system, but animals such as a planarian do not?

(a) Large animals require more oxygen and nutrients than small animals.

(b) The force of gravity has a more significant impact in larger animals.

(c) Diffusion is inadequate to move oxygen from the surface into all parts of a large animal's body.

(d) Large animals do not have a gastrovascular cavity and must compensate for it with a circulatory system.

25. In which animal does the circulatory system include a heart and a system of closed vessels?

(a) jelly

(b) snail

(c) fish

(d) beetle

26. The function of pulmonary circulation is to \_\_\_\_\_.

(a) carry oxygen and nutrients to tissues where they are needed

(b) retrieve waste products from the body tissues

(c) carry blood through the heart, lungs, and all of the body tissues

(d) carry carbon dioxide to the lungs and pick up oxygen from the lungs

27. In a fish, blood circulates through \_\_\_\_\_. whereas in a mammal, it circulates through \_\_\_\_\_.

(a) two circuits... four circuits

(b) one circuit... two circuits

(c) four circuits... two circuits

(d) one circuit... four circuits

28. What is unique about blood in pulmonary arteries compared with blood in other

- (c) It is moving toward the heart.  
(d) It is loaded with carbon dioxide.
29. Which chambers of the heart receive and pump oxygenated blood?  
(a) left ventricle and left atrium  
(b) both left and right atria  
(c) left atrium only  
(d) right atrium and right ventricle
30. Where does blood go directly after it leaves the inferior (posterior) vena cava?  
(a) into the capillaries of the upper body  
(b) into the lungs  
(c) into the pulmonary artery  
(d) into the right atrium
31. Heart valves function to \_\_\_\_\_.  
(a) keep blood moving forward through the heart  
(b) mix blood thoroughly as it passes through the heart  
(c) control the amount of blood pumped by the heart  
(d) slow blood down as it passes through the heart
32. Pressure is greatest in the ventricles when \_\_\_\_\_.  
(a) blood arrives at the right ventricle  
(b) blood arrives at the left atrium  
(c) AV valves are open and semilunar valves are closed  
(d) the ventricles contract
33. The SA node generates an electrical impulse from its location in the \_\_\_\_\_.  
(a) left atrium, causing ventricular contraction  
(b) left ventricle wall, from which the impulse is carried to the bundle branches and on to the Purkinje fibers  
(c) right atrium, causing atrial contraction  
(d) left ventricle, causing atrial contraction
34. A recording of the electrical activity of a patient's heart shows that the atria are contracting regularly and normally, but every few beats the ventricles fail to contract. Which of the following is probably functioning improperly?  
(a) AV node  
(b) aortic semilunar valve  
(c) coronary artery  
(d) pacemaker
35. Your blood pressure is 120/70. The "120" indicates \_\_\_\_\_ and the "70" indicates \_\_\_\_\_.
- (c) arterial pressure during heart contraction... arterial pressure during heart relaxation  
(d) pressure in the left ventricle... pressure in the left atrium
36. If resistance increases in the capillary beds of the lung, which structure would be affected first?  
(a) aorta  
(b) right atrium  
(c) left atrium  
(d) right ventricle
37. Which one of the following is the main factor that causes lymph to move through lymphatic vessels?  
(a) blood pressure  
(b) osmotic pressure  
(c) contractions of lymph vessels  
(d) contractions in body muscles near lymph vessels
38. Which of the following functions is not carried out by leukocytes (white blood cells)?  
(a) scavenging dead cells  
(b) synthesizing antibodies  
(c) engulfing bacteria  
(d) All of the above are carried out by leukocytes.
39. A patient with which of the following conditions would probably not be helped by injections of purified pluripotent stem cells?  
(a) impaired resistance to infection  
(b) hypertension  
(c) AIDS  
(d) leukemia
40. The primary sealants that plug leaks in damaged blood vessels are \_\_\_\_\_.  
(a) clotting factors released by platelets and fibrin  
(b) red blood cells and albumin  
(c) fibrin and white blood cells  
(d) white blood cells and clotting factors released by platelets
41. (a) severe pain of the heart muscle due to lack of oxygen  
(b) buildup of lipids along the inside of heart vessels  
(c) a condition promoted by over-exertion during exercise  
(d) the result of balloon angioplasty
42. What is the physiological cause of a heart attack?

- (c) arterial pressure during heart contraction... arterial pressure during heart relaxation  
(d) pressure in the left ventricle... pressure in the left atrium
43. In order for a body surface to be a respiratory surface, it must \_\_\_\_\_.  
(a) be dry and covered with hair  
(b) be moist and glandular  
(c) have a large surface area  
(d) be thin and moist
44. Which selection is not an essential feature for an animal's gas exchange surface?  
(a) large surface area in proportion to body size  
(b) must come in contact with the circulating body fluid  
(c) thin cell layers  
(d) living cells
45. Which respiratory organ is most often found only in fully aquatic animals?  
(a) tracheae  
(b) lungs  
(c) air sacs called alveoli  
(d) gills
46. Countercurrent exchange in the gills of a fish \_\_\_\_\_.  
(a) speeds up the flow of water through the gills  
(b) maintains a gradient that enhances diffusion  
(c) enables blood oxygenation in fish regardless of the direction of water flow relative to blood flow  
(d) means that blood and water flow in the same direction
47. What is the major reason land-dwelling mammals have evolved lungs rather than gills as a primary respiratory organ?  
(a) Gills are not as efficient as lungs in picking up oxygen.  
(b) Gills are too small to provide oxygen for a mammal.  
(c) Protecting gas-exchange surfaces from desiccation is difficult in terrestrial environments.  
(d) Air has higher oxygen content than water, so gills were no longer necessary.
48. What is the order of passage as air is inhaled during ventilation of the lungs in a typical mammal?  
(a) nasal cavity, pharynx, larynx, bronchiole, bronchus, trachea, alveolus
- (d) a blood clot lodging in a blood vessel supplying the heart
49. Which one of the following components of the mammalian gas exchange system does not have a ciliated surface covered by a thin film of mucus?  
(a) trachea  
(b) midsize to small bronchioles  
(c) bronchi  
(d) alveoli
50. Which structure in a human is most similar in function to the gill lamellae of a fish?  
(a) vocal cords  
(b) bronchioles  
(c) alveoli  
(d) trachea
51. In the alveoli and lung capillaries, carbon dioxide and oxygen are exchanged by means of \_\_\_\_\_.  
(a) diffusion  
(b) active transport  
(c) endocytosis  
(d) pinocytosis
52. When you exhale, \_\_\_\_\_.  
(a) both the diaphragm and rib muscles contract  
(b) both the diaphragm and the rib muscles relax  
(c) the rib muscles contract and the air pressure in the alveoli becomes lower than atmospheric pressure  
(d) the volume of the chest cavity increases
53. The maximum amount of air a person can exhale, after maximal inhalation, is called \_\_\_\_\_.  
(a) vital capacity  
(b) tidal volume  
(c) residual capacity  
(d) ventilation volume
54. Which one of the following is not an exchangeable lung volume?  
(a) residual volume  
(b) inspiratory capacity  
(c) tidal volume  
(d) expiratory reserve volume
55. Which of the following normally contains the highest concentration of oxygen?  
(a) body cells  
(b) inhaled air  
(c) air in the alveol  
(d) blood entering the pulmonary arteries
56. Which one of the following statements about the respiratory systems of mammals and birds is true?

- (b) In both types of animals, the sites of gas exchange are parabronchi.  
 (c) Mammals perform better at higher altitudes.  
 (d) The gas exchange system of mammals is confined to the thoracic cavity, but that of birds is not.
57. What happens when the  $\text{CO}_2$  level from cellular respiration increases in the blood?  
 (a) Cellular respiration decreases.  
 (b) A decrease in the pH of the cerebrospinal fluid triggers the brain's breathing control centers, which stimulate diaphragm and rib muscle contractions.  
 (c) The pH of the cerebrospinal fluid also increases and is detected by  $\text{O}_2$  sensors in arteries near the heart.  
 (d) The  $\text{O}_2$  level automatically increases.
58. When you hold your breath, which of the following blood gas changes leads initially to the urge to breathe again?  
 (a) rising oxygen concentration  
 (b) rising carbon dioxide concentration  
 (c) falling oxygen concentration  
 (d) falling carbon dioxide concentration
59. What causes  $\text{CO}_2$  in the blood to decrease?  
 (a) exercise  
 (b) increased cellular respiration  
 (c) hyperventilation  
 (d) running
60. Most oxygen is carried by the blood \_\_\_\_\_.  
 Most carbon dioxide is carried by the blood \_\_\_\_\_.  
 (a) attached to hemoglobin... in the form of bicarbonate ions  
 (b) dissolved in the plasma... dissolved in the plasma  
 (c) in the form of hydrogen ions... in the form of bicarbonate ions  
 (d) attached to hemoglobin... attached to hemoglobin
61. The primary functions of the \_\_\_\_\_ are to warm, filter, and humidify air.  
 (a) lungs (b) trachea  
 (c) bronchus (d) nasal cavity
62. Most carbon dioxide is carried from the body tissues to the lungs \_\_\_\_\_.  
 (a) as bicarbonate ions ( $\text{HCO}_3^-$ )  
 (b) combined with hemoglobin  
 (c) by the trachea  
 (d) as hydrogen ions ( $\text{H}^+$ )
63. By picking up hydrogen ions, hemoglobin prevents the blood from becoming too \_\_\_\_\_.  
 (a) acidic  
 (b) basic  
 (c) thick  
 (d) low in oxygen concentration
64. In the blood most of the oxygen that will be used in cellular respiration is carried from the lungs to the body tissues \_\_\_\_\_.  
 (a) as bicarbonate ions ( $\text{HCO}_3^-$ )  
 (b) combined with hemoglobin  
 (c) by the trachea  
 (d) water ( $\text{H}_2\text{O}$ )

## ANSWERS

- |       |       |       |           |
|-------|-------|-------|-----------|
| 1. c  | 2. d  | 3. c  | 4. b      |
| 5. a  | 6. d  | 7. a  | 8. b      |
| 9. a  | 10. d | 11. a | 12. d     |
| 13. a | 14. c | 15. d | 16. b     |
| 17. c | 18. a | 19. b | 20. a     |
| 21. c | 22. a | 23. c | 24. d     |
| 25. c | 26. d | 27. b | 28. d     |
| 29. a | 30. d | 31. a | 32. _____ |
| 33. c | 34. a | 35. c | 36. d     |
| 37. d | 38. d | 39. b | 40. a     |
| 41. b | 42. d | 43. d | 44. b     |
| 45. d | 46. b | 47. c | 48. c     |
| 49. d | 50. c | 51. a | 52. b     |
| 53. a | 54. a | 55. b | 56. d     |
| 57. a | 58. b | 59. c | 60. a     |
| 61. d | 62. a | 63. a | 64. B     |

## 7.4: THE IMMUNE SYSTEM

1. \_\_\_\_\_ interact with the antigen-class II MHC complex presented by macrophages.  
 (a) B cells (b) Bacterial cells  
 (c) Helper T cells (d) Epithelial cells
3. B cells that have been stimulated by interleukin-2 develop into \_\_\_\_\_.  
 (a) plasma cells (b) helper T cells  
 (c) cytotoxic T cells (d) antigens
4. The role of cytotoxic T cells is the secretion of \_\_\_\_\_, which plays a role in the \_\_\_\_\_ immune response.  
 (a) antibodies... antibody-mediated  
 (b) antibodies... humoral  
 (c) perforin... cell-mediated  
 (d) perforin... humoral
5. Clonal selection is the division of \_\_\_\_\_ that have been stimulated by binding to an antigen, which results in the production of cloned \_\_\_\_\_.  
 (a) helper T cells... plasma cells  
 (b) B cells... plasma cells and memory cells  
 (c) T cells... B cells  
 (d) B cells... macrophages
6. Which of these cells is responsible for the rapidity of the secondary immune response?  
 (a) memory cells (b) cytotoxic T cells  
 (c) macrophages (d) cytokines
7. Which of these cells produce and secrete antibodies?  
 (a) macrophages (b) cytotoxic T cells  
 (c) plasma cells (d) bacterial cells
8. The genetic material of HIV consists of \_\_\_\_\_.  
 (a) single-stranded DNA  
 (b) single-stranded RNA  
 (c) double-stranded DNA  
 (d) double-stranded RNA
9. Besides helper T cells, what are two other types of cells that HIV infects?  
 (a) macrophages and brain cells  
 (b) B cells and liver cells  
 (c) plasma cells and neutrophils  
 (d) cytotoxic T cells and brain cells
10. What is the function of reverse transcriptase?  
 (a) catalyzing the formation of DNA from a
- (b) catalyzing the formation of DNA from a polypeptide template  
 (c) catalyzing the formation of RNA from a polypeptide template  
 (d) catalyzing the formation of RNA from a DNA template
11. Which of the following describes innate immunity?  
 (a) Unbroken skin creates a physical barrier that cannot normally be penetrated by bacteria or viruses.  
 (b) Surface secretions from sebaceous and sweat glands give the skin an acidic pH that is unfavorable for bacterial colonization.  
 (c) Tears, saliva, and mucous secretions contain lysozyme, an enzyme that digests bacterial cell walls.  
 (d) All of the above.
12. Which statement best describes tissue macrophages?  
 (a) They are antigen-presenting cells that originate from neutrophils.  
 (b) They have short life spans because they self-destruct after engulfing foreign invaders.  
 (c) They are phagocytic cells that originate from monocytes, which leave the circulation and enter the tissues.  
 (d) They are most effective against parasites.
13. Which choice best describes an antigen?  
 (a) An antigen is a protein molecule that helps defend the body against disease.  
 (b) An antigen induces development of white blood cells in the bone marrow.  
 (c) An antigen could be an invading virus or bacterium.  
 (d) An antigen is a foreign molecule that evokes a specific response by a lymphocyte.
14. How do memory cells differ from effector cells?  
 (a) Memory cells are more numerous.  
 (b) Memory cells are responsible for the primary immune response.  
 (c) Memory cells combat antigens; effector cells do not.

15. The role of cytotoxic T cells is to attack \_\_\_\_\_  
 (a) body cells that have been infected  
 (b) circulating antibodies  
 (c) circulating proteins  
 (d) extracellular viruses and bacteria
16. Cell-mediated immunity differs from humoral immunity because \_\_\_\_\_  
 (a) cell-mediated immunity is longer lasting  
 (b) a subsequent secondary immune response can occur in humoral immunity  
 (c) clonal selection occurs in cell-mediated immunity  
 (d) they respond differently to invaders
17. Helper T cells are part of \_\_\_\_\_.  
 (a) a cell-mediated immune response  
 (b) innate immunity  
 (c) the complement system  
 (d) a group of phagocytic white blood cells
18. Viruses and bacteria in body fluids are attacked by \_\_\_\_\_.  
 (a) antibodies from B cells  
 (b) cytotoxic T cells  
 (c) complement proteins  
 (d) helper T cells
19. Tissues are typed before an organ transplant to make sure that the \_\_\_\_\_ of donor and recipient match as closely as possible.  
 (a) T cells  
 (b) antibodies  
 (c) MHC (major histocompatibility complex) proteins  
 (d) histamines
20. Which of the following cell types does HIV preferentially infect?  
 (a) cytotoxic T cells (b) natural killer cells  
 (c) helper T cells (d) plasma cells
21. A macromolecule produced in the body, which recognizes another molecule as "foreign" to the body, is a(n) \_\_\_\_\_.  
 (a) platelet (b) antigen  
 (c) antibody (d) lymphocyte
22. The first line of defense against infection is \_\_\_\_\_.  
 (a) the skin and mucous membranes  
 (b) the inflammatory response  
 (c) the immune system (d) antibiotics
23. Phagocytosis is best defined as \_\_\_\_\_.  
 (a) the process by which a white blood cell engulfs and destroys a bacterium

- (c) the movement of cytoplasm into an extended pseudopodium  
 (d) the fusion of an intracellular vesicle with the plasma membrane of a cell
24. What do macrophages and neutrophils have in common?  
 (a) They punch a hole in the plasma membrane of the pathogen, causing the cell to burst.  
 (b) They phagocytize pathogens.  
 (c) They secrete lysozyme.  
 (d) They stimulate antibody production.
25. Which of the following cells are part of the innate, second line of defense?  
 (a) cytotoxic T cells (b) B cells  
 (c) prostaglandins (d) macrophages
26. Which example below describes what would most likely happen to a microbe in the blood?  
 (a) They are phagocytosed by eosinophils.  
 (b) They are phagocytosed by macrophages that reside in the lymph nodes.  
 (c) They are phagocytosed by macrophages that reside in the spleen.  
 (d) They are phagocytosed by neutrophils.
27. Chemicals produced by virus-infected cells that alert neighboring cells to prepare a defense are called \_\_\_\_\_.  
 (a) antibodies (b) interferons  
 (c) cytokines (d) antigens
28. If microorganisms penetrate the innate defenses, an inflammatory response may be initiated by the \_\_\_\_\_.  
 (a) accumulation of phagocytes in an injured area  
 (b) release of interferon by infected cells  
 (c) increased blood flow to an infected or injured area  
 (d) release of chemicals such as histamine by damaged cells
29. The body's second line of defense against infections is \_\_\_\_\_.  
 (a) active immunity  
 (b) an inflammatory response  
 (c) passive immunity  
 (d) cell-mediated immunity
30. Which one of the following is part of the inflammatory response?  
 (a) constriction of the arterioles  
 (b) clonal selection of B and T lymphocytes followed by the production of effector cells  
 (c) dilation of the capillaries

- (c) the movement of cytoplasm into an extended pseudopodium  
 (d) the fusion of an intracellular vesicle with the plasma membrane of a cell
31. Which of the following is not an immediate function of histamine?  
 (a) causing local arterioles to dilate  
 (b) increasing the permeability of local capillaries  
 (c) increasing the systemic blood pressure  
 (d) causing local swelling of the tissue
32. Which one of the following is not a benefit of local inflammation?  
 (a) Increased blood flow and vessel permeability allow more neutrophils to move from the blood to injured tissues.  
 (b) Vascular changes increase the volume of clotting factors in the area.  
 (c) Chemokines promote the release of histamine and attract more phagocytes to the area.  
 (d) Moderate fever facilitates phagocytosis.
33. Which choice below describes a function of white blood cells that helps them carry out defensive functions more effectively?  
 (a) synthesis of hemoglobin  
 (b) release of cytokines  
 (c) migrate into and out of blood vessels  
 (d) The second and third answers are correct.
34. An immune response is initiated by the presence of which molecules?  
 (a) antigen (b) interferon  
 (c) histamine (d) antibody
35. The body produces antibodies complementary to foreign antigens. The process by which the body comes up with the correct antibodies to a specific invader is most like \_\_\_\_\_.  
 (a) going to a tailor and having a suit made to fit you  
 (b) ordering the lunch special at a restaurant without looking at the menu  
 (c) going to a shoe store and trying on shoes until you find a pair that fits  
 (d) picking out a video that you haven't seen yet
36. The antigen-binding sites of an antibody molecule are formed from the molecule's variable regions. Why are these regions called variable?  
 (a) They can change their shapes to fit different antigens.  
 (b) They change their shapes when they bind to an antigen.  
 (c) Their specific shapes are unimportant.  
 (d) They can be different shapes on different antibody molecules.
37. Antibodies are in which class of proteins?  
 (a) structural (b) enzymatic
38. In a series of immune system experiments, the thymus glands were removed from baby mice. Which of the following would you predict as a likely result?  
 (a) The mice suffered from numerous allergies.  
 (b) The mice never developed cancerous tumors.  
 (c) The mice suffered from autoimmune diseases.  
 (d) The mice readily accepted tissue transplants.
39. The proliferation of the B lymphocyte to which a specific antigen binds is referred to as \_\_\_\_\_.  
 (a) an activation sequence  
 (b) a cascade mechanism  
 (c) antigenic determination  
 (d) clonal selection
40. Which type of cell is responsible for causing apoptosis in cancer cells and virus-infected cells?  
 (a) dendritic cells (b) natural killer cells  
 (c) helper T cells (d) plasma cells
41. B lymphocytes \_\_\_\_\_.  
 (a) attack cells that have been infected by viruses  
 (b) engulf and destroy bacteria and viruses  
 (c) multiply and make antibodies that circulate in blood and lymph  
 (d) stimulate other lymphocytes
42. Which of the following types of cells initiate a secondary immune response?  
 (a) cytotoxic cells (b) natural killer cells  
 (c) memory cells (d) effector cells
43. Once you have been exposed to an antigen, you develop immunity against the same antigen because \_\_\_\_\_.  
 (a) antibodies against the disease are constantly circulating in your blood  
 (b) certain lymphocytes are able to make the proper antibodies quickly  
 (c) your innate defenses are strengthened  
 (d) B cells are stimulated to quickly engulf invaders
44. Which of the following cell types is specifically responsible for humoral immunity?  
 (a) T cells (b) B cells  
 (c) leukocytes (d) natural killer cells
45. What is the role of dendritic cells in the primary immune response?  
 (a) Dendritic cells present antigen via class II MHC molecules to young helper T cells.

- (c) Dendritic cells secrete cytokines to activate cytotoxic T cells.  
 (d) Dendritic cells take in foreign molecules by receptor-mediated endocytosis and present the specific antigen fragments to helper T cells.
46. A group of researchers tested many chemicals and found several that have potential for use in modifying the action of the immune system. Which of the following compounds has the most promise as a drug for inhibiting transplant rejection?  
 (a) compound A13: acts like histamine  
 (b) compound Q6: stimulates cytotoxic T cells  
 (c) compound N98: a potent allergen  
 (d) compound B55: suppresses specific cytotoxic T cells
47. Which statement is correct in about T-independent antigens?  
 (a) The response to T-independent antigens is important in defending against viruses and cancer cells.  
 (b) The response to T-independent antigens generates memory B cells.  
 (c) Typical T-independent antigens contain a single epitope.  
 (d) Typical T-independent antigens are polysaccharides of bacterial capsules and proteins of bacterial flagella.
48. Which one of the following classes of immunoglobins crosses the placenta and confers passive immunity to the fetus?  
 (a) IgM (b) IgG  
 (c) IgA (d) IgD
49. Which of the following is not initiated by the binding of antibodies to antigens?  
 (a) activation of complement proteins  
 (b) secretion of interferon by infected cells  
 (c) neutralization  
 (d) agglutination
50. What do the antibodies secreted by plasma cells (the effector cells of humoral immunity) do to attack their targets?  
 (a) activate complement to form a pore in the membrane of the targets  
 (b) clump cells together so that phagocytes can ingest them  
 (c) cross-link soluble antigen molecules, forming immobile aggregates  
 (d) all of the above
51. How do antibodies to foreign blood groups come to exist in the body?  
 (a) The "antibodies form" when a fetus is
- (b) The antibodies arise in response to bacterial inhabitants of the body that have epitopes very similar to blood groups and antigens.  
 (c) This phenomenon cannot be explained.  
 (d) Even very limited exposure to the blood of another person can evoke the production of antibodies.
52. A type of cell that makes immunizations effective is the \_\_\_\_\_.  
 (a) red blood cell (b) killer T cell  
 (c) killer B cell (d) memory B cell
53. A vaccine may contain \_\_\_\_\_.  
 (a) white blood cells that fight infection  
 (b) antibodies that recognize invading microbes  
 (c) inactivated disease-causing microbes  
 (d) a hormone that boosts immunity
54. The idea behind vaccination is to induce \_\_\_\_\_ without the vaccinated individual having to get sick.  
 (a) passive immunity  
 (b) the primary immune response  
 (c) anaphylactic shock  
 (d) nonspecific defenses
55. When searching for a donor for an organ transplant, doctors try to match the \_\_\_\_\_ of the donor and recipient as closely as possible.  
 (a) antibodies (b) blood type  
 (c) MHC proteins (d) leukocytes
56. What is the source of a viral envelope?  
 (a) host cell DNA (b) prophages  
 (c) provirus (d) host cell membrane
57. Double-stranded viral DNA is incorporated into a host cell as a \_\_\_\_\_.  
 (a) promoter (b) provirus  
 (c) transposon (d) lac

## ANSWERS

1. c 2. a 3. c 4. c  
 5. b 6. a 7. a 8. b  
 9. a 10. a 11. d 12. c  
 13. d 14. d 15. a 16. d  
 17. a 18. a 19. c 20. c  
 21. c 22. a 23. a 24. b  
 25. d 26. c 27. b 28. d  
 29. b 30. c 31. c 32. c  
 33. d 34. a 35. c 36. d  
 37. d 38. d 39. d 40. b  
 41. c 42. c 43. b 44. b  
 45. a 46. d 47. d 48. b  
 49. b 50. d 51. b 52. d  
 53. c 54. b 55. c 56. d  
 57. b

## 7.5: OSMOREGULATION AND EXCRETION

1. Alcohol consumption increases urinary output because alcohol \_\_\_\_\_.  
 (a) inhibits ADH (vasopressin) production and release  
 (b) inhibits aldosterone production  
 (c) causes cellular metabolism to proceed at a faster rate  
 (d) enhances ADH (vasopressin) production and release
10. As filtrate moves down the loop of Henle, the surrounding interstitial fluid becomes \_\_\_\_\_ concentrated than the filtrate, so \_\_\_\_\_ leaves the filtrate.  
 (a) more... urea (b) less... urea  
 (c) more... water (d) less water
11. Osmoregulation and excretion are \_\_\_\_\_.  
 (a) mechanisms that moderate change in interstitial fluid  
 (b) methods of controlling body temperature  
 (c) ways that animals control their environment  
 (d) mechanisms that require continual water loss
12. The most abundant solute in urine is \_\_\_\_\_.  
 (a) urea (and other nitrogenous wastes)  
 (b) water  
 (c) plasma proteins  
 (d) sodium chloride
13. Terrestrial animals are \_\_\_\_\_.  
 (a) osmoregulators that do not exchange quantities of water by osmosis with the environment  
 (b) likely to have problems with osmoregulation similar to those of freshwater fish  
 (c) either arthropods or vertebrates  
 (d) obligated to protect their eggs from drying with water-resistant shells
14. Birds, insects, and many reptiles excrete nitrogenous waste in the form of uric acid. An advantage of excreting uric acid is that it \_\_\_\_\_, but a disadvantage is that it \_\_\_\_\_.  
 (a) saves water... costs energy  
 (b) saves energy... is highly toxic  
 (c) is not very toxic... wastes a lot of water  
 (d) is much more soluble in water than other wastes... costs energy
15. To conserve energy, many toads secrete \_\_\_\_\_ as tadpoles but \_\_\_\_\_ as terrestrial adults.  
 (a) ammonia... urea  
 (b) urea... ammonia  
 (c) ammonia... uric acid  
 (d) uric acid... urea

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16. The appropriate group of animals to observe a Malpighian tubule would be \_\_\_\_\_.
- flatworms
  - annelids
  - insects and other terrestrial arthropods
  - amphibians
17. The kidney's filtration process is nonselective, therefore, \_\_\_\_\_.
- many valuable substances are lost in the urine
  - the proportions of the substances in urine are the same as in blood
  - urine is much less concentrated than blood
  - useful substances must be selectively reabsorbed
18. Which one of the following descriptions of the part of a mammalian kidney is not correct?
- Bowman's capsule—a ball of capillaries associated with the end of a long tubule
  - nephron—the functional unit of the kidney
  - urethra—the tube that drains the urinary bladder to the outside of the body
  - ureter—the tube that drains the kidney into the urinary bladder
19. Which one of the following structures is found only in birds and mammals and not in other vertebrates?
- juxtamedullary nephrons
  - collecting ducts
  - glomerulus
  - Bowman's capsule
20. Which one of the following statements is not correct?
- Aldosterone release decreases blood volume and blood pressure.
  - Angiotensin II increases blood pressure and blood volume.
  - The enzyme renin is involved in the conversion of angiotensinogen into angiotensin II.
  - Antidiuretic hormone increases water reabsorption.
- Osmoconformers are animals that \_\_\_\_\_.
- expend considerable energy in matching concentrations of their body fluids with
22. In a marine environment, animals that are isosmotic relative to their environment \_\_\_\_\_.
- spontaneously absorb water through the body surface and lose solutes in urine
  - experience no net water loss by osmosis
  - experience significant water gain by osmosis
  - experience significant water loss by osmosis
23. Which type of organism would have the least chance of long-term survival in the given environment?
- osmoconformers in seawater
  - euryhaline animals in fresh water
  - stenohaline animals that move between fresh water and seawater
  - osmoregulators in seawater
24. Freshwater fish excrete a large amount of very dilute urine. What is the best explanation for this?
- Because they live in a hypoosmotic solution, their cells take up excess water that must be excreted.
  - Because they live in a hypoosmotic solution, their cells tend to accumulate a lot of solute that must be excreted.
  - Because they live in a hyperosmotic solution, their cells take up an excess of water that must be excreted.
  - Because they live in a hyperosmotic solution, their cells tend to accumulate a lot of solute that must be excreted.
25. Dehydration in animals \_\_\_\_\_.
- such as the tardigrade is lethal
  - is a problem because carbohydrates are fragile and break down when they dry out
  - has nothing in common with freezing
  - may be less damaging in the presence of sugar
26. Most of our nitrogen-containing waste products are a result of \_\_\_\_\_.
- drug use
  - consumption of foods high in nitrates

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27. Most aquatic animals excrete ammonia, while land animals excrete urea or uric acid. What is the most likely explanation for this difference?
- They have different diets.
  - Land animals can get the energy needed to make urea or uric acid.
  - Ammonia is very toxic, and it takes lots of water to dilute it.
  - Land animals cannot afford the energy needed to make ammonia.
28. In our bodies, the primary nitrogen-containing compound excreted by our kidneys is \_\_\_\_\_.
- uric acid
  - amino acids
  - ammonia
  - urea
29. The most effective molecule for nitrogenous waste disposal in desert animals would be \_\_\_\_\_.
- ammonia because it uses less energy to make than uric acid or urea
  - urea because it is less toxic than uric acid
  - uric acid because it takes less energy to make than urea
  - uric acid because it does not require water for excretion
30. Many birds, insects, and reptiles excrete nitrogenous wastes in the form of uric acid, which \_\_\_\_\_.
- is synthesized in the kidneys from ammonia and CO<sub>2</sub>
  - forms solids that are relatively insoluble and nontoxic
  - readily decomposes on exposure to air
  - is readily excreted through feathers and scales
31. Which one of the following is not a function of the excretory system?
- elimination of nitrogenous wastes
  - maintenance of salt balance
  - elimination of undigested foods
  - maintenance of the water balance
32. Which of the following is filtered from blood but not normally found in urine?
- water
  - red blood cells
  - H<sup>+</sup> ions
  - amino acids
33. The filtrate formed by the nephrons in the kidney is not urine. The filtrate is first refined
- (d) filtration and reabsorption
34. Metanephridia are found in \_\_\_\_\_ and function in \_\_\_\_\_ and \_\_\_\_\_.
- insects... excretion
  - annelids... excretion and osmoregulation
  - bats... osmoregulation
  - earthworms... excretion
35. Which of the following is the most accurate and comprehensive description of the function of kidneys?
- the breakdown of body wastes
  - the excretion of wastes
  - the regulation of body fluid composition
  - filtration of the blood
36. Which one of the following is a tube that carries urine from the kidneys to the urinary bladder?
- loop of Henle
  - ureter
  - urethra
  - uvula
37. The functional units of kidneys are \_\_\_\_\_.
- neurons
  - glomeruli
  - ureters
  - nephrons
38. The bed of capillaries in a vertebrate kidney where water, urea, and salts are filtered out of the blood is the \_\_\_\_\_.
- Bowman's capsule
  - collecting duct
  - glomerulus
  - loop of Henle
39. In each nephron of the kidney, the glomerulus and Bowman's capsule \_\_\_\_\_.
- filter the blood and capture the filtrate
  - reabsorb water into the blood
  - break down harmful toxins and poisons
  - reabsorb salts and nutrients
40. In each nephron of the kidney, the glomerulus and Bowman's capsule carry out the \_\_\_\_\_.
- filtration of plasma
  - reabsorption of water into the blood
  - breakdown of harmful toxins and poisons
  - reabsorption of salts and nutrients
41. The fluid that enters vertebrate nephrons is called the filtrate. Where does the filtrate come from?

43. Which is an accurate statement about the anatomy of the human excretory system?  
 (a) Bowman's capsule is a network of capillaries inside the glomerulus.  
 (b) The proximal tubule is the portion of the nephron tubule farthest from Bowman's capsule.  
 (c) The renal cortex, which contains the nephrons, is interior to the renal medulla.  
 (d) The loop of Henle is located between the proximal tubule and the distal tubule.
44. Which of the following statements is not correct?  
 (a) The renal artery and the renal vein form the line of demarcation between the renal cortex, and the renal medulla.  
 (b) There are two capillary beds in each nephron.  
 (c) A collecting duct receives filtrate from only one nephron.  
 (d) The ureter drains the kidney; the urethra drains the bladder.
45. Which is not an accurate pairing of a key excretory function with its definition?  
 (a) Filtration happens when blood pressure forces water, nitrogenous waste, and valuable solutes from the blood into the nephron's proximal tubule.  
 (b) Reabsorption is the reclamation process that returns valuable solutes and water to the capillaries from the nephron so they are not wasted in the urine.  
 (c) Secretion transports certain toxins, drugs, and excessive ions from the capillaries to the filtrate.  
 (d) Reabsorption is the process where toxins, drugs, and excessive ions that remain in the blood after filtration are transported into the nephron for disposal in the urine.
46. All of the following processes occur in the nephron of the kidney except \_\_\_\_\_.  
 (a) tubular secretion  
 (b) capsular filtration  
 (c) blood cell formation  
 (d) cellular respiration
47. Filtrate passes through the long loop of \_\_\_\_\_.
- (c) control the pH of the interstitial fluid  
 (d) excrete a large amount of water
48. What is the function of the ascending loop of Henle?  
 (a) It provides water for reabsorption by the interstitial fluid and capillaries.  
 (b) It loses urea to the renal medulla, helping this tissue to maintain its concentration gradient of solutes.  
 (c) It absorbs some drugs and poisons from surrounding capillaries.  
 (d) It helps maintain the concentration gradient of NaCl in the interstitial fluid, thus increasing water reabsorption.
49. The lowest osmotic potential inside a nephron will be found in \_\_\_\_\_.  
 (a) Bowman's capsule and the proximal tubule  
 (b) the descending limb of the loop of Henle  
 (c) the loop of Henle  
 (d) the thick segment of the ascending limb and the distal tubule
50. At a particular position along a nephron, the osmotic potential of the filtrate is 500 mosm/L while the surrounding kidney's is 600 mosm/L. Which one of the following is a likely result?  
 (a) Water will diffuse into the nephron by osmosis.  
 (b) Water will be pumped into the nephron by active transport.  
 (c) Water will diffuse out of the nephron by osmosis.  
 (d) Water will be pumped out of the nephron by active transport.
51. What is the function of antidiuretic hormone (ADH) in the body?  
 (a) During times of increased solute concentrations, ADH causes nephrons to absorb water faster.  
 (b) During times of higher solute concentrations, ADH causes more water to be released from the nephrons to be reabsorbed by the blood.  
 (c) Low levels or the absence of ADH in the blood are the brain's response to thirst.  
 (d) ADH is the only hormone that provides a

## ANSWERS

- (b) pituitary gland... low blood osmolarity... decreased permeability to water of a kidney's collecting duct  
 (c) adrenal gland... high blood osmolarity... increased permeability to water of a collecting duct  
 (d) pituitary gland... high blood osmolarity... increased permeability to water of a collecting duct
53. Under the influence of antidiuretic hormone (ADH), \_\_\_\_ is produced.  
 (a) urine containing more glucose  
 (b) bloody urine  
 (c) urine containing a lower concentration of urea  
 (d) more concentrated urine
54. Antidiuretic hormone (ADH) makes the \_\_\_\_\_ permeable to water.  
 (a) ascending portion of the loop of Henle  
 (b) collecting duct  
 (c) Bowman's capsule  
 (d) proximal tubule

## 7.6: NERVOUS SYSTEMS

1. A neuron's nucleus is located in its \_\_\_\_\_.
  - (a) cell body
  - (b) axon
  - (c) myelin sheath
  - (d) dendrite
2. A nerve impulse moves toward a neuron's cell body along \_\_\_\_\_.
  - (a) dendrites
  - (b) synaptic terminals
  - (c) oligodendrocytes
  - (d) axons
3. A nerve impulse moves away from a neuron's cell body along \_\_\_\_\_.
  - (a) dendrites
  - (b) Nissl bodies
  - (c) synapses
  - (d) axons
4. An impulse relayed along a myelinated axon "jumps" from \_\_\_\_\_ to \_\_\_\_\_.
  - (a) oligodendrocyte... Schwann cell
  - (b) node of Ranvier... Schwann cell
  - (c) node of Ranvier... node of Ranvier
  - (d) Schwann cell... Schwann cell
5. Axons insulated by a(n) \_\_\_\_\_ are able to conduct impulses faster than those not so insulated.
  - (a) node of Ranvier
  - (b) synaptic terminal
  - (c) myelin sheath
  - (d) layer of asbestos
6. What type of cell makes up the myelin sheath of a motor neuron?
  - (a) Schwann cells
  - (b) microglial cells
  - (c) Ranvier cells
  - (d) ependymal cells
7. What part of a neuron relays signals from one neuron to another neuron or to an effector?
  - (a) dendrite
  - (b) axon hillock
  - (c) synaptic terminal
  - (d) axon
8. A neuron has a resting potential of about \_\_\_\_\_ millivolts.
  - (a) +50
  - (b) +35
  - (c) -55
  - (d) -70
9. An action potential moves along a(n) \_\_\_\_\_.
  - (a) myelin sheath
  - (b) axon
  - (c) dendrite
  - (d) synapse
10. At rest, which of these plays a role in establishing the charge differential across a neuron's plasma membrane?
  - (a) the sodium-potassium pump moving sodium ions into the neuron and potassium ions out of the neuron
  - (b) the diffusion of sodium ions out of the neuron
  - (c) the diffusion of potassium ions into the neuron
  - (d) the sodium-potassium pump moving sodium ions out of the neuron and potassium ions into the neuron
11. The transmission of a nerve impulse first triggers the \_\_\_\_\_.
  - (a) action of the sodium-potassium pump
  - (b) opening of voltage-gated sodium channels and the diffusion of sodium ions into the neuron
  - (c) opening of voltage-gated sodium channels and the diffusion of sodium ions out of the neuron
  - (d) opening of voltage-gated potassium channels and the diffusion of potassium ions out of the neuron
12. A stimulus has opened the voltage-gated sodium channels in an area of a neuron's plasma membrane. As a result, \_\_\_\_\_ rushes into the neuron and diffuses to adjacent areas; this in turn results in the \_\_\_\_\_ in the adjacent areas.
  - (a) potassium... opening of voltage-gated potassium channels
  - (b) sodium... opening of voltage-gated potassium channels
  - (c) sodium... opening of voltage-gated sodium channels
  - (d) sodium... closing of voltage-gated sodium channels
13. Which of these causes the release of neurotransmitter molecules?
  - (a) the receipt of a signal from the postsynaptic neuron
  - (b) the opening of voltage-regulated calcium channels and the diffusion of calcium ions out of the neuron
  - (c) an action potential reaching the end of the cell body

- (d) an action potential reaching the end of the axon
14. The space between an axon of one neuron and the dendrite of another neuron is called a(n) \_\_\_\_\_.
  - (a) synaptic cleft
  - (b) node of Ranvier
  - (c) internodes
  - (d) synapse
15. Neurons store neurotransmitter molecules in vesicles located within \_\_\_\_\_.
  - (a) the cell body
  - (b) synaptic terminals
  - (c) the synaptic cleft
  - (d) dendrites
16. A nerve poison that blocked acetylcholine receptors on the dendrites would \_\_\_\_\_.
  - (a) prevent receipt of a signal that crossed the synaptic gap
  - (b) inhibit the regeneration of acetylcholine for use by the synaptic terminals
  - (c) cause continued stimulation of the synaptic membrane
  - (d) inactivate acetylcholinesterase
17. Complex fire/don't fire "decision making" by neurons is most directly a result of the fact that \_\_\_\_\_.
  - (a) excitatory neurotransmitters cause "positive" action potentials and inhibitory neurotransmitters cause "negative" action potentials
  - (b) action potentials of various sizes can sum to a threshold potential
  - (c) neurons receive a combination of signals from both excitatory and inhibitory synapses
  - (d) chemical transmission allows signals to be transmitted in both directions across a synapse
18. Evolutionarily, the increasingly complex structure of the brain confers increasingly complex function. Which of the following is an example of this?
  - (a) The brainstem in most vertebrates controls homeostasis and basic bodily function.
  - (b) The medulla oblongata controls automatic functions.
  - (c) Birds and mammals show sleep/wake cycles.
  - (d) The cerebral cortex is greatly expanded in nonhuman primates and cetaceans.
19. Higher brain functions, such as creativity and analytical skills, are centered in the \_\_\_\_\_.
  - (a) corpus callosum
  - (b) hypothalamus
  - (c) cerebrum
  - (d) cerebellum
20. Damage to the nervous system presents particular challenges for physicians. Which of these is not a new development likely to translate into new therapies for damaged nervous system components?
  - (a) It has been discovered that different cells in the central nervous system do sometimes divide
  - (b) It has been discovered that the removal of certain parts of the brain may cause personality changes.
  - (c) Further discoveries have been made regarding the axonal growth cone.
  - (d) New discoveries have been made about the factors released by astrocytes.
21. The fundamental cell type in a nervous system is a(n) \_\_\_\_\_.
  - (a) axon
  - (b) cell body
  - (c) neuron
  - (d) dendrite
22. Neurons consist of \_\_\_\_\_.
  - (a) a cell body, dendrites, and an axon
  - (b) a cell body, dendrites, and glial cells
  - (c) a cell body, dendrites, and Schwann cells
  - (d) neuroglia, astroglia, and microglia
23. Which of the following maintains the resting potential (the difference in the electrical charge inside and outside a neuron membrane that enables the cell to transmit a signal)?
  - (a) charges that pull sodium and potassium through the membrane
  - (b) the opening of sodium and potassium channels in the membrane
  - (c) the myelin sheath, which prevents ions from entering or leaving the neuron
  - (d) the transport of sodium and potassium ions by the sodium/potassium pump
24. A stimulus triggers an action potential by \_\_\_\_\_.
  - (a) causing sodium ions to enter the neuron
  - (b) triggering the release of neurotransmitter
  - (c) causing potassium ions to enter the neuron
  - (d) activating the sodium-potassium pump.
25. Which of the following best describes a nerve signal?
  - (a) the flow of electricity along a neuron
  - (b) the sequential depolarization of the membrane of a neuron

- (c) the flow of neurotransmitters along a neuron  
 (d) the movement of tiny filaments of protein inside a neuron
26. Effectors include \_\_\_\_.  
 (a) endocrine glands  
 (b) touch receptors  
 (c) the motor cortex  
 (d) the retina
27. Which of the following describes a withdrawal reflex response?  
 (a) It requires a sensory neuron, an interneuron, and motor nerves.  
 (b) If results in the limb moving toward the midline of the body.  
 (c) Pain receptors in the skin send a message to the brain to initiate motor movement, away from a painful stimulus.  
 (d) The first two answers are correct.
28. The part of a neuron that carries nerve impulses toward the cell body is called \_\_\_\_.  
 (a) a nerve  
 (b) white matter  
 (c) a neurotransmitter  
 (d) dendrite
29. Schwann cells make up the \_\_\_\_.  
 (a) neurons (b) nodes of Ranvier  
 (c) myelin sheath (d) radial glia
30. Cells that provide metabolic and structural support to the neurons include \_\_\_\_.  
 (a) afferent and efferent neurons  
 (b) astrocytes  
 (c) oligodendrocytes and Schwann cells  
 (d) astrocytes, oligodendrocytes, and Schwann cells
31. Which one of the following statements is not true about the resting potential?  
 (a) The neuron's plasma membrane is much more permeable to potassium than to sodium.  
 (b) The concentration of sodium is much higher inside the cell than outside.  
 (c) The sodium-potassium pump plays a role in maintaining the resting potential.  
 (d) Inside the cell, the concentration of potassium is much higher than the concentration of sodium.
32. The sodium-potassium pump \_\_\_\_.  
 (a) expels sodium from the cell  
 (b) expels sodium and potassium from the cell  
 (c) pumps sodium into the cell
33. A drug that causes potassium to leak out of a neuron, increasing the positive charge on the outside, would \_\_\_\_.  
 (a) make it easier to trigger action potentials in the neuron  
 (b) inhibit transmission of nerve signals by the neuron  
 (c) speed up nerve signals traveling the length of the cell  
 (d) act as a stimulant
34. Threshold depolarization is of great significance in the physiology of neurons because if threshold depolarization is not reached, \_\_\_\_.  
 (a) the neuron cannot regain its resting potential  
 (b) the action potential will be "inversed," with a flux of sodium out of the cell rather than into it  
 (c) positive-feedback depolarization will not occur  
 (d) an action potential will be reached
35. An action potential is \_\_\_\_.  
 (a) a traveling wave of depolarization in the neuron membrane  
 (b) a brief neutralization of the charges on sodium and potassium ions  
 (c) a sudden increase in speed by the sodium-potassium pump  
 (d) a sudden reversal of the sodium-potassium pump
36. The period in which an axon membrane cannot act is called \_\_\_\_.  
 (a) the refractory period  
 (b) saltatory conduction  
 (c) the reticular activating system  
 (d) the node of Ranvier
37. "Saltatory conduction" means that the membrane potential changes \_\_\_\_.  
 (a) only where there is diffusion of sodium and potassium ions  
 (b) only at the nodes of Ranvier  
 (c) along the entire length of the axon  
 (d) in an all-or-none fashion
38. Action potentials are generated along a neuron because \_\_\_\_.  
 (a) of cytoplasmic streaming within the neuron  
 (b) depolarization of the membrane at one point causes an increase of permeability to sodium at the next point

- (c) they are pulled along by positive-negative attraction  
 (d) the neuron cytoskeleton conducts electricity as long as an ion gradient is maintained by the sodium-potassium pump
39. How are neurons structurally adapted to chemically transmit impulses to neighboring neurons?  
 (a) Axon terminals contain neurotransmitter substances within synaptic vesicles.  
 (b) They have numerous nodes of Ranvier.  
 (c) They have numerous dendrites.  
 (d) They have Schwann cells that surround axons.
40. Which one of the following statements about the transmission across a typical chemical synapse is not true?  
 (a) Neurotransmitter molecules are stored in vesicles in the synaptic terminal.  
 (b) Action potentials trigger chemical changes that make the neurotransmitter vesicles fuse with the plasma membrane of the transmitting cell.  
 (c) Vesicles containing neurotransmitter molecules diffuse to the receiving cell's plasma membrane.  
 (d) Neurotransmitter molecules bind to receptors in the receiving cell's plasma membrane.
41. Acetylcholinesterase is the enzyme that degrades acetylcholine. What effect on nerve transmission would occur following the administration of a chemical that inhibited acetylcholinesterase?  
 (a) There would be no effect.  
 (b) Synaptic transmission would be prevented; muscle paralysis would occur.  
 (c) It would be identical to giving an anesthetic, but it would last permanently.  
 (d) Extra excitatory postsynaptic potentials would occur in the postsynaptic neuron.
42. In humans, making more serotonin available to brain cells typically \_\_\_\_.  
 (a) increases the stimulatory effects of caffeine  
 (b) produces an effect on mood  
 (c) counteracts the effects of alcohol  
 (d) causes the heart to beat faster
43. A natural pain reliever is \_\_\_\_.  
 (a) epinephrine (b) acetylcholine  
 (c) endorphins (d) dopamine
44. Which of the following includes all the others?  
 (a) autonomic nervous system (ANS)  
 (b) motor division  
 (c) somatic nervous system  
 (d) peripheral nervous system (PNS)
45. Which of the following parts of the nervous system would allow you to discover the qualities of a mouthful of black pepper?  
 (a) somatic nervous system  
 (b) somatosensory cortex  
 (c) motor division  
 (d) sympathetic division
46. Which one of the following structures is (are) included in the peripheral nervous system?  
 (a) medulla oblongata  
 (b) gray matter  
 (c) spinal cord  
 (d) taste receptors
47. The gray matter of the cerebral cortex, where most higher-level thinking occurs, is composed mostly of \_\_\_\_.  
 (a) dendrites, unmyelinated axons, and nuclei  
 (b) myelinated axons of neurons  
 (c) sensory neuron cell bodies  
 (d) Schwann cells
48. Which of the following structures constitute(s) the mammalian forebrain?  
 (a) thalamus, epithalamus, hypothalamus, and cerebrum  
 (b) cerebellum and medulla oblongata  
 (c) pons  
 (d) cerebrum and cerebellum
49. Alex becomes so dehydrated while playing tennis that his blood pressure starts to drop. His \_\_\_\_ detects the drop in pressure and sends signals via \_\_\_\_ to speed up the heart to compensate.  
 (a) hypothalamus... parasympathetic neurons  
 (b) medulla oblongata... sympathetic neurons  
 (c) cerebellum... sympathetic neurons  
 (d) medulla oblongata... parasympathetic neurons
50. A physician friend of yours tells you about a patient with a head injury who suddenly stopped breathing during the examination. What portion of the brain was probably injured?  
 (a) medulla oblongata  
 (b) cerebrum  
 (c) cerebellum  
 (d) hypothalamus

51. As you start to pick up your biology book, you suddenly realize that it is much heavier than you expected. Which of the following brain regions is responsible for the rapid adjustment of muscle force that allows you to pick up the book smoothly?  
 (a) medulla oblongata  
 (b) cerebrum  
 (c) cerebellum  
 (d) hypothalamus
52. Monitoring blood CO<sub>2</sub> levels as well as triggering breathing at the appropriate times are functions of the \_\_\_\_\_.  
 (a) cerebrum  
 (b) hypothalamus  
 (c) medulla oblongata  
 (d) thalamus
53. The relay center for sensory messages is the \_\_\_\_\_.  
 (a) thalamus      (b) cerebrum  
 (c) cerebellum    (d) pons
54. A man is admitted to the hospital suffering from an abnormally low body temperature, a loss of appetite, and extreme thirst. A brain scan shows a tumor located in the \_\_\_\_\_.  
 (a) hypothalamus  
 (b) cerebellum  
 (c) pons  
 (d) right cerebral hemisphere
55. In mammals, the part of the brain that increases in size and complexity most significantly is derived from the embryonic \_\_\_\_\_.  
 (a) forebrain  
 (b) forebrain and midbrain  
 (c) midbrain  
 (d) midbrain and hindbrain
56. The corpus callosum connects the \_\_\_\_\_.  
 (a) cerebellum and spinal cord  
 (b) right and left cerebral hemispheres  
 (c) pituitary and the hypothalamus  
 (d) gray and white matter of the spinal cord
57. An important concept in biology is that evolution is a process that builds on present body plans. This means that embryonic development sequences often display evidence of evolutionary relationships. Such evidence would indicate that which part of the \_\_\_\_\_.  
 (a) brain is most prominent in early
58. (c) the cerebral cortex  
 (d) the pituitary gland
59. Damage to the occipital lobe would be most likely expressed as \_\_\_\_\_.  
 (a) a numbness in the extremities  
 (b) visual impairment  
 (c) auditory impairment  
 (d) spastic paralysis
60. The hearing centers are located in the \_\_\_\_\_.  
 (a) temporal lobes of the cerebral cortex  
 (b) occipital lobes of the cerebral cortex  
 (c) frontal lobe of the cerebral cortex  
 (d) parietal lobes of the cerebral cortex
61. Which of the following is **not** regulated by the association areas in the cerebral cortex?  
 (a) balance  
 (b) thought and language  
 (c) learning and memory  
 (d) judgment
62. After a stroke, Bill can feel his left leg but is unable to move it. His neurologists suspect damage to the \_\_\_\_\_.  
 (a) right frontal lobe  
 (b) right parietal lobe  
 (c) left frontal lobe  
 (d) left parietal lobe
63. The limbic system is involved in \_\_\_\_\_.  
 (a) emotion and memory  
 (b) speech and hearing  
 (c) vision  
 (d) sleep and wakefulness
64. Which ancestral region of the brain is responsible for modern humans' speech and ability to do algebra?  
 (a) forebrain      (b) midbrain  
 (c) hindbrain  
 (d) cerebral hemisphere
65. Which of the following contributes to learning and memory storage in the brain?  
 (a) repeated, weak stimulation of receiving neurons  
 (b) a decline in long-term potentiation  
 (c) excitatory neurotransmitters sent from neurons into synapses  
 (d) a decreased concentration of calcium ions entering receiving neurons through calcium channels
66. Which part of the brain's limbic system ties an emotional response to a stimulus?  
 (a) the reticular formation  
 (b) the amygdala  
 (c) the olfactory lobe
67. Which would be present in an animal with a nerve net?  
 (a) bilateral symmetry  
 (b) neurons  
 (c) fused ganglia  
 (d) cephalization
68. What is the difference between a neuron and a nerve?  
 (a) One has sensory functions, the other motor.  
 (b) Nerves are found only in the central nervous system.  
 (c) They consist of different numbers of cells.  
 (d) Neurons are made of white matter, nerves of gray matter.
69. A cluster of nerve cell bodies outside the central nervous system is referred to as a(n)  
 (a) cranial nerve      (b) nucleus  
 (c) association area    (d) ganglion
70. A neuron that transmits an impulse to the central nervous system after the neuron is stimulated by the environment is called a(n)  
 (a) sensory neuron    (b) motor neuron  
 (c) interneuron       (d) autonomic neuron

## ANSWERS

1. a      2. a      3. d      4. d  
 5. c      6. a      7. c      8. d  
 9. b      10. d     11. b     12. c  
 13. d     14. a     15. b     16. a  
 17. c     18. d     19. c     20. b  
 21. c     22. a     23. d     24. a  
 25. b     26. a     27. d     28. d  
 29. c     30. d     31. b     32. a  
 33. b     34. c     35. a     36. a  
 37. b     38. b     39. a     40. c  
 41. d     42. b     43. c     44. d  
 45. b     46. d     47. a     48. a  
 49. b     50. a     51. c     52. c  
 53. a     54. a     55. a     56. b  
 57. a     58. b     59. a     60. a  
 61. a     62. a     63. a     64. c  
 65. c     66. b     67. c     68. d  
 69. a     70. c

## 7.7: HORMONES AND THE ENDOCRINE SYSTEM

1. Which of these is the second of the three stages of cell signaling?
  - (a) gene activation
  - (b) reception
  - (c) binding of a neurotransmitter to a plasma membrane receptor
  - (d) transduction
  
2. Receptors for nonsteroid hormones are located in \_\_\_\_\_.
  - (a) association with a cell's plasma membrane
  - (b) the cytoplasm
  - (c) the nucleus
  - (d) the cytosol
  
3. Which of these is a nonsteroid hormone?
  - (a) estrogen
  - (b) testosterone
  - (c) both estrogen and testosterone
  - (d) epinephrine and oxytocin
  
4. How do nonsteroid hormones differ from steroid hormones?
  - (a) nonsteroid hormones bind to a cell's DNA; steroid hormones do not bind to a cell's DNA
  - (b) nonsteroid hormones act via signal transduction pathways; steroid hormones do not act via signal transduction pathways
  - (c) the action of nonsteroid hormones never affects gene expression; the action of steroid hormones always affects gene expression
  - (d) nonsteroid hormones bind to cytoplasmic receptors; steroid hormones bind to plasma membrane receptors
  
5. Which of these extracellular signal molecules could diffuse through a plasma membrane and bind to an intracellular receptor?
  - (a) estrogen
  - (b) epinephrine
  - (c) cellulose
  - (d) oxytocin
  
6. The primary reason steroid hormones usually bind to \_\_\_\_\_.
  - (a) they turn genes on or off and it takes time for gene products to build up or become depleted
  - (b) target cells tend to ignore steroid hormones in favor of nonsteroid hormones
  - (c) steroid hormone-receptor complexes act in the nucleus
  - (d) all of the above
  
7. Steroid hormone-receptor complexes act in \_\_\_\_\_.
  - (a) the nucleus
  - (b) lysosomes
  - (c) vesicles
  - (d) the cytoplasm
  
8. Which of these glands secretes releasing hormones?
  - (a) hypothalamus
  - (b) adrenal cortex
  - (c) thymus
  - (d) ovaries
  
9. Which of these hormones are responsible for the "fight or flight" response to danger?
  - (a) insulin and glucagon
  - (b) thyroxine and calcitonin
  - (c) androgens and estrogens
  - (d) epinephrine and norepinephrine
  
10. Adrenocorticotropic hormone (ACTH) triggers the release of \_\_\_\_\_ in response to stress.
  - (a) melatonin
  - (b) insulin
  - (c) glucocorticoids
  - (d) thymosin
  
11. Which selection is a common feature of all hormones?
  - (a) Hormones are proteins.
  - (b) Hormones act as a chemical signal between cells.
  - (c) Hormone levels are controlled by the pituitary gland.
  - (d) Hormones enter a cell, bind to their receptor, and interact with DNA.
  
12. Which selection best represents a common feature of both the endocrine and the nervous systems?
  - (a) Both utilize feedback.
  - (b) Several chemicals serve as both hormones and neurotransmitters.
  - (c) Nerve impulses can cause endocrine glands to release hormones.
  - (d) All of the above statements are true.

- (b) Hormones result in long-lasting responses, compared with nervous system responses.
- (c) Endocrine organs are sometimes derived from nervous tissue.
- (d) Hormones are secreted into the blood.
14. The action of a local regulator is illustrated when \_\_\_\_\_.
  - (a) prostaglandins released from the placenta alter the excitability of the muscle of the uterus
  - (b) histamine promotes the secretion of hydrochloric acid by stomach cells
  - (c) there is relaxation of arterial smooth muscle caused by nitric oxide
  - (d) all of the above
15. In their mechanism of action, a difference between steroid and nonsteroid hormones is that \_\_\_\_\_.
  - (a) steroid hormones use a "second messenger"
  - (b) nonsteroid hormones bind reversibly to DNA
  - (c) steroid hormones bind to an intracellular receptor and this hormone-receptor complex binds to DNA
  - (d) nonsteroid hormones cross the plasma membrane more readily than do steroid hormones
16. Which of the following is not an endocrine gland?
  - (a) pancreas
  - (b) adrenal gland
  - (c) salivary gland
  - (d) pituitary gland
17. Which statement about the lobes of the pituitary is false?
  - (a) The posterior lobe of the pituitary is nervous tissue that connects directly to the brain.
  - (b) The anterior lobe of the pituitary is glandular tissue closely associated with the brain.
  - (c) The posterior pituitary receives hypothalamic hormones from brain cells.
  - (d) The posterior pituitary produces oxytocin and antidiuretic hormone.
18. Which function below is not influenced by thyroid hormones?
  - (a) fight-or-flight response
  - (b) muscle tone
- conflict between the body's biological rhythm and the new cycle of light and dark. Some scientists suspect that jet lag may result from disruption of a daily hormone cycle known as \_\_\_\_\_.
- (a) epinephrine
- (b) insulin
- (c) melatonin
- (d) estrogen
20. When the levels of juvenile hormone are maintained at artificially high levels, insects will \_\_\_\_\_.
  - (a) be unable to molt
  - (b) bypass some larval stages and pupate prematurely
  - (c) molt more frequently
  - (d) be unable to advance to a pupal stage
21. Which is not an accurate statement regarding the difference between steroid and nonsteroid hormones?
  - (a) Steroid hormones are made from lipids; nonsteroid hormones are made from amino acids.
  - (b) Steroid hormones can pass through cell membranes; most nonsteroid hormones cannot.
  - (c) Steroid hormones are produced by endocrine glands; nonsteroid hormones are produced by nervous tissue.
  - (d) Steroid hormones activate genes; nonsteroid hormones do not directly activate genes.
22. Neurosecretory cells can be found in the \_\_\_\_\_.
  - (a) hypothalamus
  - (b) anterior pituitary
  - (c) hypothalamus and anterior pituitary
  - (d) anterior and posterior pituitary
23. Which example below is a true statement about the differences between hormones and neurotransmitters?
  - (a) Neurotransmitters produce slower responses than hormones.
  - (b) Neurotransmitters are released from ductless glands into the blood.
  - (c) Some endocrine glands release neurotransmitters, but no nervous tissue releases hormones.
  - (d) Neurotransmitters convey messages between nerve cells.
24. Since most chemical signals are unable to \_\_\_\_\_, the \_\_\_\_\_.

- (b) the activation of a signal transduction pathway  
 (c) direct stimulation of the cell's DNA molecule  
 (d) the enzymatic behavior of the signal molecule
25. What is the role of a second messenger in hormone action?  
 (a) It signals a cell to secrete a hormone.  
 (b) It informs a gland as to whether its hormones are having an effect.  
 (c) It relays a hormone's message inside a target cell.  
 (d) It stops hormone action when it is no longer needed.
26. What did experiments with melanocyte-stimulating hormone, a water-soluble hormone, in the skin cells of frogs reveal about hormone action?  
 (a) They revealed the role of cell-surface receptors in signal transduction pathways.  
 (b) They identified intracellular proteins that function as receptors.  
 (c) Hormones can only cause a reaction within target cells.  
 (d) Certain hormones can cause a change in gene expression.
27. Which one of the following hormones or types of hormones is thought to act at the cellular level by inducing a change in gene expression?  
 (a) protein hormones  
 (b) thyroid-stimulating hormone (TSH)  
 (c) sex hormones  
 (d) catecholamines
28. Which example below is a role of nitric oxide (NO), a local regulator?  
 (a) When oxygen levels fall, nitric oxide activates an enzyme that relaxes smooth muscle. This dilates blood vessels and improves blood flow.  
 (b) When secreted by certain white blood cells, NO kills some bacteria and cancer cells.  
 (c) NO increases the blood flow into the penis, producing an erection.  
 (d) All of the above are correct.
29. Ibuprofen is known for its pain-relieving and anti-inflammatory properties because it inhibits the synthesis of \_\_\_\_\_.  
 (a) prostaglandins (b) nitric oxide  
 (c) progestins (d) cytokines
30. Which one of the following endocrine organs does not actually manufacture hormones but rather, stores hormones produced elsewhere?  
 (a) thyroid  
 (b) adrenal cortex  
 (c) adrenal medulla  
 (d) posterior pituitary
31. As a young girl, Maria suffered a head injury that damaged her pituitary. An injury to the pituitary is particularly serious because of all the functions controlled by this gland. As Maria got older, she and her doctors found that all of the following except her \_\_\_\_\_ were affected.  
 (a) metabolic rate  
 (b) blood sugar level  
 (c) menstrual cycle  
 (d) water regulation
32. A doctor might give an expectant mother \_\_\_\_\_ to stimulate uterine contractions and induce labor.  
 (a) adrenocorticotrophic hormone (ACTH)  
 (b) thyroxine  
 (c) oxytocin  
 (d) insulin
33. The regulation of water volume in the blood involves which hormone?  
 (a) oxytocin (b) insulin  
 (c) FSH (d) ADH
34. How does the hypothalamus control the secretion of growth hormone (GH) from the anterior pituitary?  
 (a) The hypothalamus produces a releasing hormone that stimulates the pituitary to secrete GH.  
 (b) The hypothalamus sends a hormone to the target cells that makes them receptive to GH.  
 (c) Feedback from the target cells is sent to the posterior pituitary, which signals the hypothalamus to stimulate the anterior pituitary.  
 (d) The hypothalamus stimulates an action potential in the posterior pituitary, which then sends a releasing hormone to the anterior pituitary.
35. Which of the following is a hormone secreted by the posterior pituitary?  
 (a) insulin (b) oxytocin  
 (c) ACTH (d) thyroxine
36. FSH (follicle-stimulating hormone) and LH (luteinizing hormone) are trophic hormones that are also known as \_\_\_\_\_.  
 (a) gonadotropins

- (b) prostaglandins  
 (c) neurohormones  
 (d) cytokines
37. Which of the following hormones specifically act(s) to trigger secretion of hormones by another endocrine gland?  
 (a) thyroid hormones ( $T_3$  and  $T_4$ )  
 (b) progesterone  
 (c) adrenocorticotrophic hormone (ACTH)  
 (d) antidiuretic hormone (ADH)
38. Which is a correct statement about prolactin?  
 (a) It is produced by the posterior pituitary in all vertebrates.  
 (b) It regulates the balance between salt and water in saltwater fish such as the barracuda.  
 (c) It regulates larval development in beetles and grasshoppers.  
 (d) It controls fat metabolism and reproduction in birds.
39. The mammary glands of a pregnant female will begin to produce milk in response to changes in the level of which of the following hormones?  
 (a) prolactin (b) progesterone  
 (c) estrogen (d) relaxin
40. The major tropic action of growth hormone is to signal the \_\_\_\_\_ to release \_\_\_\_\_.  
 (a) thyroid...  $T_3$  and  $T_4$   
 (b) pancreas... glucagon  
 (c) liver... insulin-like growth factors  
 (d) hypothalamus... thyroid-releasing hormone
41. How is the level of thyroxine in the blood regulated?  
 (a) Thyroxine stimulates the pituitary to secrete thyroid-stimulating hormone (TSH).  
 (b) TSH inhibits the secretion of thyroxine from the thyroid gland.  
 (c) TSH-releasing hormone (TRH) inhibits the secretion of thyroxine by the thyroid gland.  
 (d) High levels of  $T_3$  and  $T_4$  inhibit the secretion of TRH and TSH.
42. Which disorder is correctly matched with its cause?  
 (a) pituitary dwarfism... hyposecretion of growth hormone  
 (b) infant cretinism... hypersecretion of thyroxine  
 (c) low blood calcium... hypersecretion of parathyroid hormone (PTH)
43. Which is a correct statement about the thyroid gland?  
 (a) It produces the lipid class of hormones.  
 (b) Fluorine is essential to proper thyroid function.  
 (c) Thyroid hormones trigger the change of an aquatic tadpole into a terrestrial bullfrog.  
 (d) Goiter is caused by hyperthyroidism.
44. Hyperthyroidism, typically characterized by a high metabolic rate and high blood pressure, might be expected when \_\_\_\_\_.  
 (a) the pituitary secretes high concentrations of thyroxine  
 (b) thyroid-stimulating hormone (TSH) concentration is high  
 (c) thyroxine concentration is low  
 (d) the production of TSH-releasing factor is inhibited
45. If a diet is deficient in iodine, a goiter may form because \_\_\_\_\_.  
 (a) the thyroid cannot release  $T_3$  and  $T_4$  so the hormones build up in the gland  
 (b) low blood levels of  $T_3$  and  $T_4$  inhibit the negative feedback loop. An overload of TRH causes enlargement of the gland.  
 (c) low blood levels of  $T_3$  and  $T_4$  inhibit the negative feedback loop. An overload of TSH causes enlargement of the gland.  
 (d) researchers are not sure why goiters form during iodine deficiency
46. How does parathyroid hormone affect levels of  $\text{Ca}^{2+}$  in the blood?  
 (a) When  $\text{Ca}^{2+}$  levels fall, PTH decomposes the matrix of bone and stimulates reabsorption of  $\text{Ca}^{2+}$  in the small intestines.  
 (b) When  $\text{Ca}^{2+}$  levels rise, PTH stimulates the uptake of calcium in bones and the release of calcium in urine.  
 (c) When  $\text{Ca}^{2+}$  levels fall, PTH stimulates bone cells to decompose the matrix of bone and stimulates reabsorption of  $\text{Ca}^{2+}$  in the renal tubules.  
 (d) When  $\text{Ca}^{2+}$  levels rise, PTH stimulates the conversion of vitamin D to its active hormonal form in the kidneys and facilitates accumulation of calcium in bones.
47. Every time you eat a cookie or candy bar, your blood sugar increases. This triggers an increase in the hormone \_\_\_\_\_.  
 (a) thyroxine

- (b) epinephrine  
(c) adrenocorticotrophic hormone (ACTH)  
(d) insulin
48. Which of the following hormones have antagonistic effects?  
(a) thyroxine and calcitonin  
(b) insulin and glucagon  
(c) growth hormone and epinephrine  
(d) ACTH and glucocorticoids
49. Which sequence below correctly describes the maintenance of glucose synthesis?  
(a) low blood sugar, pancreatic beta cells stimulated, insulin released, breakdown of glycogen in target cells  
(b) low blood sugar, pancreatic alpha cells stimulated, glucagon released, breakdown of glycogen in target cells  
(c) high blood sugar, pancreatic alpha cells stimulated, insulin released, uptake of glucose by target cells  
(d) high blood sugar, pancreatic alpha cells stimulated, glucagon released, glycogen synthesis in liver
50. Type 1 diabetes mellitus \_\_\_\_\_.  
(a) is an autoimmune disease in which the immune system attacks beta cells in the pancreas  
(b) is a common disorder in overweight individuals older than 40  
(c) is treated by improving insulin receptor efficiency rather than by giving insulin  
(d) is the most common form of the disease; more than 90% of all diabetics have type 1 diabetes  
Which of the following hormones has the range of targets?  
(b) oxytocin  
(d) epinephrine
- statement below about the hormones secreted by the adrenal is incorrect?  
are synthesized from the amino acid  
are released in response to ACTH.  
increase the rate of glycogen breakdown in the liver and skeletal muscles.  
increase the rate of oxygen delivery to body cells.
- is a true statement about the adrenal

61. What hormone promotes water retention by the kidneys?

- (a) follicle-stimulating hormone (FSH)  
(b) prolactin  
(c) antidiuretic hormone (ADH)  
(d) melatonin

62. Which hormone opposes the action of parathyroid hormone?

- (a) calcitonin  
(b) insulin  
(c) thyroxine  
(d) thymosin

63. Which hormone stimulates hormone production by the ovaries and testes?

- (a) progesterone  
(b) testosterone  
(c) glucocorticoids  
(d) luteinizing hormone (LH)

64. Which hormone stimulates milk production?

- (a) parathyroid hormone  
(b) mineralocorticoids  
(c) prolactin  
(d) thyroid-stimulating hormone (TSH)

## ANSWERS

1. d	2. a	3. d	4. b
5. a	6. c	7. a	8. a
9. d	10. c	11. b	12. d
13. a	14. d	15. c	16. c
17. d	18. a	19. c	20. d
21. c	22. a	23. d	24. b
25. c	26. a	27. c	28. d
29. a	30. a	31. b	32. c
33. d	34. a	35. b	36. a
37. c	38. d	39. a	40. c
41. d	42. a	43. c	44. b
45. b	46. c	47. d	48. b
49. b	50. a	51. d	52. b
53. d	54. d	55. b	56. d
57. b	58. d	59. b	60. c
61. c	62. a	63. d	64. c

## 7.8: SENSORY AND MOTOR MECHANISMS

1. The \_\_\_\_\_ is the region of the eye where photoreceptors are most highly concentrated.
  - lens
  - fovea
  - optic nerve
  - pupil
2. What name is given to the tough layer that forms the "white" of the eye?
  - blind spot
  - choroid
  - fovea
  - sclera
3. The \_\_\_\_\_ changes shape to focus light on the retina.
  - vitreous humor
  - blind spot
  - cornea
  - lens
4. What name is given to the opening that allows light into the interior of the eye?
  - sclera
  - pupil
  - ligament
  - optic nerve
5. Which of these is a component of a human's appendicular skeleton?
  - ribs
  - sternum
  - femur
  - skull
6. What type of joint allows you to open and close your mouth?
  - ball and socket
  - hinge
  - pivot
  - saddle
7. What type of joint allows you to shake your head "no"?
  - ball and socket
  - hinge
  - pivot
  - saddle
8. What type of joint is found where the humerus joins the shoulder blade?
  - ball and socket
  - hinge
  - pivot
  - saddle
9. The thick filaments of sarcomeres are composed of \_\_\_\_\_.
  - myofibrils
  - actin
  - motor neurons
  - myosin
10. The thin filaments of sarcomeres are composed of \_\_\_\_\_.
  - myofibrils
  - actin
  - motor neurons
  - myosin
11. A single muscle cell is referred to as a \_\_\_\_\_.
  - myofibril
  - muscle fiber
  - muscle neurons
  - sarcolemma
12. During the course of muscle contraction the potential energy stored in ATP is transferred to potential energy stored in \_\_\_\_\_.
  - the myosin head
  - the myosin tail
  - the thin filament
  - actin
13. The release of \_\_\_\_\_ ions from the sarcoplasmic reticulum is required for skeletal muscle contraction.
  - sodium
  - phosphate
  - calcium
  - chloride
14. Myosin heads bind to \_\_\_\_\_, which they then pull and cause to slide toward the center of the sarcomere.
  - thin filaments
  - Z lines
  - sarcomeres
  - myofibrils
15. Which of the following is not involved when information about taste intensity is transmitted to the brain?
  - the frequency of action potentials
  - the strength of an action potential
  - the strength of a receptor potential
  - the number of sensory neurons that transmit action potentials
16. When light first enters the human eye, the first structure that it must pass through is the \_\_\_\_\_.
  - lens
  - pupil
  - aqueous humor
  - cornea
17. Which statement is true for both rods and cones?
  - Rods use glutamate as a neurotransmitter, but cones do not.
  - Sufficient light stimulation of rods and cones results in a nerve impulse being sent to the brain via the optic chiasm.
  - Both rods and cones are located in the fovea.
  - Photopsin is the visual pigment found in both rods and cones.
18. In general, locomotion requires an animal to expend energy to overcome \_\_\_\_\_.
  - friction only
  - gravity only
  - friction and gravity
  - the tendency to lose balance

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19. Which of the following animals is correctly matched with its type of skeleton?
    - locust... endoskeleton
    - earthworm... exoskeleton
    - dog... exoskeleton
    - lobster... exoskeleton
  20. Muscles are arranged in pairs.
    - so if one is injured, the other can take over
    - doubling their strength
    - because one pulls while the other pushes
    - enabling them to perform opposing movements
  21. Of these events, the first to occur when a motor neuron stops sending an impulse to a muscle is \_\_\_\_\_.
    - the pumping of calcium ions out of the cytoplasm and back into the sarcoplasmic reticulum
    - the release of myosin heads from the thin filament
    - thin filaments slide back to their relaxed positions
    - proteins on the thin filaments block actin's myosin-binding sites
  22. You look all over for your glasses and then find them pushed back onto your forehead. This error could be attributed to \_\_\_\_\_.
    - perception
    - transduction
    - sensation
    - sensory adaptation
  23. A fish detects vibrations in the water around it by means of its lateral lines, rows of sensory receptors along each side of the body. Based on what you know about sensory receptors, the lateral line receptors are probably which of the following?
    - hair cells
    - electromagnetic receptors
    - chemoreceptors
    - muscle spindles
  24. If we stand up too quickly, blood pressure and, hence, blood flow to the brain will decrease. Which receptors will respond to this decrease in blood pressure?
    - chemoreceptors
    - thermoreceptors
    - photoreceptors
    - mechanoreceptors
  25. Which one of the following classes of sensory receptors consists of neurons with naked dendrites?
    - tendon stretch receptor
  26. The organ of Corti is found \_\_\_\_\_.
    - in the pain receptors
    - in the taste areas of the tongue
    - in the cochlea
    - in the semicircular canals
  27. Organs in the inner ear of mammals are the cochlea, semicircular canals, and vestibule. Match them to their functions.
    - cochlea... hearing semicircular canals... equilibrium
    - cochlea... hearing semicircular canals... hearing vestibule... equilibrium
    - cochlea... balance semicircular canals... hearing vestibule... hearing
    - cochlea... hearing semicircular canals... equilibrium vestibule... hearing
  28. Sitting too close to the amplifiers at a concert may \_\_\_\_\_.
    - affect the alignment of the semicircular canals
    - cause fluid leakage from the cochlea
    - cause the hammer to damage the anvil and stirrup bones
    - cause permanent damage to the hair cells in the ears
  29. The brain determines the loudness of a sound from the \_\_\_\_\_.
    - part of the organ of Corti stimulated by the sound
    - rate of nerve impulses received
    - range of air pressure changes in the middle ear
    - part of the brain receiving nerve impulses from the ear
  30. If the basilar membranes in the ears were equal in width and flexibility along their length, how would this affect a person's sense of hearing?
    - The person would be totally deaf.
    - The person couldn't distinguish different pitches.
    - The person couldn't distinguish loud sounds from quiet sounds.
    - The person would hear normally.
  31. A person born without otoliths in the ears would be \_\_\_\_\_.
    - totally deaf
    - unable to determine the rate of motion of the head

- (c) unable to determine the position of the head with respect to gravity  
 (d) hearing-impaired, but not totally deaf
32. Taste and smell are two distinct senses in animals living in terrestrial environments. Animals living in aquatic environments, however, have no distinction between taste and smell. Which response might explain this difference?  
 (a) Animals living in aquatic environments do not have noses.  
 (b) Aquatic animals do not rely on chemoreceptors to respond to their environment.  
 (c) The equivalent of air in the terrestrial environment does not exist in an aqueous environment.  
 (d) Aquatic animals rarely remain in one place long enough to be able to smell something.
33. Compound eyes are advantageous for small prey species to detect a potential predator because \_\_\_\_\_.  
 (a) each ommatidium contains many photoreceptor cells  
 (b) all animals with compound eyes can detect ultraviolet radiation  
 (c) they permit sensitive motion detection  
 (d) with compound eyes, the brain forms many separate visual images
34. Instead of shouting, "Don't fire until you see the whites of their eyes!" at Bunker Hill, Col. William Prescott could have said, "Don't shoot until you see their \_\_\_\_!"  
 (a) retinas                 (b) corneas  
 (c) foveas                 (d) scleras
35. Which of the following correctly traces the path of light into your eyes?  
 (a) lens, cornea, pupil, retina  
 (b) cornea, pupil, lens, retina  
 (c) cornea, lens, pupil, retina  
 (d) lens, pupil, cornea, retina
36. The fluid in the anterior chamber of the eye is the \_\_\_\_\_.  
 (a) aqueous humor         (b) ciliary humor  
 (c) vitreous humor         (d) pupillary humor
37. Correct focusing of the image on the retina in humans is achieved by changing the \_\_\_\_\_.  
 (a) distance between the lens of the eye and the retina  
 (b) shape of the lens of the eye  
 (c) size of the retina  
 (d) shape of the eyeball
38. When you move an object from 15 inches in front of your eyes to 10 inches in front of your eyes, the lenses \_\_\_\_\_.  
 (a) decrease in diameter  
 (b) move forward  
 (c) become more rounded  
 (d) become flatter
39. Incapacitating the muscles of a mammalian eye would result in an inability \_\_\_\_\_.  
 (a) to regulate the amount of light entering the eye and an inability of the photoreceptor cells to transduce light energy  
 (b) to expel aqueous humor from the eye, resulting in glaucoma  
 (c) of the photoreceptor cells to transduce light energy  
 (d) to regulate the amount of light entering the eye and an inability to focus light
40. A baby is born with the normal number and distribution of rods, but no cones. We would expect that the baby's vision would be \_\_\_\_\_.  
 (a) color-blind, easily blinded by bright light, and capable only of coarse resolving power  
 (b) normal on the left side of the visual field but blurred and gray on the right side  
 (c) normal on the right side of the visual field but totally blind on the left side  
 (d) absent; the baby would be totally blind
41. While driving your car at night, you notice that you have poor peripheral vision. You might suspect this problem to be associated with which part(s) of the eye?  
 (a) fovea                 (b) photopsin  
 (c) iris                     (d) none of the above
42. The greatest concentration of cone receptors is found at the \_\_\_\_\_.  
 (a) conal point             (b) fovea  
 (c) sclera                 (d) periphery of the retina
43. The body uses the vitamin A precursors from some foods in carrots to make a substance called retinal, which \_\_\_\_\_.  
 (a) is a visual pigment that absorbs light  
 (b) provides energy for the function of rods and cones  
 (c) colors the iris of the eye  
 (d) stimulates the neurons in the retina to form branches and connections
44. Which one of the following occurs when you move from a bright area into a darkened room?  
 (a) Rods and cones hyperpolarize.

- (b) The iris dilates, increasing the size of the pupil.  
 (c) The size of the pupil decreases.  
 (d) The lens focuses light off the cones and onto the rods.
45. Difficulty in distinguishing red from green is most likely due to a defect in which cells?  
 (a) rod cells                 (b) cone cells  
 (c) lens cells                 (d) cornea cells
46. A human born with nonfunctional rhodopsin would \_\_\_\_\_.  
 (a) lack color vision  
 (b) be unable to see in dim light  
 (c) be unable to see in bright light  
 (d) be totally blind
47. Which choice below is the correct order of the neural pathways that light travels after hitting the retina?  
 (a) photoreceptors, bipolar cells, ganglion cells (optic nerve)  
 (b) horizontal cells, ganglion cells, bipolar cells, photoreceptors  
 (c) photoreceptors, ganglion cells, horizontal cells, amacrine cells  
 (d) photoreceptors, horizontal cells, ganglion cells, bipolar cells
48. In the vertebrate eye, one kind of sensory processing occurs when light falls on a single photoreceptor cell and excites that cell and nearby receptors, whereas more distant photoreceptor cells are inhibited from transmitting impulses. This phenomenon is called \_\_\_\_\_.  
 (a) a reflex circuit  
 (b) accommodation  
 (c) lateral inhibition  
 (d) neuronal habituation
49. Why is having a hydrostatic skeleton, rather than an internal skeleton, more advantageous to an earthworm?  
 (a) Having an internal skeleton would not allow the fine movements an earthworm uses when it moves.  
 (b) Having an internal skeleton would prevent an earthworm from being able to burrow underground tunnels.  
 (c) Having an exoskeleton allows the earthworm to use peristaltic motion to move over the substrate.  
 (d) Having a hydrostatic skeleton means that having muscles is not a requirement for movement.
50. Which statement about contraction of a sarcomere is false?  
 (a) The I band shortens and the A band elongates.  
 (b) The A band shortens and the I band elongates.  
 (c) The I band, A band, and M line all shorten.  
 (d) The I band and H zone shorten.
51. What do all muscle tissues have in common?  
 (a) The individual cells are joined by intercalated discs.  
 (b) The basic contractile unit is the sarcomere.  
 (c) Calcium must enter the cytosol before contraction can occur.  
 (d) They have transverse tubules along which the action potential travels before it stimulates the release of calcium from the endoplasmic reticulum.
52. A thermoreceptor in the skin converts heat to nerve impulses. This conversion is called \_\_\_\_\_.  
 (a) sensation  
 (b) sensory transduction  
 (c) reception  
 (d) integration
53. Which one of the following is an example of adaptation by a receptor?  
 (a) Individuals who live in cold climates have fewer cold receptors in their skin.  
 (b) You no longer feel the ring you put on your finger this morning.  
 (c) Diving into a cold swimming pool gives you goosebumps.  
 (d) Water above a certain temperature may stimulate pain receptors rather than temperature receptors.
54. The nervous system distinguishes the pitch of a sound mainly on the basis of the \_\_\_\_\_.  
 (a) site along the basilar membrane where pressure is exerted  
 (b) peak amplitude (height of a wave) of basilar membrane displacement  
 (c) frequency of basilar membrane vibration  
 (d) duration of basilar membrane vibration
55. Damage to the nerve that connects the utricle and saccule to the brain could result in \_\_\_\_\_.  
 (a) a race car driver not sensing the forward motion of his car when the race begins

- (b) the sensation that you might feel when you are riding on a roller coaster which turns you upside down as it passes through one of the turns  
 (c) dizziness  
 (d) loss of the sense of smell

**ANSWERS**

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. b  | 2. d  | 3. d  | 4. b  |
| 5. c  | 6. b  | 7. c  | 8. a  |
| 9. d  | 10. a | 11. b | 12. a |
| 13. c | 14. a | 15. b | 16. d |
| 17. b | 18. c | 19. d | 20. d |
| 21. a | 22. d | 23. a | 24. d |
| 25. d | 26. c | 27. a | 28. d |
| 29. b | 30. b | 31. c | 32. c |
| 33. c | 34. d | 35. b | 36. a |
| 37. b | 38. c | 39. d | 40. a |
| 41. d | 42. b | 43. a | 44. b |
| 45. b | 46. b | 47. a | 48. c |
| 49. c | 50. d | 51. c | 52. b |
| 53. b | 54. a | 55. a |       |
- 

**7.9: ANIMAL REPRODUCTION**

1. Sperm develop in the \_\_\_\_\_  
 (a) prostate gland  
 (b) bulbourethral glands  
 (c) seminiferous tubules  
 (d) hypothalamus  
 (b) estrogens  
 (c) luteinizing hormone  
 (d) follicle-stimulating hormone
2. Sperm exit a male's body via the \_\_\_\_\_  
 (a) ejaculatory duct (b) urethra  
 (c) oviduct (d) ureter
3. Which pituitary secretion stimulates sperm production?  
 (a) LH (b) ACTH  
 (c) TSH (d) FSH
4. Which pituitary secretion stimulates the testes to secrete androgens?  
 (a) LH (b) ACTH  
 (c) TSH (d) PRL
5. Which hormone(s) is(are) directly responsible for triggering the development of the secondary sex characteristics of males, such as beard growth?  
 (a) androgens (b) thymosin  
 (c) epinephrine (d) insulin
6. The secretion of androgens is regulated by a \_\_\_\_\_ feedback mechanism involving the \_\_\_\_\_ and \_\_\_\_\_.  
 (a) positive... hypothalamus... pituitary gland  
 (b) negative... hypothalamus... pituitary gland  
 (c) positive... thyroid... pituitary gland  
 (d) negative... pancreas... pituitary gland
7. Sperm become capable of movement while in the \_\_\_\_\_.  
 (a) seminiferous tubules  
 (b) vas deferens  
 (c) ejaculatory ducts  
 (d) epididymis
8. What is the usual site of the fertilization of an egg cell?  
 (a) uterus (b) ovary  
 (c) oviduct (d) abdominal cavity
9. A fertilized egg usually implants itself and develops in the \_\_\_\_\_.  
 (a) uterus (b) ovary  
 (c) oviduct (d) abdominal cavity
10. Developing ovarian follicles primarily secrete
11. Suppose you wanted to get started in the animal-breeding business. You could start out with only one of most of the following animals, but you would have to start with at least two \_\_\_\_\_.  
 (a) sea anemones (b) frogs  
 (c) tapeworms (d) whiptail lizards
12. Which of the following is a form of sexual reproduction?  
 (a) budding (b) fission  
 (c) fragmentation (d) hermaphroditism
13. Some salamander and insect populations consist of only genetically identical females. This occurs because \_\_\_\_\_.  
 (a) males are killed at birth by their mothers  
 (b) a mutation in the population has eliminated the salamander equivalent of the Y chromosome  
 (c) sperm do not fuse with eggs during reproduction, but the eggs develop into embryos anyway  
 (d) a sex-linked, dominant, lethal mutation is fixed in the population
14. External fertilization occurs mostly in \_\_\_\_\_.  
 (a) land animals  
 (b) insects  
 (c) aquatic animals  
 (d) animals that reproduce asexually
15. Vertebrates became truly terrestrial with the development of the amniotic egg. The most primitive vertebrate group to possess such eggs are the \_\_\_\_\_.  
 (a) bony fish (b) amphibians  
 (c) reptiles (d) bird
16. Which of the following is (almost) never found in or on the human ovary?  
 (a) follicle (b) corpus luteum  
 (c) endometrium (d) egg cell
17. Which of the following correctly traces the path of sperm from their site of production to their exit from a man's body?  
 (a) seminiferous tubule... vas deferens... epididymis... urethra

- (b) epididymis... urethra... seminiferous tubule... vas deferens  
 (c) seminiferous tubule... epididymis... vas deferens... urethra  
 (d) epididymis... seminiferous tubule... vas deferens... urethra
18. Oogenesis in comparison to spermatogenesis is somewhat unusual in humans in that \_\_\_\_\_.  
 (a) cytokinesis is unequal during the meiotic divisions  
 (b) the sequence from primary oocyte to ovum is interrupted by a relatively long resting period  
 (c) the first meiotic division is not completed unless the egg is reactivated by a hormone  
 (d) a mature ovum has not yet completed its second meiotic division
19. A peak in \_\_\_\_\_ triggers ovulation around the \_\_\_\_\_ day of the monthly cycle.  
 (a) progesterone... 14th  
 (b) LH... 7th  
 (c) FSH... 2nd  
 (d) LH... 14th
20. During the first trimester \_\_\_\_\_.  
 (a) the mother may feel movements, and fetal activity may be visible through the abdominal wall  
 (b) an ultrasound can be performed to determine the gender of the fetus  
 (c) the fetus grows to about 3-3.5 kg  
 (d) the fetus is most vulnerable to exposure to drugs and radiation
21. A rapid increase in the \_\_\_\_\_ level stimulates ovulation.  
 (a) progesterone  
 (b) estrogen  
 (c) luteinizing hormone  
 (d) follicle-stimulating hormone
22. Ovulation usually occurs on or about day \_\_\_\_\_ of a 28-day ovarian cycle.  
 (a) 1 (b) 7  
 (c) 14 (d) 21
23. After ovulation, high levels of \_\_\_\_\_ inhibit \_\_\_\_\_ secretion.  
 (a) estrogen and progesterone... FSH and LH  
 (b) FSH and LH... estrogen and progesterone  
 (c) HCG... estrogen and progesterone  
 (d) estrogen... FSH
24. If there is no fertilization, degeneration of the corpus luteum results in a drop in \_\_\_\_\_ which results in the sloughing off of the uterus's endometrium.  
 (a) FSH  
 (b) estrogen and progesterone  
 (c) hypothalamic secretion of releasing hormones  
 (d) HCG
25. If there is fertilization, secretion of \_\_\_\_\_ by the early embryo maintains the corpus luteum.  
 (a) progesterone  
 (b) estrogen  
 (c) luteinizing hormone  
 (d) human chorionic gonadotropin
26. What is the source of the hormones that, when suddenly absent, are directly responsible for the onset of menstruation?  
 (a) hypothalamus (b) pituitary  
 (c) ovarian follicle (d) corpus luteum
27. A large number of hormones function in the human menstrual cycle, but only two of them are called female sex hormones. These are \_\_\_\_\_.  
 (a) follicle-stimulating hormone and estrogen  
 (b) follicle-stimulating hormone and progesterone  
 (c) follicle-stimulating hormone and luteinizing hormone  
 (d) progesterone and estrogen
28. The ovary undergoes several structural changes or events during the human female's menstrual cycle. Which one of the following sequences is correct, beginning with the oocyte?  
 (a) corpus luteum development... follicle development... ovulation  
 (b) follicle development... ovulation... corpus luteum development  
 (c) corpus luteum development... ovulation... follicle development  
 (d) follicle development... corpus luteum development... ovulation
29. Into which structure is a human oocyte released upon ovulation?  
 (a) uterus (b) oviduct  
 (c) ovary (d) abdominal cavity
30. How do egg cells enter the oviduct after ovulation?  
 (a) Follicle contraction squirts them into the oviduct.  
 (b) Ciliary currents bring fluid inside, carrying the egg cell along.

- (c) The ovaries are contained within the oviducts.  
 (d) Muscular projections of the uterine wall grasp the egg cell and force it into the tube.
31. Bartholin's gland \_\_\_\_\_.  
 (a) contains spongy tissue that fills with blood during arousal  
 (b) secretes progesterone and estrogen to maintain pregnancy  
 (c) covers the vagina before sexual intercourse  
 (d) secretes lubricating fluid
32. Where do developing sperm cells undergo meiosis?  
 (a) in the epididymis  
 (b) in the vas deferens  
 (c) in the seminal vesicle  
 (d) in the seminiferous tubules
33. The \_\_\_\_\_ is (are) the site of testosterone production in the testis.  
 (a) seminiferous tubules  
 (b) epididymis  
 (c) Leydig cells  
 (d) seminal vesicle
34. In many mammals, the testes are located outside the abdominal cavity within the scrotum because \_\_\_\_\_.  
 (a) the elevated pressure within the abdominal cavity would collapse the small passageways within the testes  
 (b) this location allows for a shorter pathway to the urethra  
 (c) blood flow to the scrotum is not interrupted during erection  
 (d) sperm are unable to mature properly at the higher temperatures found within the abdominal cavity
35. Which part of the male reproductive tract stores sperm as they mature until they exit from the male's body?  
 (a) epididymis (b) vas deferens  
 (c) glans (d) urethra
36. Where is one least likely to find complete semen (in which all the components are present)?  
 (a) in the vagina of a woman after copulation  
 (b) in the epididymis  
 (c) prior to the junction of the bulbourethral duct and the urethra  
 (d) at the male urethral opening
37. What structure is part of both the excretory and reproductive systems in males?  
 (a) ureter (b) urethra  
 (c) seminal vesicle (d) urinary bladder
38. Sperm has several components; the function of the acrosome is to \_\_\_\_\_.  
 (a) produce base to neutralize the acidic environment of the female reproductive system  
 (b) metabolize the sugars provided by the semen for energy  
 (c) release an enzyme that breaks down the membrane of the ovum  
 (d) propel the sperm as they swim through the fluid of the female reproductive tract
39. Which part of the human sperm carries a haploid set of chromosomes?  
 (a) head (b) neck  
 (c) middle piece (d) acrosome
40. In mammals, meiosis to produce the female egg cell is initiated in the \_\_\_\_\_.  
 (a) ovary (b) vagina  
 (c) uterus (d) oviduct
41. From a single cell, oogenesis in a mammal will produce \_\_\_\_\_.  
 (a) four ova (eggs)  
 (b) four spermatozoa  
 (c) an ovum and three polar bodies  
 (d) a primary oocyte
42. In spermatogenesis, each primary spermatocyte gives rise to \_\_\_\_\_ sperm.  
 (a) one (b) two  
 (c) four (d) eight
43. At what point does the secondary oocyte complete meiosis?  
 (a) when the luteinizing hormone triggers ovulation  
 (b) after species-specific proteins of sperm and ovum combine  
 (c) when the secondary oocyte implants in the endometrium of the uterus  
 (d) when the egg is fully surrounded by sperm and semen
44. The amount of cytoplasm found in an animal egg cell is \_\_\_\_\_ that found in the polar bodies.  
 (a) greater than (b) equal to  
 (c) less than (d) thinner
45. Which of the comparisons of oogenesis and spermatogenesis is not accurate?  
 (a) Follicle-stimulating hormone promotes both egg and sperm development.

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- (b) Luteinizing hormone triggers ovulation in females and androgen production in males.  
 (c) Releasing hormone triggers the anterior pituitary to release FSH and LH in both males and females.  
 (d) Primary oocytes and primary spermatocytes follow a similar pattern of development through meiosis.
46. Menstruation results in the discharge of  
 (a) the follicle  
 (b) the endometrial lining  
 (c) the corpus luteum of the uterus  
 (d) surface cells from the vagina
47. In males, FSH \_\_\_\_\_  
 (a) is not produced; it is a female hormone  
 (b) is directly responsible for facial hair growth beginning at puberty  
 (c) is produced by the hypothalamus  
 (d) stimulates development of sperm cells in the testes
48. Which is a true statement about luteinizing hormone in the female reproductive system?  
 (a) It is produced by the hypothalamus.  
 (b) It causes mitosis of the primary oocyte.  
 (c) It is responsible for mediating the production of estrogen and progesterone simultaneously.  
 (d) It triggers development of endometrium in the corpus luteum.
49. After ovulation occurs, the empty follicle  
 (a) can be recycled to produce more eggs  
 (b) changes into the corpus luteum and makes hormones  
 (c) quickly degenerates  
 (d) immediately initiates menstruation
50. Concentrations of which hormone stimulate the hypothalamus to increase or decrease hormones that stimulate sperm production in the testes?  
 (a) follicle-stimulating hormone  
 (b) luteinizing hormone  
 (c) testosterone  
 (d) releasing hormone
51. After the menstrual period, which of the following hormones is the first to increase significantly every 28 days or so, initiating the ovarian cycle?  
 (a) progesterone  
 (b) follicle-stimulating hormone
- (c) estrogen  
 (d) luteinizing hormone
52. On its way to fertilize a human egg, a sperm cell does not have to pass through which of the following?  
 (a) oviduct                          (b) vagina  
 (c) ovary                            (d) vas deferens
53. Pregnancy tests detect a hormone in a woman's urine that is present only when an embryo is developing in her uterus. This hormone is secreted by \_\_\_\_\_.  
 (a) the ovary                      (b) the embryo  
 (c) a follicle                      (d) the pituitary
54. Which of the following does not describe a function of the placenta?  
 (a) providing oxygen to the fetus  
 (b) carrying wastes from the fetus to the mother's circulatory system  
 (c) secreting hormones that keep the uterine lining from breaking down  
 (d) All of the above are functions of the placenta
55. Because the genetic composition of the fetus is not identical to that of the mother, it is somewhat surprising that the fetus is not rejected as a foreign body. It appears that this is because \_\_\_\_\_.  
 (a) the embryo does not express paternal antigens on its cells until after birth  
 (b) the embryo produces signal molecules that turn off the mother's immune system for the nine months of pregnancy  
 (c) a protective layer, the trophoblast, surrounds the embryo and prevents direct contact with maternal tissue  
 (d) special maternal immune cells produce antigenic modifier proteins (AMPs), which mask the foreign antigens
56. Which one of the following is the least effective method of birth control?  
 (a) vasectomy  
 (b) the pill  
 (c) morning after pill  
 (d) rhythm method
57. If a woman wants to become pregnant, what is the optimal day on which to have sexual intercourse?  
 (a) one week before ovulation  
 (b) three days before ovulation  
 (c) the day of ovulation, approximately mid-cycle  
 (d) the day before menstruation is due to begin

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58. Birth control pills contain synthetic estrogen and progesterone. How do these hormones prevent pregnancy?  
 (a) They trigger premature ovulation, before an egg is mature.  
 (b) They cause the lining of the uterus to be sloughed off.  
 (c) They cause the corpus luteum to degenerate.  
 (d) They keep the pituitary from secreting FSH and LH, preventing ovulation.
59. A vasectomy is an effective technique for birth control in males because it \_\_\_\_\_.  
 (a) reduces the alkaline secretions in the semen, and the sperm are then destroyed in the female reproductive tract  
 (b) severs the route used by the sperm to exit the male's body  
 (c) severs the capillaries to the spermatozoa, which then die  
 (d) severs the capillaries of the testes and prevents the arrival of pituitary hormone mismatch?
60. Which one of the following is an example of a mismatch?  
 (a) internal fertilization — terrestrial environment  
 (b) courtship behavior — aquatic and terrestrial environments  
 (c) seasonal sexual maturity — aquatic and terrestrial environments  
 (d) shedding gametes into the environment — terrestrial environments
61. In general, what is the ploidy ( $n$ ) state of human cells?  
 (a) diploid except for gametes  
 (b) haploid except for zygotes  
 (c) diploid early in life, becoming haploid with age  
 (d) haploid early in life, becoming diploid with age
62. Which of the following is not a description of reproduction involving parthenogenesis?  
 1. c     2. b     3. d     4. a  
 5. a     6. b     7. d     8. c  
 9. a     10. b     11. b     12. d  
 13. c     14. c     15. c     16. c  
 17. c     18. b     19. d     20. d  
 21. c     22. c     23. a     24. b  
 25. d     26. d     27. d     28. b  
 29. d     30. b     31. d     32. d  
 33. c     34. d     35. a     36. b  
 37. b     38. c     39. a     40. a  
 41. c     42. c     43. b     44. a  
 45. d     46. b     47. d     48. c  
 49. b     50. c     51. b     52. c  
 53. b     54. d     55. c     56. d  
 57. c     58. d     59. b     60. d  
 61. a     62. d     63. b     64. D

## 7.10: ANIMAL DEVELOPMENT

1. In sea urchins, the process of fertilization produces a(n) \_\_\_\_\_.
  - archenteron
  - morula
  - gastrula
  - zygote
2. What is the cortical reaction?
  - the formation of a fertilization envelope that bars additional sperm from entry into the egg
  - the release of hydrolytic enzymes from the sperm cell
  - a depolarization of the eggs' plasma membrane so that only one sperm cell can fuse with it
  - a series of rapid mitotic divisions that follow fertilization
3. As cleavage continues, a zygote forms into a solid multicellular ball called a(n) \_\_\_\_\_.
  - endometrium
  - morula
  - trophoblast
  - gastrula
4. Several hours after fertilization, cleavage results in the formation of a hollow ball of cells called a \_\_\_\_\_.
  - blastomere
  - morula
  - blastula
  - gastrula
5. The three-layered embryo is the \_\_\_\_\_.
  - archenteron
  - morula
  - trophoblast
  - gastrula
6. The \_\_\_\_\_ eventually develops into the sea urchin's digestive tract.
  - blastocoels
  - archenteron
  - blastomere
  - ectoderm
7. During gastrulation, invagination occurs at the \_\_\_\_\_.
  - archenteron
  - blastocoel
  - endometrium
  - blastopore
8. In vertebrates, the ectoderm gives rise to the \_\_\_\_\_.
  - skeleton
  - circulatory system
  - outer layer of skin
  - lining of the digestive tract

During gastrulation in frogs, a rod of mesoderm under the dorsal surface forms the \_\_\_\_\_.

- notochord
  - ectoderm
  - archenteron
10. During gastrulation in frogs, cells from the animal pole spread over the embryo and form the \_\_\_\_\_.
  - endoderm
  - ectoderm
  - archenteron
  - blastopore
11. The posterior portion of the neural tube will develop into the frog's \_\_\_\_\_.
  - spinal cord
  - brain
  - blastocoels
  - digestive tract
12. One consequence of the acrosomal reaction is \_\_\_\_\_.
  - epigenesis
  - the fast block to polyspermy
  - the development of the fertilization envelope
  - the slow block to polyspermy
13. The first stage of embryonic development is \_\_\_\_\_. This process produces \_\_\_\_\_.
  - gastrulation... a three-layered embryo
  - neurulation... a neurula
  - ovulation... a zygote
  - cleavage... a hollow ball of cells
14. The enlarged anterior portion of the neural tube will develop into a frog's \_\_\_\_\_.
  - spinal cord
  - brain
  - reproductive system
  - outer layer of skin
15. All of the following structures are derived from mesoderm except the \_\_\_\_\_.
  - notochord
  - pancreas
  - heart
  - bone
16. The function of the amnion in birds, reptiles, and mammals is to \_\_\_\_\_.
  - digest yolk and form a network of blood vessels to distribute nutrients to the embryo
  - collect wastes
  - create an aqueous environment in which development can occur
  - transport oxygen to the embryo
17. During the early development of a human embryo, the \_\_\_\_\_ eventually forms the \_\_\_\_\_.
  - blastocoel... archenteron

- (b) epiblast... ectodermal, mesodermal, and endodermal tissues
- (c) epiblast... placenta
- (d) trophoblast... embryo proper
18. Microscopic structures thought to be responsible for the morphogenetic movement of cells in a developing animal embryo are \_\_\_\_\_.
  - symmetrically arranged epidermal clusters of cilia
  - uncharacteristically short flagella attached to the embryo's surface
  - contractile filaments contained within individual cells
  - vacuoles containing inducer substances located near the cell surface
19. Cells relocated from the dorsal lip of an amphibian embryo to an abnormal position result in the development of a second notochord at the graft location. This is an example of \_\_\_\_\_.
  - developmental potential
  - induction
  - pattern formation
  - positional information
20. The differences between cells in the late embryo result from induction. An example of induction in amphibians is the \_\_\_\_\_.
  - role of EP cadherin in organizing the blastula
  - movement of mesoderm cells along the fibronectin fibers that line the blastocoel
  - migration of cells into the center of the blastula during gastrulation
  - inactivation of the growth factor BMP-4 on the dorsal side of the gastrula
21. The idea that an egg or sperm contains a preformed, miniature infant that in turn contains a preformed, miniature infant is known as \_\_\_\_\_.
  - preformation
  - cleavage
  - gastrulation
  - implantation
22. In many species, the uneven distribution of \_\_\_\_\_ within the unfertilized eggs causes the embryonic cells to develop differently.
  - cytoplasmic determinants
  - tissues
  - nuclei
  - gametes
23. As an animal develops, organs form and the body transforms into a shape typical of the species, in a process called \_\_\_\_\_.
  - morphogenesis
- (b) preformation
- (c) cleavage
- (d) cell differentiation
24. A sea urchin sperm penetrates the jelly coat of an egg and adheres to receptor proteins on the egg's surface as a result of \_\_\_\_\_.
  - the acrosomal reaction
  - cleavage
  - gastrulation
  - the cortical reaction
25. How does a zygote differ from an ovum?
  - A zygote has more chromosomes.
  - A zygote is smaller.
  - A zygote consists of more than one cell.
  - A zygote is much larger.
26. After a sperm penetrates an egg, a fertilization envelope forms. This envelope \_\_\_\_\_.
  - secretes important hormones
  - enables the fertilized egg to implant itself in the wall of the uterus
  - prevents more than one sperm from entering the egg
  - attracts additional sperm to the egg
27. Cell divisions called \_\_\_\_\_ proceed so rapidly in the developing embryo that there is no growth of the cells between divisions.
  - meiosis
  - binary fission
  - cleavage
  - fragmentation
28. During cleavage the single large zygote is converted into a \_\_\_\_\_.
  - multicellular embryo consisting of smaller cells called blastomeres
  - three-layered embryo called a gastrula
  - multicellular embryo with a blastopore and an archenteron
  - multicellular embryo consisting of a zona pellucida and a zygote
29. How is the animal hemisphere of a frog blastula different from the vegetal hemisphere?
  - The cells of the vegetal hemisphere have more yolk than the cells of the animal hemisphere.
  - The cells of the vegetal hemisphere do not participate in gastrulation.
  - The vegetal hemisphere is where the polar bodies were produced during oogenesis.
  - The cells of the vegetal hemisphere are pigmented more darkly than the cells of the animal hemisphere.

30. In a frog gastrula, the area where the gray crescent occurred will be the \_\_\_\_\_ of the embryo and the blastopore its \_\_\_\_\_.  
 (a) dorsal side... anus  
 (b) dorsal side... mouth  
 (c) ventral side... mouth  
 (d) ventral side... anus
31. In meroblastic cleavage \_\_\_\_\_.  
 (a) all cell divisions are perpendicular to the animal-vegetal pole  
 (b) mesoderm and endoderm differentiate via cell division from mesenchyme  
 (c) newly formed cells migrate toward the interior of the embryo  
 (d) cell division is restricted to a small disk of yolk-free cytoplasm at the animal pole of the zygote
32. During gastrulation, the primitive \_\_\_\_\_ forms.  
 (a) eye (b) gut  
 (c) nervous system (d) heart
33. What is the embryonic origin of the lining of the digestive tube?  
 (a) endoderm  
 (b) ectoderm  
 (c) mesoderm  
 (d) both endoderm and mesoderm
34. One difference between the blastula and gastrula stages of development is that \_\_\_\_\_.  
 (a) blastula cells are more differentiated than gastrula cells  
 (b) there are many more cells in a blastula  
 (c) the blastula consists of more cell layers  
 (d) there is an opening from the cavity inside the gastrula to the outside
35. \_\_\_\_\_ of the following events is not part of gastrulation.  
 (a) migration  
 (b) separation of the blastocoel  
 (c) formation of the archenteron  
 (d) differentiation of cells into tissues
36. The primitive streak of a bird embryo is the \_\_\_\_\_ equivalent of the \_\_\_\_\_ in a frog.  
 (a) blastopore (b) archenteron  
 (c) yolk plug (d) blastocoel
37. Which one of the following describes the correct sequence of stages during gastrulation?  
 (a) invagination... differentiation of cells into tissues  
 (b) differentiation of cells into tissues... invagination  
 (c) invagination... formation of the archenteron  
 (d) formation of the archenteron... differentiation of cells into tissues
38. The human brain develops from \_\_\_\_\_.  
 (a) endoderm  
 (b) mesoderm  
 (c) ectoderm  
 (d) both mesoderm and ectoderm
39. In humans, the skeleton and muscles develop from the embryonic \_\_\_\_\_.  
 (a) endoderm (b) ectoderm  
 (c) mesoderm (d) haploderm
40. Which one of the following statements is false?  
 (a) The eggs of placental mammals are quite small, with much less yolk than is found in bird eggs.  
 (b) Cleavage in mammals is holoblastic, whereas cleavage in birds is meroblastic.  
 (c) Birds have three extraembryonic membranes, whereas mammals have four.  
 (d) The mammalian zygote experiences compaction at the eight-cell stage.
41. Which one of the following extraembryonic membranes functions in gas exchange and encloses a chamber for the deposition of wastes of a bird embryo?  
 (a) allantois  
 (b) amnion  
 (c) chorion  
 (d) fertilization envelope
42. If you wanted to examine the extraembryonic membranes surrounding a lizard or mouse embryo, you would have to cut through which of the following to see all the others?  
 (a) yolk sac (b) amnion  
 (c) endoderm (d) chorion
43. In mammals, the allantois is an extraembryonic membrane that is continuous with \_\_\_\_\_.  
 (a) the trophoblast cells  
 (b) the rudimentary gut  
 (c) the chorion  
 (d) the amnion
44. The \_\_\_\_\_ is(are) formed when the neural folds join and a portion of the neural plate sinks beneath the embryo's surface.  
 (a) archenteron (b) anus  
 (c) back muscles (d) neural tube
45. Which one of the following statements is false?  
 (a) During cleavage, gastrulation, and organogenesis, cells change shape.  
 (b) During cleavage, gastrulation, and organogenesis, cells change position.  
 (c) Fibronectin inhibits cell migration.  
 (d) The extracellular matrix can direct the migration of cells.

- (c) Fibronectin is a glycoprotein found in the extracellular matrix.  
 (d) Cell adhesion molecules are located on cell surfaces.
47. Up to the eight-cell stage, the blastomeres of a mouse embryo can each form a complete embryo if isolated. This indicates that \_\_\_\_\_.  
 (a) differentiation does not depend on cytoplasmic determinants  
 (b) the mouse embryo is strongly polarized  
 (c) only the zygote is totipotent  
 (d) cytoplasmic determinants are equally distributed during the early cleavage divisions
48. In humans, the cell divisions producing the earliest blastomeres do not result in an asymmetric distribution of cytoplasmic determinants. One consequence of this division pattern is \_\_\_\_\_.  
 (a) that only the zygote is totipotent  
 (b) the possibility of identical twins or triplets  
 (c) that the "progressive restriction of potency" hypothesis does not apply  
 (d) that each cleavage event further restricts the potency of the early blastomeres
49. In an experiment on eye development, a thin piece of aluminum foil was placed between the bulging wall of the brain and the overlying ectoderm where the eye normally forms. Wherever the foil was placed, the lens failed to develop, because the foil \_\_\_\_\_.  
 (a) prevented the inductive contact that normally stimulates the lens to form  
 (b) changed the gravity in the region  
 (c) rearranged the cytoplasmic determinants in the adjacent cells  
 (d) prevented the cortical reaction

## ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. c  | 2. b  | 3. d  | 4. a  |
| 5. a  | 6. b  | 7. d  | 8. c  |
| 9. a  | 10. b | 11. b | 12. d |
| 13. c | 14. c | 15. c | 16. c |
| 17. c | 18. b | 19. d | 20. d |
| 21. c | 22. c | 23. a | 24. b |
| 25. d | 26. c | 27. c | 28. a |
| 29. a | 30. a | 31. d | 32. b |
| 33. a | 34. d | 35. d | 36. a |
| 37. a | 38. c | 39. c | 40. c |
| 41. a | 42. d | 43. b | 44. d |
| 45. a | 46. a | 47. d | 48. b |
| 49. a | 50. a | 51. a | 52. b |

## INTRODUCTION TO ECOLOGY AND THE BIOSPHERE

1. In animal populations, DDT causes \_\_\_\_.  
(a) birth defects  
(b) tuberculosis  
(c) sleeping sickness  
(d) the flu
2. DDT is \_\_\_\_-soluble so it accumulates in \_\_\_\_.  
(a) fat... milk      (b) water... milk  
(c) water... streams      (d) fat... streams
3. Which of these is a biotic component of an environment?  
(a) bacteria on the surface of your skin  
(b) light  
(c) the availability of water  
(d) the mineral supplements you consume
4. Desert owls are inactive during the day and active at night. They also have small bodies. This describes \_\_\_\_ adaptation to the hot and dry desert.  
(a) anatomical  
(b) behavioral  
(c) physiological  
(d) anatomical and behavioral
5. Horned lizards are desert animals that are active during the day. Their skin and kidneys are efficient at conserving water; when they get hot, they move to the shade so they can cool off. This describes \_\_\_\_ adaptation to the hot and dry desert.  
(a) anatomical  
(b) behavioral  
(c) anatomical, behavioral, and physiological  
(d) behavioral and physiological
6. Cacti are desert plants with C<sub>4</sub> metabolism. In addition, cacti bloom at night. This describes \_\_\_\_ adaptation to the hot and dry desert.  
(a) anatomical  
(b) behavioral  
(c) physiological  
(d) behavioral and physiological
7. Which of these is characteristic of the photic zone of a freshwater biome?  
(a) the presence of algae  
(b) relatively cool water
8. (c) relatively stable water temperature  
(d) dead organic matter  
The benthic zone of aquatic environments is defined as the \_\_\_\_.  
(a) region that receives abundant sunlight  
(b) region where phytoplankton are found  
(c) region that receives little or no light  
(d) substrate at the bottom of the body of water
9. The \_\_\_\_ biome is the largest of Earth's biomes.  
(a) marine      (b) grassland  
(c) freshwater      (d) rain forest
10. A(n) \_\_\_\_ is a region where fresh water and salt water mix.  
(a) benthic zone      (b) intertidal zone  
(c) aphotic zone      (d) estuary
11. What are the two major factors determining the distribution of terrestrial biomes?  
(a) temperature and light  
(b) temperature and rainfall  
(c) light and rainfall  
(d) plants and animals
12. Which of these biomes is characterized by little rainfall?  
(a) temperate broadleaf forest  
(b) coniferous forest  
(c) desert  
(d) temperate grassland
13. Which of these is the largest terrestrial biome on Earth?  
(a) tundra  
(b) coniferous forest  
(c) temperate broadleaf forest  
(d) temperate grassland
14. Why are experiments that involve transplanting species seldom conducted today?  
(a) There are no criteria to determine if they are successful.  
(b) The success of the transplant cannot be measured in one researcher's lifetime.  
(c) The transplanted species are often disruptive to their new communities.

- (d) The potential range of a transplanted species can never be greater than its actual range.
15. In most cases, the two major climatic factors affecting the distribution of organisms are \_\_\_\_\_.  
 (a) temperature and sunlight  
 (b) predators and parasites  
 (c) wind and water  
 (d) water and temperature
16. A biome is a(n) \_\_\_\_\_.  
 (a) major type of biosphere  
 (b) major type of ecosystem  
 (c) set of similar communities  
 (d) area with a uniform distribution of organisms and abiotic environmental conditions
- What are the most abundant animals found in the pelagic zone?  
 (a) zooplankton (b) marine mammals  
 (c) cnidarians (d) dinoflagellates
- When \_\_\_\_\_, it can lead to \_\_\_\_\_.  
 (a) levels of dissolved CO<sub>2</sub> rise... bicarbonate levels that are too high to support life  
 (b) movements from human-altered terrestrial systems are deposited in the water  
 (c) anaerobic conditions in deeper waters  
 (d) substances accumulate in lake sediments... biohazards in the food web
- Substances are washed off agricultural lands and decreased aquatic biodiversity helps to maintain the existence of which savanna, chaparral, temperate grassland, and coniferous forest  
 tropical forest, savanna, chaparral, temperate grassland, and coniferous forest  
 (c) savanna, desert, chaparral, temperate grassland, and temperate broadleaf forest  
 (d) savanna, chaparral, temperate grassland, tundra, and coniferous forest
20. In which biome would you most likely find plants that exhibit C<sub>4</sub> or CAM photosynthesis?  
 (a) tropical forest (b) temperate grassland  
 (c) tundra (d) desert
21. Which biome is characterized by the presence of permafrost?  
 (a) taiga (b) tropical forest  
 (c) tundra (d) coniferous forest
22. The sum of all Earth's ecosystems is called the \_\_\_\_\_.  
 (a) stratosphere (b) lithosphere  
 (c) biosphere (d) hydrosphere
23. An immature frog (a tadpole) lives in a pond or lake. However, the adult frog possesses special adaptations that permit it to survive in a terrestrial environment. These special adaptations \_\_\_\_\_.  
 (a) help prevent the adult frog's body from drying out  
 (b) maximize body temperature  
 (c) permit the adult frog to maintain its internal water balance given the solute concentration of its hypotonic surroundings  
 (d) maximize the rate of water loss from its body
24. Why are many of the world's deserts located at latitudes of between 30° north and 30° south?  
 (a) Earth is tilted on its axis.  
 (b) The greatest amount of solar energy per unit area is absorbed by Earth between 30° north latitude and 30° south latitude.  
 (c) Dry air, originating at the equator, descends toward Earth's surface between 30° north latitude and 30° south latitude.  
 (d) Warm air rises between 30° north latitude and 30° south latitude and spreads toward the poles and the equator.
25. Earth's biosphere is not completely self-contained (or closed) because \_\_\_\_\_.  
 (a) humans pollute the atmosphere and bodies of water  
 (b) plants, algae, and photosynthetic bacteria obtain energy from sunlight, and heat escapes from the biosphere into space  
 (c) the precipitation that falls on the interior of western North America is derived from the Pacific Ocean  
 (d) bacteria that live on snowy mountains receive nutrients blown to them by winds
26. When people speak of the "rain shadow" of the California Coast Range, they are referring to \_\_\_\_\_.  
 (a) the shadow cast by the mist and clouds that hover above the crest of the range  
 (b) the forested condition on the eastern flank of the range compared with the western flank  
 (c) the scarcity of rain on the eastern flank and adjacent lowlands compared with the western flank

- (d) the dark-colored chaparral vegetation that grows on the eastern flank
27. Which one of the following statements about biomes is correct?  
 (a) Each biome type occurs on every continent.  
 (b) The major factors affecting the distribution of biomes are temperature and precipitation.  
 (c) Most biomes are characterized by unique groups of particular species of plants and animals.  
 (d) Most biomes are unaffected by human activity.
28. Communities that exist in the aphotic zone ultimately depend on food manufactured by chemoautotrophic bacteria or \_\_\_\_\_.  
 (a) algae and cyanobacteria that also live in the aphotic zone  
 (b) algae and cyanobacteria that live in the photic zone  
 (c) decomposers  
 (d) scavengers
29. Which biome is characterized by an extensive canopy that allows little light to penetrate to the ground and by the presence of epiphytes?  
 (a) temperate grassland  
 (b) coniferous forest  
 (c) tropical rain forest  
 (d) desert
30. Plankton consists of \_\_\_\_\_.  
 (a) algae, cyanobacteria, and animals that drift near the surfaces of oceans only  
 (b) photosynthetic organisms that drift near the surfaces of aquatic biomes  
 (c) algae, cyanobacteria, and animals that belong to the benthic communities of oceans, lakes, ponds, rivers, and streams  
 (d) algae, cyanobacteria, and animals that drift near the surfaces of oceans, lakes, ponds, rivers, and streams
31. Which one of the following is characteristic of oligotrophic lakes?  
 (a) seasonal O<sub>2</sub> depletion  
 (b) summer turnover  
 (c) frequent algal blooms  
 (d) few littoral plants and a low density of phytoplankton
32. Rooted plants are found only in the \_\_\_\_\_ zone of a lake.  
 (a) pelagic (b) thermocline  
 (c) limnetic (d) littoral
33. Below the photic zone of the ocean, \_\_\_\_\_.  
 (a) phytoplankton outnumber zooplankton  
 (b) plants are rooted in the sandy bottom  
 (c) food chains are detritus-based  
 (d) primary producers capture the sun's energy, which is then passed up the energy pyramid
34. Different species that inhabit the same type of biome, but occur in widely separated geographic regions, often appear similar due to \_\_\_\_\_.  
 (a) their close evolutionary relationships  
 (b) convergent evolution  
 (c) the occurrence of the same sets of species within a biome, wherever it is found  
 (d) recent common ancestry
35. Permafrost is characteristic of the \_\_\_\_\_.  
 (a) tundra (b) temperate forest  
 (c) taiga (d) desert
36. Which biome is the largest terrestrial biome on Earth?  
 (a) temperate broadleaf forest  
 (b) coniferous forest  
 (c) savanna  
 (d) desert
37. Which statement comparing tropical rain forests and temperate broadleaf forests is incorrect?  
 (a) Both types of forests may be found in midlatitudes of the southern hemisphere.  
 (b) Both have distinct vertical layers.  
 (c) Both have an enclosed canopy.  
 (d) Both can claim epiphytes as a common plant type.
38. Fringe wetlands develop \_\_\_\_\_.  
 (a) along shallow and periodically flooded banks of rivers and streams  
 (b) along the coasts of lakes where water flows back and forth because of falling and rising lake levels  
 (c) along the coasts of seas where water flows back and forth because of tidal action  
 (d) The second and third answers are correct.
39. Which one of the following choices does not correctly pair a terrestrial biome with some of its characteristics?  
 (a) temperate broadleaf forest: cold winters, moderate to high rainfall

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40. Which one of the following biomes is dominated by gymnosperm or conifer trees (pines, firs, spruces)?  
 (a) taiga      (b) tundra  
 (c) desert      (d) broadleaf forest
41. Of these biomes, vertical stratification (layers of plants) is most pronounced in the \_\_\_\_\_.  
 (a) grassland      (b) tundra  
 (c) desert      (d) tropical rain forest
42. What could a climatograph be used for?  
 (a) to compare the temperature and altitude of different biomes  
 (b) to compare the latitude and precipitation of different biomes  
 (c) to compare the temperature and precipitation of different biomes  
 (d) to compare geographic range and diversity of organisms in different biomes
43. Which statement is true about the tundra?  
 (a) Tundra only exists in the Arctic.  
 (b) Permafrost prevents much water from infiltrating the soil.  
 (c) Migratory birds leave the tundra during the summer to find warmer places to nest.  
 (d) Due to rich mineral content, agriculturists have recently focused their attention on the tundra.
44. Which choice below describes a feature of grassland that explains why its remnants are concentrated in arid regions of North America and central Asia?  
 (a) Grassland is often consumed by fire.  
 (b) The soil is fertile and most grassland has been converted to farmland.  
 (c) Larger grazers, such as bison and wild horses, have depleted grassland.  
 (d) Woody shrubs and trees have taken over in areas that receive more precipitation.
45. Which one of the following pairs of biomes is characterized by relatively simple food webs (low biological diversity)?  
 (a) tundra and grassland  
 (b) tundra and desert  
 (c) desert and grassland
46. In which one of the following biomes would you expect decomposers to work most rapidly and efficiently?  
 (a) tundra      (b) savanna  
 (c) desert      (d) tropical rain forest
47. Which of the following investigations is not an example of the study of a biotic factor?  
 (a) identifying food sources for an egret population  
 (b) observing interactions among various organisms in a rainforest canopy  
 (c) investigating how the amount of annual precipitation affects a tree species  
 (d) investigating how an elk population competes for food
48. A researcher is investigating how individual foxes are coping with the destruction of part of their habitat due to construction of a new highway. Which area of ecology is this researcher focusing on?  
 (a) organismal ecology  
 (b) population ecology  
 (c) community ecology  
 (d) ecosystem ecology
49. The most inclusive level of organization in nature is the \_\_\_\_\_.  
 (a) cell      (b) biosphere  
 (c) community      (d) population
- ANSWERS**
- |       |       |       |       |
|-------|-------|-------|-------|
| 1. a  | 2. a  | 3. a  | 4. d  |
| 5. c  | 6. d  | 7. a  | 8. d  |
| 9. a  | 10. d | 11. b | 12. c |
| 13. b | 14. c | 15. d | 16. b |
| 17. a | 18. b | 19. a | 20. d |
| 21. c | 22. c | 23. a | 24. c |
| 25. b | 26. c | 27. b | 28. b |
| 29. c | 30. d | 31. d | 32. d |
| 33. c | 34. b | 35. a | 36. b |
| 37. d | 38. d | 39. d | 40. a |
| 41. d | 42. c | 43. b | 44. b |
| 45. b | 46. d | 47. c | 48. a |
| 49. b |       |       |       |

## 8.2: BEHAVIORAL ECOLOGY

1. A behavior that is genetically determined and that cannot be modified is \_\_\_\_\_.  
 (a) a fixed action pattern  
 (b) a conditioned response  
 (c) modified by learning  
 (d) one that requires parental guidance
2. Bees can see colors we cannot see, and they can detect minute amounts of chemicals we cannot sense. Unlike many insects, bees probably give which of the following as the ultimate explanation for their poor hearing?  
 (a) Bees are too small to have functional ears.  
 (b) Hearing may not contribute much to a bee's reproductive success.  
 (c) If a bee could hear, its tiny brain would be swamped with information.  
 (d) This is an example of altruism.
3. A learning process that can occur only during a limited period of the individual's development is called \_\_\_\_\_.  
 (a) instinct      (b) conditioning  
 (c) imprinting      (d) prenatal influence
4. Kineses and taxes are simple automatic movements in response to stimuli. (The phototaxis.) What is the difference between kineses and taxes?  
 (a) Taxes are directed toward a stimulus, and kineses are directed away.  
 (b) Kineses are innate, and taxes are learned.  
 (c) Kineses are more random, and taxes are more directed.  
 (d) Kineses are performed much faster than taxes.
5. A frog may at first be startled by tree branches swaying in the wind, but it soon stops responding to these kinds of unimportant changes in its environment. The lack of response is an example of \_\_\_\_\_.  
 (a) a fixed action pattern  
 (b) imprinting  
 (c) altruism  
 (d) habituation
6. Every morning a graduate student turns on the light in the laboratory and then feeds the fish in the aquarium. After a couple of weeks of this routine, the graduate student noticed that the fish came to the surface to feed as soon as the lights were turned on. The behavior of the fish is a result of \_\_\_\_\_.  
 (a) habituation  
 (b) positive phototaxis  
 (c) imprinting  
 (d) classical conditioning
7. Imagine that you are studying the food preferences of a lizard species across its range. You have hypothesized that because these populations are fairly separate from one another, the lizards have evolved different food preferences. You discover that in the desert, the lizard seems to prefer various types of flies, while at higher, wetter altitudes, it prefers one type of beetle. Does this observation support your hypothesis?  
 (a) Yes. The lizards obviously prefer different foods.  
 (b) Yes. Not only do the lizards prefer different foods, but there is also evidence that the foods they prefer are not necessarily the most abundant.  
 (c) No. First, I must determine if both groups can be trained to eat the same type of food.  
 (d) No. First I need to determine whether the offspring of these lizards, raised in the laboratory under the same conditions, will reflect the parental food preferences.
8. You observe a large black bird with a shiny black crest engaging in courtship behavior with a little brown bird. It would be reasonable to hypothesize that this is an example of \_\_\_\_\_.  
 (a) monogamy  
 (b) mating with wrong species  
 (c) polygyny  
 (d) polygamy
9. An individual organism has the option to raise various offspring and/or genetic relatives. Which of the following options represents the greatest genetic success?  
 (a) two offspring

10. The key idea of sociobiology is that \_\_\_\_\_.  
 (a) human social behavior is the same as animal social behavior  
 (b) social behavior has an evolutionary basis in social situations  
 (c) little behavior is inherited; most is learned  
 (d) almost all human and animal behavior is preprogrammed
11. In cross-fostering experiments, offspring of two species are switched early in development and reared by the opposite species. They are then compared to similar offspring reared by their own species. What is the point of this experimental design?  
 (a) This experimental design demonstrates that maternal care is universal, no matter what offspring are receiving care.  
 (b) This experimental design separates the effects of genetics and environment.  
 (c) This experimental design reveals the source of aggression.  
 (d) Animals that are cross-fostered will be easier to tame because they will have been exposed to a wide variety of species.
12. When *Drosophila* were exposed to a particular odor and electric shock at the same time, they started to avoid the odor. This is an example of \_\_\_\_\_.  
 (a) classical conditioning  
 (b) operant conditioning  
 (c) reasoning  
 (d) imprinting
13. In \_\_\_\_\_, an animal learns to associate one of its behaviors with reward or punishment.  
 (a) classical conditioning  
 (b) operant conditioning  
 (c) fixed-action-pattern (FAP) learning  
 (d) habituation
14. One way to determine whether or not food preferences have a genetic basis is to \_\_\_\_\_.  
 (a) compare food preferences of two different wild populations  
 (b) give animals from two different populations food and see if they
15. Which of the following best illustrates optimal foraging?  
 (a) A robin will repeatedly attack any red object near its territory.  
 (b) Musk oxen will form a circle to fend off a wolf attack.  
 (c) Bats emerge to feed at about the same time each night.  
 (d) A sunbird will defend more fiercely flowers that produce more food.
16. Animals that exhibit which type of mating behavior are often so morphologically similar that it is difficult to distinguish the sexes based on external characteristics?  
 (a) agnostic (b) promiscuous  
 (c) monogamous (d) polygamous
17. When animals engage in \_\_\_\_\_, they often perform displays that make them look as large and dangerous as possible.  
 (a) courtship rituals (b) altruism  
 (c) kin selection (d) agonistic behavior
18. Which problem below could be explained by applying game theory?  
 (a) the reason that animals practice play behavior  
 (b) the reason that some species are monogamous and others are polygamous  
 (c) how a species with three different phenotypes of various aggression levels can survive in the same population  
 (d) how females choose their mates
19. Altruistic behavior \_\_\_\_\_.  
 (a) never occurs in natural populations  
 (b) is expected when the species as a whole benefits from it  
 (c) occurs only when closely related individuals benefit from it  
 (d) is expected when it increases the long-term inclusive fitness of the altruists
20. Which one of the following statements best defines an altruistic act?  
 (a) It immediately benefits both the performer and another individual.  
 (b) It immediately benefits another individual at the expense of the performer.
21. preferences under identical conditions in the lab, and see whether or not their food preferences reflect parental ones.  
 (d) bring animals from two populations into the lab and observe whether they have different food preferences

(d) It imposes a cost on the performer and the other individual.

21. The coefficient of relatedness between two brothers \_\_\_\_\_.  
 (a) is 0.75  
 (b) is the same as the coefficient of daughter between mother and  
 (c) is 0.25  
 (d) is less than the coefficient of relatedness between father and son
22. Altruistic behaviors can be understood, in part, by considering the coefficient of relatedness (*r*) between the individuals involved. Assume that an individual mammal has the option to raise its own offspring, other genetic relatives, or a combination of offspring and other genetic relatives. From a genetic point of view, which one of the following represents the least successful option?  
 (a) two offspring  
 (b) two offspring and two first cousins  
 (c) four grandchildren  
 (d) seven first cousins
23. The survival, through apparently altruistic behavior, of related individuals with common alleles is referred to as \_\_\_\_\_.  
 (a) founder effect  
 (b) kin selection  
 (c) competitive exclusion  
 (d) adaptive radiation
24. Imagine a population of birds in which first-year birds can either (1) find a mate and raise an average of three offspring or (2) stay in their parents' territory and help the parents raise two more offspring than the parents would have been able to raise without any help. Based on the theory of kin selection, we would expect that \_\_\_\_\_.  
 (a) most territories would have young birds helping at the nest  
 (b) altruistic behavior would be common in this population  
 (c) the behavior of helping at the nest would not evolve in this population  
 (d) most first-year birds would choose to forgo breeding
25. Which of the following sayings best summarizes the idea of reciprocal altruism?  
 (a) A rolling stone gathers no moss.  
 (b) You scratch my back, and I'll scratch
26. Ecology and the biosphere 197
- (d) A bird in the hand is worth two in the bush.  
 Pheasants do not feed their chicks. Immediately after hatching, a pheasant chick starts pecking at seeds and insects on the ground. How might a behavioral ecologist explain the ultimate cause of this behavior?  
 (a) Pecking is a fixed action pattern (FAP).  
 (b) Pheasants learned to peck, and their offspring inherited this behavior.  
 (c) Pheasants that pecked survived and reproduced best.  
 (d) Pecking is the result of imprinting during a critical period.
27. Ants carry dead ants out of an anthill and dump them on a "trash" pile. If a chemical from a dead ant is applied to a live ant, other ants will carry it, kicking and struggling, from the anthill, until the substance wears off. Which of the following explains this behavior?  
 (a) The chemical is a sign stimulus for a fixed action pattern.  
 (b) The ants have become imprinted on the chemical.  
 (c) The ants continue the behavior until they become habituated.  
 (d) The ants can only learn by operant conditioning
28. Which of the following is a fixed action pattern?  
 (a) A stickleback fish attacks a wood block with a red bottom.  
 (b) A hamster becomes active at the same time each evening.  
 (c) A wolf tracks its prey.  
 (d) A robin eats a distasteful bug, spits it out, and never eats a bug that looks like that again.
29. Graylag geese learn to follow their mothers. This is an example of \_\_\_\_\_.  
 (a) habituation  
 (b) operant conditioning  
 (c) altruism  
 (d) imprinting
30. An aquaculture facility hatched salmon eggs and released young fish into a river leading to the ocean. The fish fed and grew in the ocean, and in a few years they returned to the facility. Because the number of returning fish was low, a scientist suggested adding a chemical to the river that would \_\_\_\_\_.  
 (a) decrease their agonistic behavior

- 31 A kinesis differs from a taxis in that a kinesis is \_\_\_\_\_ whereas a taxis is \_\_\_\_\_.  
 (a) innate... learned  
 (b) a change in activity... a directional response to stimulus  
 (c) a response to chemicals... a response to light  
 (d) proximate... ultimate
- 32 A blackcap warbler from a captive migratory population is mated with another blackcap warbler from a captive nonmigratory population. The lab-reared offspring exhibit a modest amount of migratory restlessness. This behavior, which is intermediate between that of the two parents, could be interpreted as evidence that \_\_\_\_\_.  
 (a) migratory behavior is determined exclusively by environmental factors  
 (b) the differences in migratory behavior between populations are influenced by genetic differences among the populations  
 (c) birds must learn how to migrate  
 (d) migratory behavior cannot evolve by natural selection
- 33 What signals might be best employed by a nocturnal forest animal seeking to identify its territory?  
 (a) visual and olfactory  
 (b) auditory and olfactory  
 (c) tactile and olfactory  
 (d) visual and auditory
- 34 Pheromones are examples of \_\_\_\_\_.  
 (a) hormones  
 (b) chemical signals  
 (c) visual signals  
 (d) instinctive behavior
- 35 Male prairie voles are monogamous. They are attentive to young, and aggressive toward intruders. This appears to be related to \_\_\_\_\_.  
 (a) the prevalence of monogamy among rodent species
- (b) the heavy investment most male mammals place in parental care  
 (c) an unusual tendency for prairie voles to produce litters of same-sex offspring. In the case of males, this promotes monogamy and aggression  
 (d) the distribution of certain neuropeptide receptors in the brain of the voles
- 36 Which of these bee dances communicates only the information that a food source is nearby?  
 (a) rumba (b) tango  
 (c) round dance (d) waltz
- 37 Which of these bee dances communicates information about the direction and distance to a food source?  
 (a) rumba (b) tango  
 (c) round dance (d) waggle dance
- 38 In the waggle dance, distance to a food source is indicated by the speed of the dance and by the \_\_\_\_\_.  
 (a) angle of the straight-run component of the dance  
 (b) number of waggles  
 (c) angle made when turning out of the straight run  
 (d) diameter of the circle made by the waggle dance

## ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. a  | 2. b  | 3. c  | 4. c  |
| 5. d  | 6. d  | 7. d  | 8. d  |
| 9. c  | 10. b | 11. b | 12. a |
| 13. b | 14. c | 15. d | 16. c |
| 17. d | 18. c | 19. d | 20. b |
| 21. b | 22. d | 23. b | 24. c |
| 25. b | 26. c | 27. a | 28. a |
| 29. d | 30. b | 31. b | 32. b |
| 33. b | 34. b | 35. d | 36. c |
| 37. d | 38. b |       |       |

## 8.3: POPULATION ECOLOGY

- 1 Which of these was the third of the major events that stimulated an increase in the size of the human population?  
 (a) the Industrial Revolution  
 (b) the discovery of antibiotics  
 (c) the discovery of vaccines and the discovery of antibiotics  
 (d) the discovery of vaccines
- 2 Currently, how large is the worldwide population of humans relative to Earth's carrying capacity for humans?  
 (a) at the carrying capacity  
 (b) above the carrying capacity  
 (c) below the carrying capacity  
 (d) there is insufficient information to answer this question
- 3 The mark-recapture method would be best for sampling a population of \_\_\_\_\_.  
 (a) sharks (b) maple trees  
 (c) rose bushes (d) wheat
- 4 Which of these species typically has a mortality rate that remains fairly constant over an individual's life span?  
 (a) humans (b) robins  
 (c) grasses (d) elephants
- 5 Oyster populations are primarily, if not exclusively, composed of \_\_\_\_\_.  
 (a) larvae  
 (b) adults  
 (c) juveniles  
 (d) larval and juvenile oysters
- 6 Which of these organisms has a survivorship curve similar to that of oysters?  
 (a) humans (b) robins  
 (c) grasses (d) elephants
- 7 Which of these organisms has a survivorship curve similar to that of humans?  
 (a) oysters (b) robins  
 (c) grasses (d) elephants
- 8 At current rates of growth, the current human population size is expected to double in about \_\_\_\_ years.  
 (a) 10 (b) 20  
 (c) 40 (d) 80
- 9 Which of these was the first of the major events that stimulated an increase in the size of the human population?  
 (a) the Industrial Revolution  
 (b) the discovery of antibiotics  
 (c) the advent of agriculture  
 (d) the discovery of vaccines
- 10 Which of these was the second of the major events that stimulated an increase in the size of the human population?  
 (a) the Industrial Revolution  
 (b) the discovery of antibiotics  
 (c) the advent of agriculture  
 (d) the discovery of vaccines
- 11 Which of the following is a population?  
 (a) a spider and the fly it is about to eat  
 (b) all the plants that live near each other in a forest  
 (c) the earthworms that live in a grassland plus the earthworms that live in a forest  
 (d) all of the redwood trees that live in a forest
- 12 To determine the density of a rabbit population, you would need to know the number of rabbits and \_\_\_\_\_.  
 (a) the factors that limit population growth  
 (b) their birth rate  
 (c) the size of the area in which they live  
 (d) their population growth rate
- 13 In wild populations, individuals most often show a \_\_\_\_\_ pattern of dispersion.  
 (a) random (b) density-dependent  
 (c) equilibrium (d) clumped
- 14 Which of the following conditions favors big-bang reproduction?  
 (a) intense intraspecific competition  
 (b) predictable physical environment  
 (c) low rates of offspring survival  
 (d) high levels of parental care
- 15 In the models that describe population growth, *r* stands for \_\_\_\_\_.  
 (a) population density  
 (b) a time interval  
 (c) total number of individuals in the population  
 (d) per capita population growth rate

16. The number of individuals that a particular habitat can support with no degradation of the habitat is called \_\_\_\_\_.  
 (a) biotic potential (b) survivorship  
 (c) niche (d) carrying capacity
17. Which one of the following is regarded as a density-independent factor in the growth of natural populations?  
 (a) intraspecific competition  
 (b) interspecific competition  
 (c) emigration  
 (d) flooding
18. A broad-based pyramid-shaped age structure is characteristic of a population that is \_\_\_\_\_.  
 (a) growing rapidly  
 (b) at carrying capacity  
 (c) stable  
 (d) limited by density-dependent factors
19. Which of the following is the most accurate comment on Earth's carrying capacity for humans?  
 (a)  $K$  is smaller now than it was a thousand years ago.  
 (b) The human population is still a long way from  $K$ .  
 (c) Our technology has allowed us to keep increasing  $K$ .  
 (d) When it comes to humans, the concept of  $K$  is irrelevant.
20. Which statement regarding human population growth is not true?  
 (a) Human population growth was exponential until about 1650.  
 (b) The human population reached 4 billion in 1975. It is expected to double by about 2025.  
 (c) The rate of population growth has slowed since about the 1960s.  
 (d) Changes in population dynamics due to disease and voluntary population control have slowed the rate of human population growth.
21. To calculate the human population density of your community, you would need to know the number of people living there and \_\_\_\_\_.  
 (a) the size of the area in which they live  
 (b) the birth rate of the population  
 (c) whether population growth is logistic or exponential  
 (d) the dispersion pattern of the population
22. Which choice below is an example of an expression of population density?  
 (a) 255 dogfish sharks
- (b) 100 sea stars, barnacles, and mussels per 25 m<sup>2</sup> of a tide pool  
 (c) the number of *Paramecium caudatum* in a 250 mL solution in a glass flask  
 (d) the total number of sturgeon per cubic meter in San Francisco Bay and in Tomales Bay
23. When needed resources are unevenly distributed, organisms often show a \_\_\_\_\_ dispersion pattern.  
 (a) density-dependent  
 (b) clumped  
 (c) exponential  
 (d) random
24. Organisms that live in a homogenous abiotic environment and cooperate to avoid being eaten would likely show a(n) \_\_\_\_\_ pattern of dispersion.  
 (a) continuous (b) clumped  
 (c) even (d) random
25. Herring gulls fiercely defend the areas around their nests in cliff-top breeding colonies. Within the colony they would show a \_\_\_\_\_ dispersion pattern.  
 (a) uniform (b) random  
 (c) dense (d) density-independent
26. Pine trees in a forest tend to shade and kill pine seedlings that sprout nearby. This causes the pine trees to \_\_\_\_\_.  
 (a) increase exponentially  
 (b) grow in a clumped pattern  
 (c) grow in a uniform pattern  
 (d) exceed their carrying capacity
27. A demographer may study \_\_\_\_\_.  
 (a) birth rates in a small town in Iowa  
 (b) emigration rates in a forest that has been cleared partially for farming  
 (c) offspring mortality rates in humpback whales  
 (d) all of the above
28. Life tables typically follow the fate of a cohort, a \_\_\_\_\_.  
 (a) group of individuals who live in the same community  
 (b) group of individuals who are the same age  
 (c) group of individuals who died from the same disease  
 (d) group of individuals who reproduced at the same age

29. An oak tree produces thousands of acorns, but very few grow into mature oak trees. The oak tree exhibits a \_\_\_\_\_ survivorship curve.  
 (a) Type I (b) Type II  
 (c) Type III (d) Type I or II
30. Chimpanzees have a relatively low birth rate. They care for their young, and most chimps live a long life. The chimp survivorship curve would look like \_\_\_\_\_.  
 (a) a line that slopes gradually upward  
 (b) a relatively flat line that drops steeply at the end  
 (c) a line that drops steeply at first, then flattens out  
 (d) a line that slopes gradually downward
31. Which of the following describes the distribution of survivorship or mortality for a population that has a Type II survivorship curve?  
 (a) Little death occurs until late in life.  
 (b) Most of the mortality occurs among younger individuals.  
 (c) Survivorship is greatest in younger individuals.  
 (d) The chance of death is roughly constant over all ages.
32. Ignoring migration, the age structure of a human population likely to increase in size will have what shape?  
 (a) pyramid  
 (b) inverted pyramid  
 (c) a rectangle tapering toward the top  
 (d) both a pyramid and a rectangle tapering toward the top result in a population that increases in size
33. A dog gives birth to 3 puppies one year. Three years later, she gives birth to 6 puppies. Which type of life history pattern is characteristic of this organism?  
 (a) semelparity  
 (b) exponential population growth  
 (c) big-bang reproduction  
 (d) iteroparity
34. A certain fish had a population of 1,100 individuals. They had a birth rate of 12/100, a death rate of 8/100, and an emigration (individuals leaving the population) rate of 2/100. How many people were added to fish's population in one year?  
 (a) 2 (b) 6  
 (c) 20 (d) 22
35. When the per capita birth rate equals the per capita death rate, \_\_\_\_\_.  
 (a) a population grows rapidly
- (b) the size of a population remains constant  
 (c) density-dependent limiting factors do not affect the population  
 (d) a population is in danger of extinction
36. A population will always grow exponentially if \_\_\_\_\_.  
 (a) if it is limited only by density-dependent factors  
 (b) until it reaches carrying capacity  
 (c) if there are no limiting factors  
 (d) if it is a population with an equilibrium life history
37. Which of the following populations probably exhibits exponential growth?  
 (a) a protozoan population grown in a sealed glass culture flask  
 (b) a fruit fly population that recently arrived on a lush mid-oceanic island previously inhabited only by plants  
 (c) a redwood tree population in a forest  
 (d) a population of deer in an area with few palatable food plants
38. No population can grow indefinitely. The ultimate size of any population is limited by \_\_\_\_\_.  
 (a) its  $r$   
 (b) its birth rate  
 (c) its death rate  
 (d) the carrying capacity of its environment
39. A newly mated queen ant founds a nest in an unoccupied patch of suitable habitat. Assuming that no disasters strike the nest, which one of the following types of equations is likely to best describe the population growth of the new colony?  
 (a) linear (b) circular  
 (c) logistic (d) quadratic
40. In an equilibrium population (at its carrying capacity), thousands of eggs and hundreds of tadpoles are produced by a single pair of frogs. On average, about how many offspring per pair will live to reproduce?  
 (a) 0 (b) 2  
 (c) 10 to 20 (d) 100
41. Ignoring migration, the age structure diagram of a human population likely to maintain a relatively stable size will have what shape?  
 (a) pyramid  
 (b) inverted pyramid  
 (c) a rectangle tapering toward the top  
 (d) both a pyramid and a rectangle tapering toward the top result in a population that remains stable in size

42. Assuming that  $r$  has a positive value, in the formula  $dN/dt = r_{max}N(K - N)/K$  the factor  $rN$  tends to cause the population to \_\_\_\_\_.  
 (a) grow increasingly rapidly  
 (b) remain stable at the carrying capacity  
 (c) decrease in size  
 (d) grow at a slower rate than the  $(K - N/K)$  factor
43. Ignoring migration, the age structure of a human population likely to decrease in size will have what shape?  
 (a) pyramid  
 (b) inverted pyramid  
 (c) a rectangle tapering toward the top  
 (d) both a pyramid and a rectangle tapering toward the top result in a population that decreases in size
44. A population that is growing logistically \_\_\_\_\_.  
 (a) grows fastest when density is lowest  
 (b) has a high  $r$   
 (c) grows fastest at an intermediate population density  
 (d) grows fastest as it approaches carrying capacity
45. The logistic growth model differs from the exponential growth model in that it \_\_\_\_\_.  
 (a) expresses the effects of population-limiting factors on exponential growth  
 (b) is J-shaped and the exponential growth model is S-shaped  
 (c) never shows the effects of population-limiting factors  
 (d) implies that population size stabilizes at  $K$  when the birth rate is zero
46. Which sentence below summarizes the Allee effect?  
 (a) New individuals are added to the population most rapidly at intermediate population size.  
 (b) Individuals have a more difficult time surviving or reproducing if the population size is too small.  
 (c) Populations adjust instantaneously and approach carrying capacity smoothly.  
 (d) Different populations of the same species may show a balance of  $K$ -selected and  $r$ -selected traits.
47. Which one of the following would most likely be an example of a density-independent factor limiting population growth?  
 (a) food availability
- (b) diseases  
 (c) accumulation of toxic wastes  
 (d) daily temperature extremes
48. A particular environmental change causes the deaths of 25 individuals in a herd of 100 wild horses, and it kills 50 individuals in a herd of 200 horses. In this case, the growth of a wild horse population is most likely limited by \_\_\_\_\_. (Assume that the two herds are found in territories of equal size.)  
 (a) a density-dependent factor  
 (b) food supply  
 (c) a predator  
 (d) a density-independent factor
49. Which one of the following is most likely a density-dependent growth regulator of animal populations?  
 (a) a decrease in clutch size  
 (b) hurricanes  
 (c) fires  
 (d) droughts
50. The cyclic growth exhibited by populations of snowshoe hares in the North American taiga most likely results from \_\_\_\_\_.  
 (a) predation by lynx  
 (b) fluctuations in the hare's food resources  
 (c) predation by lynx and fluctuations in the hare's food resources  
 (d) hunting by humans
51. Which statement regarding human population growth is not true?  
 (a) Human population growth was very slow until about 1650.  
 (b) The human population reached 4 billion in 1975. It is expected to double by about 2025.  
 (c) Researchers project that exponential growth of the human population will continue until about 2050.  
 (d) Changes in population dynamics due to disease and voluntary population control have slowed the rate of human population growth.
52. If you wanted to determine what percentage of the population of Thailand is less than 10 years old, you could look at \_\_\_\_\_.  
 (a) a logistic curve for the population  
 (b) the population's age structure  
 (c) a life table for the population  
 (d) a plot of population density

53. An ecologist would suspect a population to be growing rapidly if it \_\_\_\_\_.  
 (a) contains many more prereproductive than reproductive individuals  
 (b) is near its carrying capacity  
 (c) is limited only by density-dependent factors  
 (d) shows a clumped pattern of dispersion
54. To calculate the \_\_\_\_\_. of a nation, researchers summarize arable land, pasture, fossil energy land, and several other factors appropriated by each nation to produce all of the resources it consumes and to absorb all the waste it generates.  
 (a) ecological footprint  
 (b) carrying capacity  
 (c) ecological capacity

## ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. c  | 2. d  | 3. a  | 4. b  |
| 5. b  | 6. c  | 7. d  | 8. c  |
| 9. c  | 10. a | 11. d | 12. c |
| 13. d | 14. c | 15. d | 16. d |
| 17. d | 18. a | 19. c | 20. a |
| 21. a | 22. c | 23. b | 24. b |
| 25. a | 26. c | 27. d | 28. b |
| 29. c | 30. b | 31. d | 32. a |
| 33. d | 34. d | 35. b | 36. c |
| 37. b | 38. d | 39. c | 40. b |
| 41. c | 42. a | 43. b | 44. c |
| 45. a | 46. b | 47. d | 48. a |
| 49. a | 50. c | 51. c | 52. b |
| 53. a | 54. a |       |       |

## 8.4: COMMUNITY ECOLOGY

1. A human eats a deer. Which of these terms applies to the relationship between the human and the deer?  
 (a) predation    (b) competition  
 (c) parasitism    (d) commensalism
2. Humans and sharks both eat fish. Which of these terms applies to the relationship between the human and the shark?  
 (a) predation    (b) competition  
 (c) parasitism    (d) commensalism
3. Humans who have pets tend to be healthier than humans who do not have pets. Which of these terms applies to the relationship between a human and a pet?  
 (a) predation    (b) competition  
 (c) parasitism    (d) mutualism
4. Which of these terms applies to the relationship between a dog and a blood-sucking tick?  
 (a) predation    (b) competition  
 (c) parasitism    (d) commensalism
5. An egret eats insects stirred up by grazing animals. Which of these terms applies to the relationship between the egret and the grazing animal?  
 (a) predation    (b) competition  
 (c) parasitism    (d) commensalism
6. In an ecosystem, phytoplankton are \_\_\_\_\_.  
 (a) producers  
 (b) primary consumers  
 (c) secondary consumers  
 (d) tertiary consumers
7. An earthworm that feeds on the remains of plants and animals is acting as a \_\_\_\_\_.  
 (a) producer  
 (b) primary consumer  
 (c) secondary consumer  
 (d) detritivore
8. When a human eats a steak, the human is acting as a \_\_\_\_\_.  
 (a) producer    (b) primary consumer  
 (c) secondary consumer    (d) tertiary consumer
9. A cow eating grass is an example of a \_\_\_\_\_.  
 (a) producer  
 (b) primary consumer  
 (c) secondary consumer  
 (d) tertiary consumer
10. A human who just ate a hamburger is eaten by a shark while swimming. The shark is acting as a \_\_\_\_\_.  
 (a) producer  
 (b) primary consumer  
 (c) secondary consumer  
 (d) tertiary consumer
11. Which of these is a starting point for primary succession?  
 (a) a surface exposed by a retreating glacier  
 (b) abandoned farmland  
 (c) an abandoned city  
 (d) a neglected yard
12. According to island biogeography, what is the relationship between an island's distance from the mainland and the number of species present on the island?  
 (a) The closer an island is to the mainland, the fewer the number of species found on the island.  
 (b) The farther an island is from the mainland, the larger the number of species found on the island.  
 (c) The farther an island is from the mainland, the fewer the number of species found on the island.  
 (d) The closer an island is to the mainland, the fewer the number of species found on the island; and the farther an island is from the mainland, the larger the number of species found on the island.
13. Why is a new island more hospitable to colonizers than an older island is?  
 (a) Competition is more intense on the newer island.  
 (b) Predation is less of a factor on older islands.  
 (c) The extinction rate is higher on the newer island.  
 (d) The intensity of both competition and predation is less on the newer island.
14. What is the relationship between colonizing success and the number of species already established on an island?  
 (a) As the number of established species on an island decreases, colonizing success also decreases.

- (b) There is no relationship between the number of established species on an island and colonizing success.
- (c) As the number of established species on an island increases, colonizing success also decreases.
- (d) As the number of established species on an island increases, colonizing success also increases.
15. The number of species on an island remains relatively constant when \_\_\_\_\_.  
 (a) the rate of successful colonization is less than the extinction rate  
 (b) the rate of successful colonization equals the extinction rate  
 (c) the rate of successful colonization is greater than the extinction rate  
 (d) species richness increases
16. An organism's "trophic level" refers to \_\_\_\_\_.  
 (a) the rate at which it uses energy  
 (b) where it lives  
 (c) its food source  
 (d) whether it is early or late in ecological succession
17. Keystone species are those species \_\_\_\_\_.  
 (a) whose absence would cause major disruption in an ecosystem  
 (b) that live primarily on or under rocks and stones  
 (c) that have provided key foods and medicines  
 (d) with the largest number of individuals in an ecosystem
18. Which of the following best illustrates ecological succession?  
 (a) A mouse eats seeds, and an owl eats the mouse.  
 (b) Decomposition in soil releases nitrogen that plants can use.  
 (c) Grass grows on a sand dune, followed by shrubs, and then trees.  
 (d) Imported pheasants increase, while local quail disappear.
19. According to MacArthur and Wilson's hypothesis of island biogeography, species immigration and extinction rates on a particular island correlate to \_\_\_\_\_.  
 (a) how the island formed  
 (b) the number of other islands in the archipelago  
 (c) the island's size and distance from the mainland  
 (d) when the island formed
20. The idea that the destruction of one species in a community could greatly affect other members of the community has its roots in the \_\_\_\_\_. of community structure, which reiterates the \_\_\_\_\_. of almost 100 years ago.  
 (a) rivet model, integrated hypothesis of community structure  
 (b) redundancy model, integrated hypothesis of community structure  
 (c) redundancy model, individualistic hypothesis of community structure  
 (d) rivet model, individualistic hypothesis of community structure
21. What type of population interaction benefits neither population?  
 (a) predation    (b) parasitism  
 (c) competition    (d) mutualism
22. Under which of the following circumstances would interspecific competition be most obvious?  
 (a) when resources are most abundant  
 (b) in the presence of a keystone species  
 (c) when organisms have quite different ecological niches  
 (d) when a non-native organism is introduced to a community
23. The niche of an animal is \_\_\_\_\_.  
 (a) the number of individuals of the species the environment will support  
 (b) the same as its habitat  
 (c) the way the animal fits into its environment  
 (d) its den or nest
24. When goats were introduced to an island off the California coast, the goats inhabited the same areas and ate the same plants as the native deer. The deer population dwindled and finally disappeared. This is an example of \_\_\_\_\_.  
 (a) competitive exclusion  
 (b) succession  
 (c) a food chain  
 (d) coevolution
25. Two species of turtles that inhabit different lakes are more similar morphologically than two species that occupy the same lake. This is an example of \_\_\_\_\_.  
 (a) coevolution    (b) character displacement  
 (c) Müllerian mimicry    (d) commensalism
26. Flounder is a type of fish that looks like the seafloor. This is an example of \_\_\_\_\_.  
 (a) Müllerian mimicry  
 (b) warning coloration

- (c) character displacement  
(d) crypto coloration
27. The flower fly resembles a honeybee, but the flower fly has no stinger. This is an example of \_\_\_\_\_  
 (a) Batesian mimicry (b) Müllerian mimicry  
(c) cryptic coloration (d) interspecific competition
28. The poison-arrow frogs *Dendrobates* of tropical America are all brightly colored and have very similar patterns. Each species is distasteful to predators and all possess toxic skin secretions, although some of the species live quite separate from the others. The adaptive relationship among these species is best termed \_\_\_\_\_  
 (a) cryptic coloration (b) parasitism  
(c) Müllerian mimicry (d) Batesian mimicry
29. A leech that attaches itself to a swimmer is an example of a \_\_\_\_\_  
 (a) prey (b) parasitoid  
(c) endoparasite (d) ectoparasite
30. Certain species of acacia trees in Central and South America have hollow thorns that house stinging ants, which attack anything that touches the tree. The ants feed on nutrients produced by the acacias. This is an example of \_\_\_\_\_  
 (a) mutualism (b) parasitism  
(c) predation (d) competitive exclusion
31. The relationship between species A and species B is described as commensalism. This means that \_\_\_\_\_  
 (a) both species suffer  
(b) one species benefits and the other species suffers  
(c) both species benefit  
(d) one species benefits and the other species is unaffected
32. Which example below correctly lists members of a desert ecosystem from the producer level to the quaternary consumer level?  
 (a) detritivores, brittlebush, collared lizard, red-tailed hawk  
(b) red-tailed hawk, collared lizard, pallid-winged grasshopper, brittlebush  
(c) pallid-winged grasshopper, collared lizard, red-tailed hawk, detritivores  
(d) none of the above
33. A field contains 950 kg of plant material. How many kilograms of tertiary consumers could be supported?  
 (a) 9,500 (b) 950  
(c) 95 (d) 0.95
- (c) character displacement  
(d) crypto coloration
35. In Paine's study of the intertidal zone on the coast of Washington State, he found that \_\_\_\_\_  
 (a) competitive exclusion inevitably reduced species richness  
(b) mutualism among prey species maintained species diversity  
(c) the mussel *Mytilus* preyed on the sea star *Pisaster*  
(d) the presence of a keystone species maintained community diversity
36. A species of malaria-carrying mosquito lives in a forest in which two species of monkeys, A and B, coexist. Species A is immune to malaria, but species B is not. The malaria-carrying mosquito is the chief food for a particular kind of bird in the forest. If all these birds were suddenly eliminated by hunters, which of the following would be an immediately observable consequence?  
 (a) increased mortality (death rate) in monkey species A  
(b) increased mortality in monkey species B  
(c) increased mortality in the malaria-carrying mosquitoes  
(d) emergence of malaria-resistant strains in monkey species B
37. A lake community suddenly suffers from algal blooms. Using the strategy of biomanipulation, an ecologist may propose \_\_\_\_\_  
 (a) removing zooplankton  
(b) adding mineral nutrients to the water  
(c) adding fish that eat zooplankton  
(d) removing fish that eat zooplankton
38. The current view of biological communities is \_\_\_\_\_  
 (a) that they eventually reach a state of equilibrium  
(b) that disturbance and nonequilibrium are the norm

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- (c) that they maintain a relatively constant composition of species  
(d) that the effect of disturbances is usually negative
39. Succession of communities occurs because \_\_\_\_\_  
 (a) each existing community changes the environment  
(b) climatic changes lead to reduced water availability  
(c) most populations have a limited life span and die making room for others  
(d) resources in an area are limited
40. Which statement below correctly describes conditions on a glacier moraine during the reign of pioneer species?  
 (a) Vegetation consists of sphagnum bogs on poorly drained flat areas  
(b) Decomposition of acidic spruce needles reduces the pH of the soil  
(c) Low nitrogen content causes many plants to have yellow leaves.  
(d) Alder forms dense thickets up to 9-meters-tall.
41. What are two key factors in species richness equatorial-polar gradients?  
 (a) length of seasons and water availability  
(b) evolutionary history and climate  
(c) altitude and evolutionary history  
(d) evapotranspiration and temperature
42. When equilibrium is reached on an island, \_\_\_\_\_  
 (a) the number of organisms does not change  
(b) ecological disturbance is minimized  
(c) the rate of species immigration will equal the rate of species extinction  
(d) the food web will be highly stable
43. \_\_\_\_\_ views a community as the chance assemblage of organisms with similar abiotic needs.  
 (a) The niche concept  
(b) The individualistic hypothesis  
(c) Species richness  
(d) Commensalism
44. Which theory below suggests that reducing or increasing the abundance of one species in a community affects many other species?  
 (a) integrated hypothesis  
(b) individualistic hypothesis
45. According to the principle of competitive exclusion, two species cannot continue to occupy the same \_\_\_\_\_  
 (a) environmental habitat  
(b) ecological niche  
(c) territory  
(d) range
46. Which answer below describes the effect predation has on the organisms involved in the relationship?  
 (a) The answer cannot be determined without more information about the relationship  
(b) benefit; no effect  
(c) benefit; benefit  
(d) benefit; harmed
47. The term used to describe a harmless organism resembling a harmful one is \_\_\_\_\_  
 (a) aposematic coloration  
(b) Batesian mimicry  
(c) warning coloration  
(d) cryptic coloration
48. Cellulose-digesting microorganisms live in the guts of termites and ruminant mammals. The microorganisms have a home and food, while their hosts gain more nutrition from their meals. This relationship is an example of \_\_\_\_\_  
 (a) mutualism (b) parasitism  
(c) herbivory (d) commensalism

## ANSWERS

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. a  | 2. b  | 3. d  | 4. c  |
| 5. d  | 6. a  | 7. d  | 8. c  |
| 9. b  | 10. d | 11. a | 12. c |
| 13. d | 14. c | 15. b | 16. c |
| 17. a | 18. c | 19. c | 20. a |
| 21. c | 22. d | 23. c | 24. a |
| 25. b | 26. d | 27. a | 28. c |
| 29. d | 30. a | 31. d | 32. d |
| 33. d | 34. c | 35. d | 36. b |
| 37. d | 38. b | 39. a | 40. c |
| 41. b | 42. c | 43. b | 44. c |
| 45. b | 46. d | 47. b | 48. a |

## 8.5: ECOSYSTEMS

1. \_\_\_\_\_ are secondary consumers.  
 (a) Carnivores      (b) Herbivores  
 (c) Plants      (d) Cows
2. Approximately \_\_\_\_\_ % of the energy at one trophic level is passed on to the next highest trophic level.  
 (a) 0–5      (b) 5–10  
 (c) 10–15      (d) 15–20
3. 10,000 kcal of producer could support approximately \_\_\_\_\_ kcal of tertiary consumer.  
 (a) 1,000      (b) 100  
 (c) 10      (d) 1
4. Where do plants get the energy to make organic molecules?  
 (a) minerals      (b) glucose  
 (c) vitamins      (d) light
5. Which of these is not an organic molecule?  
 (a) carbohydrates      (b) minerals  
 (c) proteins      (d) glucose
6. Where do plants get the carbon they use to make organic molecules?  
 (a) glucose      (b) carbon dioxide  
 (c) water      (d) starch
7. What name is given to the process by which detritivores return carbon to the atmosphere?  
 (a) burning      (b) predation  
 (c) photosynthesis      (d) decomposition
8. Which of these removes carbon from the atmosphere?  
 (a) logging trees      (b) rabbits  
 (c) algae      (d) bobcats
9. Detritus is composed of \_\_\_\_\_.  
 (a) detritivores  
 (b) dead organic matter  
 (c) inorganic minerals  
 (d) dead organic matter and excreted wastes
10. Nitrifying bacteria convert \_\_\_\_\_ to \_\_\_\_\_.  
 (a) nitrogen gas... ammonium  
 (b) nitrogen gas... nitrates  
 (c) ammonium... nitrites  
 (d) nitrates... nitrogen gas
11. The energy for nearly every organism in nearly every ecosystem ultimately comes from \_\_\_\_\_.  
 (a) minerals in the soil
12. An organism's "trophic level" refers to \_\_\_\_\_.  
 (a) the rate at which it uses energy  
 (b) where it lives  
 (c) what it eats  
 (d) whether it is early or late in ecological succession
13. Switching from fossil fuels to \_\_\_\_\_ energy would significantly decrease the release of carbon dioxide into the atmosphere.  
 (a) solar      (b) nuclear  
 (c) geothermal  
 (d) solar, nuclear, and geothermal
14. The relationship between biomass and primary productivity is that \_\_\_\_\_.  
 (a) biomass is the rate of primary productivity  
 (b) biomass is the inverse of primary productivity  
 (c) biomass is the natural log of primary productivity  
 (d) primary productivity is the rate at which biomass is produced
15. Why is a diagram of energy flow from trophic level to trophic level shaped like a pyramid?  
 (a) Organisms at each level store most of the energy and pass little on.  
 (b) There are more producers than primary consumers, and so on.  
 (c) Organisms eventually die.  
 (d) Most energy at each level is lost, leaving little for the next.
16. Consider this segment of a food web: Snails and grasshoppers eat pepper plants; spiders eat grasshoppers; shrews eat snails and spiders; owls eat shrews. The shrew occupies the trophic level(s) of \_\_\_\_\_.  
 (a) primary consumer  
 (b) secondary consumer  
 (c) tertiary consumer  
 (d) secondary and tertiary consumers
17. Biogeochemical cycles are crucial to ecosystem function because \_\_\_\_\_.  
 (a) they keep the planet warm enough for living things to survive

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- (b) nutrients and other life-sustaining molecules are in limited supply and must be continually recycled
  - (c) energy flows through ecosystems in one direction only and is eventually dissipated as heat
  - (d) they remove poisons and keep them locked up in "sinks"
  18. An ecosystem is unlikely to be limited by the supply of \_\_\_\_\_ because it is obtained from the air.  
 (a) water      (b) carbon  
 (c) phosphorus      (d) calcium
  19. Ospreys and other top predators in food chains are most severely affected by pesticides such as DDT because \_\_\_\_\_.  
 (a) their systems are especially sensitive to chemicals  
 (b) of their rapid reproductive rates  
 (c) the pesticides become concentrated in their prey  
 (d) they cannot store the pesticides in their tissues
  20. Which one of the following processes does not increase the concentration of greenhouse gases in the atmosphere?  
 (a) using coal to generate electricity  
 (b) putting salt on roads to prevent ice from forming  
 (c) burning tropical rain forests to clear land for grazing  
 (d) failing to repair leaks in natural gas pipelines
  21. The biggest difference between the flow of energy and the flow of chemical nutrients in an ecosystem is that \_\_\_\_\_.  
 (a) the amount of energy is much greater than the amount of nutrients  
 (b) energy is recycled, but nutrients are not  
 (c) organisms always need nutrients, but they don't always need energy  
 (d) nutrients are recycled, but energy is not
  22. In an ecosystem, all incoming energy will eventually be \_\_\_\_\_.  
 (a) transferred from one trophic level to the next  
 (b) transferred to the decomposers  
 (c) dissipated into space as heat  
 (d) used in photosynthesis
  23. Which of the following is a primary producer?  
 (a) detritivores      (b) shrimp  
 (c) poison ivy      (d) lions
  24. Photosynthetic organisms are called \_\_\_\_\_.  
 (a) autotrophs      (b) heterotrophs  
 (c) herbivores      (d) carnivores
  25. When you eat an apple, you are a \_\_\_\_\_.  
 (a) primary consumer  
 (b) carnivore  
 (c) primary producer  
 (d) secondary consumer
  26. The main decomposers in an ecosystem are \_\_\_\_\_.  
 (a) plants and animals  
 (b) prokaryotes and animals  
 (c) fungi and prokaryotes  
 (d) prokaryotes and plants
  27. Most of the solar energy that reaches Earth \_\_\_\_\_.  
 (a) is used by plants for photosynthesis  
 (b) is not captured for use by living things  
 (c) is continually recycled by ecosystems  
 (d) is trapped by greenhouse gases
  28. The rate at which producers convert solar energy to the chemical energy of organic compounds, minus the energy used during respiration, is called \_\_\_\_\_.  
 (a) biomass      (b) standing crop  
 (c) biomagnification      (d) net productivity
  29. A study of metabolic rates in a terrestrial community showed that the energy released by respiration exceeded the energy captured in photosynthesis. Which one of the following situations is most likely?  
 (a) Community biomass is increasing.  
 (b) Community biomass is decreasing.  
 (c) A climax community has been reached.  
 (d) The first law of thermodynamics (energy is conserved) is not in effect.
  30. Which statement below about primary production and ecosystems is correct?  
 (a) Overall, terrestrial ecosystems contribute two-thirds of global net primary production, and marine ecosystems contribute about one-third.  
 (b) Overall, marine ecosystems contribute about two-thirds of global net primary production, and terrestrial ecosystems contribute about one-third.  
 (c) Satellite images reveal how unproductive tropical rain forests are on a per-unit-area basis.  
 (d) The primary production per unit area of the open ocean is greater than that of any other single ecosystem.

31. How do iron levels affect phytoplankton populations in a marine ecosystem?  
 (a) Without iron, eukaryotic phytoplankton populations fall because they cannot convert atmospheric N<sub>2</sub> to nitrogenous minerals.  
 (b) In the presence of too much iron, eukaryotic phytoplankton populations fall because they cannot convert atmospheric N<sub>2</sub> to nitrogenous minerals.  
 (c) Iron stimulates the growth of cyanobacteria, which convert atmospheric N<sub>2</sub> to nitrogenous minerals, stimulating the growth of phytoplankton.  
 (d) Iron halts the growth of cyanobacteria, which convert atmospheric N<sub>2</sub> to nitrogenous minerals; therefore, phytoplankton populations are limited.
32. Eutrophication in lakes is frequently the direct result of \_\_\_\_\_.  
 (a) a diminished supply of nitrates and phosphates  
 (b) industrial poisons  
 (c) nutrient enrichment such as nitrate and phosphate runoffs from land  
 (d) an increase in predators
33. The amount of chemical energy in a consumer's food that is converted to its own new biomass over a period of time is called \_\_\_\_\_.  
 (a) primary production  
 (b) secondary production  
 (c) production efficiency  
 (d) assimilation of primary production
34. In the transition from each trophic level of the food chain to the next trophic level, there is about a(n) \_\_\_\_\_.  
 (a) 80% gain of energy  
 (b) 2% gain of energy  
 (c) 80% loss of energy  
 (d) 2% loss of energy
35. Which one of the following best describes the base of a pyramid of net production?  
 (a) Its size depends on the energy available from detritivores.  
 (b) It contains the energy left after the producers have died.  
 (c) It represents the energy available to secondary consumers.  
 (d) It contains the energy captured by photosynthesis.
36. In general, the biomass in an ecosystem will be greatest at the trophic level comprising \_\_\_\_\_.  
 (a) producers  
 (b) herbivores  
 (c) primary consumers  
 (d) tertiary consumers
37. In ecosystems, organisms at the highest trophic levels usually contain less collective biomass than the organisms at lower trophic levels because \_\_\_\_\_.  
 (a) organisms are inefficient at converting the energy they consume into biomass  
 (b) biomass shrinks as it rises  
 (c) top-level predators use so much energy to catch their food  
 (d) producers (for example, plants) tend to be heavier than consumers (for example, birds)
38. Which example below is not proposed by the green world hypothesis as a factor that keeps herbivores in check?  
 (a) Plants have defenses against herbivores  
 (b) Intraspecific competition can limit herbivore numbers.  
 (c) Abiotic factors limit herbivores.  
 (d) Energy supply, not nutrients, usually limits herbivores.
39. What is the main abiotic reservoir for elements involved in local biogeochemical cycles such as calcium and phosphorus?  
 (a) oceans                                  (b) rivers  
 (c) soil                                      (d) wind
40. Which of the following statements is correct?  
 (a) Over land, evaporation exceeds transpiration and precipitation.  
 (b) Over land, evaporation and transpiration exceed precipitation.  
 (c) Over oceans, transpiration exceeds precipitation.  
 (d) Over oceans, evaporation exceeds precipitation.
41. The global hydrologic cycle supports a net flow of atmospheric water vapor \_\_\_\_\_.  
 (a) from the oceans to land  
 (b) from land to the oceans  
 (c) from polar to tropical regions  
 (d) from tropical to polar regions
42. Local conditions such as heavy rainfall or the removal of plants may limit the amount of nitrogen, phosphorus, or calcium available to a particular ecosystem, but the amount of

carbon available to the system is seldom a problem. Why?

- (a) Organisms do not need very much carbon.  
 (b) Plants can make their own carbon using water and sunlight.  
 (c) Plants are much better at absorbing carbon from the soil.  
 (d) Many nutrients come from the air.
43. Three or four of the following processes are key parts of the carbon cycle. Which one, if any, is not a key part of the carbon cycle?  
 (a) return of CO<sub>2</sub> to the atmosphere by microbial respiration in soils  
 (b) assimilation of atmospheric CO<sub>2</sub> by plant photosynthesis  
 (c) return of CO<sub>2</sub> to the atmosphere by animal and plant respiration  
 (d) All of the above processes are key parts of the carbon cycle.
44. By which process is carbon dioxide released from plants back to the atmosphere?  
 (a) photosynthesis  
 (b) respiration  
 (c) ammonification  
 (d) phosphorylation
45. Bacteria are especially important in making \_\_\_\_\_ available to plants.  
 (a) water                                    (b) nitrogen  
 (c) carbon                                (d) phosphorus
46. The direct product of nitrogen fixation is \_\_\_\_\_.  
 (a) NH<sub>4</sub><sup>+</sup>                                  (b) NO<sub>2</sub><sup>-</sup>  
 (c) NO<sub>3</sub><sup>-</sup>                                   (d) NH<sub>3</sub>
47. Which one of the following is not true of the nitrogen cycle?  
 (a) It requires different types of bacteria.  
 (b) Plants can take in and use atmospheric nitrogen through their leaves.  
 (c) Nitrogen needs to be cycled through living organisms.  
 (d) When plants and animals die, the nitrogen within their bodies is recycled.
48. The phosphorus cycle lacks a(n) \_\_\_\_\_. component.  
 (a) atmospheric                            (b) organic  
 (c) mineral                                (d) aquatic
49. When researchers at Hubbard Brook Experimental Forest cut down trees and measured subsequent mineral levels in the soil, they found that \_\_\_\_\_.  
 (a) the mineral levels were unaffected as long as the tree remains were not removed
50. How have human activities increased the supply of fixed nitrogen available to primary producers?  
 (a) use of nitrogen fertilizers  
 (b) increased cultivation of legumes  
 (c) deliberate burning of fields  
 (d) The first, second, and third answers are correct.
51. Why are freshwater ecosystems in North America and northern Europe particularly sensitive to the effects of acid rain?  
 (a) The water in these areas is acidic to begin with.  
 (b) The lakes tend to have relatively poor buffering capacity.  
 (c) The wildlife in these areas tends to be more sensitive to change in pH.  
 (d) Other types of industrial pollution tend to magnify the effects of acid rain.
52. \_\_\_\_\_ are the most affected by toxic compounds in the environment because \_\_\_\_\_.  
 (a) Cyanobacteria... many of these compounds prevent nitrogen-fixation  
 (b) Phytoplankton... many of these compounds halt photosynthesis  
 (c) Primary consumers... they consume primary producers containing the compounds  
 (d) Top-level carnivores... the biomass at any given trophic level is produced from a larger biomass ingested at the level below
53. Which of the following is not thought to be a possible consequence of rising CO<sub>2</sub> levels?  
 (a) C<sub>4</sub> crops, such as corn, being replaced by more C<sub>3</sub> plants such as wheat and soybeans  
 (b) rising global temperature  
 (c) increased breakdown of atmospheric ozone  
 (d) increased vegetative productivity
54. Ozone is \_\_\_\_\_.  
 (a) harmful in the upper atmosphere  
 (b) beneficial in the upper atmosphere  
 (c) beneficial in the lower atmosphere  
 (d) harmful in the upper atmosphere and beneficial in the lower atmosphere

55. The destruction of the ozone layer is most directly linked to \_\_\_\_\_  
 (a) increasing levels of CO<sub>2</sub> in the atmosphere  
 (b) destruction of tropical rain forests  
 (c) release of chlorofluorocarbons (CFCs) into the atmosphere  
 (d) decrease in the production of ozone precursors by chemical production plants
56. \_\_\_\_\_ removes nitrogen from the atmosphere.  
 (a) Denitrification  
 (b) Nitrification  
 (c) Mineralization  
 (d) Nitrogen fixation
57. Which of these are the two major sources of nitrate pollution in rivers?  
 (a) the burning of fossil fuels by factories and cars  
 (b) animal wastes and the burning of fossil fuels by cars  
 (c) animal wastes and fertilizers  
 (d) fertilizer runoff and the burning of fossil fuels by cars
58. Aquatic nitrate pollution can result in \_\_\_\_\_  
 (a) algal bloom  
 (b) oxygen depletion  
 (c) an algal bloom that, when the algae die and are decomposed by bacteria, leads to hypoxia and the death of fish  
 (d) hypoxia

59. Which of these would not contribute to a global increase in temperature?  
 (a) deforestation  
 (b) increasing the use of gasoline-burning vehicles  
 (c) increasing the industrial release of carbon dioxide  
 (d) planting trees

**ANSWERS**

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. a  | 2. b  | 3. c  | 4. d  |
| 5. d  | 6. b  | 7. d  | 8. c  |
| 9. d  | 10. c | 11. b | 12. c |
| 13. d | 14. d | 15. d | 16. d |
| 17. b | 18. b | 19. c | 20. b |
| 21. d | 22. c | 23. c | 24. a |
| 25. a | 26. c | 27. b | 28. d |
| 29. b | 30. a | 31. c | 32. c |
| 33. b | 34. c | 35. d | 36. a |
| 37. a | 38. d | 39. c | 40. d |
| 41. a | 42. d | 43. d | 44. b |
| 45. b | 46. d | 47. b | 48. a |
| 49. d | 50. d | 51. b | 52. d |
| 53. c | 54. b | 55. c | 56. d |
| 57. c | 58. c | 59. d |       |

## 8.6: CONSERVATION BIOLOGY AND RESTORATION ECOLOGY

1. What percent of the plant species found on Madagascar are unique to that island?  
 (a) 10 (b) 20  
 (c) 40 (d) 80
2. The human population of Madagascar doubles about every \_\_\_\_\_ years.  
 (a) 10 (b) 25  
 (c) 40 (d) 60
3. What is a lemur?  
 (a) a primate only found on Madagascar  
 (b) a poisonous snake found only on Madagascar  
 (c) a type of orchid found only on Madagascar  
 (d) a type of tree found only on Madagascar
4. Much of the original forest cover on Madagascar has been destroyed primarily as a result of \_\_\_\_\_.  
 (a) the building of malls  
 (b) pollution from automobile emissions  
 (c) the building of tract housing  
 (d) burning for agricultural purposes
5. What is the cause of the red color of the waters about Madagascar?  
 (a) dinoflagellates  
 (b) a persistent red tide  
 (c) the high concentration of iron found in these waters  
 (d) soil that has washed into the ocean
6. From 1930 to 1939 fire ants spread inland about 60 miles from their point of introduction in Mobile, Alabama. What was the cause of their spread over this distance?  
 (a) a natural spread  
 (b) airplanes  
 (c) being transported along with soil  
 (d) being transported along with plants
7. From 1940 to 1970 fire ants spread through many southern states, sometimes at a rate of 100 miles in a year. What was the cause of their spread over this distance?  
 (a) a natural spread  
 (b) dispersion via ship ballast  
 (c) airplanes
- (d) being transported along with plants and soil
8. In 1958 federal law restricted the movement of soil and plants from areas where fire ants were established. Why was this law unsuccessful in stopping the spread of fire ant colonies?  
 (a) People were unaware of the federal law and, when they moved, transported plants bearing fire ant colonies.  
 (b) A single mated queen can be transported without being noticed  
 (c) Many states originally thought to be free of fire ant colonies already had them.  
 (d) People were unaware of the federal law and, when they moved, transported plants bearing fire ant colonies; moreover, a single mated queen can be transported without being noticed
9. Techniques used, or are being considered for use, in controlling the spread of fire ants include \_\_\_\_\_.  
 (a) setting baits that kill the queen when they are carried back to the nest  
 (b) applying chemical powders that kill the colony  
 (c) introducing a protist to infect the fire ant queen and her eggs  
 (d) setting baits that kill the queen when they are carried back to the nest, applying chemical powders that kill the colony, introducing a protist to infect the fire ant queen and her eggs, and introducing a fly that lays eggs in fire ants so that the eggs will hatch into larvae that eat their way into the ants' heads, which will then fall off
10. As of the time of the writing of Activity: Introduced Species: Fire Ants, fire ants have caused about \_\_\_\_\_ deaths in the United States.  
 (a) 5 (b) 20  
 (c) 50 (d) 100
11. Current rates of extinction may be \_\_\_\_\_ those of the past 100,000 years.  
 (a) 100 times higher than  
 (b) 50 times lower than

12. The primary cause of the extinction of native species of cichlids in Lake Victoria is \_\_\_\_\_.  
 (a) a decrease in the lake's size due to the use of water in irrigation  
 (b) recreational use  
 (c) the introduction of an exotic predator  
 (d) fragmentation
13. The single greatest current threat to biodiversity is \_\_\_\_\_.  
 (a) global warming  
 (b) introduced species  
 (c) overhunting  
 (d) habitat destruction
14. In a population of 3,000 adult males and 7,000 adult females, where all adult females and 10% of adult males mate, the effective population size would be approximately \_\_\_\_\_.  
 (a) 8,400    (b) 600  
 (c) 1,150    (d) 840
15. Which of the following does not apply to a population with a low effective population size?  
 (a) genetic drift  
 (b) increased genetic diversity  
 (c) reduced heterozygosity  
 (d) increased homozygosity
16. The estimated density or number of individuals needed for a species to maintain or increase its numbers in a region is the \_\_\_\_\_.  
 (a) minimum viable population (MVP)  
 (b) stochastic population  
 (c) metapopulation  
 (d) Hardy-Weinberg equilibrium
17. Landscape ecology addresses \_\_\_\_\_.  
 (a) metapopulation studies  
 (b) the populations found in the same environment  
 (c) the trees and flowers planted around human dwellings  
 (d) patterns of landscape use and biodiversity conservation
18. Edge species \_\_\_\_\_.  
 (a) decrease biodiversity  
 (b) exist only in areas that have been altered by humans  
 (c) may require conditions found in both of the bordering ecosystems  
 (d) are all nest parasites
19. Connections between habitat fragments are referred to as \_\_\_\_\_.  
 (a) movement corridors  
 (b) highways  
 (c) minimum dynamic areas  
 (d) riparian areas
20. Biodiversity hot spots are \_\_\_\_\_.  
 (a) distributed evenly throughout the biosphere  
 (b) regions with the potential for high levels of extinction  
 (c) the same for all groups of organisms  
 (d) regions where thermophilic species thrive
21. The integration of several sciences such as ecology and genetics to sustain biological diversity at all levels is known as \_\_\_\_\_.  
 (a) conservation biology  
 (b) restoration ecology  
 (c) ecology  
 (d) bioremediation
22. Extinction is a naturally occurring phenomenon that has occurred on Earth since life began. Why are scientists so concerned about extinction now?  
 (a) The greatest period of mass extinction is occurring now.  
 (b) Human activities are directly responsible for today's mass extinctions.  
 (c) Extinction is occurring faster than ever before and faster than rates of respeciation.  
 (d) All of the above.
23. What are the three levels of biodiversity?  
 (a) genetic, species, biome  
 (b) molecular, species, biome  
 (c) genetic, species, ecosystem  
 (d) molecular, species, ecosystem
24. Dispersal of seeds, nutrient cycling, and moderation of weather extremes are just a few examples of \_\_\_\_\_.  
 (a) ecosystem diversity  
 (b) biological augmentation  
 (c) disruption of interaction networks  
 (d) ecosystem services
25. The major cause of extinction of species today is \_\_\_\_\_.  
 (a) habitat destruction  
 (b) global warming  
 (c) predation  
 (d) the greenhouse effect

26. Which example below is not a threat to biodiversity?  
 (a) habitat destruction  
 (b) bioremediation  
 (c) introduced species  
 (d) overexploitation
27. Which of the following factors does not play a role in increased biodiversity?  
 (a) complex population interactions  
 (b) introduced species  
 (c) a higher degree of habitat heterogeneity  
 (d) narrower niches
28. Which major threat to biodiversity has contributed to about 40% of the extinctions recorded since 1750, and is brought on by humans both deliberately and accidentally?  
 (a) habitat destruction  
 (b) bioremediation  
 (c) introduced species  
 (d) overexploitation
29. What is the key factor driving an extinction vortex?  
 (a) the size of the endangered organisms  
 (b) loss of genetic variation  
 (c) the size of the population  
 (d) the major threats to biodiversity that were involved in making the species endangered
30. What is the effective population size of a population containing 1,200 individuals when 500 females breed with 500 males?  
 (a) 1,000 or 83.3%  
 (b) 1,000 or 100%  
 (c) 250 or 20.8%  
 (d) 1,200 or 100%
31. The declining-population approach \_\_\_\_\_.  
 (a) emphasizes the environmental factors that caused a population's decline  
 (b) emphasizes smallness itself as an ultimate cause of a population's extinction  
 (c) emphasizes the impact of the loss of genetic diversity in a population  
 (d) was used to help increase the population size of prairie chickens in Illinois
32. What is one viable solution to help increase the effective size and genetic variation in the grizzly bear population in Yellowstone National Park?  
 (a) Conservation biologists could increase genetic diversity by selectively breeding bears within the Yellowstone population that have not bred together before.
33. Which statement below describes a finding of researchers who studied the decline of red-cockaded woodpeckers?  
 (a) The population decline could be traced to periodic brush fires.  
 (b) The woodpeckers live in groups of one breeding pair and up to four sterile "helpers" that help incubate eggs and feed nestlings.  
 (c) Individuals generally have a better chance of reproducing by remaining behind than by dispersing and excavating homes in new territories.  
 (d) The birds would not occupy nesting cavities created by the researchers.
34. Which of the following is not true about edge effects?  
 (a) They are defining features of landscapes.  
 (b) Edges have their own set of physical conditions, which differ from those on either side.  
 (c) As a habitat patch becomes progressively smaller, the percentage of the patch influenced by the edge effect increases.  
 (d) When edges expand, this is detrimental to all species.
35. Which statement below about movement corridors is not true?  
 (a) Streamside habitats often serve as corridors.  
 (b) Corridors have been shown to increase the exchange of individuals among subpopulations and metapopulations.  
 (c) Corridors have been instrumental in stopping the spread of disease.  
 (d) Corridors are especially important to species that migrate among different habitats seasonally.
36. The "zoned reserve" system of landscape management calls for \_\_\_\_\_.  
 (a) many small interconnected nature reserves  
 (b) protected areas to be surrounded by transitional areas  
 (c) bioremediation

- (d) assisting the movement of individuals from a source to a sink population
37. \_\_\_\_\_ is the science of facilitating the return of a degraded ecosystem to a more natural condition.  
 (a) PVA  
 (b) Preservationism  
 (c) Landscape management  
 (d) Restoration ecology
38. One of the most impressive models of sustainable development can be seen in \_\_\_\_\_  
 (a) the United States' national park system  
 (b) use of petroleum products in Western countries  
 (c) the increasing popularity of organic farming  
 (d) Costa Rican zoned reserves
39. One of the most severe consequences of habitat degradation is the \_\_\_\_\_ of a population.  
 (a) magnification (b) eutrophication  
 (c) fragmentation (d) fossilization
40. A sink habitat is where a subpopulation's death rate is \_\_\_\_\_.  
 (a) equal to its reproductive rate  
 (b) greater than its reproductive rate  
 (c) less than its reproductive rate  
 (d) at its lowest
41. Fertilizer runoff can result in \_\_\_\_\_ a lake.  
 (a) the eutrophication of  
 (b) the ozonation of  
 (c) the creation of source habitats for fish within  
 (d) the irrigation of
42. Most biodiversity hot spots are in the \_\_\_\_\_  
 (a) Arctic (b) coniferous forests  
 (c) deserts (d) tropics
43. \_\_\_\_\_ is the increase in pesticide concentration as the pesticides pass up a food chain.  
 (a) Eutrophication  
 (b) Biodiversity  
 (c) The greenhouse effect  
 (d) Biological magnification

**ANSWERS**

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. d  | 2. b  | 3. a  | 4. d  |
| 5. d  | 6. a  | 7. d  | 8. a  |
| 9. d  | 10. b | 11. c | 12. c |
| 13. d | 14. c | 15. b | 16. a |
| 17. d | 18. c | 19. a | 20. b |
| 21. a | 22. d | 23. c | 24. d |
| 25. a | 26. b | 27. b | 28. c |
| 29. b | 30. a | 31. a | 32. c |
| 33. c | 34. d | 35. c | 36. b |
| 37. d | 38. d | 39. c | 40. b |
| 41. a | 42. d | 43. d |       |

# Section I

# ENGLISH