Visual Anatomy and Physiology, 3e **(Martini)**
Chapter 2 Chemical Level of Organization

Multiple Choice Questions

1) The smallest stable units of matter are
A) atoms.
B) molecules.
C) protons.
D) neutrons.
E) electrons.
Answer: A
Learning Outcome: 2.1
Bloom's Taxonomy: Remembering

2) The nucleus of an atom consists of
A) electrons.
B) protons.
C) neutrons.
D) protons + neutrons.
E) protons + electrons.
Answer: D
Learning Outcome: 2.1
Bloom's Taxonomy: Remembering

3) The center of an atom is called the
A) element.
B) electron cloud.
C) nucleus.
D) proton.
E) molecule.
Answer: C
Learning Outcome: 2.1
Bloom's Taxonomy: Remembering

4) A(n) _____ is a pure substance composed of atoms.
A) element
B) compound
C) molecule
D) electron
E) neutron
Answer: A
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

5) The actual mass of an atom is known as its
A) atomic number.
B) atomic weight.
C) mass number.
D) atomic mass unit.
E) element number.
Answer: B
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

6) Atoms of the same element whose nuclei contain the same number of protons, but different numbers of neutrons, are called
A) isotopes.
B) ions.
C) isomers.
D) trace elements.
E) principal elements.
Answer: A
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

7) The "atomic number" of an atom is determined by the number of _____ it has.
A) electrons
B) protons
C) neutrons
D) protons + neutrons
E) protons + electrons
Answer: B
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

8) Isotopes of an element differ in the number of
A) protons in the nucleus.
B) electrons in the nucleus.
C) neutrons in the nucleus.
D) electron clouds.
E) electrons in energy shells.
Answer: C
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

9) The mass number represents the number of
A) protons in an atom.
B) electrons in an ion.
C) neutrons in an atom.
D) protons + neutrons.
E) neutrons + electrons.
Answer: D
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

10) The atomic weight of an atom reflects the average number of
A) protons.
B) neutrons.
C) electrons.
D) protons + neutrons.
E) protons + neutrons + electrons.
Answer: E
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

11) If an isotope of oxygen has 8 protons, 10 neutrons, and 8 electrons, its mass number is
A) 26.
B) 16.
C) 18.
D) 8.
E) 12.
Answer: C
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

12) Which element commonly has only a proton as its nucleus?
A) helium
B) neon
C) argon
D) hydrogen
E) None of the answers is correct.
Answer: D
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

13) The mass of an atom is largely determined by the number of _____ it has.
A) electrons
B) protons
C) neutrons
D) protons + neutrons
E) protons + electrons
Answer: D
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

14) By weight, which element is the most plentiful in the human body?
A) sulfur
B) sodium
C) oxygen
D) potassium
E) carbon
Answer: C
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

15) By weight, which element is the second most abundant in the human body?
A) oxygen
B) carbon
C) hydrogen
D) nitrogen
E) calcium
Answer: B
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

16) Which of the following lists contains only trace elements?
A) sulfur, chlorine, oxygen
B) selenium, hydrogen, calcium
C) boron, oxygen, carbon
D) silicon, fluorine,
E) cobalt, calcium, sodium
Answer: D
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

17) Oxygen is required in biological systems for
A) cellular respiration.
B) storage of energy.
C) serving as a structural component of bone.
D) serving as a catalyst.
E) chemical messengers.
Answer: A
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

18) If an element is composed of atoms with an atomic number of 6 and a mass number of 14, then the nucleus of a neutral atom of this element contains
A) 6 protons.
B) 8 electrons.
C) 8 neutrons.
D) 6 protons and 8 electrons.
E) 6 protons and 8 neutrons.
Answer: E
Learning Outcome: 2.2
Bloom's Taxonomy: Understanding

19) The innermost electron shell in an atom holds up to _____ electrons.
A) 1
B) 2
C) 4
D) 6
E) 8
Answer: B
Learning Outcome: 2.3
Bloom's Taxonomy: Remembering

20) The chemical behavior of an atom is determined by the
A) number of protons.
B) number of neutrons.
C) outermost electron shell.
D) size of the atom.
E) mass of the nucleus.
Answer: C
Learning Outcome: 2.3
Bloom's Taxonomy: Remembering

21) Ions with a + charge are called
A) cations.
B) anions.
C) radicals.
D) positrons.
E) isotopes.
Answer: A
Learning Outcome: 2.3
Bloom's Taxonomy: Remembering

22) Elements that have atoms with full outer shells of electrons
A) will form many compounds.
B) will normally form anions.
C) will normally form cations.
D) frequently form hydrogen bonds.
E) are inert gases.
Answer: E
Learning Outcome: 2.3
Bloom's Taxonomy: Remembering

23) Which of the following is **not** a cation?
A) Na^+
B) Cl^-
C) K^+
D) Ca^{2+}
E) Mg^{2+}
Answer: B
Learning Outcome: 2.3
Bloom's Taxonomy: Remembering

24) In an aqueous solution, cations are attracted toward
A) water.
B) salt.
C) buffers.
D) anions.
E) hydrogen ions.
Answer: D
Learning Outcome: 2.3
Bloom's Taxonomy: Remembering

25) In an aqueous solution, sodium ions would move toward
A) a negative terminal.
B) a positive terminal.
C) a pH terminal.
D) an organic terminal.
E) the bottom.
Answer: A
Learning Outcome: 2.3
Bloom's Taxonomy: Remembering

26) Magnesium atoms have two electrons in the outermost shell. As a result, you would expect magnesium to form ions with a charge of
A) +1.
B) +2.
C) -1.
D) -2.
E) either +2 or -2.
Answer: B
Learning Outcome: 2.3
Bloom's Taxonomy: Understanding

27) In chemical notation, the symbol Ca^{2+} means
A) two calcium atoms.
B) a calcium ion that has lost two electrons.
C) a calcium ion that has gained two protons.
D) a calcium ion that has gained two electrons.
E) a calcium ion that has lost two protons.
Answer: B
Learning Outcome: 2.3
Bloom's Taxonomy: Remembering

28) Ions with a negative charge are called
A) cations.
B) anions.
C) protons.
D) positrons.
E) polar molecules.
Answer: B
Learning Outcome: 2.3
Bloom's Taxonomy: Remembering

29) Ionic bonds are formed when
A) atoms share electrons.
B) electrons are completely transferred from one atom to another.
C) a pair of electrons is shared unequally by two atoms.
D) hydrogen forms bonds with negatively charged atoms.
E) two or more atoms lose electrons at the same time.
Answer: B
Learning Outcome: 2.4
Bloom's Taxonomy: Remembering

30) In a molecule of oxygen gas, two pairs of electrons are shared equally by two oxygen atoms. The type of bond that is formed is an example of a
A) single trivalent bond.
B) double nonpolar covalent bond.
C) triple nonpolar covalent bond.
D) double polar covalent bond.
E) hydrogen bond.
Answer: B
Learning Outcome: 2.4
Bloom's Taxonomy: Remembering

31) If one pair of electrons is unequally shared between two atoms, a _____ occurs.
A) single nonpolar covalent bond
B) double nonpolar covalent bond
C) double polar covalent bond
D) single polar covalent bond
E) hydrogen bond
Answer: D
Learning Outcome: 2.4
Bloom's Taxonomy: Remembering

32) When atoms complete their outer electron shell by sharing electrons, they form
A) ionic bonds.
B) covalent bonds.
C) hydrogen bonds.
D) anions.
E) cations.
Answer: B
Learning Outcome: 2.4
Bloom's Taxonomy: Remembering

33) Which of the following is both an anion and a compound?
A) Na^+
B) Cl^-
C) K^+
D) HCO_3^-
E) NaCl
Answer: D
Learning Outcome: 2.4
Bloom's Taxonomy: Remembering

34) When electrons are transferred from one atom to another, and the two atoms unite as a result of the opposite charges,
A) an ion is formed.
B) a free electron is formed.
C) a hydrogen bond is formed.
D) an ionic bond is formed.
E) a covalent bond is formed.
Answer: D
Learning Outcome: 2.4
Bloom's Taxonomy: Remembering

35) Magnesium atoms have two electrons in their outermost shells, and chlorine atoms have seven. The compound magnesium chloride would contain
A) 1 magnesium and 1 chlorine.
B) 1 magnesium and 2 chlorine.
C) 2 magnesium and 1 chlorine.
D) 2 magnesium and 7 chlorine.
E) It is impossible to determine without more information.
Answer: B
Learning Outcome: 2.4
Bloom's Taxonomy: Understanding

36) The molecule CO_2 is known as
A) carbonized oxygen.
B) carbonated oxygen.
C) carbon monoxide.
D) carbon oxide.
E) carbon dioxide.
Answer: E
Learning Outcome: 2.4
Bloom's Taxonomy: Remembering

37) The molecule H_2 is known as
A) hydrohydrogen.
B) hydrogen.
C) hydroxide.
D) helium.
E) semi-water.
Answer: B
Learning Outcome: 2.4
Bloom's Taxonomy: Remembering

38) The molecule O_2 is known as
A) oxide.
B) oxygen.
C) organic.
D) oxygen and organic.
E) oxyous.
Answer: B
Learning Outcome: 2.4
Bloom's Taxonomy: Remembering

39) H_2O is an example of a(n)
A) ionic formula.
B) glucose molecule.
C) molecular formula.
D) covalent formula.
Answer: C
Learning Outcome: 2.4
Bloom's Taxonomy: Remembering

40) The weakest bond between two atoms is the _____ bond.
A) ionic
B) covalent
C) polar
D) nonpolar
E) hydrogen
Answer: E
Learning Outcome: 2.5
Bloom's Taxonomy: Remembering

41) Which of the following statements about hydrogen bonds is **false**?
A) Hydrogen bonds are strong attractive forces between hydrogen atoms and negatively charged atoms.
B) Hydrogen bonds can occur within a single molecule.
C) Hydrogen bonds can form between neighboring molecules.
D) Hydrogen bonds are important for holding large molecules together.
E) Hydrogen bonds are responsible for many of the properties of water.
Answer: A
Learning Outcome: 2.5
Bloom's Taxonomy: Remembering

42) A dust particle floating on a water surface illustrates
A) surface tension.
B) chemical tension.
C) static electricity.
D) heat capacity.
E) hydrophilic attraction.
Answer: A
Learning Outcome: 2.5
Bloom's Taxonomy: Remembering

43) The three familiar states of matter listed in order from the least to most thermal energy are
A) gas, solid, liquid.
B) liquid, gas, solid.
C) gas, liquid, solid.
D) solid, gas, liquid.
E) solid, liquid, gas.
Answer: C
Learning Outcome: 2.5
Bloom's Taxonomy: Remembering

44) Kinetic energy is stored as _____ energy when a spring is stretched.
A) chemical
B) work
C) thermal
D) potential
E) motion
Answer: D
Learning Outcome: 2.6
Bloom's Taxonomy: Remembering

45) In the reaction listed below, what coefficient needs to be added to balance the equation?
$6\ CO_2 + 6\ H_2O \rightarrow C_6H_{12}O_6 +$ _____ O_2.
A) 2
B) 4
C) 6
D) 8
E) 10
Answer: C
Learning Outcome: 2.7
Bloom's Taxonomy: Understanding

46) AB → A + B is to decomposition as A + B → AB is to
A) exchange.
B) synthesis.
C) combustion.
D) replacement.
E) metabolism.
Answer: B
Learning Outcome: 2.8
Bloom's Taxonomy: Remembering

47) The reaction $N_2 + 3\ H_2 \rightarrow 2\ NH_3$ is an example of a(n)
A) exchange reaction.
B) decomposition reaction.
C) synthesis reaction.
D) enzyme reaction.
E) metabolic reaction.
Answer: C
Learning Outcome: 2.8
Bloom's Taxonomy: Remembering

48) In hydrolysis reactions, compounds react with
A) hydrogen, causing decomposition.
B) glucose, causing decomposition.
C) water, causing decomposition.
D) carbon, causing decomposition.
E) water, causing synthesis.
Answer: C
Learning Outcome: 2.8
Bloom's Taxonomy: Remembering

49) In dehydration reactions, compounds
A) lose water molecules.
B) gain water molecules.
C) convert water molecules to hydrogen and oxygen.
D) convert hydrogen and oxygen to water.
E) gain electrons.
Answer: A
Learning Outcome: 2.8
Bloom's Taxonomy: Remembering

50) The reaction A + B + energy → AB is an example of a(n)
A) exergonic reaction.
B) endergonic reaction.
C) equilibrium reaction.
D) decomposition reaction.
E) exchange reaction.
Answer: B
Learning Outcome: 2.9
Bloom's Taxonomy: Remembering

51) Chemical reactions that yield energy, such as heat, are said to be
A) endergonic.
B) activated.
C) exergonic.
D) neutral.
E) thermonuclear.
Answer: C
Learning Outcome: 2.9
Bloom's Taxonomy: Remembering

52) All of the following are true concerning enzymes **except** that they
A) are proteins.
B) function as biological catalysts.
C) lower the activation energy required for a reaction.
D) affect only the rate of a chemical reaction.
E) are consumed during the reaction.
Answer: E
Learning Outcome: 2.9
Bloom's Taxonomy: Remembering

53) Compounds that can be synthesized or broken down by chemical reactions inside the body are called
A) inorganic compounds.
B) organic compounds.
C) nutrients.
D) metabolites.
E) enzymes.
Answer: D
Learning Outcome: 2.9
Bloom's Taxonomy: Remembering

54) Each of the following is an example of an inorganic compound **except**
A) water.
B) acids.
C) bases.
D) salts.
E) proteins.
Answer: E
Learning Outcome: 2.9
Bloom's Taxonomy: Remembering

55) Which of the following is/are inorganic substance(s)?
A) fructose
B) water
C) glycerol
D) carbon dioxide
E) both water and carbon dioxide
Answer: E
Learning Outcome: 2.9
Bloom's Taxonomy: Remembering

56) Chemical reactions that release energy are called
A) energetic.
B) exergonic.
C) endergonic.
D) metabolic.
E) enzymatic.
Answer: B
Learning Outcome: 2.9
Bloom's Taxonomy: Remembering

57) Chemical reactions that absorb energy are called
A) energetic.
B) exergonic.
C) endergonic.
D) metabolic.
E) enzymatic.
Answer: C
Learning Outcome: 2.9
Bloom's Taxonomy: Remembering

58) _____ accelerate chemical reactions that occur in the human body.
A) Enzymes
B) Reactants
C) Products
D) Metabolites
E) Nutrients
Answer: A
Learning Outcome: 2.9
Bloom's Taxonomy: Remembering

59) In living cells, complex metabolic reactions proceed in a series of steps called
A) enzymes.
B) a metabolic pathway.
C) catalysts.
D) reactants.
E) products.
Answer: B
Learning Outcome: 2.9
Bloom's Taxonomy: Remembering

60) _____ molecules are compounds that contain carbon as the primary structural atom.
A) Complex
B) Inorganic
C) Exergonic
D) Endergonic
E) Organic
Answer: E
Learning Outcome: 2.9
Bloom's Taxonomy: Remembering

61) _____ compounds do not usually contain carbon as a primary structural atom.
A) Complex
B) Inorganic
C) Exergonic
D) Endergonic
E) Organic
Answer: B
Learning Outcome: 2.9
Bloom's Taxonomy: Remembering

62) Which of the following statements about water is **not** correct?
A) It is composed of polar molecules.
B) It is responsible for much of the mass of the human body.
C) It has a relatively low heat capacity.
D) It can dissolve many substances.
E) It contains hydrogen bonds.
Answer: C
Learning Outcome: 2.10
Bloom's Taxonomy: Remembering

63) A(n) _____ is a homogeneous mixture containing a solvent and a solute.
A) concoction
B) organic molecule
C) inorganic molecule
D) blend
E) solution
Answer: E
Learning Outcome: 2.10
Bloom's Taxonomy: Remembering

64) Which property of water helps keep body temperature stabilized?
A) kinetic energy
B) lubrication
C) surface tension
D) reactivity
E) thermal inertia
Answer: E
Learning Outcome: 2.10
Bloom's Taxonomy: Remembering

65) _____ are soluble inorganic compounds whose solutions will conduct an electric current.
A) Proteins
B) Lipids
C) Ions
D) Electrolytes
E) Enzymes
Answer: D
Learning Outcome: 2.11
Bloom's Taxonomy: Remembering

66) Molecules that do **not** readily dissolve in water are called
A) hydrophobic.
B) hydrophilic.
C) electrolytes.
D) isophilic.
E) isophobic.
Answer: A
Learning Outcome: 2.11
Bloom's Taxonomy: Remembering

67) During ionization, water molecules disrupt the ionic bonds of a salt to produce a mixture of ions. These ions can carry a current and so are called
A) cations.
B) anions.
C) acids.
D) electrolytes.
E) counter ions.
Answer: D
Learning Outcome: 2.11
Bloom's Taxonomy: Remembering

68) Oppositely charged ions in solution are prevented from combining by
A) heat capacity of water.
B) hydration spheres.
C) water's nonpolar nature.
D) free radicals.
E) hydrogen bonding.
Answer: B
Learning Outcome: 2.11
Bloom's Taxonomy: Remembering

69) Hydrophilic molecules readily associate with
A) lipid molecules.
B) hydrophobic molecules.
C) water molecules.
D) both lipid molecules and hydrophobic molecules.
E) cholesterol.
Answer: C
Learning Outcome: 2.11
Bloom's Taxonomy: Remembering

70) Nonpolar organic molecules are good examples of
A) electrolytes.
B) molecules that will dissociate when placed into water.
C) hydrophobic compounds.
D) hydrophilic compounds.
E) solutes.
Answer: C
Learning Outcome: 2.11
Bloom's Taxonomy: Remembering

71) A solution containing equal numbers of hydrogen ions and hydroxide ions is
A) acidic.
B) basic.
C) neutral.
D) alkaline.
E) in equilibrium.
Answer: C
Learning Outcome: 2.12
Bloom's Taxonomy: Remembering

72) Which of the following substances would be most acidic?
A) lemon juice, pH = 2
B) urine, pH = 6
C) tomato juice, pH = 4
D) white wine, pH = 3
E) stomach secretions, pH = 1
Answer: E
Learning Outcome: 2.12
Bloom's Taxonomy: Remembering

73) If a substance has a pH that is greater than 7, it is
A) neutral.
B) acidic.
C) alkaline.
D) a buffer.
E) a salt.
Answer: C
Learning Outcome: 2.12
Bloom's Taxonomy: Remembering

74) An important buffer in body fluids is
A) NaCl.
B) NaOH.
C) HCl.
D) $NaHCO_3$.
E) H_2O.
Answer: D
Learning Outcome: 2.12
Bloom's Taxonomy: Remembering

75) In the body, inorganic compounds
A) can serve as buffers.
B) can make up proteins.
C) can make up lipids.
D) are structural components of cells.
E) are all very large.
Answer: A
Learning Outcome: 2.12
Bloom's Taxonomy: Remembering

76) Of the following choices, the pH of the least acidic solution is
A) 6.0.
B) 4.5.
C) 2.3.
D) 1.0.
E) 12.0.
Answer: E
Learning Outcome: 2.12
Bloom's Taxonomy: Remembering

77) Which has the greater concentration of hydrogen ions, a substance with a pH of 5 or a substance with a pH of 4?
A) A pH of 4 is greater.
B) A pH of 5 is greater.
C) They are both equal; 4 and 5 are relative values.
D) pH 9, if you mixed the solutions.
E) Neither; pH has nothing to do with hydrogen ion concentration.
Answer: A
Learning Outcome: 2.12
Bloom's Taxonomy: Remembering

78) Of the list below, which has the highest concentration of hydroxide ions?
A) pH 1
B) pH 14
C) pH 7
D) pH 10
E) pH 2
Answer: B
Learning Outcome: 2.12
Bloom's Taxonomy: Remembering

79) Which pH is closest to normal blood pH?
A) pH 7
B) pH 8
C) pH 4
D) pH 3
E) pH 2
Answer: A
Learning Outcome: 2.12
Bloom's Taxonomy: Remembering

80) A(n) _____ removes hydrogen ions, and a(n) _____ releases hydrogen ions.
A) acid; base
B) base; acid
C) compound; element
D) element; compound
E) molecule; acid
Answer: B
Learning Outcome: 2.12
Bloom's Taxonomy: Remembering

81) An excess of hydrogen ions in the body fluids can have fatal results because this can
A) block ion movements.
B) change the shape of large complex molecules, rendering them nonfunctional.
C) disrupt tissue functions.
D) All of the answers are correct.
E) None of the answers is correct.
Answer: D
Learning Outcome: 2.12
Bloom's Taxonomy: Understanding

82) When placed in water, an inorganic compound dissociates 99 percent, forming hydrogen ions and anions. This compound would be a
A) strong base.
B) weak base.
C) strong acid.
D) weak acid.
E) salt.
Answer: C
Learning Outcome: 2.12
Bloom's Taxonomy: Understanding

83) When a small amount of HCl or NaOH is added to a solution of Na_2HPO_4, the pH of the solution barely changes. Based on these observations, all of the following are true concerning the compound Na_2HPO_4 **except**
A) Na_2HPO_4 is able to accept extra hydrogen ions from the HCl.
B) Na_2HPO_4 is able to donate hydrogen ions to the OH^- from NaOH.
C) Na_2HPO_4 adsorbs excess H^+ and OH^- directly onto the surface of its crystalline structure.
D) Na_2HPO_4 is a salt formed from reacting a strong base with a weak acid.
E) Na_2HPO_4 acts as a buffer.
Answer: C
Learning Outcome: 2.12
Bloom's Taxonomy: Applying

84) The _____ of a solution is the negative logarithm of the hydrogen ion concentration expressed in moles per liter.
A) dissociation
B) electronegativity
C) electrical current
D) pH
E) electropositivity
Answer: D
Learning Outcome: 2.12
Bloom's Taxonomy: Remembering

85) All fatty acids contain a functional group at one end called the _____ group.
A) amino
B) carboxyl
C) hydroxyl
D) phosphate
E) nitroxyl
Answer: B
Learning Outcome: 2.13
Bloom's Taxonomy: Remembering

86) Carbohydrates, lipids, and proteins are classified as
A) organic molecules.
B) inorganic molecules.
C) acids.
D) salts.
E) bases.
Answer: A
Learning Outcome: 2.13
Bloom's Taxonomy: Remembering

87) Which of the following is the symbol for an amino group?
A) -COOH
B) $-PO_3$
C) $-NH_2$
D) -AMO
E) -OH
Answer: C
Learning Outcome: 2.13
Bloom's Taxonomy: Remembering

88) Which of the following functional groups of organic compounds link molecules through dehydration synthesis?
A) amino group
B) hydroxyl group
C) phosphate group
D) carboxyl group
E) none of the above
Answer: B
Learning Outcome: 2.13
Bloom's Taxonomy: Remembering

89) A functional group is best described as reoccurring clusters of
A) elements that occur in a salt.
B) atoms that greatly influence the chemical properties of molecules they are part of.
C) atoms that function in the body.
D) elements that form at high pH.
E) amino acids in a globular protein.
Answer: B
Learning Outcome: 2.13
Bloom's Taxonomy: Remembering

90) Carbohydrate molecules
A) are the building blocks of cellular membranes.
B) form the regulatory molecules known as enzymes.
C) are the body's most readily available source of energy.
D) are composed of C, H, O, and N atoms.
E) contain the genetic information found in cells.
Answer: C
Learning Outcome: 2.14
Bloom's Taxonomy: Remembering

91) The most important metabolic fuel molecule in the body is
A) sucrose.
B) caffeine.
C) protein.
D) vitamins.
E) glucose.
Answer: E
Learning Outcome: 2.14
Bloom's Taxonomy: Remembering

92) Which of the following are large polysaccharides and major dietary source of energy?
A) maltose
B) fructose
C) sucrose
D) starch
E) lactose
Answer: D
Learning Outcome: 2.14
Bloom's Taxonomy: Remembering

93) A polysaccharide that is formed in muscle cells to store glucose is
A) lactose.
B) cellulose.
C) glycogen.
D) sucrose.
E) fructose.
Answer: C
Learning Outcome: 2.14
Bloom's Taxonomy: Remembering

94) The group of organic compounds containing carbon, hydrogen, and oxygen in a near 1:2:1 ratio is defined as a
A) carbohydrate.
B) lipid.
C) protein.
D) nucleic acid.
E) cholesterol.
Answer: A
Learning Outcome: 2.14
Bloom's Taxonomy: Remembering

95) Which of the following is correct regarding fructose?
A) It is a disaccharide.
B) It is a polysaccharide.
C) It is the most important metabolic fuel in the body.
D) It is obtained only from food.
E) It is an isomer of glucose.
Answer: E
Learning Outcome: 2.14
Bloom's Taxonomy: Remembering

96) When two monosaccharides undergo a dehydration synthesis,
A) two new monosaccharides are formed.
B) a disaccharide is formed.
C) a polysaccharide is formed.
D) a starch is formed.
E) All of the answers are correct.
Answer: B
Learning Outcome: 2.14
Bloom's Taxonomy: Understanding

97) Which one of the following must be broken down to fatty acids and glycerol for use as an energy source?
A) lauric acid
B) triglycerides
C) prostaglandins
D) cholesterol
E) lecithin
Answer: B
Learning Outcome: 2.15
Bloom's Taxonomy: Remembering

98) Which of the following is a chemical messenger coordinating local cellular activities?
A) diglycerides
B) leukotrienes
C) vholesterol
D) lauric acid
E) lecithin
Answer: B
Learning Outcome: 2.15
Bloom's Taxonomy: Remembering

99) Which of the following is a structural component of cell membranes?
A) diglycerides
B) prostaglandins
C) cholesterol
D) lauric acid
E) glycogen
Answer: C
Learning Outcome: 2.15
Bloom's Taxonomy: Remembering

100) Which of the following is a structural component of hormones?
A) monoglycerides
B) prostaglandins
C) lauric acid
D) phospholipids
E) steroids
Answer: E
Learning Outcome: 2.15
Bloom's Taxonomy: Remembering

101) Which of the following is a structural component of digestive secretions in bile?
A) steroids
B) glycerides
C) eicosanoids
D) fatty acids
E) glycolipids
Answer: A
Learning Outcome: 2.15
Bloom's Taxonomy: Remembering

102) _____ are short-chain fatty acids in which five of the carbon atoms are joined in a ring.
A) Cholesterol
B) Estrogen
C) Testosterone
D) Prostaglandins
E) Glycolipids
Answer: D
Learning Outcome: 2.16
Bloom's Taxonomy: Remembering

103) A shortage of cholesterol in the body could interfere with the formation of
A) sex hormones.
B) proteins.
C) cytoplasm.
D) glycogen.
E) nucleic acids.
Answer: A
Learning Outcome: 2.16
Bloom's Taxonomy: Understanding

104) A carbohydrate is attached to a diglyceride in which type of lipid?
A) phospholipids
B) prostaglandins
C) leukotrienes
D) steroids
E) glycolipids
Answer: E
Learning Outcome: 2.16
Bloom's Taxonomy: Remembering

105) Which of the following lipids are produced in response to cellular injury or disease?
A) cholesterol
B) glycolipids
C) phospholipids
D) sex steroids
E) leukotrienes
Answer: E
Learning Outcome: 2.16
Bloom's Taxonomy: Remembering

106) _____ are large lipid molecules with distinctive carbon-ring frameworks.
A) Steroids
B) Eicosanoids
C) Phospholipids
D) Glycolipids
E) Micelles
Answer: A
Learning Outcome: 2.16
Bloom's Taxonomy: Remembering

107) All amino acid molecules contain
A) carbon, hydrogen, oxygen and phosphate.
B) carbon, oxygen and nitrogen.
C) carbon, nitrogen and hydrogen.
D) carbon, nitrogen, hydrogen and oxygen.
E) carbon, nitrogen, oxygen, phosphate and sulfate.
Answer: D
Learning Outcome: 2.17
Bloom's Taxonomy: Remembering

108) Every amino acid has a central carbon atom to which all of the followings are attached **except**
A) a hydrogen atom.
B) a phosphate group.
C) an amino group.
D) a carboxyl group.
E) a variable side group labeled as R.
Answer: B
Learning Outcome: 2.17
Bloom's Taxonomy: Remembering

109) A sequence of amino acids bonded together in a linear chain is called a
A) primary structure.
B) secondary structure.
C) tertiary structure.
D) quaternary structure.
E) tripeptide.
Answer: A
Learning Outcome: 2.17
Bloom's Taxonomy: Remembering

110) Which of the following is a result of convoluted coiling and folding that grants protein its final three-dimensional shape?
A) primary structure
B) secondary structure
C) tertiary structure
D) quaternary structure
E) pentagonal
Answer: C
Learning Outcome: 2.17
Bloom's Taxonomy: Remembering

111) All of the following are correct regarding protein denaturation **except**
A) with increase in temperature, enzyme function deteriorates.
B) tertiary structure becomes nonfunctional.
C) secondary structure becomes nonfunctional.
D) quaternary structure becomes nonfunctional.
E) death may occur at very high temperature.
Answer: C
Learning Outcome: 2.17
Bloom's Taxonomy: Remembering

112) Which of the following is correct regarding enzymes?
A) They are made of lipids.
B) They slow down cellular reactions.
C) They are organic catalysts and are made of proteins.
D) They bind to the active site of substrates.
E) They are released during cellular injury.
Answer: C
Learning Outcome: 2.18
Bloom's Taxonomy: Remembering

113) Substrate molecules bind to enzymes at the _____ sites.
A) amino
B) active
C) carboxyl
D) reactant
E) neutral
Answer: B
Learning Outcome: 2.18
Bloom's Taxonomy: Remembering

114) The maximum rate of an enzyme reaction occurs at
A) dehydration.
B) hydrolysis.
C) synthesis.
D) reversible.
E) saturation limit.
Answer: E
Learning Outcome: 2.18
Bloom's Taxonomy: Remembering

115) The most abundant high-energy compound in cells is
A) DNA.
B) adenosine diphosphate.
C) adenosine monophosphate.
D) adenosine triphosphate.
E) RNA.
Answer: D
Learning Outcome: 2.19
Bloom's Taxonomy: Remembering

116) A high-energy bond in ATP is present between
A) adenine and ribose.
B) adenine and a phosphate group.
C) the first and second phosphate group.
D) the second and third phosphate group.
E) the first and second, and the second and third phosphate groups.
Answer: E
Learning Outcome: 2.19
Bloom's Taxonomy: Remembering

117) What product is formed from the addition of a phosphate group to ADP?
A) adenosine diphosphate
B) adenine
C) adenosine triphosphate
D) deoxyribonucleic acid
E) ribose
Answer: C
Learning Outcome: 2.19
Bloom's Taxonomy: Remembering

118) AMP + P →
A) ADP.
B) 2ADP.
C) DNA.
D) ATP.
E) adenine.
Answer: A
Learning Outcome: 2.19
Bloom's Taxonomy: Remembering

119) Adding a phosphate group to adenosine forms
A) ADP.
B) ATP.
C) AMP.
D) 2ATP.
E) ribose.
Answer: C
Learning Outcome: 2.19
Bloom's Taxonomy: Remembering

120) Adenosine is formed by combining
A) adenine and ribose.
B) adenine and phosphate group.
C) ribose and a phosphate group.
D) adenine, ribose, and a phosphate group.
E) adenine, ribose, and 3 phosphate groups.
Answer: A
Learning Outcome: 2.19
Bloom's Taxonomy: Remembering

121) The hydrolysis of ATP yields ADP, a phosphate ion, and
A) a second phosphate ion.
B) a hydrogen ion.
C) energy.
D) ribose sugar.
E) adenine.
Answer: C
Learning Outcome: 2.19
Bloom's Taxonomy: Remembering

122) What is the individual subunit of nucleic acid called?
A) ribonucleic acid
B) deoxyribonucleic acid
C) purine
D) nucleotide
E) pyrimidine
Answer: D
Learning Outcome: 2.20
Bloom's Taxonomy: Understanding

123) Molecules that store and process genetic information are
A) proteins.
B) nucleic acids.
C) carbohydrates.
D) lipids.
E) steroids.
Answer: B
Learning Outcome: 2.20
Bloom's Taxonomy: Remembering

124) What is an important characteristic of amino acid uracil?
A) It is found only in DNA.
B) It is found only in RNA.
C) It is found both in DNA and RNA.
D) It is not found in DNA or RNA.
E) It is an essential part of quaternary proteins.
Answer: B
Learning Outcome: 2.20
Bloom's Taxonomy: Remembering

125) All of the following are correct regarding RNA **except**
A) it contains ribose sugar.
B) molecular shape varies with hydrogen bonding along the length of the strand.
C) the nitrogenous base is made of adenine, guanine, cytosine, and uracil.
D) it makes protein as directed by DNA.
E) it contains a double helix.
Answer: E
Learning Outcome: 2.20
Bloom's Taxonomy: Remembering

126) All of the following are correct regarding DNA **except**
A) it contains deoxyribose sugar.
B) molecular shape varies with hydrogen bonding along the length of the strand.
C) the nitrogenous base is made of adenine, guanine, cytosine, and thymine.
D) it stores genetic information.
E) it contains a double helix.
Answer: B
Learning Outcome: 2.20
Bloom's Taxonomy: Remembering

127) Adenine and guanine are
A) purines represented by T and C.
B) pyrimidines represented by A and G.
C) purines represented by A and G.
D) pyrimidines represented by T and C.
E) nucleotides represented by A and G.
Answer: C
Learning Outcome: 2.20
Bloom's Taxonomy: Remembering

128) The structure of RNA differs from DNA in that
A) the backbone of RNA contains ribose.
B) RNA contains pyrimidines but not purines.
C) RNA contains purines but not pyrimidines.
D) DNA contains pyrimidines but not purines.
E) DNA contains purines but not pyrimidines.
Answer: A
Learning Outcome: 2.20
Bloom's Taxonomy: Understanding

129) The purines found in DNA are _____ and _____.
A) cytosine; guanine
B) adenine; guanine
C) thymine; cytosine
D) adenine; cytosine
E) thymine; guanine
Answer: B
Learning Outcome: 2.20
Bloom's Taxonomy: Remembering

130) The pyrimidine bases found in DNA are _____ and _____.
A) cytosine; guanine
B) adenine; guanine
C) thymine; cytosine
D) adenine; cytosine
E) thymine; guanine
Answer: C
Learning Outcome: 2.20
Bloom's Taxonomy: Remembering

131) What is the relationship between an atom and matter? (Module 2.1A)
A) An atom is the smallest stable unit of matter, and matter is anything that takes up space and has mass.
B) An atom is the largest stable unit of matter, and matter is anything that takes up space and has mass.
C) An atom is a particle with a negative electrical charge, and matter is mass within a gravitational field.
D) An atom is a chemical substance made up of two or more different elements in a fixed proportion, and matter is a pure substance consisting only of atoms with the same atomic number.
E) An atom is the smallest stable unit of matter, and matter is a pure substance consisting only of atoms with the same atomic number.
Answer: A
Learning Outcome: 2.1
Bloom's Taxonomy: Remembering

132) Which subatomic particles have a positive charge? Which are uncharged? (Module 2.1B)
A) protons; electrons
B) electrons; protons
C) protons; neutrons
D) neutrons; electrons
E) electrons; neutrons
Answer: C
Learning Outcome: 2.1
Bloom's Taxonomy: Remembering

133) Describe the subatomic particle not in the nucleus. (Module 2.1C)
A) Protons are not in the nucleus. They whirl around the nucleus creating a proton cloud.
B) Electrons are not in the nucleus. They whirl around the nucleus creating an electron cloud.
C) Neutrons are not in the nucleus. They whirl around the nucleus creating a neutron cloud.
D) Protons and neutrons are not in the nucleus. They whirl around the nucleus creating a proton and neutron cloud.
E) Protons and electrons are not in the nucleus. They whirl around the nucleus creating a proton and electron cloud.
Answer: B
Learning Outcome: 2.1
Bloom's Taxonomy: Remembering

134) The gravitational field of the moon is 17% of Earth's. How would the weight and mass of a 100-pound astronaut change on the moon? (Module 2.1D)
A) On the moon, the astronaut would have more mass than on Earth but would weigh the same.
B) On the moon, the astronaut would have less mass than on Earth but would weigh the same.
C) On the moon, the astronaut would have the same mass as on Earth but would weigh 17 pounds (100 × 0.17).
D) On the moon, the astronaut would have the same mass as on Earth but would weigh 588 pounds (100/0.17).
E) On the moon, the astronaut would have less mass than on Earth and would weigh 17 pounds (100 × 0.17).
Answer: C
Learning Outcome: 2.1
Bloom's Taxonomy: Applying

135) Which is larger: an element's atomic number or mass number? (Module 2.2A)
A) atomic number
B) mass number
Answer: B
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

136) Carbon-12 (^{12}C) is the most common form of the element carbon. How is the isotope carbon-13 (^{13}C) similar to and different from ^{12}C? (Module 2.2B)
A) Isotope ^{13}C has the same chemical properties but has one more electron than ^{12}C.
B) Isotope ^{13}C has the same chemical properties but has one more proton than ^{12}C.
C) Isotope ^{13}C has the same chemical properties but has one more neutron than ^{12}C.
D) Isotope ^{13}C has different chemical properties and has one more electron and one more proton than ^{12}C.
E) Isotope ^{13}C has different chemical properties and has one more electron than ^{12}C.
Answer: C
Learning Outcome: 2.2
Bloom's Taxonomy: Understanding

137) Describe trace elements. (Module 2.2D)
A) Trace elements are abundant in the atmosphere and also abundant in the human body.
B) Trace elements are present in small amounts in the body and are required for normal growth and maintenance.
C) Trace elements are present in small amounts in the body and are not necessary for normal growth and maintenance.
D) Trace elements are present in small amounts in the atmosphere but accumulate in the body at high levels.
E) Trace elements are the elements produced by nuclear reactions in research laboratories.
Answer: B
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

138) List the chemical symbols of the six most abundant elements in the human body and their total percentage contribution to total body weight. (Module 2.2E)
A) O, C, H, N, K, Na. They account for 65% of total body weight.
B) O, C, H, N, K, Na. They account for 99.3% of total body weight.
C) O, C, H, N, Ca, and P. They account for 65% of total body weight.
D) O, C, H, N, Ca, and P. They account for 99.3% of total body weight.
E) O, C, H, N, Ca, and P. They account for 100% of total body weight.
Answer: D
Learning Outcome: 2.2
Bloom's Taxonomy: Remembering

139) Indicate the maximum number of electrons that can occupy each of the first three energy levels of an atom. (Module 2.3A)
A) 1, 4, 8
B) 1, 2, 4
C) 2, 4, 8
D) 2, 8, 8
E) 2, 8, 16
Answer: D
Learning Outcome: 2.3
Bloom's Taxonomy: Remembering

140) Explain why the atoms of inert elements do not react with one another or combine with atoms of other elements. (Module 2.3B)
A) Atoms of inert elements are nonreactive because the innermost electron shell contains the maximum number of electrons possible.
B) Atoms of inert elements are nonreactive because the innermost electron shell contains the minimum number of electrons possible.
C) Atoms of inert elements are nonreactive because the outermost electron shell (valence shell) contains the maximum number of electrons possible.
D) Atoms of inert elements are nonreactive because the outermost electron shell (valence shell) contains the minimum number of electrons possible.
E) Atoms of inert elements are nonreactive because the number of electrons is equal to the number of protons.
Answer: C
Learning Outcome: 2.3
Bloom's Taxonomy: Understanding

141) Cations are smaller in diameter than their electrically neutral atom. Why? (Module 2.3D)
A) When electrons are lost, the remaining electrons are pulled closer toward the nucleus.
B) When electrons are lost, the remaining electrons are pulled further away from the nucleus.
C) When electrons are gained, the electrons are pulled closer toward the nucleus.
D) When electrons are gained, the electrons are pulled further away from the nucleus.
E) When electrons are lost, the remaining electrons enter the nucleus.
Answer: A
Learning Outcome: 2.3
Bloom's Taxonomy: Understanding

142) Describe why table salt is a compound. (Module 2.4A)
A) Table salt is a compound because it is made up of more than one element in different proportions.
B) Table salt is a compound because it is made up of only one element with different isotopes.
C) Table salt is a compound because it is made up of only one element bound with more than one type of chemical bond.
D) Table salt is a compound because it is made up of more than one isotope in different proportions.
E) Table salt is a compound because it is made up of more than one element in a fixed proportion.
Answer: E
Learning Outcome: 2.4
Bloom's Taxonomy: Understanding

143) How many electrons are shared by the oxygen atoms in an oxygen molecule? (Module 2.4B)
A) one electron
B) eight electrons
C) 1 pair of electrons
D) 2 pairs of electrons
E) 3 pairs of electrons
Answer: D
Learning Outcome: 2.4
Bloom's Taxonomy: Remembering

144) Describe the kind of bonds that hold the atoms in a water molecule together. (Module 2.4C)
A) Water molecule bonds are ionic bonds, in which electrons are gained and lost to create the bond.
B) Water molecule bonds are oxygen bonds, in which oxygen atoms form bonds together.
C) Water molecule bonds are polar covalent bonds, in which unequal sharing of electrons occurs.
D) Water molecule bonds are nonpolar covalent bonds, in which equal sharing of electrons occurs.
E) Water molecules bonds are nonpolar ionic bonds, in which equal movement of electrons occurs.
Answer: C
Learning Outcome: 2.4
Bloom's Taxonomy: Remembering

145) Describe the different states of matter in terms of shape and volume. (Module 2.5A)
A) Solids have a fixed volume and shape, liquids have a constant volume but no fixed shape, and gases have neither a constant volume nor a fixed shape.
B) Solids have a constant volume but not fixed shape, liquids have a fixed volume and shape, and gases have neither a constant volume nor a fixed shape.
C) Solids have a constant volume but not fixed shape, liquids have neither a constant volume nor a fixed shape, and gases have a fixed volume and shape.
D) Solids have a fixed volume and shape, liquids have neither a constant volume nor a fixed shape, and gases have a constant volume but no fixed shape.
E) Solids have neither a constant volume nor a fixed shape, liquids have a constant volume but no fixed shape, and gases have a fixed volume and shape.
Answer: A
Learning Outcome: 2.5
Bloom's Taxonomy: Remembering

146) By what means are water molecules attracted to each other? (Module 2.5B)
A) by oxygen bonds
B) by hydrogen bonds
C) by ionic bonds
D) by nonpolar covalent bonds
E) by isotopes
Answer: B
Learning Outcome: 2.5
Bloom's Taxonomy: Remembering

147) Explain why small insects can walk on the surface of a pond and why tears protect the surface of the eye from dust particles. (Module 2.5C)
A) The attraction of the water molecules disrupts the ionic bonds preventing small objects from penetrating the water.
B) The attraction of water molecules creates a gas layer that prevents small objects from penetrating the water.
C) The attraction of water molecules creates an ice layer that prevents small objects from penetrating the water.
D) The attraction of water molecules creates a surface tension barrier that prevents small objects from penetrating the water.
E) The attraction of water molecules forms ionic bonds creating a barrier that prevents small objects from penetrating the water.
Answer: D
Learning Outcome: 2.5
Bloom's Taxonomy: Understanding

148) Name the participants in a chemical reaction. (Module 2.7A)
A) reactants
B) products
C) enzymes
D) vitamins
E) cofactors
Answer: A
Learning Outcome: 2.7
Bloom's Taxonomy: Remembering

149) How are chemical reactions represented? (Module 2.7B)
A) Reactions are represented by line plots and the line represents the direction of the reaction.
B) Reactions are represented by a sine wave and the slope represents the direction of the reaction.
C) Reactions are represented by chemical equations and the arrow represents the direction of the reaction.
D) Reactions are represented by Lewis structural models and the total number of atoms represents the direction of the reaction.
E) Reactions are represented by superscripts and subscripts and the charge represents the direction of the reaction.
Answer: C
Learning Outcome: 2.7
Bloom's Taxonomy: Remembering

150) What is formula weight? (Module 2.7C)
A) the sum of the atomic weights of its component atoms
B) the weight in grams equal to the element's atomic weight
C) the total weight of an element including the isotopes
D) the average weight of an element's different atomic masses and proportions of its different isotopes
E) the sum of the atomic weights of the elements making up an ionic compound
Answer: E
Learning Outcome: 2.7
Bloom's Taxonomy: Remembering

151) Using chemical notation, write the molecular formula for glucose, a compound composed of 6 carbon (C) atoms, 12 hydrogen (H) atoms, and 6 oxygen (O) atoms. (Module 2.7D)
A) CHO
B) CH_2O
C) $C_1H_2O_1$
D) $C_6H_{12}O_6$
E) CHO (6-12-6)
Answer: D
Learning Outcome: 2.7
Bloom's Taxonomy: Remembering

152) Calculate the weight of 1 mol of glucose. (The atomic weight of carbon = 12). (Module 2.7E)
A) 29 grams
B) 180 grams
C) 12 grams
D) 24 grams
E) 120 grams
Answer: B
Learning Outcome: 2.7
Bloom's Taxonomy: Applying

153) Compare the role of water in hydrolysis and dehydration synthesis reactions. (Module 2.8A)
A) In hydrolysis, water is a reactant; in dehydration synthesis, water is a product.
B) In hydrolysis, water is a product; in dehydration synthesis, water is a reactant.
C) In hydrolysis and dehydration synthesis, water is a reactant.
D) In hydrolysis and dehydration synthesis, water is a product.
E) In hydrolysis and dehydration synthesis, water is an enzyme.
Answer: A
Learning Outcome: 2.8
Bloom's Taxonomy: Remembering

154) What is the source of energy that converts glucose, a six-carbon molecule, into two three-carbon molecules in cells? (Module 2.8C)
A) The potential energy stored in the ionic bonds of the glucose molecule is released when some of the bonds break.
B) The kinetic energy released as ions are formed when glucose is broken down.
C) The potential energy stored in the covalent bonds of the glucose molecule is released when some of the bonds break.
D) The kinetic energy released as one glucose molecule combines with another glucose molecule.
E) The kinetic energy is converted to potential energy as the glucose molecule forms.
Answer: C
Learning Outcome: 2.8
Bloom's Taxonomy: Understanding

155) What is an enzyme? (Module 2.9A)
A) An enzyme is a protein that increases the activation energy so more energy can be generated.
B) An enzyme is a protein that lowers the activation energy of a reaction.
C) An enzyme provides the activation energy of a reaction.
D) An enzyme is an inorganic compound.
E) An enzyme is a polymer produced by linking monomers together.
Answer: B
Learning Outcome: 2.9
Bloom's Taxonomy: Remembering

156) Why do our cells need enzymes? (Module 2.9B)
A) Enzymes are important sources of nutrients.
B) Enzymes are important inorganic compounds used by cells.
C) Enzymes provide the activation energy of a reaction so it can occur.
D) Enzymes lower the activation energy of a reaction so it can occur.
E) Enzymes increase the activation energy of a reaction so it can occur.
Answer: D
Learning Outcome: 2.9
Bloom's Taxonomy: Understanding

157) What is an important by-product of exergonic reactions? (Module 2.9C)
A) water
B) carbon dioxide
C) oxygen
D) polymers
E) heat
Answer: E
Learning Outcome: 2.9
Bloom's Taxonomy: Remembering

158) Explain how the ionic compound sodium chloride dissolves in water. (Module 2.11A)
A) The positive poles of water molecules are attracted to the negatively charged chloride ions, and the negative poles of water molecules are attracted to the positively charged sodium ions.
B) The positive poles of water molecules are attracted to the positively charged chloride ions, and the negative poles of water molecules are attracted to the negatively charged sodium ions.
C) The negative poles of water molecules are attracted to the negatively charged chloride ions, and the positive poles of water molecules are attracted to the positively charged sodium ions.
D) The negative poles of water molecules are attracted to the positively charged chloride ions, and the positive poles of water molecules are attracted to the negatively charged sodium ions.
E) Sodium chloride is hydrophobic so it does not dissolve in water.
Answer: A
Learning Outcome: 2.11
Bloom's Taxonomy: Understanding

159) Define *electrolytes*. (Module 2.11B)
A) Electrolytes are enzymes that create energy in a solution.
B) Electrolytes are enzymes that lower the activation energy for a solution.
C) Electrolytes are ions that will conduct an electrical current in a solution.
D) Electrolytes are hydrophobic and will create an electrical barrier between the hydrophobic substances and the hydrophilic substances in a solution.
E) Electrolytes are sugar polymers used to rehydrate by increasing plasma volume.
Answer: C
Learning Outcome: 2.11
Bloom's Taxonomy: Remembering

160) Distinguish between hydrophilic and hydrophobic molecules. (Module 2.11C)
A) Hydrophilic molecules are attracted to water, whereas hydrophobic molecules do not interact with water molecules.
B) Hydrophilic molecules do not interact with water molecules, whereas hydrophobic molecules are attracted to water.
C) Hydrophilic molecules are inorganic, whereas hydrophobic molecules are organic.
D) Hydrophilic molecules are organic, whereas hydrophobic molecules are inorganic.
E) Hydrophilic molecules are monomers, whereas hydrophobic molecules are polymers.
Answer: A
Learning Outcome: 2.11
Bloom's Taxonomy: Understanding

161) Define *pH*. (Module 2.12A)
A) pH is a measure of the oxygen concentration in a solution.
B) pH is a measure of the pressure of all the dissolved gases in a solution.
C) pH is a measure of blood pressure.
D) pH is a measure of the temperature in a solution.
E) pH is a measure of the hydrogen ion concentration in a solution.
Answer: E
Learning Outcome: 2.12
Bloom's Taxonomy: Remembering

162) A hydrogen ion is the same as what subatomic particle? (Module 2.12B)
A) electron
B) neutron
C) proton
D) quark
E) neutrino
Answer: C
Learning Outcome: 2.12
Bloom's Taxonomy: Remembering

163) List the elements that make up organic compounds. (Module 2.13A)
A) hydrogen and oxygen only
B) hydrogen and carbon, and generally oxygen as well
C) hydrogen, oxygen, sodium, chloride
D) sodium, chloride, and potassium
E) hydrogen, nitrogen, and sodium
Answer: B
Learning Outcome: 2.13
Bloom's Taxonomy: Remembering

164) What is a functional group? (Module 2.13B)
A) A functional group is the result of dissociation of organic molecules.
B) A functional group is the final energy source in organic catabolism.
C) A functional group is the complex created when an enzymes binds its substrate to complete a reaction.
D) A functional group is a grouping of atoms that confer specific chemical properties to the rest of the molecule to which it is attached.
E) A functional group is the specific grouping of atoms on a molecule to which enzymes can bind.
Answer: D
Learning Outcome: 2.13
Bloom's Taxonomy: Remembering

165) Describe the functional groups that are considered acidic or basic. (Module 2.13D)
A) An amino group acts as a base because it can accept hydrogen ions, and a carboxyl group acts as an acid because it releases a hydrogen ion.
B) An amino group acts as a base because it releases a hydrogen ion, and a carboxyl group acts as an acid because it can accept hydrogen ions.
C) A phosphate group acts as a base because it can accept hydrogen ions, and a hydroxyl group acts as an acid because it releases a hydrogen ion.
D) A phosphate group acts as an acid because it can accept hydrogen ions, and a hydroxyl group acts as a base because it releases a hydrogen ion.
E) Phosphate groups can act as an acid or a base depending on the pH of the surrounding solution.
Answer: A
Learning Outcome: 2.13
Bloom's Taxonomy: Understanding

166) What is the most important function of carbohydrates? (Module 2.14A)
A) to form and maintain the cell membrane
B) to provide the basic structure for all steroid hormones to be derived
C) they act as enzymes
D) they are the building blocks of proteins
E) they are the primary energy source
Answer: E
Learning Outcome: 2.14
Bloom's Taxonomy: Remembering

167) Which of the structural representations of glucose shown below is more common in the body? (Module 2.14B)
A) linear form
B) ring form
C) ionic form
D) unsaturated form
E) saturated form
Answer: B
Learning Outcome: 2.14
Bloom's Taxonomy: Remembering

168) List the three structural classes of carbohydrates, and give an example of each. (Module 2.14C)
A) monosaccharides (glucose), disaccharides (sucrose), and polysaccharides (starch)
B) monosaccharides (sucrose), disaccharides (starch), and polysaccharides (glucose)
C) monosaccharides (glucose), disaccharides (starch), and polysaccharides (sucrose)
D) monosaccharides (sucrose), disaccharides (glucose), and polysaccharides (starch)
E) monosaccharides (starch), disaccharides (glucose), and polysaccharides (sucrose)
Answer: A
Learning Outcome: 2.14
Bloom's Taxonomy: Remembering

169) Predict the reactants and the type of chemical reaction involved when muscle cells make and store glycogen. (Module 2.14D)
A) glucose and fructose; dehydration synthesis
B) glucose and fructose; hydrolysis
C) many glucose monomers; dehydration synthesis
D) many glucose monomers; hydrolysis
E) many starch monomers; hydrolysis
Answer: C
Learning Outcome: 2.14
Bloom's Taxonomy: Remembering

170) Describe lipids in terms of their elemental composition and solubility in water. (Module 2.15A)
A) water-soluble organic compounds made up of carbon, hydrogen, and oxygen
B) water-insoluble organic compounds made up of carbon, hydrogen, and oxygen
C) water-soluble inorganic compounds made up of hydrogen and oxygen
D) water-insoluble inorganic compounds made up of hydrogen and oxygen
E) water-soluble organic compounds made up of hydrogen and oxygen
Answer: B
Learning Outcome: 2.15
Bloom's Taxonomy: Remembering

171) In the hydrolysis of a triglyceride, what are the reactants and the products? (Module 2.15D)
A) The reactants are a glycerol molecule and three fatty acids; the products are a triglyceride and three water molecules.
B) The reactants are a triglyceride and three water molecules; the products are a glycerol molecule and three fatty acids.
C) The reactants are a glucose monomer and three water molecules; the products are a glycogen molecule and three fatty acids.
D) The reactants are a glycogen molecule and three water molecules; the products are a glucose monomer and three fatty acids.
E) The reactants are a glycine molecule and three water molecules; the products are a glyceride molecule and three fatty acids.
Answer: B
Learning Outcome: 2.15
Bloom's Taxonomy: Remembering

172) Describe the structure and role of prostaglandins. (Module 2.16A)
A) They are a type of leukotrienes released by cells to coordinate local cellular activities and produce pain sensations.
B) They are a type of steroid used to maintain the plasma membrane and for cell growth and division.
C) They are a type of eicosanoid released by cells to coordinate local cellular activities and produce pain sensations.
D) They have a carbohydrate attached to a diglyceride and are used to maintain the plasma membrane.
E) They have a carbon-ring structure and are used for producing many steroid hormones.
Answer: C
Learning Outcome: 2.16
Bloom's Taxonomy: Remembering

173) Why is cholesterol necessary in the body? (Module 2.16B)
A) It is important for energy production.
B) It is an important enzyme.
C) It is a building block for proteins.
D) It is a component of plasma membranes and is important for cell growth and division.
E) It makes up the genetic material.
Answer: D
Learning Outcome: 2.16
Bloom's Taxonomy: Remembering

174) Describe the orientations of phospholipids and glycolipids when they form a micelle. (Module 2.16C)
A) The hydrophobic tails are inside, and the hydrophilic heads form the surface of the micelle.
B) The hydrophilic tails are inside, and the hydrophobic heads form the surface of the micelle.
C) The hydrophobic heads are inside, and the hydrophilic tails form the surface of the micelle.
D) The hydrophilic heads are inside, and the hydrophobic tails form the surface of the micelle.
E) The phospholipids are on the inside, and the glycolipids form the surface of the micelle.
Answer: A
Learning Outcome: 2.16
Bloom's Taxonomy: Remembering

175) What do cholesterol, phospholipids, and glycolipids have in common? (Module 2.16D)
A) They all form ring structures.
B) They all have carbohydrate groups attached.
C) They are all linear structures.
D) They are all structural lipids that form membranes of cells.
E) They are all soluble in water.
Answer: D
Learning Outcome: 2.16
Bloom's Taxonomy: Understanding

176) What kind of bond forms during the dehydration synthesis of two amino acids, and which functional groups are involved? (Module 2.17B)
A) A glycosidic bond forms between the amino group of one amino acid and the carboxyl group of the other amino acid.
B) A hydrogen bond forms between the hydrogen atom of one amino acid and the oxygen atom of the other amino acid.
C) An ionic bond forms between the amino ion of one amino acid and the carboxylic acid of the other amino acid.
D) A lipophilic bond forms between the hydrophobic tail of one amino acid and the hydrophilic head of the other amino acid.
E) A peptide bond forms between the amino group of one amino acid and the carboxyl group of the other amino acid.
Answer: E
Learning Outcome: 2.17
Bloom's Taxonomy: Remembering

177) What are the reactants in an enzymatic reaction called? (Module 2.18A)
A) ATP
B) energy
C) substrates
D) products
E) inhibitors
Answer: C
Learning Outcome: 2.18
Bloom's Taxonomy: Remembering

178) Relate an enzyme's structure to its reaction specificity. (Module 2.18B)
A) The reaction specificity relates to the unique shape of the active site to which only a complementary shape can bind.
B) The reaction specificity relates to the number of enzymes with the same structure.
C) The reaction specificity relates to the size of the enzyme.
D) The reaction specificity relates to how many active sites are present on the enzyme.
E) The reaction specificity relates to how much energy is created when the enzyme-substrate complex forms.
Answer: A
Learning Outcome: 2.18
Bloom's Taxonomy: Remembering

179) Describe ATP. (Module 2.19A)
A) ATP consists of an adenine molecule with three potassium ions attached.
B) ATP consists of an adenosine molecule with three phosphate groups attached.
C) ATP consists of an adenosine, a thymine, and a pyrimidine molecule linked together.
D) ATP consists of an adenine molecule with three phosphate groups attached.
E) ATP consists of an adenosine with three potassium ions attached.
Answer: B
Learning Outcome: 2.19
Bloom's Taxonomy: Remembering

180) Compare AMP with ADP. (Module 2.19B)
A) AMP has one potassium ion and ADP has two potassium ions.
B) AMP has one sugar molecule and ADP has two sugar molecules.
C) AMP has one fatty acid and ADP has two fatty acids.
D) AMP has one phosphate group and ADP has two phosphate groups.
E) AMP has one binding site and ADP has two binding sites.
Answer: D
Learning Outcome: 2.19
Bloom's Taxonomy: Remembering

181) Where do cells obtain the energy needed for their vital functions? (Module 2.19C)
A) Energy depends on the number of rings in their structure.
B) Energy comes from the type of sugar molecule bound to the structure.
C) Energy comes from breaking high energy bonds in a compound.
D) Energy comes from the number of enzymes that are present in the cell.
E) Energy comes from the type of nitrogenous base in the structure.
Answer: C
Learning Outcome: 2.19
Bloom's Taxonomy: Understanding

182) What are the products of ATP hydrolysis? (Module 2.19D)
A) AMP, two phosphate groups, and energy
B) ADP, a phosphate group, and energy
C) 3 phosphate groups and energy
D) an adenosine, a phosphate group, and energy
E) ribose, adenine, a phosphate group, and energy
Answer: B
Learning Outcome: 2.19
Bloom's Taxonomy: Remembering

183) Explain how the complementary strands of DNA are held together. (Module 2.20B)
A) They are held by ionic bonds.
B) They are held by complementary base pairing; adenine to thymine and guanine to cytosine.
C) They are held by complementary base pairing; adenine to cytosine and thymine to guanine.
D) They are held by complementary base pairing; adenine to guanine and thymine to cytosine.
E) They are held by complementary base pairing; adenine to adenine, thymine to thymine, guanine to guanine, and cytosine to cytosine.
Answer: B
Learning Outcome: 2.20
Bloom's Taxonomy: Remembering

Essay Questions

184) Compare and contrast ionic and covalent bonds.
Answer: An ionic bond is when one molecule loses an electron and gives it to another molecule. One molecule becomes positive and the other one becomes negative. This forms a weak magnetic attraction between the two molecules. A covalent bond is when two or more molecules share an electron with each other. The bond is much stronger than an ionic bond.
Learning Outcome: 2.3
Bloom's Taxonomy: Analyzing

185) Predict what will happen in the human body when a person ingests a large amount of Rolaids®, i.e., a base.
Answer: Because the Rolaids® are a base, they would neutralize some of the acid in the stomach. If enough of the acid is neutralized, the body's buffer systems would need to correct the pH shift.
Learning Outcome: 2.9
Bloom's Taxonomy: Applying

186) Justify why blood has a very narrow normal pH range. What happens if the blood pH gets too high or too low?
Answer: Homeostasis requires that the pH of body fluids be maintained almost constant to avoid disruptions of normal cell and tissue function. If the pH of the blood and body fluids gets too high, alkalosis occurs, causing uncontrollable muscle contractions. If the pH of the blood and body fluids gets too low, acidosis occurs and will result in coma and death.
Learning Outcome: 2.9
Bloom's Taxonomy: Analyzing

187) Explain the role of water molecules in polysaccharide formation.
Answer: Water molecules are removed in the dehydration synthesis of polysaccharides.
Learning Outcome: 2.10
Bloom's Taxonomy: Understanding

188) Describe the importance of hemoglobin.
Answer: It is a globular protein, which is made of quaternary structure. It is comprised of four polypeptide subunits. Red blood cells contain a large amount of hemoglobin. Oxygen binds to heme unit of the molecule and carried from the lung to the tissue.
Learning Outcome: 2.17
Bloom's Taxonomy: Understanding

189) What are the characteristics of an RNA molecule?
Answer: It consists of a single chain of nucleotide. The order of nucleotides and the interactions among them will affect the shape and the function of RNA. There are three different types of RNA and each one has its own specific function: (1) messenger RNA (mRNA), (2) transfer RNA (tRNA), and (3) ribosomal RNA (rRNA).
Learning Outcome: 2.20
Bloom's Taxonomy: Remembering

190) How is it possible for two samples of hydrogen to contain the same number of atoms yet have different weights? (Module 2.2C)
Answer: Isotopes are atoms with the same number of protons but different numbers of neutrons. Hydrogen has three isotopes: hydrogen-1, with a mass number of 1; deuterium, with a mass number of 2; and tritium, with a mass number of 3. The mass number is greater in each isotope because the atoms contain an increasing number of neutrons. The heavier hydrogen sample must contain a higher proportion of one or both of the heavier isotopes.
Learning Outcome: 2.2
Bloom's Taxonomy: Understanding

191) Explain how cations and anions form. (Module 2.3C)
Answer: A cation is formed when an atom loses one or more electrons from its outermost electron shell; it has an overall positive charge because it contains more protons than electrons. An anion is formed when an atom gains one or more electrons in its outermost electron shell; it has an overall negative charge because it contains more electrons than protons.
Learning Outcome: 2.3
Bloom's Taxonomy: Understanding

192) Explain why we can use the term *molecule* for the smallest particle of water but not for that of table salt. (Module 2.4D)
Answer: The term molecule refers only to chemical structures held together by covalent bonds. Table salt is an ionic compound whose components — sodium ions and chloride ions — are held together by ionic bonds.
Learning Outcome: 2.4
Bloom's Taxonomy: Understanding

193) Describe the relationship between thermal energy (temperature) and stability of the hydrogen bonds between water molecules in ice, in liquid water, and as a gas. (Module 2.5D)
Answer: The low thermal energy of ice slows the vibration of water molecules, resulting in stable hydrogen bonds. Liquid water has more thermal energy than does ice, and hydrogen bonds are less stable as they break and re-form. At the boiling point, hydrogen bonds are broken, and the water molecules are independent of each other.
Learning Outcome: 2.5
Bloom's Taxonomy: Understanding

194) Describe how cells are chemical factories. (Module 2.6A)
Answer: Cells are chemical factories because they use complex chemical reactions to provide the energy they need to maintain homeostasis and to perform essential functions.
Learning Outcome: 2.6
Bloom's Taxonomy: Understanding

195) Compare and contrast the terms *work*, *energy*, *potential energy*, and *kinetic energy*. (Module 2.6B)
Answer: *Work* is the movement of an object or a change in the physical structure of matter. *Energy* is the capacity to perform work. *Potential energy* is stored energy that has the potential (capability) to do work. *Kinetic energy* is the energy of motion.
Learning Outcome: 2.6
Bloom's Taxonomy: Understanding

196) Relate the terms *work*, *energy*, *potential energy*, and *kinetic energy* to a muscle contraction at the cellular level. (Module 2.6C)
Answer: Cells do *work* when they synthesize complex molecules and move materials into and out of cells. Muscle contraction requires *energy*. Molecules inside muscle cells store the *potential energy* of contraction. The potential energy of contraction is converted into *kinetic energy* when a muscle contracts.
Learning Outcome: 2.6
Bloom's Taxonomy: Applying

197) Identify and describe three types of chemical reactions important in human physiology. (Module 2.8B)
Answer: Three types of chemical reactions important in human physiology are (1) decomposition reactions, in which a molecule is broken down into smaller fragments; (2) synthesis reactions, in which small molecules are assembled into larger ones; and (3) exchange reactions, in which parts of the reacting molecules are shuffled around to produce new products.
Learning Outcome: 2.8
Bloom's Taxonomy: Understanding

198) Explain the differences between metabolites and nutrients. (Module 2.9D)
Answer: Metabolites are molecules that can be synthesized or broken down by chemical reactions inside our bodies. Nutrients are essential metabolites normally obtained from the diet.
Learning Outcome: 2.9
Bloom's Taxonomy: Understanding

199) Explain why enzymes are often called organic catalysts. (Module 2.9E)
Answer: Enzymes are special protein catalysts. Proteins are one class of organic compounds.
Learning Outcome: 2.9
Bloom's Taxonomy: Understanding

200) Predict how water plays a role as a lubricant, reactant, coolant, and solvent during exercise. (Module 2.10A)
Answer: During exercise, water lubricates the joints for easy movement. It also functions in dehydration synthesis and hydrolysis reactions that occur during muscle contraction. Water also cools the body through the evaporation of perspiration from the skin. Water dissolves wastes generated by exercise.
Learning Outcome: 2.10
Bloom's Taxonomy: Applying

201) Explain the differences among an acid, a base, and a salt. (Module 2.12C)
Answer: An acid is a compound whose dissociation in solution releases a hydrogen ion (H^+) and an anion; a base is a compound whose dissociation releases a hydroxide ion (OH^-) into the solution or removes a hydrogen ion (H^+) from the solution; and a salt is an ionic compound consisting of a cation other than H^+ and an anion other than OH^-.
Learning Outcome: 2.12
Bloom's Taxonomy: Understanding

202) What is the relationship between buffers and pH in physiological systems? (Module 2.12D)
Answer: Buffers stabilize body pH by removing or replacing hydrogen ions. The pH of various body fluids must remain relatively constant if the body is to maintain homeostasis and remain healthy.
Learning Outcome: 2.12
Bloom's Taxonomy: Understanding

203) Identify the important functional groups of organic compounds. (Module 2.13C)
Answer: Amino groups are the functional groups of amino acids. Carboxyl groups are functional groups of fatty acids and amino acids. Hydroxyl groups are the functional groups that link molecules by dehydration synthesis and affect a molecule's solubility. Phosphate groups are functional groups found in nucleic acids and high-energy compounds.
Learning Outcome: 2.13
Bloom's Taxonomy: Remembering

204) List examples of representative lipids in the body. (Module 2.15B)
Answer: Examples of lipids found in the body are fatty acids, glycerides, eicosanoids, steroids, phospholipids, and glycolipids.
Learning Outcome: 2.15
Bloom's Taxonomy: Remembering

205) Describe the structures of saturated and unsaturated fatty acids. (Module 2.15C)
Answer: All fatty acids consist of a hydrocarbon chain and a carboxyl group. In saturated fatty acids, each carbon atom in the hydrocarbon chain has four single covalent bonds that bind the maximum number of hydrogen atoms possible. In unsaturated fatty acids, one or more of the carbon atoms in the hydrocarbon chain has double covalent bonds, so fewer hydrogen atoms are bonded.
Learning Outcome: 2.15
Bloom's Taxonomy: Remembering

206) Summarize the functions of lipids in the body. (Module 2.15E)
Answer: Lipids are both a source of energy and a means of energy storage and insulation and physical protection. Some lipids act as chemical messengers between cells. Lipids are essential components of plasma membranes.
Learning Outcome: 2.15
Bloom's Taxonomy: Remembering

207) Describe proteins. (Module 2.17A)
Answer: Proteins are organic compounds formed from amino acids. Each amino acid contains a carbon atom, a hydrogen atom, an amino group ($-NH_2$), a carboxyl group (-COOH), and a variable group, known as an R group or side chain.
Learning Outcome: 2.17
Bloom's Taxonomy: Remembering

208) Why does boiling a protein affect its functional properties? (Module 2.17C)
Answer: The heat of boiling breaks bonds that maintain the protein's tertiary structure, quaternary structure, or both. The resulting change in shape affects the ability of the protein molecule to perform its normal biological functions. These changes are known as denaturation.
Learning Outcome: 2.17
Bloom's Taxonomy: Applying

209) Describe and identify the two classes of nucleic acids. (Module 2.20A)
Answer: Nucleic acids are large organic molecules composed of carbon, hydrogen, oxygen, nitrogen, and phosphorus that regulate the synthesis of proteins and make up the genetic material in cells. The two classes of nuclei acids are ribonucleic acid (RNA) and deoxyribonucleic acid (DNA).
Learning Outcome: 2.20
Bloom's Taxonomy: Remembering

210) Compare and contrast the nucleotides of DNA and RNA. (Module 2.20C)
Answer: DNA is composed of a pair of nucleotide chains, and RNA is made up of a single chain. The nitrogenous bases adenine, guanine, and cytosine are common to both DNA and RNA nucleotides. The nitrogenous base thymine is found only in DNA, and uracil is found only in RNA.
Learning Outcome: 2.20
Bloom's Taxonomy: Understanding