Test Bank

to accompany

Life: The Science of Biology, Tenth Edition

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Chapter 3: Proteins, Carbohydrates, and Lipids

TEST FILE QUESTIONS

(By Amy Burnside)

Multiple Choice

1. Large biological molecules that contain carbon and are held together by covalent bonds are categorized as
a. proteins.
b. polymers.
c. nucleic acids.
d. macromolecules.
e. monomers.
Answer: d
Textbook Reference: 3.0 Chapter Introduction
Bloom's Category: 2. Understanding

2. In large polymeric macromolecules, atoms are held together by _____ bonds.
a. hydrogen
b. peptide
c. disulfide
d. covalent
e. ionic
Answer: d
Textbook Reference: 3.0 Chapter Introduction
Bloom's Category: 1. Remembering

3. All of the following are macromolecules *except* for
a. RNA.
b. DNA.
c. vitamins D, E, and K.
d. protein.
e. salt.
Answer: e
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Bloom's Category: 2. Understanding

4. Which of the following is *not* a correct monomer/polymer pairing?
a. Monosaccharide/polysaccharide

b. Amino acid/protein
c. Cellulose/triglyceride
d. Nucleotide/nucleic acid
e. Monosaccharide/oligosaccharide
Answer: c
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?; 3.3 What Are the Chemical Structures and Functions of Carbohydrates?; 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 3. Applying

5. Amino and carboxyl functional groups tend to form bases and acids by gaining or losing
a. a neutron.
b. a proton.
c. an electron.
d. Both a and b
e. Both b and c
Answer: b
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Bloom's Category: 4. Analyzing

6. Aldehydes and ketones are very similar in that they both contain
a. phosphorus atoms.
b. sulfur atoms.
c. a carbonyl group (C=O).
d. nitrogen atoms.
e. two "R" groups.
Answer: c
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Bloom's Category: 2. Understanding

7. Molecules containing a large number of hydroxyl groups are
a. basic.
b. structurally less stable than those with fewer hydroxyls.
c. complex macromolecules.
d. nonpolar.
e. soluble in water.
Answer: e
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Bloom's Category: 4. Analyzing

8. An essential functional group involved in cellular energy transfer is the _____ group.
a. phosphate
b. amino
c. sulfhydryl

d. hydroxyl
e. saccharide
Answer: a
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Bloom's Category: 2. Understanding

9. Which of the following statements regarding the functional groups of carbon-based molecules is *false*?
a. They determine how the molecule interacts with other molecules in the environment.
b. They determine the shape of the molecule.
c. They determine the specific properties of the molecule.
d. They may have interactions with specific functional groups on the same molecule.
e. They repel each other.
Answer: e
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Bloom's Category: 5. Evaluating

10. In condensation reactions, the atoms that make up a water molecule are derived from
a. oxygen.
b. one of the reactants.
c. both reactants.
d. carbohydrates.
e. the enzyme.
Answer: c
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Bloom's Category: 2. Understanding

11. Polymerization reactions in which polysaccharides are synthesized from monosaccharides
a. require the formation of phosphodiester bonds between the monosaccharides.
b. release phosphate.
c. are hydrolysis reactions.
d. depend upon van der Waals forces to hold the monosaccharides together.
e. result in the formation of water.
Answer: e
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?; 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 4. Analyzing

12. What do polysaccharides, polypeptides, and polynucleotides have in common?
a. They contain simple sugars.
b. They are broken down in hydrolysis reactions.
c. They are located in cell membranes.
d. They contain nitrogen.
e. They have molecular weights less than 30,000 daltons.
Answer: b

Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Bloom's Category: 2. Understanding

13. During the formation of a peptide linkage, a(n) _____ is formed.
a. molecule of water
b. disulfide bridge
c. hydrophobic bond
d. hydrophilic bond
e. ionic bond
Answer: a
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

14. Each amino acid has a unique _____ group.
a. amino
b. hydroxyl
c. carboxyl
d. "R"
e. phosphate
Answer: d
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

15. Which of the following statements about proteins is true?
a. They are insoluble in water.
b. Some are the structural units of glycogen.
c. Some possess glycosidic linkages between amino acids.
d. Some function as enzymes.
e. They are involved in information storage.
Answer: d
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

16. All of the following amino acids have an optical isomer *except* for
a. arginine.
b. cysteine.
c. alanine.
d. glycine.
e. methionine.
Answer: d
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

17. Leucine and valine have side chains that do not interact with water; therefore, they
a. are hydrophilic.
b. are nonpolar.

c. have sulfur atoms in their side chains.
d. are electrically charged.
e. form only left-handed isomers.
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 4. Analyzing

18. Aspartate and glutamate can form hydrogen bonds with water because they
a. are hydrophobic.
b. have sulfur atoms in their side chains.
c. have electrically charged side chains.
d. are nonpolar.
e. form only left-handed isomers.
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 4. Analyzing

19. If all of the cysteine residues of a protein were changed to threonines,
a. the structure of the protein would not change because both residues have hydrophobic properties.
b. the protein would lose activity but the structure would remain the same.
c. the protein would lose peptide bond formation and thus it would lose its primary structure.
d. the protein would lose disulfide bond formation, which would affect its tertiary structure.
e. the hydrogen bonds would be lost, affecting α helix and β pleated sheet formation.
Answer: d
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 4. Analyzing

20. Amino acids can be classified by the
a. number of monosaccharides they contain.
b. number of carbon–carbon double bonds in their fatty acids.
c. number of peptide bonds they can form.
d. number of disulfide bridges they can form.
e. characteristics of their side chains, or "R" groups.
Answer: e
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

21. What type of amino acid side chains would you expect to find on the surface of a protein embedded in a cell membrane?
a. Short
b. Hydrophobic
c. Hydrophilic
d. Charged

e. Polar, but not charged
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

22. Which of the following amino acids is small enough to fit into tight corners of protein molecules?
a. Proline
b. Glycine
c. Cysteine
d. Asparagine
e. Glutamine
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

23. The shape of a folded protein is determined by
a. its tertiary structure.
b. the sequence of its amino acids.
c. whether the peptide bonds have α or β linkages.
d. the number of peptide bonds.
e. the base-pairing rules.
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

24. Peptide chains have a(n) _____ and a(n) _____ end.
a. start; stop
b. plus; minus
c. N terminus; C terminus
d. 5′; 3′
e. A; Z
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

25. Suppose you want to construct a protein that is 50 amino acids long. What is the theoretical number of different proteins that you could make?
a. 10^{50}
b. 20^{50}
c. 20×50
d. 50^{20}
e. 50×50
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 3. Applying

26. How many different types of tripeptides (molecules of three amino acids linked together) can be synthesized from the 20 common amino acids?
a. 3
b. 20
c. 60
d. 900
e. 8,000
Answer: e
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 3. Applying

27. The amino acids of the protein keratin are arranged in a helix. This secondary structure is stabilized by
a. covalent bonds.
b. peptide bonds.
c. glycosidic linkages.
d. polar bonds.
e. hydrogen bonds.
Answer: e
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

28. A β pleated sheet organization in a polypeptide chain is an example of _____ structure.
a. primary
b. secondary
c. tertiary
d. quaternary
e. coiled
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

29. A protein embedded in the plasma membrane has four distinct regions of hydrophobic residues separated by hydrophilic regions. It also has hydrophilic C and N terminals. This protein most likely has _____ extracellular region(s) and _____ cytoplasmic region(s).
a. two; three
b. three; two
c. two; one
d. one; two
e. Either a or b
Answer: e
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 3. Applying

30. A macromolecule that is isolated from the bone of dinosaurs and found to have nitrogen-carbon-carbon repeats would be classified as a(n)
a. polysaccharide.
b. oligosaccharide.
c. polypeptide.
d. triglyceride.
e. lipid.
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

31. The tertiary structure of a protein is determined by its
a. interactions among R groups.
b. right-handed coil.
c. size.
d. branching.
e. glycosidic linkages.
Answer: a
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

32. Which of the following does *not* contribute to the overall structure of proteins?
a. Charge differences between R groups
b. The formation of disulfide bonds between glycines
c. Interactions between R groups and the environment
d. The N—H from the peptide backbone
e. The C=O groups from the peptide backbone
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 4. Analyzing

33. The magnesium chelatase protein has quaternary structure. This means that magnesium chelatase
a. is composed of subunits.
b. binds to the surface of membranes.
c. forms part of a quadruple complex.
d. changes over time.
e. has four-fold symmetry.
Answer: a
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

34. An enzyme that has become nonfunctional due to the loss of its three-dimensional structure is said to be
a. permanently disabled.

b. reversible.
c. denatured.
d. hydrolyzed.
e. environmentalized.
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

35. Which of the following protein structures is destroyed by denaturation?
a. Primary
b. Secondary
c. Tertiary
d. Both b and c
e. All of the above
Answer: d
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

36. Which of the following solutions is *least* likely to denature an enzyme?
a. Urea
b. Vinegar
c. Milk
d. Boiling water
e. Bleach
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 5. Evaluating

37. When an egg is exposed to extreme heat, it turns from a liquid into a solid. Even when the egg is allowed to cool, these changes are not reversible. Which of the following is *not* one of the reasons that they are irreversible?
a. Water has been removed from the egg proteins.
b. The hydrogen bonds and hydrophobic interactions in the egg proteins have been broken.
c. Denatured proteins in the egg have lost secondary and tertiary structure.
d. Denatured proteins in the egg have aggregated due to lack of chaperone proteins in the egg.
e. Fats in the egg have become saturated and less fluid.
Answer: e
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 4. Analyzing

38. If an amino acid involved in the ability of an enzyme to bind a substrate were changed from a tyrosine to a phenylalanine, what would happen to the enzyme?
a. Nothing would change because both residues have hydrophobic properties.

b. The change in amino acid would cause disulfide bonds to form, thus increasing its binding ability.
c. Nothing would change because both residues have polar side chains.
d. Quaternary structure would be affected because subunits would not be able to bind together.
e. The ability of the substrate to bind to the enzyme would be affected because of the change in R groups.
Answer: e
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 4. Analyzing

39. If a hydrophilic amino acid on the surface of an enzyme were changed to hydrophobic instead, a number of results could be possible. Which of the following is *not* one of these possible results?
a. The activity of the enzyme could remain unchanged.
b. The enzyme could alter its folding to imbed the hydrophobic region in the membrane.
c. The function of the enzyme could be affected because it would no longer be able to bind the correct substrate.
d. The tertiary structure could be affected due to the interaction between the environment and the R group
e. The protein's ability to form peptide bonds could be affected.
Answer: e
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 3. Applying

40. Researchers find that removing an enzyme from a neutral pH environment and placing it in an acidic pH environment causes a loss of activity. However, when the enzyme is returned to its original neutral pH, its activity has doubled from its original state. What is one possible explanation for this observation?
a. The enzyme has refolded differently due to an absence of chaperones, and now the active site is more available to the substrate.
b. The R groups were chemically altered with a phosphate group from the acid, increasing the energy of the enzyme.
c. The temporary decrease in pH cleaved all of the disulfide bonds, giving the enzyme more energy.
d. The pH change increased the mobility of the enzyme, allowing it to process more substrate.
e. None of the above
Answer: a
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 5. Evaluating

41. When an organism is exposed to extreme heat, _____ can help return its enzymes to their proper functions.
a. hydrolysis reactions
b. condensation reactions

c. protein chaperones
d. amino acids
e. carbohydrates
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

42. A type of protein that functions by helping other proteins fold correctly is called a
a. foldzyme.
b. renaturing protein.
c. chaperone.
d. hemoglobin.
e. denaturing protein.
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

43. A molecule with the formula $C_{15}H_{30}O_{15}$ is a
a. hydrocarbon.
b. carbohydrate.
c. lipid.
d. protein.
e. nucleic acid.
Answer: b
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 3. Applying

44. The atoms that make up carbohydrates are
a. C, H, and N.
b. C and H.
c. C, H, and P.
d. C, H, and O.
e. C, H, O, and N.
Answer: d
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 1. Remembering

45. A carbohydrate with 12 oxygen molecules would have _____ hydrogen molecules.
a. 6
b. 12
c. 18
d. 24
e. None of the above; the number of hydrogen molecules cannot be determined from the number of oxygen molecules.

Answer: d
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 3. Applying

46. What is the difference between α-glucose and β-glucose?
a. They have different numbers of covalent bonds.
b. They differ in the placement of their OH and H groups.
c. They have a different R group attached to the terminal carbon.
d. α-glucose is polar, whereas β-glucose is nonpolar.
e. α-glucose is a pentose, whereas β-glucose is a hexose.
Answer: b
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 1. Remembering

47. Glucose and fructose both have the formula $C_6H_{12}O_6$, but the atoms in these two compounds are arranged differently. Glucose and fructose are therefore
a. isomers.
b. polysaccharides.
c. stereosaccharides.
d. pentoses.
e. isotopes.
Answer: a
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 2. Understanding

48. The monomers that make up polymeric carbohydrates like starch are called
a. nucleotides.
b. trisaccharides.
c. monosaccharides.
d. nucleosides.
e. fatty acids.
Answer: c
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 1. Remembering

49. A simple sugar with the formula $C_5H_{10}O_5$ can be classified as a
a. hexose.
b. polysaccharide.
c. disaccharide.
d. pentose.
e. lipid.
Answer: d

Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 3. Applying

50. DNA and RNA both include
a. pentoses.
b. hexoses.
c. fructoses.
d. maltoses.
e. amyloses.
Answer: a
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 2. Understanding

51. Lactose, or milk sugar, is composed of one glucose unit and one galactose unit. It can therefore be classified as a
a. disaccharide.
b. hexose.
c. pentose.
d. polysaccharide.
e. monosaccharide.
Answer: a
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 2. Understanding

52. Maltose and sucrose are similar in that they both are
a. simple sugars.
b. amino acids.
c. insoluble in water.
d. disaccharides.
e. hexoses.
Answer: d
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 2. Understanding

53. Seeds contain dense aggregates of starch. Water is needed to
a. break the hydrogen bonds in the starch aggregates, facilitating the seeds' access to energy storage.
b. break the peptide bonds in the starch polymers in order to release more water for the plant.
c. activate enzymes that will dissolve the starch into its disaccharide monomers that are used for plant growth.

d. dissolve the starch so that it can mix with fats and create new energy compounds utilized by the growing plant.
e. help transport starch across membranes, allowing communication between the newly growing plant cells.
Answer: a
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 3. Applying

54. Why does a starchy food, like bread, become hard when it dries out?
a. Cellulose molecules in the cells aggregate in the absence of water.
b. In the absence of water, unbranched starch molecules aggregate together by forming hydrogen bonds.
c. The release of carbon dioxide from drying starch causes the bread to harden.
d. The remaining water and heat cause the polysaccharide chains to bind together.
e. Mold growth interferes with α linkages, causing the bread to harden.
Answer: b
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 4. Analyzing

55. Starch and glycogen are different in that only one of them
a. is a polymer of glucose.
b. contains ribose.
c. is made in plants.
d. is an energy storage molecule.
e. can be digested by humans.
Answer: c
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 2. Understanding

56. Starch and glycogen are similar in that they
a. both store genetic information.
b. are both polymers of amino acids.
c. are both composed of fructose monomers.
d. both contain carbon, hydrogen, and oxygen.
e. both denature into a peptide backbone.
Answer: d
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 2. Understanding

57. Starch and glycogen, which are both polysaccharides, differ in their functions in that starch is _____, whereas glycogen _____.
a. the main component for plant structural support; is an energy source for animals

b. a structural material found in plants and animals; forms external skeletons in animals
c. the principle energy storage compound of plants; is the main energy storage of animals
d. a temporary compound used to store glucose; is a highly stable compound that stores complex lipids
e. is the main energy storage of animals; a temporary compound used to store glucose
Answer: c
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 2. Understanding

58. The main function of cellulose, the most abundant organic compound on Earth, is
a. to store genetic information.
b. as a storage compound for energy in plant cells.
c. as a storage compound for energy in animal cells.
d. as a component of biological membranes.
e. to provide mechanical strength to plant cell walls.
Answer: e
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 1. Remembering

59. If you chew a cracker long enough, it eventually tastes sweet. This is because the amylase enzyme in your saliva is
a. breaking down the starch into monosaccharides.
b. causing the release of glucose from glycogen stores.
c. breaking down the quaternary structure of the starch.
d. emulsifying the lipids.
e. chemically modifying your taste buds.
Answer: a
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 3. Applying

60. If an unknown substance dissolves when placed in water, this substance is *least* likely
a. glycogen.
b. a starch.
c. composed of chitin.
d. a lipid.
e. Any of the above
Answer: d
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 5. Evaluating

61. Chitin is a polymer of
a. galactosamine.

b. glucose.
c. glucosamine.
d. glycine.
e. All of the above
Answer: c
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 1. Remembering

62. Lipids are
a. insoluble in water.
b. important for energy storage.
c. hydrophobic.
d. important constituents of biological membranes.
e. All of the above
Answer: e
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

63. Oil and water do not mix easily because _____ cause the fat molecules of the oil to aggregate together in water.
a. van der Waals forces
b. covalent bonds
c. disulfide bonds
d. ester linkages
e. glycosidic linkages
Answer: a
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

64. Which of the following statements about fatty acids molecules is true?
a. They contain three fats bonded to a glycerol.
b. They are composed of hydrocarbon tails and a carboxyl group.
c. They are carbohydrates linked to a hydrocarbon chain.
d. They contain glycerol and a carboxyl group.
e. They become saturated at low pH.
Answer: b
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

65. A fat contains fatty acids and
a. glycerol.
b. a base.
c. an amino acid.
d. a phosphate.
e. glucose.

Answer: a
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 1. Remembering

66. Lipids play an important role in a number of functions. Which of the following is *not* one of those functions?
a. Vision
b. Energy storage
c. Membrane structure
d. Storing of genetic information
e. Chemical signaling
Answer: d
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

67. Which of the following statements about lipids is *false*?
a. They are readily soluble in water.
b. They may help capture light energy.
c. They release large amounts of energy when broken down.
d. They may form two layers when mixed with water.
e. They can act as an energy storehouse.
Answer: a
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

68. You have isolated an unidentified liquid from a sample of beans. You add the liquid to a beaker of water and shake vigorously. After a few minutes, the water and the other liquid separate into two layers. To which class of large biological molecules does the unknown liquid most likely belong?
a. Carbohydrates
b. Lipids
c. Proteins
d. Enzymes
e. Nucleic acids
Answer: b
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 3. Applying

69. A molecule that has an important role in limiting what gets into and out of cells is
a. glucose.
b. maltose.
c. phospholipid.
d. fat.
e. phosphohexose.
Answer: c
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?

Bloom's Category: 2. Understanding

70. You look at the label on a container of shortening and see the words "hydrogenated vegetable oil." This means that during processing, the number of carbon–carbon double bonds in the oil was decreased and the
a. oil now has a lower melting point.
b. oil is now solid at room temperature.
c. fatty acid chains now have more "kinks."
d. oil is now a derivative carbohydrate.
e. fatty acid is now a triglyceride.
Answer: b
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 3. Applying

71. The portion of a phospholipid that contains the phosphorous group has one or more electric charges. The charged region of the molecule is
a. hydrophobic.
b. hydrophilic.
c. nonpolar.
d. unsaturated.
e. saturated.
Answer: b
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

72. Unsaturated fatty acids do not pack together due to the _____ in their hydrocarbon chains.
a. double bonds
b. glycosidic linkages
c. peptide bonds
d. disulfide bridges
e. van der Waals forces
Answer: a
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

73. You are given two fatlike solid substances and determine that sample A has a higher melting point than sample B. Sample A, therefore,
a. has a higher number of carbon–carbon double bonds.
b. has a lower number of carbon–carbon double bonds.
c. is a saturated fat and sample B is an unsaturated fat
d. is an unsaturated fat and sample B is a saturated fat
e. is a triglyceride and sample B is a simple lipid.
Answer: b
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 4. Analyzing

74. Lipids form the barriers surrounding various compartments within an organism. Which property of lipids makes them a good barrier?
a. Many biologically important molecules are not soluble in lipids.
b. They contain fatty acids.
c. They contain glycerol.
d. They are the basis for hormones and other signaling molecules.
e. Large amounts of energy are released when they are broken down.
Answer: a
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 4. Analyzing

75. In a biological membrane, the phospholipids are arranged with the fatty acid chains facing the interior of the membrane. As a result, the interior of the membrane is
a. hydrophobic.
b. hydrophilic.
c. charged.
d. polar.
e. filled with water.
Answer: a
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

76. Molecules that are both attracted to water and repel water are called
a. hydrophilic.
b. hydrophobic.
c. amphipathic.
d. amphoric.
e. glycosidic.
Answer: c
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 1. Remembering

77. Cholesterol is soluble in ether, a nonpolar organic solvent, but it is not soluble in water. Based on this information, to which class of biological macromolecules does cholesterol belong?
a. Nucleic acids
b. Carbohydrates
c. Proteins
d. Enzymes
e. Lipids
Answer: e
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 3. Applying

78. Steroids are classified as lipids because they

a. have a ring structure similar to glucose.
b. are amphipathic.
c. are composed of nonpolar and hydrophobic molecules.
d. are composed of molecules that are bound together with glycosidic linkages.
e. form α and β isomers.
Answer: c
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

79. Which of the following vitamins is excreted in urine instead of being stored in fatty tissue in your body?
a. Vitamin A
b. Vitamin D
c. Vitamin E
d. Vitamin K
e. None of the above
Answer: e
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 3. Applying

80. Waxes are formed by the
a. addition of water to fatty acids.
b. removal of water from fatty acids.
c. combining of fatty acids with alcohol.
d. condensing of fatty acids with glycerol.
e. combining of fatty acids with vitamin A.
Answer: c
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 1. Remembering

Fill in the Blank

1. Starch is a polymer of glucose subunits. The subunits of any polymer are called _____.
Answer: monomers
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Bloom's Category: 2. Understanding

2. The functional group written as —COOH is called the _____ group.
Answer: carboxyl
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Bloom's Category: 1. Remembering

3. Due to its six hydroxyl groups attached to its six-carbon backbone, the carbohydrate compound inositol can be classified as a(n) _____.
Answer: alcohol

Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Bloom's Category: 2. Understanding

4. The reaction H—A—OH + H—B—OH → H—A—B—OH + H_2O represents a(n) _____ reaction.
Answer: condensation
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Bloom's Category: 3. Applying

5. All amino acids have a hydrogen atom, an amino group, an R group, and a(n) _____ group.
Answer: carboxyl
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

6. In proteins, amino acids are linked together by _____ bonds.
Answer: peptide
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

7. The linear arrangement of amino acids in the polypeptide chain is referred to as the _____ structure of the protein.
Answer: primary
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

8. van der Waals forces can form between _____ side chains in proteins.
Answer: hydrophobic
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

9. The covalent bond formed between the sulfur atoms of two cysteine side chains is called a(n) _____.
Answer: disulfide bridge
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

10. Carbohydrates made up of two simple sugars are called _____.
Answer: disaccharides
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 1. Remembering

11. The bonds that link sugar monomers in a starch molecule are _____ bonds.
Answer: glycosidic

Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 1. Remembering

12. Fructose has a five-member ring like deoxyribose and ribose. However, fructose is not classified as a pentose because it has _____ total carbon atoms.
Answer: six
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 3. Applying

13. In response to low blood sugar, the body breaks down _____ stored in the liver into monomers of _____.
Answer: glycogen; glucose
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 3. Applying

14. The highly branched polysaccharide that stores glucose in the muscles and the liver of animals is _____.
Answer: glycogen
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 1. Remembering

15. Glucosamine and galactosamine are monosaccharides in which a hydroxyl group has been replaced by a(n) _____ group.
Answer: amino
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 1. Remembering

16. A(n) _____ linkage connects the fatty acid molecule to glycerol.
Answer: ester
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 1. Remembering

17. Fatty acids with more than one carbon–carbon double bond are called _____.
Answer: polyunsaturated
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 1. Remembering

18. The fluidity and melting point of fatty acids are partially determined by the number of _____ bonds.
Answer: unsaturated (or carbon double)
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?

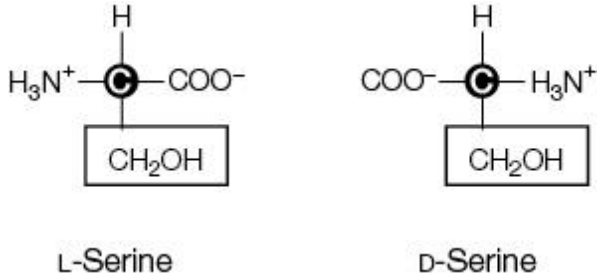
Bloom's Category: 1. Remembering

19. Cholesterol is classified as a(n) _____.
Answer: lipid (or steroid)
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 1. Remembering

20. Vitamins D, E, and K have a multiple-ring structure and are classified as _____.
Answer: lipids
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 1. Remembering

Diagram

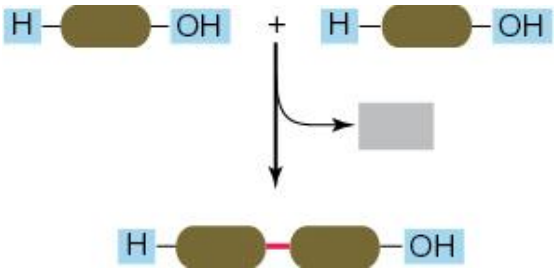
1.–2. Refer to the figure below.



1. The molecules in the figure are
a. structural isomers.
b. optical isomers.
c. hydrophobic.
d. hydrophilic.
e. Both b and d
Answer: e
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Bloom's Category: 4. Analyzing

2. The molecules in the figure are joined in polymeric chains with other amino acids by _____ bonds.
a. peptide
b. hydrogen
c. glycosidic
d. ionic
e. disulfide
Answer: a
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

3.–5. Refer to the diagram below showing a condensation reaction.

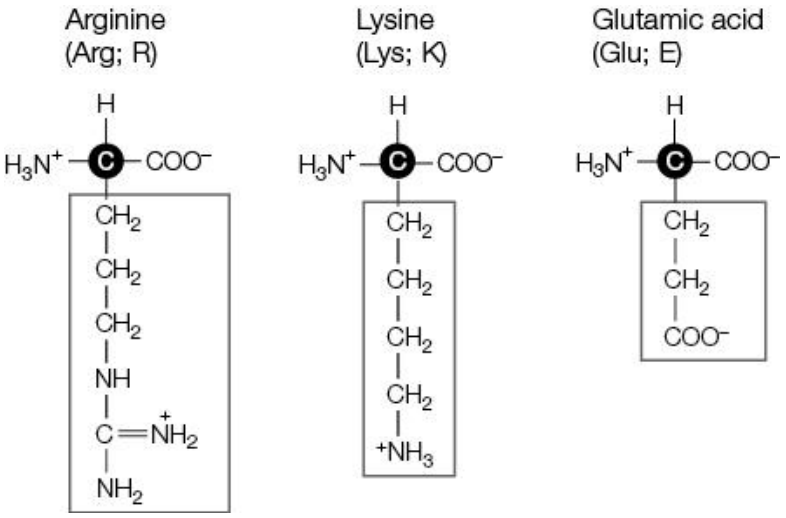


3. Fill in the gray box with the correct molecule.
Answer: Water (or H_2O)
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things
Bloom's Category: 3. Applying

4. The reaction shown in the diagram does *not* occur during the formation of a(n)
a. peptide bond.
b. glycosidic linkage.
c. disulfide bond.
d. ester linkage.
e. polypeptide chain.
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?; 3.3 What Are the Chemical Structures and Functions of Carbohydrates?; 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 3. Applying

5. The reaction shown in the diagram occurs during the formation of which protein structure?
a. Peptide backbone
b. α helix
c. β sheet
d. Disulfide bridge
e. Ionic bond
Answer: a
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 3. Applying

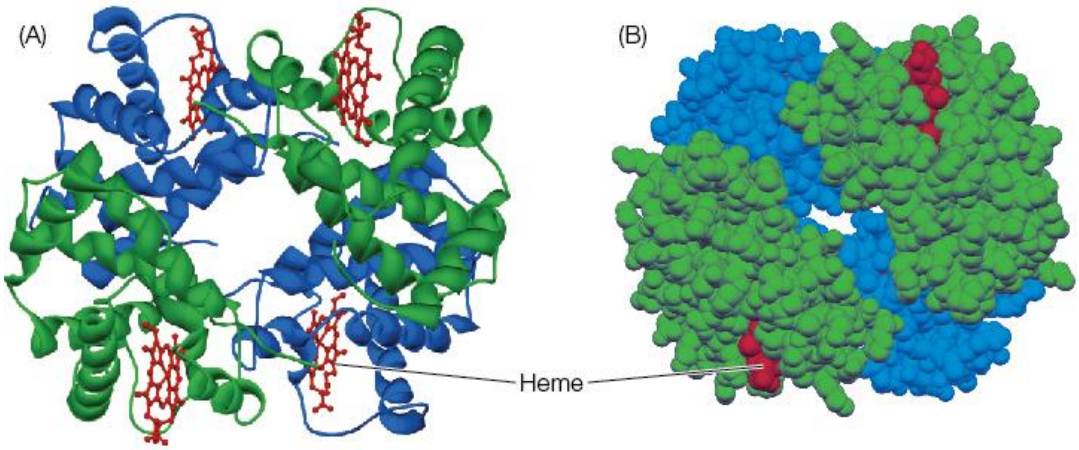
6.–7. Refer to the figure below.



6. The three amino acids shown
a. are hydrophilic.
b. are hydrophobic.
c. have positively charged R groups.
d. form disulfide bridges.
e. are smaller than the other amino acids.
Answer: a
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 3. Applying

7. During the creation of a peptide backbone, these amino acids will form
a. disulfide bridges.
b. ester linkages.
c. hydrogen bonds.
d. peptide bonds.
e. glycosidic linkages.
Answer: d
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

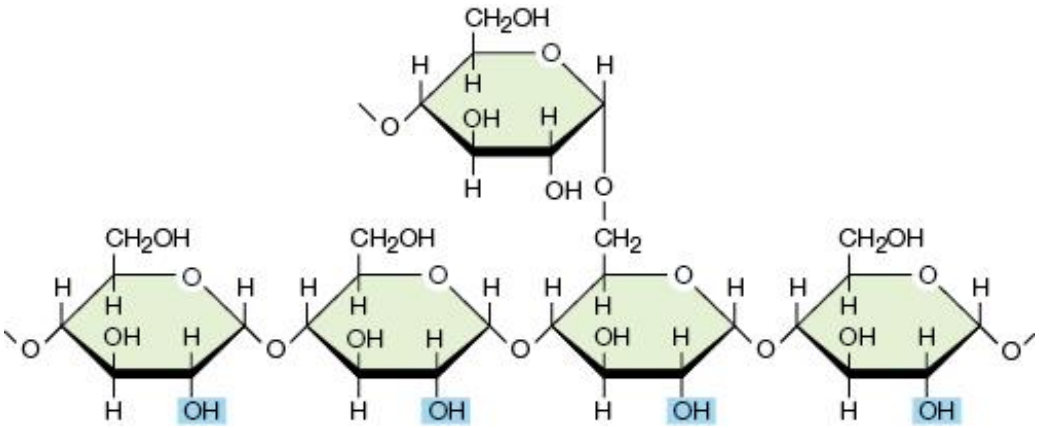
8.–9. Refer to the figure below of a hemoglobin protein.



8. The hemoglobin protein has four subunits. If it were exposed to high temperatures, it would most likely
a. remain unchanged, since it is protected by the interaction of the R subunits.
b. become covalently modified.
c. become denatured into four peptide backbones.
d. release amino acids when the peptide bonds break.
e. show increased function in activity assays.
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 3. Applying

9. If a hemoglobin exposed to high temperatures is returned to normal temperature in the presence of chaperone proteins, it will refold _____ and _____ function.
a. correctly; lose
b. correctly; regain
c. incorrectly; lose
d. incorrectly; regain
e. incorrectly; gain new
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

10.–12. Refer to the diagram below of a polysaccharide.

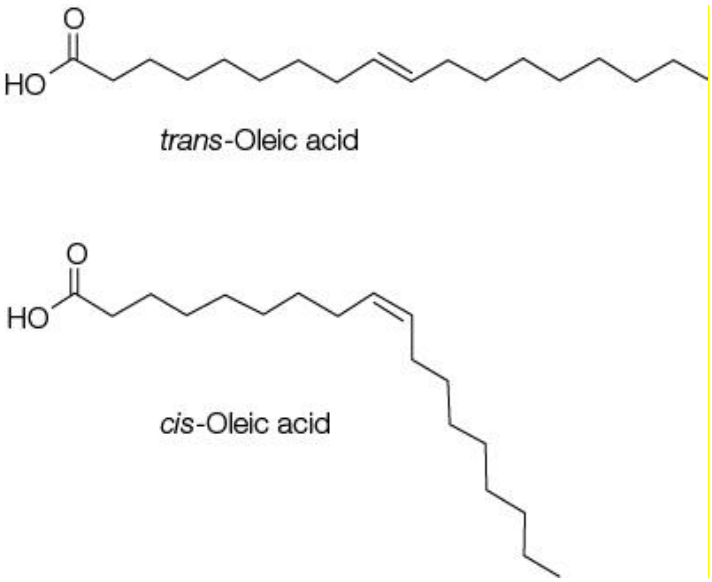


10. The polysaccharide shown in the diagram contains five molecules of _____.
Answer: glucose
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 2. Understanding

11. The monosaccharides shown in the diagram are linked by
a. disulfide bridges.
b. glycosidic linkages.
c. peptide bonds.
d. noncovalent bonds.
e. ionic bonds.
Answer: b
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 2. Understanding

12. The formation of bonds or linkages, as shown in the diagram, result in the production of _____ as a by-product.
a. energy
b. heat
c. CO_2
d. water
e. light
Answer: d
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 3. Applying

13.–15. Refer to the figure below showing the chemical structures of *cis*- and *trans*-isomers of oleic acid. The *trans*-oleic, also known as elaidic acid, is the main trans fat in the hydrogenated vegetable oil found in food. (Note: Each single line represents a single covalent bond. Carbons are at the vertices and are not labeled).

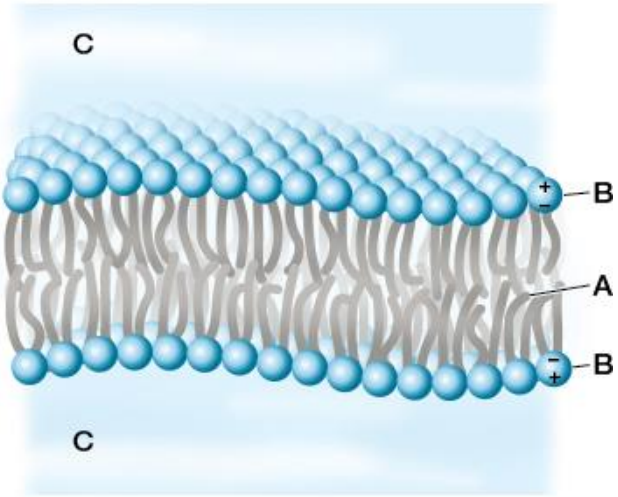


13. What kind of bond leads to a "kink" in the *cis*-oleic acid but not in the *trans*-oleic acid, as shown in the figure?
a. C—C
b. C=C
c. C—O
d. C=O
e. C—OH
Answer: b
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

14. These fatty acids are acidic because of the presence of a _____ in the molecules.
a. carboxyl group (—COOH)
b. hydroxyl group (—OH)
c. C—OH bond
d. C=C double bond
e. All of the above
Answer: a
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 4. Analyzing

15. Which part of the *cis*-oleic acid molecule is hydrophobic?
a. The carboxyl group (—COOH)
b. The hydrocarbon chain (—$[CH_2]_n$)
c. The C—OH bond
d. The C=C double bond
e. All of the above
Answer: b
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

16.–17. Refer to the diagram below of a phospholipid bilayer.



16. The membrane structure shown in the diagram forms in water because the individual phospholipids
a. have a hydrophilic head.
b. have a hydrophobic head.
c. are amphipathic.
d. have a hydrophobic tail.
e. have a hydrophilic tail.
Answer: c
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

17. With reference to the diagram, a steroid hormone would be found in region _____, a hydrophobic protein would be found in region _____, and a hydrophilic protein would be found in region _____.
Answer: A; A; B or C
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 4. Analyzing

DIAGNOSTIC QUIZ QUESTIONS (from BioPortal)

(By Amy Burnside)

1. Cholesterol is soluble in chloroform, a nonpolar organic solvent, but it is not soluble in water. Based on this information, what class of biological macromolecules does cholesterol belong to?
a. Oligosaccharides
b. Carbohydrates
c. Proteins

d. Enzymes
e. Lipids
Answer: e
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?; 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 4. Analyzing

2. There are a number of functional groups in biological molecules. Which of the following about their presence in different classes of molecules is most accurate?
a. Hydroxyl groups are only present in carbohydrates.
b. Aldehyde groups are common in proteins.
c. Amino groups may be found in modified carbohydrates and in proteins.
d. Carboxyl groups are found in small molecules but not in macromolecules.
e. Sulfhydryl groups are important features of fats.
Answer: c
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?; 3.2 What Are the Chemical Structures and Functions of Proteins?; 3.3 What Are the Chemical Structures and Functions of Carbohydrates?; 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

3. Which of the following physiological functions is *not* usually served by proteins?
a. Catalysis
b. Energy reserve
c. Structural support
d. Defense
e. Hormone binding
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

4. Which of the following amino acids would, when incorporated into a polypeptide chain (not at the N or C terminus), make the charge of the polypeptide more positive?
a. Alanine
b. Arginine
c. Aspartate
d. Serine
e. Cysteine
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 3. Applying

5. Which of the following functional groups is found in the R group of the amino acid cysteine?
a. —SH
b. —OH

c. —NH_2
d. —COO
e. —CHO
Answer: a
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

6. Where would the leucine side chain most likely be found in a protein dissolved in water?
a. In the interior of the protein in contact with nonpolar side chains
b. In the interior of the protein in contact with polar side chains
c. On the exterior of the protein
d. In the interior of the protein in contact with water
e. Either on the interior or exterior of the protein
Answer: a
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 4. Analyzing

7. The primary structure of proteins is the _____. The primary structure contains the information necessary for the formation of secondary structure, including the _____ and the _____. Secondary structure of proteins is stabilized by the formation of _____ bonds.
a. amino acid sequence; β pleated sheet; α helix; disulfide
b. α helix; amino acid sequence; β pleated sheet; hydrophobic
c. amino acid sequence; α helix; β pleated sheet; hydrogen
d. amino acid sequence; α helix; β pleated sheet; peptide
e. β pleated sheet; α helix; amino acid sequence; hydrogen
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

8. Quaternary structure of proteins refers to
a. the arrangement of the protein's atoms in three-dimensional space.
b. whether the polypeptide chain is an α helix or β pleated sheet.
c. the number and kind of polypeptide subunits the protein has.
d. the four-fold symmetry of the protein.
e. the lipids or carbohydrates that are attached to the proteins.
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

9. Which of the following statements about to protein structure is *false*?
a. Chaperones may assist in folding proteins.
b. Most of the interactions that stabilize folded proteins are covalent.
c. α helix and β pleated sheets are common secondary structures in proteins.
d. Proper folding is essential to the function of a protein.

e. Some proteins contain more than one polypeptide chain.
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 4. Analyzing

10. Molecular chaperones
a. are small molecules present in the cytoplasm.
b. are made in lesser amounts after exposure of an organism to high temperatures.
c. are enzymes that add functional groups onto polypeptides.
d. can prevent harmful interactions caused by improperly folded proteins.
e. bind proteins irreversibly to denature them.
Answer: d
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

11. Which of the following biological molecules is/are linked by covalent bonds formed by the removal of water from the reactants (condensation reaction)?
a. Oils
b. Waxes
c. Proteins
d. Starch
e. All of the above
Answer: e
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?; 3.3 What Are the Chemical Structures and Functions of Carbohydrates?; 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

12. The "building blocks" of polysaccharides are _____ and the blocks are covalently linked together by _____ bonds.
a. glycerol and fatty acids; ester
b. amino acids; peptide
c. monosaccharides; glycosidic
d. phospholipids; ester
e. disaccharides; glycosidic
Answer: c
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 2. Understanding

13. Which of the following statements about starch is *false*?
a. It may be partially branched.
b. It is a polymer of glucose.
c. It is formed by the condensation of monomers.
d. It has properties very similar to those of cellulose.
e. It can be digested by humans.

Answer: d
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 4. Analyzing

14. Chitin is
a. a polymer of glucose.
b. present in the cell walls of plants.
c. a soluble molecule.
d. used as an energy reserve in fungi.
e. a polymer of a modified sugar.
Answer: e
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 2. Understanding

15. The main function of cellulose is
a. to provide mechanical strength to plant cell walls.
b. as a storage compound for energy in plant cells.
c. as a storage compound for energy in animal cells.
d. as a component of biological membranes.
e. to provide mechanical strength to insect cell walls.
Answer: a
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 2. Understanding

16. Oils and fats
a. form membranes.
b. are triglycerides.
c. all contain the same fatty acids.
d. are good for humans in large amounts.
e. have peptide bonds.
Answer: b
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

17. Based on its structure, a fat is most closely related to which of the following molecules?
a. A wax
b. A phospholipid
c. An oil
d. Cholesterol
e. A carotenoid
Answer: c
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?

Bloom's Category: 2. Understanding

18. Fatty acids are
a. carboxylic acids with long hydrocarbon tails.
b. linked to glycerol in fats by phosphodiester bonds.
c. saturated hydrocarbons.
d. large polymers of monosaccharides.
e. generally present in water-soluble proteins.
Answer: a
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

19. Olive oil melts at a lower temperature than beef fat because
a. oils contain glycerol whereas fats do not.
b. fats contain more saturated fatty acids than oils do.
c. fats contain more unsaturated fatty acids than oils do.
d. oils are made by plants whereas fats are made by animals.
e. olive trees occur in warmer climates than beef cattle do.
Answer: b
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 3. Applying

20. Phospholipids differs from triglycerides in that phospholipids
a. are not derivatives of glycerol.
b. are amphipathic.
c. do not have both hydrophilic and hydrophobic parts.
d. are used to store energy for the cell.
e. do not contain fatty acids.
Answer: b
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 4. Analyzing

LEARNINGCURVE QUESTIONS (from BioPortal)

(By Amy Burnside)

1. Proteins, carbohydrates, and nucleic acids are large molecules made up of monomers linked together by
a. covalent bonds.
b. ionic bonds.
c. hydrogen bonds.
d. disulfide bonds.
e. van der Waals bonds.
Answer: a
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Difficulty: Easy

Bloom's Category: 1. Remembering

2. Hydroxyl groups are polar, and thus a molecule that contains multiple hydroxyl groups will be
a. basic.
b. soluble in water.
c. involved in reactions forming more complex molecules.
d. nonpolar.
e. hydrophobic.
Answer: b
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Difficulty: Hard
Bloom's Category: 4. Analyzing

3. The reactive _____ contributes to the ability of aldehydes and ketones to be involved in energy reactions.
a. phosphate
b. C=O (carbonyl)
c. sulfur
d. "R" group
e. nitrogen
Answer: b
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Difficulty: Hard
Bloom's Category: 4. Analyzing

4. The functional groups of organic molecules help to determine all of the following *except*
a. interaction of the molecule with the environment.
b. the shape of the molecule.
c. specific properties of the molecule.
d. interactions with other specific functional groups of the same molecule.
e. antagonistic interactions among molecules, creating multiple forces that drive chemical reactions.
Answer: e
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Difficulty: Hard
Bloom's Category: 4. Analyzing

5. Molecules with the same chemical formula but different arrangement of atoms are
a. macromolecules.
b. isomers.
c. nucleic acids.
d. amino acids.
e. partners.
Answer: b

Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Difficulty: Easy
Bloom's Category: 2. Understanding

6. A structural isomer for the molecule $NaOCH_2CH_3$ would be expected to have how many carbon atoms?
a. 1
b. 2
c. 3
d. 5
e. 9
Answer: b
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Difficulty: Medium
Bloom's Category: 3. Applying

7. Optical isomers
a. are centered around carbon double bonds.
b. come in *cis* and *trans* forms.
c. have a different arrangement but the same number of atoms.
d. are mirror images of each other in structure.
e. do not exist in nature.
Answer: d
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Difficulty: Medium
Bloom's Category: 2. Understanding

8. *Cis* and *trans* isomers
a. have similar properties despite opposite orientations in structure.
b. have the same structure, but the *cis* form has an extra double bond.
c. have the same structure but the trans form has an extra double bond.
d. are mirror images of each other in structure.
e. are centered around a double bond with atoms on either side in different orientations with respect to each other.
Answer: e
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Difficulty: Hard
Bloom's Category: 2. Understanding

9. Of the nonmineral components of a living organism, the most prevalent macromolecule is
a. water.
b. polypeptides.
c. polysaccharides.
d. nucleic acids.
e. lipids.

Answer: b
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Difficulty: Medium
Bloom's Category: 1. Remembering

10. A hydrolysis reaction requires
a. water.
b. oxygen.
c. hydrogen.
d. hydroxyl group.
e. carboxyl group.
Answer: a
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Difficulty: Easy
Bloom's Category: 1. Remembering

11. Monomers are joined together by _____ and broken down by _____.
a. proteins; lipids
b. condensation; hydrolysis
c. phosphorylation; dephosphorylation
d. acids; bases
e. hydrogen; oxygen
Answer: b
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Difficulty: Easy
Bloom's Category: 2. Understanding

12. A condensation reaction
a. uses carboxyl groups in beginning catabolism.
b. requires oxygen when forming glycosidic linkages.
c. removes water when linking together amino acids.
d. gives hydrogen during the formation of hydrogen bonds.
e. adds hydroxyl groups to nucleic acid linkages.
Answer: c
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Difficulty: Medium
Bloom's Category: 4. Analyzing

13. All of the following are typical functions of proteins *except*
a. defense.
b. transport.
c. movement.
d. information storage.
e. protection.
Answer: d
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?

Difficulty: Easy
Bloom's Category: 2. Understanding

14. The three-dimensional structure of a protein(s)
a. is determined by the sequence of amino acids in the polypeptide chain.
b. always contains multiple polypeptide chains.
c. cannot be altered once folded by chaperone proteins.
d. will be different in different organisms, despite the same amino acid sequence.
e. is not related to its function.
Answer: a
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Easy
Bloom's Category: 2. Understanding

15. An amino acid is considered both an acid and a base because it has an amino and a carboxyl functional group, which are ionized by the addition or loss of
a. an oxygen.
b. a hydrogen ion.
c. an electron.
d. a hydroxyl.
e. a phosphate.
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Easy
Bloom's Category: 2. Understanding

16. A peptide linkage forms between
a. a phosphate group and a hydroxyl group.
b. R groups.
c. the two peptide chains of a protein dimer.
d. an amino group and a carboxyl group.
e. sulfhydryl groups.
Answer: d
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Easy
Bloom's Category: 2. Understanding

17. The "R" groups of amino acids have certain properties and allow for amino acids to be organized into all of the following groups *except*
a. positively charged and hydrophilic.
b. negatively charged and hydrophilic.
c. uncharged hydrophilic.
d. positively charged and hydrophobic.
e. nonpolar hydrophobic.
Answer: d
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?

Difficulty: Medium
Bloom's Category: 1. Remembering

18. Which of the following amino acids does *not* have a charged R group?
a. Arginine
b. Histidine
c. Lysine
d. Asparagine
e. Glutamic acid
Answer: d
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Easy
Bloom's Category: 1. Remembering

19. Which amino acid substitution for alanine would *least* likely affect the three-dimensional shape of the resulting protein?
a. Tyrosine
b. Cysteine
c. Isoleucine
d. Histidine
e. Aspartic acid
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Hard
Bloom's Category: 2. Understanding

20. Amino acids with a six carbon ring are known to have fluorescent properties where they absorb light of a short wavelength and give off light at a longer wavelength. Therefore, peptides made of these amino acids are also fluorescent. Given this information, all of the following peptides would be fluorescent *except*
a. AKD.
b. MFR.
c. VWN.
d. CGY.
e. SRF.
Answer: a
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Medium
Bloom's Category: 4. Analyzing

21. Which of the following peptides could be found inside a phospholipid bilayer membrane due to its hydrophobic properties?
a. RKE
b. HGD
c. GTC
d. LMV

e. STA
Answer: d
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Medium
Bloom's Category: 3. Applying

22. A molecule that has an N—C—C repeat in its structure is classified as a
a. carbohydrate.
b. lipid.
c. protein.
d. polysaccharide.
e. fat.
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Easy
Bloom's Category: 2. Understanding

23. Protein function
a. is independent of three-dimensional structure.
b. will not be affected by changes in pH.
c. is determined by interaction of surface R groups with other molecules.
d. is the same even with covalent modifications.
e. will not change in a nonpolar environment.
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Medium
Bloom's Category: 2. Understanding

24. In an alpha helix, the coiling is stabilized by
a. the hydrophobic nature of the R chains, which causes the chain to coil with the R groups inward.
b. hydrogen bonding of the N—H groups on one amino acid and the C=O groups on another.
c. repulsion of the R chains from each other causing the coil to form with the R groups on the outside.
d. disulfide bond formation between cysteines that are regularly spaced along peptide chains.
e. the N—C—C repeat of the peptide backbone, allowing for regularly spaced peptide bonds between chain segments.
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Hard
Bloom's Category: 4. Analyzing

25. All of the following contribute to the three dimensional shape of a protein *except*
a. temperature.

b. ester linkages.
c. pH.
d. R groups.
e. peptide backbone.
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Medium
Bloom's Category: 2. Understanding

26. Which of the following interactions are *not* involved in the formation of a protein's tertiary structure?
a. Hydrogen bonds
b. van der Waals interactions
c. Disulfide bridges
d. Salt bridges
e. Peptide bonds
Answer: e
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Medium
Bloom's Category: 2. Understanding

27. Salt bridges are a part of a protein's tertiary structure and can occur between
a. glutamic acid and arginine.
b. tryptophan and valine.
c. serine and threonine.
d. histidine and lysine.
e. two cysteines.
Answer: a
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Hard
Bloom's Category: 4. Analyzing

28. All of the following require water to break *except*
a. peptide bonds.
b. ester linkages.
c. glycosidic bonds.
d. starch aggregates.
e. salt bridges.
Answer: e
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Medium
Bloom's Category: 4. Analyzing

29. Which of the following statements is true about the three-dimensional structure of a protein?
a. If you disturb the hydrogen bonding, only the primary structure will be left.

b. If you disturb the van der Waals forces, only the quaternary structure will be affected.
c. Tertiary and quaternary structures are held together by similar types of interactions.
d. Tertiary structure is independent of primary structure.
e. All proteins have primary, secondary, tertiary, and quaternary structure.
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Hard
Bloom's Category: 2. Understanding

30. Tertiary and quaternary structures share all of the following properties *except*
a. disulfide bridges.
b. multiple subunits.
c. hydrogen bonding.
d. ionic interactions.
e. van der Waals interactions.
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Medium
Bloom's Category: 2. Understanding

31. You are trying to determine something about the structure of a particular enzyme. For one of your experiments, you mutate the protein to include some cysteine residues in sections you think might be folded close to each other. You place properly folded original and mutant proteins into a denaturing solution (urea), then back into a physiological solution. You discover that your mutant has recovered more of its enzymatic activity than the nonmutant protein. What is the best explanation for this phenomenon?
a. Urea bound to cysteine residues, stabilizing the protein structure.
b. The cysteine residues formed a bond between the R groups that was not broken during denaturation, thus stabilizing protein structure.
c. The cysteine residues destabilized the structure.
d. Proteins that contain cysteine were resistant to urea denaturation.
e. Adding cysteine residues gave the enzyme higher activity.
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Hard
Bloom's Category: 4. Analyzing

32. Which of the following is true about the substrate binding pocket of a protein?
a. The R groups inside the pocket determine interactions with substrate.
b. The secondary structure components of the pocket should be a mirror image of the substrate.
c. The shape of the pocket should match the substrate.
d. Both a and b
e. Both a and c
Answer: e
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?

Difficulty: Medium
Bloom's Category: 2. Understanding

33. If a protein is placed in urea, it will retain only its
a. peptide bonds.
b. alpha sheets.
c. beta sheets.
d. hydrogen bonds.
e. ionic interactions.
Answer: a
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Hard
Bloom's Category: 4. Analyzing

34. All of the following will affect the shape of a protein *except*
a. interaction with another protein.
b. a covalent modification.
c. temperature.
d. an amino acid substitution.
e. a polar environment.
Answer: e
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Hard
Bloom's Category: 2. Understanding

35. Proteins can change their structure when they interact with other molecules. This is
a. true, because binding of a molecule to a protein alters the shape of the protein.
b. true, because van der Waals forces between molecules can change interactions between R groups within a protein.
c. true, because covalent modifications can alter intramolecular interactions.
d. false, because only a change in solvent can change protein structure.
e. a, b, and c
Answer: e
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Easy
Bloom's Category: 2. Understanding

36. All of the following can result in the misfolding of a protein *except*
a. the addition of chaperones.
b. denaturation.
c. placement in a polar substance.
d. a pH of 9.
e. placement in a nonpolar substance.
Answer: a
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Hard

Bloom's Category: 2. Understanding

37. Chaperones
a. assist protein shuttling across a cell.
b. prevent folded proteins from interacting with other molecules.
c. are involved in proper protein folding.
d. monitor peptide bond formation.
e. are only needed in times of cellular stress.
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Easy
Bloom's Category: 2. Understanding

38. You are designing an experiment that requires a protein to be exposed to high heat, yet remain functional. You find, however, that the protein has lost its function on returning to its normal physiological temperature. You determine that the loss of function is due to an error in refolding of the protein. To remedy this, you could
a. covalently modify the protein.
b. add a chaperone.
c. change the peptide backbone.
d. increase the pH.
e. add mercaptoethanol.
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Hard
Bloom's Category: 2. Understanding

39. How many unique polypeptide chains are there of 50 amino acids in length?
a. 2^{20}
b. 2^{40}
c. 20^{20}
d. 20^{40}
e. 20^{50}
Answer: e
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Difficulty: Easy
Bloom's Category: 2. Understanding

40. A molecule with the formula $C_6H_{12}O_6$ can be classified as
a. a protein.
b. a carbohydrate.
c. a lipid.
d. a fat.
e. Classification cannot be determined by formula alone.
Answer: b

Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Easy
Bloom's Category: 3. Applying

41. A carbohydrate with 24 carbon atoms can be expected to have how many hydrogen and oxygen atoms?
a. 24 H and 24 O
b. 48 H and 24 O
c. 48 H and 48 O
d. 48 H and 64 O
e. 64 H and 48 O
Answer: b
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Medium
Bloom's Category: 3. Applying

42. Carbohydrates
a. are a store of genetic information.
b. are the main structure of the plasma membrane.
c. are a base from which other molecules can be made.
d. cannot be chemically modified.
e. aid in the folding of proteins.
Answer: c
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Medium
Bloom's Category: 2. Understanding

43. All of the following are simple sugars *except*
a. mannose.
b. galactose.
c. fructose.
d. glucose.
e. sucrose.
Answer: e
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Easy
Bloom's Category: 2. Understanding

44. Glucose
a. is a disaccharide.
b. is broken down for energy.
c. is a pentose.

d. has six hydrogens.
e. is a polysaccharide.
Answer: b
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Easy
Bloom's Category: 2. Understanding

45. All of the following are structural isomers *except*
a. mannose.
b. fructose.
c. galactose.
d. glucose.
e. maltose.
Answer: e
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Hard
Bloom's Category: 4. Analyzing

46. Monosaccharides are joined together by
a. hydrolysis.
b. glycosidic linkages.
c. peptide bonds.
d. salt bridges.
e. hydrophobic reactions.
Answer: b
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Easy
Bloom's Category: 1. Remembering

47. An example of a structural isomer pairing is
a. ribose and deoxyribose.
b. maltose and sucrose.
c. glucosamine and galactosamine.
d. vitamin A and cholesterol.
e. isoleucine and valine.
Answer: b
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Hard
Bloom's Category: 4. Analyzing

48. Oligosaccharides are commonly
a. cell surface recognition signals.

b. structural isomers to polysaccharides.
c. main sources of cellular energy.
d. highly branched carbohydrates.
e. monomers from which complex carbohydrates are synthesized.
Answer: a
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Hard
Bloom's Category: 2. Understanding

49. A substance that is soluble in water and turns sweet in the presence of amylase, an enzyme that hydrolyzes glycosidic linkages, is most likely
a. hemoglobin.
b. glycogen.
c. starch.
d. glycerol.
e. collagen.
Answer: c
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Hard
Bloom's Category: 4. Analyzing

50. All starches are
a. insoluble in water.
b. linear polymers.
c. aggregates in the presence of water.
d. the principal energy storage for all organisms.
e. composed of only glucose monomers.
Answer: e
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Medium
Bloom's Category: 2. Understanding

51. Glycogen is all of the following *except*
a. a form of energy storage.
b. composed of glucose monomers.
c. highly branched.
d. a base from which cellulose is made.
e. insoluble in water.
Answer: d
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Medium
Bloom's Category: 2. Understanding

52. Two important polysaccharides made up of glucose monomers are _____ and _____.
a. guanine; cytosine
b. RNA; DNA
c. sucrose; lactose
d. cellulose; starch
e. testosterone; cortisone
Answer: d
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Easy
Bloom's Category: 1. Remembering

53. Cells break down stored energy into the usable monosaccharide glucose using
a. combustion.
b. hydrolysis.
c. salt bridges.
d. condensation.
e. glycoproteins.
Answer: b
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Easy
Bloom's Category: 2. Understanding

54. Starch and glycogen, which are both polysaccharides, differ structurally in that glycogen _____, whereas starch _____.
a. is highly branched; is moderately branched
b. consists of parallel strands; is highly branched
c. consists of a combination of branching and parallel strands; is moderately branched
d. is moderately branched; consists of parallel strands
e. is highly branched; consists of parallel strands
Answer: a
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Medium
Bloom's Category: 2. Understanding

55. Starch and glycogen, which are both polysaccharides, differ in that starch is _____, while glycogen _____.
a. the main component for plant structural support; is an energy source for animals
b. a structural material found in plants and animals; forms external skeletons in animals
c. the principal energy storage compound of plants; is the main energy storage in animals
d. a temporary compound used to store glucose; is a highly stable compound that stores complex lipids

e. the main energy storage in animals; is a temporary compound used to store glucose
Answer: c
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Medium
Bloom's Category: 2. Understanding

56. Cellulose is
a. a structural organic compound.
b. made up of α-glycosidic linkages.
c. readily soluble in water.
d. a form of energy storage.
e. highly unstable.
Answer: a
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Medium
Bloom's Category: 2. Understanding

57. An essential functional group involved in cellular energy reactions is the _____ group.
a. phosphate
b. amino
c. sulfhydryl
d. hydroxyl
e. saccharide
Answer: a
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Hard
Bloom's Category: 2. Understanding

58. All of the following are chemically modified carbohydrates *except*
a. glucosamine.
b. galactosamine.
c. chitin.
d. glucuronic acid.
e. cellulose.
Answer: e
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Easy
Bloom's Category: 1. Remembering

59. Carbohydrates are chemically modified in all of the following ways *except*
a. oxidation–reduction reactions.

b. phosphate addition.
c. amino substitution.
d. sulfhydryl reactions.
e. glycosidic reaction.
Answer: d
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Hard
Bloom's Category: 2. Understanding

60. Chemical modification of macromolecules
a. affects structure not function.
b. affects structure and function.
c. affects function not structure.
d. does not occur.
e. only occurs in plants, not animals.
Answer: b
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Difficulty: Hard
Bloom's Category: 2. Understanding

61. Fats and proteins share _____ in establishing their three-dimensional structure.
a. van der Waals forces
b. ester linkages
c. peptide bonds
d. ionic interactions
e. hydrolysis reactions
Answer: a
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Difficulty: Medium
Bloom's Category: 2. Understanding

62. Lipids differ from polysaccharides in that they
a. store energy.
b. have important structural roles.
c. are insoluble in water.
d. contain carbon.
e. can aggregate.
Answer: c
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Difficulty: Medium
Bloom's Category: 4. Analyzing

63. All of the following are examples of lipids *except*
a. chlorophylls.

b. steroids.
c. wax.
d. glucosamine.
e. oil.
Answer: d
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Difficulty: Easy
Bloom's Category: 2. Understanding

64. Butter is solid at room temperature yet liquid at higher temperatures because
a. heat causes formation of double bonds in the fatty acid molecules.
b. butter is more saturated at room temperature.
c. temperature breaks the van der Waals forces holding the fat molecules together.
d. addition of the milk protein helps the fat molecules aggregate at room temperature.
e. loss of chaperone molecules allows for the separation of the monomers.
Answer: c
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Difficulty: Hard
Bloom's Category: 4. Analyzing

65. In the creation of trans fats, hydrogen is added to unsaturated fats causing them to become more saturated and causing
a. the fat to soften.
b. the fat to lose carbon double bonds.
c. glycosidic bonds to be broken.
d. ester linkages to be broken.
e. the formation of water molecules.
Answer: b
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Difficulty: Hard
Bloom's Category: 4. Analyzing

66. Which of the following turns unsaturated fat solid at room temperature?
a. Adding hydrogen to break carbon bonds
b. Removing water to cause aggregation of the lipid molecules
c. Adding hydroxyl ions to increase carbon double bonds
d. Adding water to break the ester linkages
e. Adding glycerol
Answer: a
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Difficulty: Hard
Bloom's Category: 4. Analyzing

67. Triglycerides are composed of
a. glycerol and fatty acids.
b. phosphatidylcholine and linoleic acid.

c. carotenoids and palmitic acid.
d. aggregates of glycerol.
e. steroids and saturated fats.
Answer: a
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Difficulty: Easy
Bloom's Category: 2. Understanding

68. Compared to synthesis of a disaccharide, synthesis of a triglyceride produces _____ water molecules.
a. more
b. fewer
c. an equal number of
d. The number varies, depending on the disaccharide.
e. Neither triglycerides or disaccharides produce water molecules.
Answer: a
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Difficulty: Medium
Bloom's Category: 2. Understanding

69. Phospholipids are
a. a type of triglyceride.
b. amphipathic with hydrophilic and hydrophobic properties.
c. a functional group.
d. saturated.
e. rigid.
Answer: b
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Difficulty: Easy
Bloom's Category: 2. Understanding

70. Phospholipids form a bilayer that
a. dissolves in a liquid environment.
b. is impermeable to other molecules.
c. is held together by covalent interactions.
d. is broken down by hydrolysis.
e. has a hydrophobic core.
Answer: e
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Difficulty: Medium
Bloom's Category: 2. Understanding

71. Fats are able to perform all of the following functions *except*
a. signal from one part of the body to the other.
b. color the leaves of a tree.
c. prevent feathers from getting wet.

d. store energy.
e. dissolve polar substances.
Answer: e
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Difficulty: Medium
Bloom's Category: 2. Understanding

72. Vitamins D, K, and E would be found stored in fatty tissues because they are
a. made from proteins.
b. glycogen intermediates.
c. hydrophilic.
d. lipids.
e. minerals.
Answer: d
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Difficulty: Hard
Bloom's Category: 4. Analyzing

73. Cholesterol
a. is a vitamin.
b. is classified as a carbohydrate.
c. can only be consumed by animals and is not synthesized.
d. is involved in membrane integrity.
e. is hydrophilic.
Answer: d
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Difficulty: Easy
Bloom's Category: 1. Remembering

74. You are given an orange substance that has been isolated from plants. After several experiments, you determine that you are able to synthesize vitamin A from this substance. Thus, you determine that your original substance must have been
a. beta-carotene.
b. cholesterol.
c. chitin.
d. glycogen.
e. maltose.
Answer: a
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Difficulty: Hard
Bloom's Category: 4. Analyzing

75. Wax is all of the following *except*
a. a component of bee hives.
b. a barrier to pathogens.
c. a waterproofer.

d. an extremely short molecule.
e. made by animals and plants.
Answer: d
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Difficulty: Easy
Bloom's Category: 1. Remembering

STUDY GUIDE QUESTIONS

(By Mark Sarvary)

1. Which of the following statements about polymers is *false*?
a. Polymers are synthesized from monomers during condensation.
b. Polymers are synthesized from monomers during dehydration.
c. Polymers consist of at least two types of monomers.
d. Both a and c
e. Both b and c
Answer: e
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Bloom's Category: 1. Remembering

2. A macromolecule with many hydrogen and peptide bonds is most likely a
a. carbohydrate.
b. lipid.
c. protein.
d. nucleic acid.
e. vitamin.
Answer: c
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 2. Understanding

3. An α helix is an example of the _____ level of protein structure.
a. primary
b. secondary
c. tertiary
d. quaternary
e. hepternary
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

4. Which of the following statements about isomers is true?
a. They all have different chemical formulas but the same arrangement.
b. They are found only in proteins.
c. They can only be structural.
d. They all have the same chemical formula but different arrangements.

e. None of the above
Answer: d
Textbook Reference: 3.1 What Kinds of Molecules Characterize Living Things?
Bloom's Category: 2. Understanding

5. Cellulose and starch are composed of the same monomers but have structural and functional differences. Which of the following is the characteristic that accounts for those differences?
a. Different types of glycosidic linkages
b. Different numbers of glucose monomers
c. Different types of bonds holding them together
d. A linear shape in one versus a ring shape in the other
e. None of the above
Answer: a
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 2. Understanding

6. Which of the following statements about proteins is *false*?
a. Enzymes are proteins.
b. Proteins are part of the phospholipid bilayer.
c. Some hormones are proteins.
d. Proteins are structural components of the cell.
e. All of the above are true of proteins.
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

7. A disulfide bridge is formed by
a. two cysteine side chains.
b. two glycerol linkages.
c. two proline side chains.
d. condensation.
e. hydrolysis.
Answer: a
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

8. Triglycerides are synthesized from _____ and _____.
a. glycerol; amino acids
b. amino acids; cellulose
c. steroid precursors; starch
d. cholesterol; glycerol
e. fatty acids; glycerol
Answer: e
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?

Bloom's Category: 1. Remembering

9. Proteins consist of amino acids linked together by
a. noncovalent bonds.
b. peptide bonds.
c. phosphodiester bonds.
d. van der Waals forces.
e. Both a and b
Answer: b
Textbook Reference: 3.2 What Are the Chemical Structures and Functions of Proteins?
Bloom's Category: 1. Remembering

10. Which of the following characteristics distinguishes carbohydrates from other macromolecule types?
a. Carbohydrates are constructed of monomers that always have a ring structure.
b. Carbohydrates never contain nitrogen.
c. Carbohydrates consist of a carbon bonded to hydrogen and a hydroxyl group.
d. Carbohydrates contain glycerol.
e. None of the above
Answer: c
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 2. Understanding

11. Which of the following statements about carbohydrates is *false*?
a. Monomers of carbohydrates have six carbon atoms.
b. Monomers of carbohydrates are linked together during dehydration.
c. Carbohydrates are energy-storage molecules.
d. Carbohydrates can be used as carbon skeletons.
e. All of the above are true; none is false.
Answer: a
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 1. Remembering

12. One could predict that the R groups of amino acids located on the surface of protein molecules embedded in the interior of biological membranes would be
a. hydrophobic.
b. hydrophilic.
c. polar.
d. able to form disulfide.
e. electrically charged.
Answer: a
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 3. Applying

13. The characteristic of phospholipids that allows them to form a bilayer is their
a. hydrophilic fatty acid tail.
b. hydrophobic head.
c. hydrophobic fatty acid tail.
d. hydrophilic glycogen acid tail.
e. All of the above
Answer: c
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 1. Remembering

14. A five-carbon sugar is known as a
a. glutamine.
b. glucose.
c. hexose.
d. pentose.
e. None of the above
Answer: d
Textbook Reference: 3.3 What Are the Chemical Structures and Functions of Carbohydrates?
Bloom's Category: 1. Remembering

15. Which of the following statements about lipids is *false*?
a. Lipids are a major component of the phospholipid bilayer.
b. Lipids provide waterproofing for the surfaces of organisms.
c. Steroid hormones are lipids.
d. A number of vitamins are lipids.
e. All of the above statements are true; none is false.
Answer: e
Textbook Reference: 3.4 What Are the Chemical Structures and Functions of Lipids?
Bloom's Category: 2. Understanding

CHAPTER REVIEW QUESTIONS (from Textbook)

1. The most abundant molecule in the cell is
a. a carbohydrate.
b. a lipid.
c. a nucleic acid.
d. a protein.
e. water.
Answer: e
Bloom's Category: 1. Remembering

2. All lipids are
a. triglycerides.
b. polar.

c. hydrophilic.
d. polymers of fatty acids.
e. more soluble in nonpolar solvents than in water.
Answer: e
Bloom's Category: 1. Remembering

3. All carbohydrates
a. are polymers.
b. are simple sugars.
c. consist of one or more simple sugars.
d. are found in biological membranes.
e. are more soluble in nonpolar solvents than in water.
Answer: c
Bloom's Category: 1. Remembering

4. Which of the following statements about the primary structure of a protein is *not* true?
a. It may be branched.
b. It is held together by covalent bonds.
c. It is unique to that protein.
d. It determines the tertiary structure of the protein.
e. It is the sequence of amino acids in the protein.
Answer: a
Bloom's Category: 1. Remembering

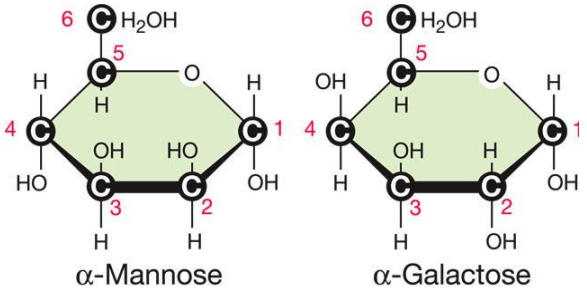
5. The amino acid leucine
a. is found in all proteins.
b. cannot form peptide linkages.
c. has a hydrophobic side chain.
d. has a hydrophilic side chain.
e. is identical to the amino acid lysine.
Answer: c
Bloom's Category: 1. Remembering

6. The amphipathic nature of phospholipids is
a. determined by the fatty acid composition.
b. important in membrane structure.
c. polar but not nonpolar.
d. shown only if the lipid is in a nonpolar solvent.
e. important in energy storage by lipids.
Answer: b
Bloom's Category: 1. Remembering

7. A single amino acid change in a protein can change its shape. Normally, at a certain position in a protein is the amino acid glycine (see Table 3.2). If glycine is replaced with either glutamic acid or arginine, the protein shape near that amino acid changes significantly. There are two possible explanations for this:

a. A small amino acid at that position in the polypeptide is necessary for normal shape.
b. An uncharged amino acid is necessary for normal shape.
Further amino acid substitutions are done to distinguish between these possibilities. Replacing glycine with serine or alanine results in normal shape; but replacing glycine with valine changes the shape. Which of the two possible explanations is supported by the observations? Explain your answer.
Answer: The observations support explanation "a." Glycine is small and nonpolar. Glutamic acid and arginine are larger and polar (charged). Serine and alanine are small: the protein retains its shape. But serine is polar (it has –OH as its R group), and that does not affect the structure. Valine is larger and nonpolar, and this affects shape. So the issue is size.
Bloom's Category: 3. Applying

8. Examine the hexose isomers mannose and galactose below. What makes them structural isomers of one another? Which functional groups do these carbohydrates contain, and what properties do these functional groups give to the molecules?



Answer: Mannose and galactose have the same atomic formula, $C_6H_{12}O_6$, but the arrangement of atoms is different: compare carbons 2 and 4. These sugars have the hydroxyl (–OH) functional group. Its polarity helps the sugars dissolve in water. The –OH group also can participate in bonding the sugar to other molecules through condensation reactions (see Figures 3.4 and 3.17).
Bloom's Category: 2. Understanding

9. How does high temperature affect protein structure? When an organism is exposed to high temperature, it often makes a special class of molecular chaperones called heat shock proteins. How do you think these proteins work?
Answer: High temperature disrupts weak interactions such as hydrogen bonds. Heat shock proteins might work by stabilizing the protein so that the weak interactions are not necessary to preserve its structure.
Bloom's Category: 2. Understanding

10. Suppose that, in a given protein, one lysine is replaced by aspartic acid (see Table 3.2). Does this change occur in the primary structure or in the secondary structure? How might it result in a change in tertiary structure? In quaternary structure?
Answer: A change from lysine is a change in primary structure. The change could affect tertiary structure if the protein folds as a result of electrostatic attractions between charged amino acids (+ to –). In this case, the presence of a negatively charged amino

acid (aspartic acid) where there should be a positively charged one (lysine) might prevent correct folding if a negatively charged amino acid elsewhere in the polypeptide chain is involved in folding (it is attracted to a + amino acid). The same forces might be at work in the interaction of separate chains for quaternary structure.
Bloom's Category: 5. Evaluating

11. Human hair is composed of the protein keratin. At the hair salon, two techniques are used to modify the three-dimensional shape of hair. Styling involves heat, and a perm involves cleaving and re-forming disulfide bonds. How would you investigate these phenomena in terms of protein structure?
Answer: See Figure 3.10. Heat breaks hydrogen bonds and other weak interactions that maintain protein shape. Disulfide bonds also required for normal protein shape. Styling and perms partially denature keratin, then renature the protein in a new shape. Your investigation might involve measuring keratin protein structure of hair before and after disrupting hydrogen bonds and disulfide bonds.
Bloom's Category: 4. Analyzing