

Chapter 5 The Structure and Function of Large Biological Molecules

Most of the new and revised questions in Chapter 5 are based on the concept of macromolecules as polymers. Questions require the student to recognize the structure, formation, properties, and function of carbohydrates, lipids, proteins, and nucleic acids. Most questions are at the Knowledge/Comprehension level, but wherever possible, Application/Analysis questions are utilized.

Multiple-Choice Questions

- 1) For this pair of items, choose the option that best describes their relationship.
- (A) The number of alpha glucose 1-4 linkages in cellulose
 - (B) The number of alpha glucose 1-4 linkages in starch
- A) Item (A) is *greater* than item (B).
 - B) Item (A) is *less* than item (B).
 - C) Item (A) is exactly or very approximately *equal* to item (B).
 - D) Item (A) may stand in more than one of the above relations to item (B).

Answer: B

Topic: Concept 5.1

Skill: Knowledge/Comprehension

- 2) For this pair of items, choose the option that best describes their relationship.
- (A) The probability of finding chitin in fungal cell walls
 - (B) The probability of finding chitin in arthropod exoskeletons
- A) Item (A) is *greater* than item (B).
 - B) Item (A) is *less* than item (B).
 - C) Item (A) is exactly or very approximately *equal* to item (B).
 - D) Item (A) may stand in more than one of the above relations to item (B).

Answer: C

Topic: Concept 5.2

Skill: Knowledge/Comprehension

- 3) For this pair of items, choose the option that best describes their relationship.
- (A) The number of cis double bonds in saturated fatty acids
 - (B) The number of cis double bonds in unsaturated fatty acids
- A) Item (A) is *greater* than item (B).
 - B) Item (A) is *less* than item (B).
 - C) Item (A) is exactly or very approximately *equal* to item (B).
 - D) Item (A) may stand in more than one of the above relations to item (B).

Answer: B

Topic: Concept 5.3

Skill: Knowledge/Comprehension

- 4) For this pair of items, choose the option that best describes their relationship.
- (A) The probability that amino acids with nonpolar side chains are hydrophobic.
 - (B) The probability that amino acids with side chains containing a carboxyl group are hydrophobic.
- A) Item (A) is *greater* than item (B).
 - B) Item (A) is *less* than item (B).
 - C) Item (A) is exactly or very approximately *equal* to item (B).
 - D) Item (A) may stand in more than one of the above relations to item (B).

Answer: A

Topic: Concept 5.4

Skill: Knowledge/Comprehension

- 5) For this pair of items, choose the option that best describes their relationship.
- (A) The number of purines in the DNA strand 5'-AAGAGGAGAAA-3'
 - (B) The number of pyrimidines in the DNA strand 5'-AAGAGGAGAAA-3'
- A) Item (A) is *greater* than item (B).
 - B) Item (A) is *less* than item (B).
 - C) Item (A) is exactly or very approximately *equal* to item (B).
 - D) Item (A) may stand in more than one of the above relations to item (B).

Answer: A

Topic: Concept 5.5

Skill: Application/Analysis

- 6) Which of the following is not a polymer?
- A) glucose
 - B) starch
 - C) cellulose
 - D) chitin
 - E) DNA

Answer: A

Topic: Concept 5.1

Skill: Knowledge/Comprehension

- 7) What is the chemical mechanism by which cells make polymers from monomers?
- A) phosphodiester linkages
 - B) hydrolysis
 - C) dehydration reactions
 - D) ionic bonding of monomers
 - E) the formation of disulfide bridges between monomers

Answer: C

Topic: Concept 5.1

Skill: Knowledge/Comprehension

8) How many molecules of water are needed to completely hydrolyze a polymer that is 11 monomers long?

- A) 12
- B) 11
- C) 10
- D) 9
- E) 8

Answer: C

Topic: Concept 5.1

Skill: Knowledge/Comprehension

9) Which of the following best summarizes the relationship between dehydration reactions and hydrolysis?

- A) Dehydration reactions assemble polymers, and hydrolysis reactions break down polymers.
- B) Macromolecular synthesis occurs through the removal of water and digestion occurs through the addition of water.
- C) Dehydration reactions can occur only after hydrolysis.
- D) Hydrolysis creates monomers, and dehydration reactions break down polymers.
- E) A and B are correct.

Answer: E

Topic: Concept 5.1

Skill: Knowledge/Comprehension

10) Which of the following polymers contain nitrogen?

- A) starch
- B) glycogen
- C) cellulose
- D) chitin
- E) amylopectin

Answer: D

Topic: Concept 5.2

Skill: Knowledge/Comprehension

11) The molecular formula for glucose is $C_6H_{12}O_6$. What would be the molecular formula for a molecule made by linking three glucose molecules together by dehydration reactions?

- A) $C_{18}H_{36}O_{18}$
- B) $C_{18}H_{30}O_{15}$
- C) $C_6H_{10}O_5$
- D) $C_{18}H_{10}O_{15}$
- E) $C_3H_6O_3$

Answer: B

Topic: Concept 5.2

Skill: Application/Analysis

12) The enzyme amylase can break glycosidic linkages between glucose monomers only if the monomers are the α form. Which of the following could amylase break down?

- A) glycogen
- B) cellulose
- C) chitin
- D) A and B only
- E) A, B, and C

Answer: A

Topic: Concept 5.2

Skill: Knowledge/Comprehension

13) On food packages, to what does the term "insoluble fiber" refer?

- A) cellulose
- B) polypeptides
- C) starch
- D) amylopectin
- E) chitin

Answer: A

Topic: Concept 5.2

Skill: Knowledge/Comprehension

14) A molecule with the chemical formula $C_6H_{12}O_6$ is probably a

- A) carbohydrate.
- B) lipid.
- C) monosaccharide
- D) A and B only.
- E) A, B, and C.

Answer: E

Topic: Concept 5.2

Skill: Knowledge/Comprehension

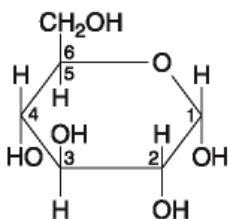


Figure 5.1

15) If 2 molecules of the general type shown in Figure 5.1 were linked together, carbon 1 of one molecule to carbon 4 of the other, the single molecule that would result would be

- A) maltose.
- B) fructose.
- C) glucose.
- D) galactose.
- E) sucrose.

Answer: A

Topic: Concept 5.2

Skill: Knowledge/Comprehension

16) Which of the following descriptors is true of the molecule shown in Figure 5.1?

- A) hexose
- B) fructose
- C) glucose
- D) A and B only
- E) A and C only

Answer: E

Topic: Concept 5.2

Skill: Knowledge/Comprehension

17) Lactose, a sugar in milk, is composed of one glucose molecule joined by a glycosidic linkage to one galactose molecule. How is lactose classified?

- A) as a pentose
- B) as a hexose
- C) as a monosaccharide
- D) as a disaccharide
- E) as a polysaccharide

Answer: D

Topic: Concept 5.2

Skill: Knowledge/Comprehension

18) All of the following are polysaccharides except

- A) glycogen
- B) starch
- C) chitin
- D) cellulose
- E) amylopectin

Answer: A

Topic: Concept 5.2

Skill: Knowledge/Comprehension

19) Which of the following is *true* of both starch and cellulose?

- A) They are both polymers of glucose.
- B) They are geometric isomers of each other.
- C) They can both be digested by humans.
- D) They are both used for energy storage in plants.
- E) They are both structural components of the plant cell wall.

Answer: A

Topic: Concept 5.2

Skill: Knowledge/Comprehension

20) Which of the following is *true* of cellulose?

- A) It is a polymer composed of sucrose monomers.
- B) It is a storage polysaccharide for energy in plant cells.
- C) It is a storage polysaccharide for energy in animal cells.
- D) It is a major structural component of plant cell walls.
- E) It is a major structural component of animal cell plasma membranes.

Answer: D

Topic: Concept 5.2

Skill: Knowledge/Comprehension

- 21) Humans can digest starch but not cellulose because
- A) the monomer of starch is glucose, while the monomer of cellulose is galactose.
 - B) humans have enzymes that can hydrolyze the beta (β) glycosidic linkages of starch but not the alpha (α) glycosidic linkages of cellulose.
 - C) humans have enzymes that can hydrolyze the alpha (α) glycosidic linkages of starch but not the beta (β) glycosidic linkages of cellulose.
 - D) humans harbor starch-digesting bacteria in the digestive tract.
 - E) the monomer of starch is glucose, while the monomer of cellulose is maltose.

Answer: C

Topic: Concept 5.2

Skill: Knowledge/Comprehension

- 22) All of the following statements concerning *saturated* fats are true except
- A) They are more common in animals than in plants.
 - B) They have multiple double bonds in the carbon chains of their fatty acids.
 - C) They generally solidify at room temperature.
 - D) They contain more hydrogen than saturated fats having the same number of carbon atoms.
 - E) They are one of several factors that contribute to atherosclerosis.

Answer: B

Topic: Concept 5.3

Skill: Knowledge/Comprehension

- 23) A molecule with the formula $C_{18}H_{36}O_2$ is probably a
- A) carbohydrate.
 - B) fatty acid.
 - C) protein.
 - D) nucleic acid.
 - E) hydrocarbon.

Answer: B

Topic: Concept 5.3

Skill: Knowledge/Comprehension

- 24) Which of the following statements is *false* for the class of biological molecules known as lipids?
- A) They are soluble in water.
 - B) They are an important constituent of cell membranes.
 - C) They contain more energy than proteins and carbohydrates.
 - D) They are not true polymers.
 - E) They contain waxes and steroids.

Answer: A

Topic: Concept 5.3

Skill: Knowledge/Comprehension

25) What is a triacylglycerol?

- A) a protein with tertiary structure
- B) a lipid made with three fatty acids and glycerol
- C) a lipid that makes up much of the plasma membrane
- D) a molecule formed from three alcohols by dehydration reactions
- E) a carbohydrate with three sugars joined together by glycosidic linkages

Answer: B

Topic: Concept 5.3

Skill: Knowledge/Comprehension

26) Which of the following is *true* regarding saturated fatty acids?

- A) They are the predominant fatty acid in corn oil.
- B) They have double bonds between carbon atoms of the fatty acids.
- C) They are the principal molecules in lard and butter.
- D) They are usually liquid at room temperature.
- E) They are usually produced by plants.

Answer: C

Topic: Concept 5.3

Skill: Knowledge/Comprehension

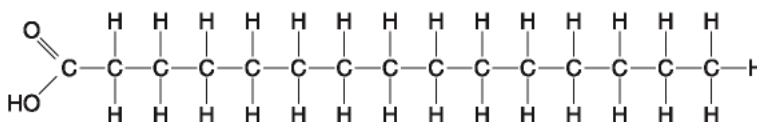


Figure 5.2

27) Which of the following statements is true regarding the molecule illustrated in Figure 5.2?

- A) It is a saturated fatty acid.
- B) A diet rich in this molecule may contribute to atherosclerosis.
- C) Molecules of this type are usually liquid at room temperature.
- D) A and B only
- E) A, B and C

Answer: D

Topic: Concept 5.3

Skill: Knowledge/Comprehension

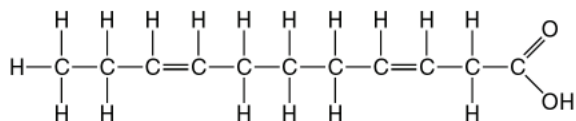


Figure 5.3

- 28) Which of the following statements is true regarding the molecule illustrated in Figure 5.3?
- A) It is a saturated fatty acid.
 - B) A diet rich in this molecule may contribute to atherosclerosis.
 - C) Molecules of this type are usually liquid at room temperature.
 - D) A and B only
 - E) A, B and C

Answer: C

Topic: Concept 5.3

Skill: Knowledge/Comprehension

- 29) The molecule shown in Figure 5.3 is a
- A) polysaccharide.
 - B) polypeptide.
 - C) saturated fatty acid.
 - D) triacylglycerol.
 - E) unsaturated fatty acid.

Answer: E

Topic: Concept 5.3

Skill: Knowledge/Comprehension

- 30) Large organic molecules are usually assembled by polymerization of a few kinds of simple subunits. Which of the following is an *exception* to this statement?
- A) a steroid
 - B) cellulose
 - C) DNA
 - D) an enzyme
 - E) a contractile protein

Answer: A

Topic: Concepts 5.1–5.3

Skill: Knowledge/Comprehension

- 31) The hydrogenation of vegetable oil results in which of the following?
- A) saturated fats and unsaturated fats with *trans* double bonds
 - B) an increased contribution to atherosclerosis
 - C) the oil (fat) being a solid at room temperature
 - D) A and C only
 - E) A, B, and C

Answer: E

Topic: Concept 5.3

Skill: Knowledge/Comprehension

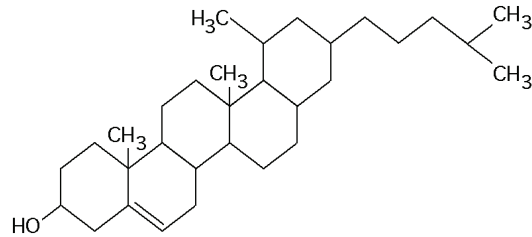


Figure 5.4

32) What is the structure shown in Figure 5.4?

- A) starch molecule
- B) protein molecule
- C) steroid molecule
- D) cellulose molecule
- E) phospholipid molecule

Answer: C

Topic: Concept 5.3

Skill: Knowledge/Comprehension

33) Why are human sex hormones considered to be lipids?

- A) They are essential components of cell membranes.
- B) They are steroids, which are not soluble in water.
- C) They are made of fatty acids.
- D) They are hydrophilic compounds.
- E) They contribute to atherosclerosis.

Answer: B

Topic: Concept 5.3

Skill: Knowledge/Comprehension

34) All of the following contain amino acids except

- A) hemoglobin.
- B) cholesterol.
- C) antibodies.
- D) enzymes.
- E) insulin.

Answer: B

Topic: Concepts 5.3, 5.4

Skill: Knowledge/Comprehension

35) The bonding of two amino acid molecules to form a larger molecule requires

- A) the release of a water molecule.
- B) the release of a carbon dioxide molecule.
- C) the addition of a nitrogen atom.
- D) the addition of a water molecule.
- E) both B and C

Answer: A

Topic: Concept 5.4

Skill: Knowledge/Comprehension

- 36) There are 20 different amino acids. What makes one amino acid different from another?
- different carboxyl groups attached to an alpha (α) carbon
 - different amino groups attached to an alpha (α) carbon
 - different side chains (R groups) attached to an alpha (α) carbon
 - different alpha (α) carbons
 - different asymmetric carbons

Answer: C

Topic: Concept 5.4

Skill: Knowledge/Comprehension

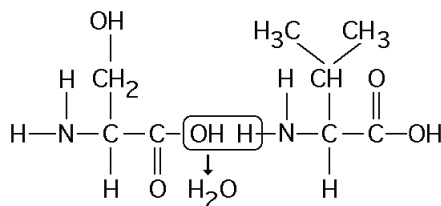


Figure 5.5

- 37) Which of the following statements is/are true regarding the chemical reaction illustrated in Figure 5.5?
- It is a hydrolysis reaction.
 - It results in a peptide bond.
 - It joins two fatty acids together.
 - A and B only
 - A, B, and C
- 38) The bonding of two amino acid molecules to form a larger molecule requires which of the following?
- removal of a water molecule
 - addition of a water molecule
 - formation of an ionic bond
 - formation of a hydrogen bond
 - both A and C

Answer: B

Topic: Concept 5.4

Skill: Application/Analysis

- 39) Polysaccharides, lipids, and proteins are similar in that they
- are synthesized from monomers by the process of hydrolysis.
 - are synthesized from monomers by dehydration reactions.
 - are synthesized as a result of peptide bond formation between monomers.
 - are decomposed into their subunits by dehydration reactions.
 - all contain nitrogen in their monomer building blocks.

Answer: B

Topic: Concepts 5.1–5.4

Skill: Knowledge/Comprehension

- 40) Dehydration reactions are used in forming which of the following compounds?
- A) triacylglycerides
 - B) polysaccharides
 - C) proteins
 - D) A and C only
 - E) A, B, and C

Answer: E

Topic: Concepts 5.1–5.4

Skill: Knowledge/Comprehension

- 41) Upon chemical analysis, a particular polypeptide was found to contain 100 amino acids. How many peptide bonds are present in this protein?
- A) 101
 - B) 100
 - C) 99
 - D) 98
 - E) 97

Answer: C

Topic: Concept 5.4

Skill: Knowledge/Comprehension

Refer to Figure 5.6 to answer the following questions.

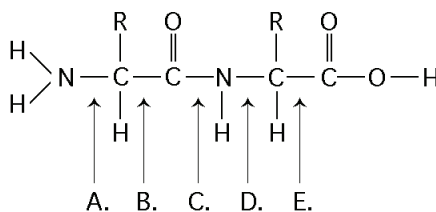


Figure 5.6

- 42) At which bond would water need to be added to achieve hydrolysis of the peptide, back to its component amino acid?
- Answer: C
- Topic: Concept 5.4
- Skill: Knowledge/Comprehension
- 43) Which bond is a peptide bond?
- Answer: C
- Topic: Concept 5.4
- Skill: Knowledge/Comprehension
- 44) Which bond is closest to the N-terminus of the molecule?
- Answer: A
- Topic: Concept 5.4
- Skill: Knowledge/Comprehension

45) Which bond is closest to the carboxyl end of the molecule?

Answer: E

Topic: Concept 5.4

Skill: Knowledge/Comprehension

46) How many different kinds of polypeptides, each composed of 12 amino acids, could be synthesized using the 20 common amino acids?

A) 4^{12}

B) 12^{20}

C) 12^5

D) 20

E) 20^{12}

Answer: E

Topic: Concept 5.4

Skill: Application/Analysis

47) Which bonds are created during the formation of the primary structure of a protein?

A) peptide bonds

B) hydrogen bonds

C) disulfide bonds

D) phosphodiester bonds

E) A, B, and C

Answer: A

Topic: Concept 5.4

Skill: Knowledge/Comprehension

48) What maintains the secondary structure of a protein?

A) peptide bonds

B) hydrogen bonds

C) disulfide bonds

D) ionic bonds

E) phosphodiester bonds

Answer: B

Topic: Concept 5.4

Skill: Knowledge/Comprehension

49) Which type of interaction stabilizes the alpha (α) helix and the beta (β) pleated sheet structures of proteins?

A) hydrophobic interactions

B) nonpolar covalent bonds

C) ionic bonds

D) hydrogen bonds

E) peptide bonds

Answer: D

Topic: Concept 5.4

Skill: Knowledge/Comprehension

- 50) The α helix and the β pleated sheet are both common polypeptide forms found in which level of protein structure?
- A) primary
 - B) secondary
 - C) tertiary
 - D) quaternary
 - E) all of the above

Answer: B

Topic: Concept 5.4

Skill: Knowledge/Comprehension

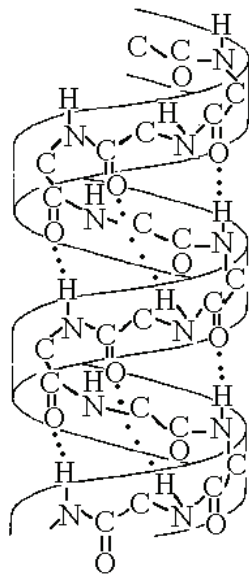


Figure 5.7

- 51) The structure depicted in Figure 5.7 shows the
- A) 1-4 linkage of the α glucose monomers of starch.
 - B) 1-4 linkage of the β glucose monomers of cellulose.
 - C) double helical structure of a DNA molecule.
 - D) α helix secondary structure of a polypeptide.
 - E) β pleated sheet secondary structure of a polypeptide.

Answer: D

Topic: Concept 5.4

Skill: Knowledge/Comprehension

- 52) Figure 5.7 best illustrates the
- A) secondary structure of a polypeptide.
 - B) tertiary structure of a polypeptide.
 - C) quaternary structure of a protein.
 - D) double helix structure of DNA.
 - E) primary structure of a polysaccharide.

Answer: A

Topic: Concept 5.4

Skill: Knowledge/Comprehension

- 53) The tertiary structure of a protein is the
- A) bonding together of several polypeptide chains by weak bonds.
 - B) order in which amino acids are joined in a polypeptide chain.
 - C) unique three-dimensional shape of the fully folded polypeptide.
 - D) organization of a polypeptide chain into an α helix or β pleated sheet.
 - E) overall protein structure resulting from the aggregation of two or more polypeptide subunits.

Answer: C

Topic: Concept 5.4

Skill: Knowledge/Comprehension

- 54) A strong covalent bond between amino acids that functions in maintaining a polypeptide's specific three-dimensional shape is a (an)
- A) ionic bond.
 - B) hydrophobic interaction.
 - C) van der Waals interaction.
 - D) disulfide bond.
 - E) hydrogen bond.

Answer: D

Topic: Concept 5.4

Skill: Knowledge/Comprehension

- 55) At which level of protein structure are interactions between the side chains (R groups) *most* important?
- A) primary
 - B) secondary
 - C) tertiary
 - D) quaternary
 - E) all of the above

Answer: C

Topic: Concept 5.4

Skill: Knowledge/Comprehension

- 56) The R group or side chain of the amino acid serine is $-\text{CH}_2-\text{OH}$. The R group or side chain of the amino acid alanine is $-\text{CH}_3$. Where would you expect to find these amino acids in a globular protein in aqueous solution?
- A) Serine would be in the interior, and alanine would be on the exterior of the globular protein.
 - B) Alanine would be in the interior, and serine would be on the exterior of the globular protein.
 - C) Both serine and alanine would be in the interior of the globular protein.
 - D) Both serine and alanine would be on the exterior of the globular protein.
 - E) Both serine and alanine would be in the interior and on the exterior of the globular protein.

Answer: B

Topic: Concept 5.4

Skill: Application/Analysis

57) Misfolding of polypeptides is a serious problem in cells. Which of the following diseases are associated with an accumulation of misfolded proteins?

- A) Alzheimer's
- B) Parkinson's
- C) diabetes
- D) A and B only
- E) A, B, and C

Answer: D

Topic: Concept 5.4

Skill: Knowledge/Comprehension

58) What would be an unexpected consequence of changing one amino acid in a protein consisting of 325 amino acids?

- A) The primary structure of the protein would be changed.
- B) The tertiary structure of the protein might be changed.
- C) The biological activity or function of the protein might be altered.
- D) Only A and C are correct.
- E) A, B, and C are correct.

Answer: E

Topic: Concept 5.4

Skill: Knowledge/Comprehension

59) Altering which of the following levels of structural organization could change the function of a protein?

- A) primary
- B) secondary
- C) tertiary
- D) quaternary
- E) all of the above

Answer: E

Topic: Concept 5.4

Skill: Knowledge/Comprehension

60) What method did Frederick Sanger use to elucidate the structure of insulin?

- A) X-ray crystallography
- B) bioinformatics
- C) analysis of amino acid sequence of small fragments
- D) NMR spectroscopy
- E) high-speed centrifugation

Answer: C

Topic: Concept 5.4

Skill: Knowledge/Comprehension

- 61) Roger Kornberg used this method for elucidating the structure of RNA polymerase.
- A) X-ray crystallography
 - B) bioinformatics
 - C) analysis of amino acid sequence of small fragments
 - D) NMR spectroscopy
 - E) high-speed centrifugation

Answer: A

Topic: Concept 5.4

Skill: Knowledge/Comprehension

- 62) Which of the following uses the amino acid sequences of polypeptides to predict a protein's three-dimensional structure?
- A) X-ray crystallography
 - B) bioinformatics
 - C) analysis of amino acid sequence of small fragments
 - D) NMR spectroscopy
 - E) high-speed centrifugation

Answer: B

Topic: Concept 5.4

Skill: Knowledge/Comprehension

- 63) The function of each protein is a consequence of its specific shape. What is the term used for a change in a protein's three-dimensional shape or conformation due to disruption of hydrogen bonds, disulfide bridges, or ionic bonds?
- A) hydrolysis
 - B) stabilization
 - C) destabilization
 - D) renaturation
 - E) denaturation

Answer: E

Topic: Concept 5.4

Skill: Knowledge/Comprehension

- 64) What is the term used for a protein molecule that assists in the proper folding of other proteins?
- A) tertiary protein
 - B) chaperonin
 - C) enzyme protein
 - D) renaturing protein
 - E) denaturing protein

Answer: B

Topic: Concept 5.4

Skill: Knowledge/Comprehension

- 65) DNAase is an enzyme that catalyzes the hydrolysis of the covalent bonds that join nucleotides together. What would first happen to DNA molecules treated with DNAase?
- A) The two strands of the double helix would separate.
 - B) The phosphodiester bonds between deoxyribose sugars would be broken.
 - C) The purines would be separated from the deoxyribose sugars.
 - D) The pyrimidines would be separated from the deoxyribose sugars.
 - E) All bases would be separated from the deoxyribose sugars.

Answer: B

Topic: Concepts 5.1, 5.5

Skill: Knowledge/Comprehension

- 66) Which of the following statements about the 5' end of a polynucleotide strand of DNA is correct?
- A) The 5' end has a hydroxyl group attached to the number 5 carbon of ribose.
 - B) The 5' end has a phosphate group attached to the number 5 carbon of ribose.
 - C) The 5' end has thymine attached to the number 5 carbon of ribose.
 - D) The 5' end has a carboxyl group attached to the number 5 carbon of ribose.
 - E) The 5' end is the fifth position on one of the nitrogenous bases.

Answer: B

Topic: Concept 5.5

Skill: Knowledge/Comprehension

- 67) Of the following functions, the major purpose of RNA is to
- A) transmit genetic information to offspring.
 - B) function in the synthesis of protein.
 - C) make a copy of itself, thus ensuring genetic continuity.
 - D) act as a pattern or blueprint to form DNA.
 - E) form the genes of higher organisms.

Answer: B

Topic: Concept 5.5

Skill: Knowledge/Comprehension

- 68) Which of the following *best* describes the flow of information in eukaryotic cells?
- A) DNA → RNA → proteins
 - B) RNA → proteins → DNA
 - C) proteins → DNA → RNA
 - D) RNA → DNA → proteins
 - E) DNA → proteins → RNA

Answer: A

Topic: Concept 5.5

Skill: Knowledge/Comprehension

- 69) Which of the following descriptions *best* fits the class of molecules known as nucleotides?
- A) a nitrogenous base and a phosphate group
 - B) a nitrogenous base and a pentose sugar
 - C) a nitrogenous base, a phosphate group, and a pentose sugar
 - D) a phosphate group and an adenine or uracil
 - E) a pentose sugar and a purine or pyrimidine

Answer: C

Topic: Concept 5.5

Skill: Knowledge/Comprehension

70) Which of the following are nitrogenous bases of the pyrimidine type?

- A) guanine and adenine
- B) cytosine and uracil
- C) thymine and guanine
- D) ribose and deoxyribose
- E) adenine and thymine

Answer: B

Topic: Concept 5.5

Skill: Knowledge/Comprehension

71) Which of the following are nitrogenous bases of the purine type?

- A) cytosine and guanine
- B) guanine and adenine
- C) adenine and thymine
- D) thymine and uracil
- E) uracil and cytosine

Answer: B

Topic: Concept 5.5

Skill: Knowledge/Comprehension

72) If a DNA sample were composed of 10% thymine, what would be the percentage of guanine?

- A) 10
- B) 20
- C) 40
- D) 80
- E) impossible to tell from the information given

Answer: C

Topic: Concept 5.5

Skill: Application/Analysis

73) A double-stranded DNA molecule contains a total of 120 purines and 120 pyrimidines. This DNA molecule could be composed of

- A) 120 adenine and 120 uracil molecules.
- B) 120 thymine and 120 adenine molecules.
- C) 120 cytosine and 120 thymine molecules.
- D) 240 adenine and 240 cytosine molecules.
- E) 240 guanine and 240 thymine molecules.

Answer: B

Topic: Concept 5.5

Skill: Application/Analysis

74) The difference between the sugar in DNA and the sugar in RNA is that the sugar in DNA

- A) is a six-carbon sugar and the sugar in RNA is a five-carbon sugar.
- B) can form a double-stranded molecule.
- C) has a six-membered ring of carbon and nitrogen atoms.
- D) can attach to a phosphate.
- E) contains one less oxygen atom.

Answer: E

Topic: Concept 5.5

Skill: Knowledge/Comprehension

75) Which of the following statements *best* summarizes the structural differences between DNA and RNA?

- A) RNA is a protein, whereas DNA is a nucleic acid.
- B) DNA is a protein, whereas RNA is a nucleic acid.
- C) DNA nucleotides contain a different sugar than RNA nucleotides.
- D) RNA is a double helix, but DNA is single-stranded.
- E) A and D are correct.

Answer: C

Topic: Concept 5.5

Skill: Knowledge/Comprehension

76) In the double helix structure of nucleic acids, cytosine hydrogen bonds to

- A) deoxyribose.
- B) ribose.
- C) adenine.
- D) thymine.
- E) guanine.

Answer: E

Topic: Concept 5.5

Skill: Knowledge/Comprehension

77) If one strand of a DNA molecule has the sequence of bases 5'ATTGCA3', the other complementary strand would have the sequence

- A) 5'TAACGT3'.
- B) 3'TAACGT5'.
- C) 5'UAACGU3'.
- D) 3'UAACGU5'.
- E) 5'UGCAAU3'.

Answer: B

Topic: Concept 5.5

Skill: Knowledge/Comprehension

78) What is the structural feature that allows DNA to replicate?

- A) sugar-phosphate backbone
- B) complementary pairing of the nitrogenous bases
- C) disulfide bonding (bridging) of the two helices
- D) twisting of the molecule to form an α helix
- E) three-component structure of the nucleotides

Answer: B

Topic: Concept 5.5

Skill: Knowledge/Comprehension

- 79) A new organism is discovered in the forests of Costa Rica. Scientists there determine that the polypeptide sequence of hemoglobin from the new organism has 72 amino acid differences from humans, 65 differences from a gibbon, 49 differences from a rat, and 5 differences from a frog. These data suggest that the new organism
- A) is more closely related to humans than to frogs.
 - B) is more closely related to frogs than to humans.
 - C) may have evolved from gibbons but not rats.
 - D) is more closely related to humans than to rats.
 - E) may have evolved from rats but not from humans and gibbons.

Answer: B

Topic: Concept 5.5

Skill: Application/Analysis

- 80) Which of the following is an example of hydrolysis?
- A) the reaction of two monosaccharides, forming a disaccharide with the release of water
 - B) the synthesis of two amino acids, forming a peptide with the release of water
 - C) the reaction of a fat, forming glycerol and fatty acids with the release of water
 - D) the reaction of a fat, forming glycerol and fatty acids with the utilization of water
 - E) the synthesis of a nucleotide from a phosphate, a pentose sugar, and a nitrogenous base with the production of a molecule of water

Answer: D

Topic: Concepts 5.1–5.4

Skill: Knowledge/Comprehension

- 81) The element nitrogen is present in all of the following *except*
- A) proteins.
 - B) nucleic acids.
 - C) amino acids.
 - D) DNA.
 - E) monosaccharides.

Answer: E

Topic: Concepts 5.1–5.4

Skill: Knowledge/Comprehension

- 82) Which of the following is a diverse group of hydrophobic molecules?
- A) carbohydrates
 - B) lipids
 - C) proteins
 - D) nucleic acids

Answer: B

Topic: Concept 5.3

Skill: Knowledge/Comprehension

- 83) Which of the following store and transmit hereditary information?
- A) carbohydrates
 - B) lipids
 - C) proteins
 - D) nucleic acids

Answer: D

Topic: Concept 5.5

Skill: Knowledge/Comprehension

- 84) Enzymes are
- A) carbohydrates.
 - B) lipids.
 - C) proteins.
 - D) nucleic acids.

Answer: C

Topic: Concept 5.4

Skill: Knowledge/Comprehension

The following questions are based on the 15 molecules illustrated in Figure 5.8. Each molecule may be used once, more than once, or not at all.

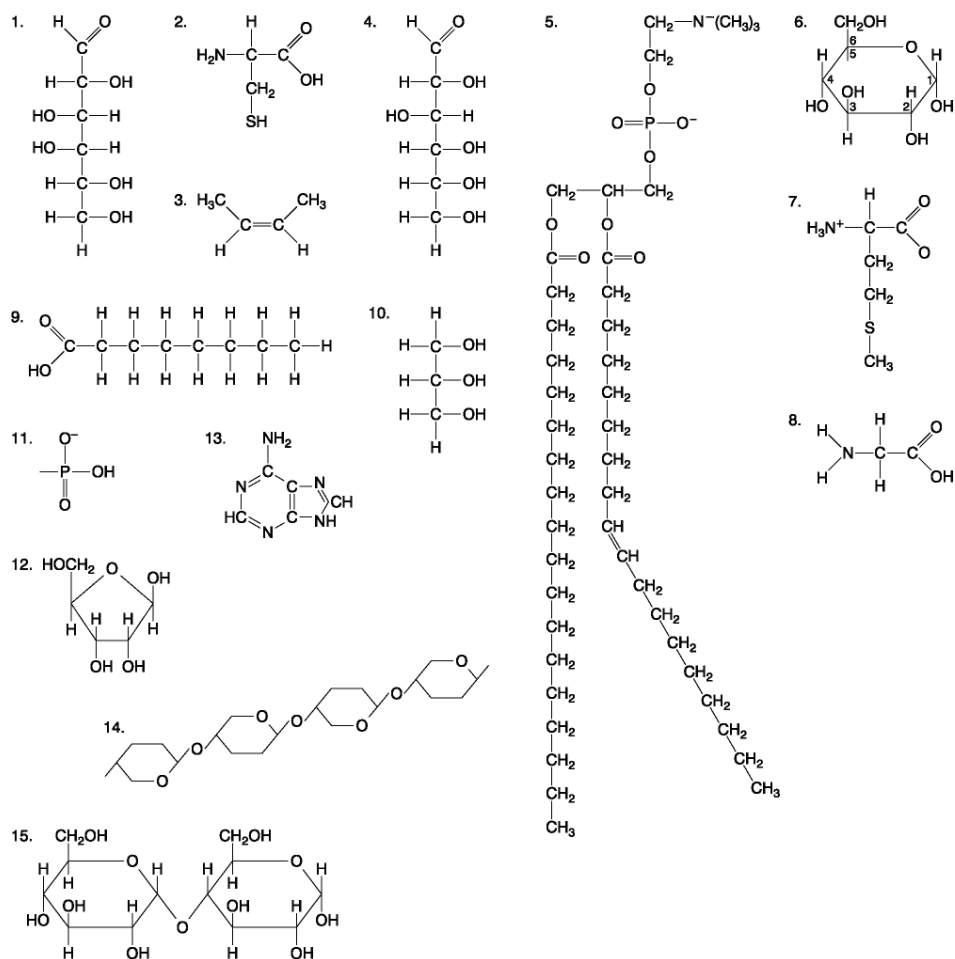


Figure 5.8

- 85) Which molecule has hydrophilic and hydrophobic properties and would be found in plasma membranes?
- A) 1
 - B) 5
 - C) 6
 - D) 12
 - E) 14

Answer: B

Topic: Concept 5.2
Skill: Knowledge/Comprehension

- 86) Which of the following combinations could be linked together to form a nucleotide?
- A) 1, 2, and 11
 - B) 3, 7, and 8
 - C) 5, 9, and 10
 - D) 11, 12, and 13
 - E) 12, 14, and 15

Answer: D

Topic: Concept 5.5
Skill: Knowledge/Comprehension

- 87) Which of the following molecules contain(s) an aldehyde type of carbonyl functional group?
- A) 1
 - B) 4
 - C) 8
 - D) 10
 - E) 1 and 4

Answer: E

Topic: Concept 5.2
Skill: Knowledge/Comprehension

- 88) Which molecule is glycerol?
- A) 1
 - B) 6
 - C) 10
 - D) 14
 - E) 15

Answer: C

Topic: Concept 5.2
Skill: Knowledge/Comprehension

- 89) Which molecule is a saturated fatty acid?
- A) 1
 - B) 5
 - C) 6
 - D) 8
 - E) 9

Answer: E

Topic: Concept 5.3
Skill: Knowledge/Comprehension

90) Which of the following molecules is a purine type of nitrogenous base?

- A) 2
- B) 3
- C) 5
- D) 12
- E) 13

Answer: E

Topic: Concept 5.5

Skill: Knowledge/Comprehension

91) Which of the following molecules act as building blocks (monomers) of polypeptides?

- A) 1, 4, and 6
- B) 2, 7, and 8
- C) 7, 8, and 13
- D) 11, 12, and 13
- E) 12, 13, and 15

Answer: B

Topic: Concept 5.4

Skill: Knowledge/Comprehension

92) Which of the following molecules is an amino acid with a hydrophobic R group or side chain?

- A) 3
- B) 5
- C) 7
- D) 8
- E) 12

Answer: C

Topic: Concept 5.4

Skill: Knowledge/Comprehension

93) Which of the following molecules could be joined together by a peptide bond as a result of a dehydration reaction?

- A) 2 and 3
- B) 3 and 7
- C) 7 and 8
- D) 8 and 9
- E) 12 and 13

Answer: C

Topic: Concept 5.4

Skill: Knowledge/Comprehension

94) A fat (or triacylglycerol) would be formed as a result of a dehydration reaction between

- A) one molecule of 9 and three molecules of 10.
- B) three molecules of 9 and one molecule of 10.
- C) one molecule of 5 and three molecules of 9.
- D) three molecules of 5 and one molecule of 9.
- E) one molecule of 5 and three molecules of 10.

Answer: B

Topic: Concept 5.3

Skill: Knowledge/Comprehension

95) Which of the following molecules could be joined together by a phosphodiester type of covalent bond?

- A) 3 and 4
- B) 3 and 8
- C) 6 and 15
- D) 11 and 12
- E) 11 and 13

Answer: D

Topic: Concept 5.3

Skill: Knowledge/Comprehension

96) Which of the following molecules is the pentose sugar found in RNA?

- A) 1
- B) 4
- C) 6
- D) 12
- E) 13

Answer: D

Topic: Concept 5.5

Skill: Knowledge/Comprehension

97) Which of the following molecules contains a glycosidic linkage type of covalent bond?

- A) 4
- B) 6
- C) 12
- D) 13
- E) 15

Answer: E

Topic: Concept 5.2

Skill: Knowledge/Comprehension

98) Which of the following molecules has (have) a functional group that frequently is involved in maintaining the tertiary structure of a protein?

- A) 2
- B) 3
- C) 9
- D) 11
- E) 9 and 11

Answer: A

Topic: Concept 5.4

Skill: Knowledge/Comprehension

99) Which of the following molecules consists of a hydrophilic "head" region and a hydrophobic "tail" region?

- A) 2
- B) 5
- C) 7
- D) 9
- E) 11

Answer: B

Topic: Concept 5.3

Skill: Knowledge/Comprehension

100) Which of the following statements is *false*?

- A) 1 and 4 could be joined together by a glycosidic linkage to form a disaccharide.
- B) 9 and 10 could be joined together by ester bonds to form a triacylglycerol.
- C) 2 and 7 could be joined together to form a short peptide.
- D) 2, 7, and 8 could be joined together to form a short peptide.
- E) 14 and 15 could be joined together to form a polypeptide.

Answer: E

Topic: Concepts 5.2–5.4

Skill: Knowledge/Comprehension

Self-Quiz Questions

The following questions are from the end-of-chapter-review Self-Quiz questions in Chapter 5 of the textbook.

1) Which term includes all others in the list?

- A) monosaccharide
- B) disaccharide
- C) starch
- D) carbohydrate
- E) polysaccharide

Answer: D

2) The molecular formula for glucose is $C_6H_{12}O_6$. What would be the molecular formula for a polymer made by linking ten glucose molecules together by dehydration reactions?

- A) $C_{60}H_{120}O_{60}$
- B) $C_6H_{12}O_6$
- C) $C_{60}H_{102}O_{51}$
- D) $C_{60}H_{100}O_{50}$
- E) $C_{60}H_{111}O_{51}$

Answer: C

3) The enzyme amylase can break glycosidic linkages between glucose monomers only if the monomers are the α form. Which of the following could amylase break down?

- A) glycogen, starch, and amylopectin
- B) glycogen and cellulose
- C) cellulose and chitin
- D) starch and chitin
- E) starch, amylopectin, and cellulose

Answer: A

4) Which of the following statements concerning *unsaturated* fats is true?

- A) They are more common in animals than in plants.
- B) They have double bonds in the carbon chains of their fatty acids.
- C) They generally solidify at room temperature.
- D) They contain more hydrogen than saturated fats having the same number of carbon atoms.
- E) They have fewer fatty acid molecules per fat molecule.

Answer: B

5) The structural level of a protein least affected by a disruption in hydrogen bonding is the

- A) primary level.
- B) secondary level.
- C) tertiary level.
- D) quaternary level.
- E) All structural levels are equally affected.

Answer: A

6) Which of the following pairs of base sequences could form a short stretch of a normal double helix of DNA?

- A) 5'-purine-pyrimidine-purine-pyrimidine-3' with 3'-purine-pyrimidine-purine-pyrimidine-5'
- B) 5'-A-G-C-T-3' with 5'-T-C-G-A-3'
- C) 5'-G-C-G-C-3' with 5'-T-A-T-A-3'
- D) 5'-A-T-G-C-3' with 5'-G-C-A-T-3'
- E) All of these pairs are correct.

Answer: D

7) Enzymes that break down DNA catalyze the hydrolysis of the covalent bonds that join nucleotides together. What would happen to DNA molecules treated with these enzymes?

- A) The two strands of the double helix would separate.
- B) The phosphodiester linkages between deoxyribose sugars would be broken.
- C) The purines would be separated from the deoxyribose sugars.
- D) The pyrimidines would be separated from the deoxyribose sugars.
- E) All bases would be separated from the deoxyribose sugars.

Answer: B

8) Construct a table that organizes the following terms, and label the columns and rows.

phosphodiester linkages	polypeptides	monosaccharides
peptide bonds	triacylglycerols	nucleotides
glycosidic linkages	polynucleotides	amino acids
ester linkages	polysaccharides	fatty acids

Answer:

	Monomers or Components	Polymer or larger molecule	Type of linkage
Sugars	Monosaccharides	Polysaccharides	Glycosidic linkages
Lipids	Fatty acids	Triacylglycerols	Ester linkages
Proteins	Amino acids	Polypeptides	Peptide bonds
Nucleic acids	Nucleotides	Polynucleotides	Phosphodiester linkages

- 9) Draw the polynucleotide strand in Figure 5.27a from your textbook, and label the bases G, T, C, and T, starting from the 5' end. Now, draw the complementary strand of the double helix, using the same symbols for phosphates (circles), sugars (pentagons), and bases. Label the bases. Draw arrows showing the 5' → 3' direction of each strand. Use the arrows to make sure the second strand is antiparallel to the first. Hint: After you draw the first strand vertically, turn the paper upside down; it is easier to draw the second strand from the 5' toward the 3' direction as you go from top to bottom.

Answer:

