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***Fundamentals of Anatomy & Physiology, 10e, GE* (Martini)**
Chapter 2 The Chemical Level of Organization

Multiple Choice Questions: Section One

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: Knowledge

2) 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: 2-1
Bloom's Taxonomy: Knowledge

3) 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: D
Learning Outcome: 2-1
Bloom's Taxonomy: Knowledge

4) One mole of any element has the same
A) mass.
B) weight.
C) number of atoms.
D) number of electrons.
E) All of the answers are correct.
Answer: C
Learning Outcome: 2-1
Bloom's Taxonomy: Knowledge

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5) 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: Knowledge

6) 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: 2-1
Bloom's Taxonomy: Knowledge

7) 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: 2-1
Bloom's Taxonomy: Knowledge

8) 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: 2-1
Bloom's Taxonomy: Knowledge

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9) Radioisotopes have unstable
A) ions.
B) nuclei.
C) isotopes.
D) electron clouds.
E) protons.
Answer: B
Learning Outcome: 2-1
Bloom's Taxonomy: Knowledge

10) 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: 2-1
Bloom's Taxonomy: Knowledge

11) Which of these lists contains only trace elements?
A) sulfur, chlorine, oxygen
B) selenium, hydrogen, calcium
C) boron, oxygen, carbon
D) silicon, fluorine, tin
E) cobalt, calcium, sodium
Answer: D
Learning Outcome: 2-1
Bloom's Taxonomy: Knowledge

12) The atomic number represents the number of
A) electrons in an atom.
B) protons in an atom.
C) neutrons in an atom.
D) protons and neutrons in an atom.
E) chemical bonds the atom may form.
Answer: B
Learning Outcome: 2-1
Bloom's Taxonomy: Knowledge

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13) Helium (He) has an atomic number of 2. It is chemically stable because it
A) is neutral in electrical charge.
B) readily ionizes to react with other atoms.
C) has a full outer electron shell.
D) will form a covalent bond with another He atom.
E) lacks electrons, thus the He atom is stable.
Answer: C
Learning Outcome: 2-1
Bloom's Taxonomy: Comprehension

14) Which element commonly has only a proton as its nucleus?
A) helium
B) neon
C) argon
D) hydrogen
E) carbon
Answer: D
Learning Outcome: 2-1
Bloom's Taxonomy: Comprehension

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: 2-1
Bloom's Taxonomy: Comprehension

16) In any given molecule, the sum of the atomic weights of its component atoms is called
A) molecular mass.
B) molecular weight.
C) atomic mass.
D) atomic weight.
E) chemical mass.
Answer: B
Learning Outcome: 2-1
Bloom's Taxonomy: Knowledge

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17) Given the following approximate values, calculate the molecular weight for NaCl.
Atomic number for Na: 11, Atomic weight for Na: 23 g/mol, Atomic number for Cl: 17, Atomic weight for Cl: 35 g/mol, Boiling point for Cl: -34 °C
A) 11 g/mol
B) 28 g/mol
C) 34 g/mol
D) 40 g/mol
E) 58 g/mol
Answer: E
Learning Outcome: 2-1
Bloom's Taxonomy: Application

18) 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: 2-1
Bloom's Taxonomy: Comprehension

19) 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: 2-1
Bloom's Taxonomy: Application

20) If an element is composed of atoms with an atomic number of 6 and a mass number of 14, then a non-isotopic 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 neurons.
Answer: E
Learning Outcome: 2-1
Bloom's Taxonomy: Application

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21) The molecule NO is known as
A) nitric oxide.
B) noxious oxide.
C) noxious oxygen.
D) nitric oxygen.
E) nitrous oxide.
Answer: A
Learning Outcome: 2-2
Bloom's Taxonomy: Knowledge

22) 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: 2-2
Bloom's Taxonomy: Knowledge

23) The molecule H_2 is known as
A) hydrohydrogen.
B) hydrogen.
C) hydroxide.
D) helium.
E) semi-water.
Answer: B
Learning Outcome: 2-2
Bloom's Taxonomy: Knowledge

24) When electrons are transferred from one atom to another, and the two atoms unite as a result of the opposite charges, a(n) _____ is formed.
A) ion
B) molecule
C) hydrogen bond
D) ionic bond
E) covalent bond
Answer: D
Learning Outcome: 2-2
Bloom's Taxonomy: Knowledge

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25) 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: 2-2
Bloom's Taxonomy: Comprehension

26) 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: 2-2
Bloom's Taxonomy: Knowledge

27) The molecule O_2 is known as
A) oxide.
B) oxygen.
C) organic.
D) oxate.
E) a salt.
Answer: B
Learning Outcome: 2-2
Bloom's Taxonomy: Knowledge

28) H_2O is an example of a(n)
A) ionic formula.
B) glucose molecule.
C) compound.
D) ion.
E) covalent formula.
Answer: C
Learning Outcome: 2-2
Bloom's Taxonomy: Knowledge

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

30) 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: 2-2
Bloom's Taxonomy: Knowledge

31) In an aqueous solution, cations are attracted toward
A) sodium.
B) salt.
C) buffers.
D) anions.
E) hydrogen ions.
Answer: D
Learning Outcome: 2-2
Bloom's Taxonomy: Knowledge

32) 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: 2-2
Bloom's Taxonomy: Knowledge

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33) 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: 2-2
Bloom's Taxonomy: Knowledge

34) Ions with a + charge are called
A) cations.
B) anions.
C) radicals.
D) positrons.
E) isotopes.
Answer: A
Learning Outcome: 2-2
Bloom's Taxonomy: Knowledge

35) The weakest bond between two atoms is the _____ bond.
A) ionic
B) covalent
C) polar
D) nonpolar
E) hydrogen
Answer: E
Learning Outcome: 2-2
Bloom's Taxonomy: Knowledge

36) 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: 2-2
Bloom's Taxonomy: Knowledge

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37) Ionic bonds are formed when
A) atoms share electrons.
B) an electron or 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: 2-2
Bloom's Taxonomy: Knowledge

38) If a pair of electrons is unequally shared between two atoms, a(n) _____ bond occurs.
A) single covalent
B) double covalent
C) triple covalent
D) polar covalent
E) hydrogen
Answer: D
Learning Outcome: 2-2
Bloom's Taxonomy: Knowledge

39) 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: 2-2
Bloom's Taxonomy: Knowledge

40) Ions in an ionic molecule are held together due to
A) the sharing of electrons.
B) the attraction of opposite electrical charges.
C) each electron orbiting all of the ions in the molecule.
D) the presence of water molecules.
E) the attraction of similar charges of the ions' protons.
Answer: B
Learning Outcome: 2-2
Bloom's Taxonomy: Knowledge

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41) Sodium (Na) has an atomic number of 11. How many electrons are in the outer electron shell of a neutral sodium atom?
A) 1
B) 2
C) 3
D) 4
E) 8
Answer: A
Learning Outcome: 2-2
Bloom's Taxonomy: Comprehension

42) Oxygen (atomic number 8) requires how many **additional** electrons to fill its outer electron shell?
A) 1
B) 2
C) 4
D) 6
E) 8
Answer: B
Learning Outcome: 2-2
Bloom's Taxonomy: Comprehension

43) The formula for methane gas is CH_4. What does the formula $4CH_4$ represent?
A) a molecule with 4 carbon atoms
B) a molecule with 4 carbon atoms and 16 hydrogen atoms
C) 4 molecules, each containing a carbon and a hydrogen atom
D) 4 molecules, each containing a carbon atom and 4 hydrogen atoms
E) an inorganic compound with ionic bonds
Answer: D
Learning Outcome: 2-2
Bloom's Taxonomy: Comprehension

44) In an ionic bond, the electron donor is the _____, whereas the electron acceptor is the _____.
A) acid; base
B) salt; ion
C) anion; cation
D) base; acid
E) cation; anion
Answer: E
Learning Outcome: 2-2
Bloom's Taxonomy: Comprehension

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45) In a molecule of nitrogen, three pairs of electrons are shared by two nitrogen atoms. The type of bond that is formed is an example of a _____ bond.
A) single trivalent
B) double divalent
C) triple covalent
D) polar covalent
E) hydrogen
Answer: C
Learning Outcome: 2-2
Bloom's Taxonomy: Comprehension

46) 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: 2-2
Bloom's Taxonomy: Comprehension

47) Magnesium atoms have two electrons in the outermost shell 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) impossible to tell without more information
Answer: B
Learning Outcome: 2-2
Bloom's Taxonomy: Application

48) $AB \rightarrow A + B$ is to decomposition as $A + B \rightarrow AB$ is to
A) exchange.
B) synthesis.
C) combustion.
D) replacement.
E) metabolism.
Answer: B
Learning Outcome: 2-3
Bloom's Taxonomy: Knowledge

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

50) The reaction A + B + energy → AB is an example of a(n) _____ reaction.
A) exergonic
B) endergonic
C) equilibrium
D) decomposition
E) exchange
Answer: B
Learning Outcome: 2-3
Bloom's Taxonomy: Knowledge

51) 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: 2-3
Bloom's Taxonomy: Knowledge

52) Which one of the following statements is **false** about the reaction $H_2 + Cl_2 \rightarrow 2\ HCl$?
A) H_2 and Cl_2 are the reactants.
B) HCl is the product.
C) One molecule of hydrogen contains two atoms.
D) Two molecules of HCl are formed in the reaction.
E) This reaction is easily reversible.
Answer: E
Learning Outcome: 2-3
Bloom's Taxonomy: Comprehension

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53) In dehydration synthesis 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: 2-3
Bloom's Taxonomy: Comprehension

54) 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: 2-3
Bloom's Taxonomy: Application

55) 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: 2-4
Bloom's Taxonomy: Knowledge

56) Which of the following descriptors is **false** regarding enzymes?
A) They are proteins.
B) They function as biological catalysts.
C) They lower the activation energy required for a reaction.
D) They affect only the rate of a chemical reaction.
E) They are consumed during the reaction.
Answer: E
Learning Outcome: 2-4
Bloom's Taxonomy: Knowledge

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57) 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: 2-5
Bloom's Taxonomy: Knowledge

58) Each of the following is an inorganic compound **except**
A) water.
B) acids.
C) bases.
D) salts.
E) carbohydrates.
Answer: E
Learning Outcome: 2-5
Bloom's Taxonomy: Knowledge

59) 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: 2-5
Bloom's Taxonomy: Knowledge

60) 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: 2-6
Bloom's Taxonomy: Knowledge

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61) 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) counterions.
Answer: D
Learning Outcome: 2-6
Bloom's Taxonomy: Knowledge

62) 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: 2-6
Bloom's Taxonomy: Knowledge

63) An example of an inorganic substance is
A) fructose.
B) water.
C) glycerol.
D) carbon dioxide.
E) water and carbon dioxide.
Answer: E
Learning Outcome: 2-6
Bloom's Taxonomy: Knowledge

64) Hydrophilic molecules readily associate with
A) lipid molecules.
B) hydrophobic molecules.
C) water molecules.
D) acids.
E) salts.
Answer: C
Learning Outcome: 2-6
Bloom's Taxonomy: Knowledge

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65) Which of the following statements about water is **false**?
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: 2-6
Bloom's Taxonomy: Knowledge

66) Which property of water helps keeps body temperature stabilized?
A) kinetic energy
B) lubrication
C) surface tension
D) reactivity
E) thermal inertia
Answer: E
Learning Outcome: 2-6
Bloom's Taxonomy: Knowledge

67) Which of the following 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: 2-7
Bloom's Taxonomy: Knowledge

68) Which pH is closest to normal body pH?
A) pH 7
B) pH 8
C) pH 4
D) pH 3
E) pH 2
Answer: A
Learning Outcome: 2-7
Bloom's Taxonomy: Knowledge

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69) 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: 2-7
Bloom's Taxonomy: Knowledge

70) An excess of hydrogen ions in the body fluids can have fatal results because this can
A) break chemical bonds.
B) change the shape of proteins, rendering them nonfunctional.
C) disrupt tissue functions.
D) change body fluid pH.
E) All of the answers are correct.
Answer: E
Learning Outcome: 2-7
Bloom's Taxonomy: Knowledge

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: 2-7
Bloom's Taxonomy: Knowledge

72) The chemical notation that indicates concentration is represented as
A) ().
B) <>.
C) [ ].
D) {}.
E) ||.
Answer: C
Learning Outcome: 2-7
Bloom's Taxonomy: Knowledge

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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: 2-7
Bloom's Taxonomy: Knowledge

74) An important buffer in body fluids is
A) NaCl.
B) NaOH.
C) HCl.
D) $NaHCO_3$.
E) H_2O.
Answer: D
Learning Outcome: 2-7
Bloom's Taxonomy: Knowledge

75) 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: 2-7
Bloom's Taxonomy: Comprehension

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: 2-7
Bloom's Taxonomy: Comprehension

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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) There is not enough information to determine the answer.
Answer: A
Learning Outcome: 2-7
Bloom's Taxonomy: Comprehension

78) In the body, inorganic compounds
A) can serve as buffers.
B) can make up proteins.
C) are made from organic compounds.
D) are structural components of cells.
E) are metabolized for cellular energy.
Answer: A
Learning Outcome: 2-8
Bloom's Taxonomy: Knowledge

79) 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: 2-8
Bloom's Taxonomy: Comprehension

80) 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: 2-8
Bloom's Taxonomy: Comprehension

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81) Carbohydrates, lipids, and proteins are classified as
A) organic molecules.
B) inorganic molecules.
C) acids.
D) salts.
E) bases.
Answer: A
Learning Outcome: 2-9
Bloom's Taxonomy: Knowledge

82) A functional group is best described as reoccurring clusters of
A) elements that occur in a salt and that can neither be hydrolyzed nor dehydrated.
B) atoms that form the main reactive area for a particular compound.
C) atoms that function in the body even if temperatures and pH reach extreme values.
D) elements that form at high pH and who can successfully resist the action of buffers.
E) amino acids in a globular protein such as hemoglobin, immunoglobulins, and albumins.
Answer: B
Learning Outcome: 2-9
Bloom's Taxonomy: Knowledge

83) Artificial sweeteners
A) are naturally similar to sugars.
B) are always some form of carbohydrate.
C) are usually not broken down by the body.
D) are inorganic sugar substitutes.
E) provide the same number of calories as an equivalent amount of sucrose.
Answer: C
Learning Outcome: 2-9
Bloom's Taxonomy: Knowledge

84) Fructose is
A) a hexose.
B) an isomer of glucose.
C) found in male reproductive fluids.
D) a carbohydrate.
E) All of the answers are correct.
Answer: E
Learning Outcome: 2-9
Bloom's Taxonomy: Knowledge

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85) Molecules that have the same molecular formula but different structural formulas are called
A) isotopes.
B) isomers.
C) isozymes.
D) isotypes.
E) isomoles.
Answer: B
Learning Outcome: 2-9
Bloom's Taxonomy: Knowledge

86) The most important metabolic fuel molecule in the body is
A) sucrose.
B) caffeine.
C) protein.
D) vitamins.
E) glucose.
Answer: E
Learning Outcome: 2-9
Bloom's Taxonomy: Knowledge

87) A polysaccharide that is formed in liver and muscle cells to store glucose is
A) lactose.
B) cellulose.
C) glycogen.
D) sucrose.
E) fructose.
Answer: C
Learning Outcome: 2-9
Bloom's Taxonomy: Knowledge

88) 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) saturated fat.
Answer: A
Learning Outcome: 2-9
Bloom's Taxonomy: Knowledge

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89) An example of an organic substance is
A) sucrose.
B) carbonic acid.
C) sodium chloride.
D) oxygen.
E) nitric oxide.
Answer: A
Learning Outcome: 2-9
Bloom's Taxonomy: Knowledge

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: 2-9
Bloom's Taxonomy: Knowledge

91) 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) hydrolysis occurs.
Answer: B
Learning Outcome: 2-9
Bloom's Taxonomy: Comprehension

92) To bond two monomers together, a molecule of water must be _____ to/from monomers. This process is called _____.
A) added; hydrolysis
B) removed; dehydration synthesis
C) removed; crenation
D) added; denaturation
E) added; ionization
Answer: B
Learning Outcome: 2-9
Bloom's Taxonomy: Comprehension

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93) Lipids
A) form essential structural components of cells.
B) provide a significant energy reserve.
C) help to maintain body temperature.
D) cushion organs against shocks.
E) All of the answers are correct.
Answer: E
Learning Outcome: 2-10
Bloom's Taxonomy: Knowledge

94) A fatty acid that contains two or more double covalent bonds is said to be
A) saturated.
B) monounsaturated.
C) polyunsaturated.
D) hydrogenated.
E) carboxylated.
Answer: C
Learning Outcome: 2-10
Bloom's Taxonomy: Knowledge

95) Alaska Natives have a lower incidence of heart disease even though their diets are high in fat and cholesterol. This may be due to the large amount of _____ in their diets.
A) vitamins
B) triglycerides
C) prostaglandins
D) omega-3 fatty acids
E) oleic acid
Answer: D
Learning Outcome: 2-10
Bloom's Taxonomy: Knowledge

96) Which of the following is/are needed to form a triglyceride molecule?
A) 3 glycerol molecules
B) 1 glycerol molecule
C) 3 fatty acid molecules
D) 3 glycerol molecules and 3 fatty acid molecules
E) 3 fatty acid molecules and 1 glycerol molecule
Answer: E
Learning Outcome: 2-10
Bloom's Taxonomy: Knowledge

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97) A shortage of steroids in the body would result in a shortage of
A) sex hormones.
B) proteins.
C) plasma membranes.
D) glycogen.
E) sex hormones and plasma membranes.
Answer: E
Learning Outcome: 2-10
Bloom's Taxonomy: Knowledge

98) Most of the fat found in the human body is in the form of
A) cholesterol.
B) phospholipids.
C) triglycerides.
D) prostaglandins.
E) monoglycerides.
Answer: C
Learning Outcome: 2-10
Bloom's Taxonomy: Knowledge

99) Lipids that are produced by nearly every tissue in the body and act as local regulators are the
A) prostaglandins.
B) steroids.
C) monoglycerides.
D) phospholipids.
E) glycolipids.
Answer: A
Learning Outcome: 2-10
Bloom's Taxonomy: Knowledge

100) Cholesterol, phospholipids, and glycolipids are examples of
A) dietary fats.
B) prostaglandins.
C) structural lipids.
D) lipid drugs.
E) steroids.
Answer: C
Learning Outcome: 2-10
Bloom's Taxonomy: Knowledge

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101) A fatty acid with no double bonds between carbon atoms is
A) unsaturated.
B) polyunsaturated.
C) dehydrated.
D) saturated.
E) denatured.
Answer: D
Learning Outcome: 2-10
Bloom's Taxonomy: Knowledge

102) Many lipids are composed of fatty acids and
A) glycerol.
B) amino acids.
C) sugars.
D) monosaccharides.
E) polypeptides.
Answer: A
Learning Outcome: 2-10
Bloom's Taxonomy: Knowledge

103) The monomers of protein are
A) glucose.
B) fatty acids.
C) amino acids.
D) nucleotides.
E) nitrogen base.
Answer: C
Learning Outcome: 2-11
Bloom's Taxonomy: Knowledge

104) Substrate molecules bind to enzymes at the _____ sites.
A) amino
B) active
C) carboxyl
D) reactant
E) neutral
Answer: B
Learning Outcome: 2-11
Bloom's Taxonomy: Knowledge

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105) The term _____ refers to certain amino acids, which can have both a positive charge and a negative charge.
A) anion
B) cation
C) twinion
D) zwitterion
E) double ion
Answer: D
Learning Outcome: 2-11
Bloom's Taxonomy: Knowledge

106) You would expect a peptide bond to link
A) two simple sugars.
B) two amino acids.
C) two nucleotides.
D) a sugar and a peptide.
E) a peptide and a fatty acid.
Answer: B
Learning Outcome: 2-11
Bloom's Taxonomy: Knowledge

107) Each amino acid differs from another in the
A) number of central carbon atoms.
B) size of the amino group.
C) number of carboxyl groups.
D) nature of the side chain.
E) number of peptide bonds in the molecule.
Answer: D
Learning Outcome: 2-11
Bloom's Taxonomy: Knowledge

108) The term _____ means each enzyme catalyzes only one type of reaction.
A) saturation
B) specificity
C) inertia
D) activation
E) monoreactive
Answer: B
Learning Outcome: 2-11
Bloom's Taxonomy: Knowledge

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109) A side chain on an amino acid is sometimes called
A) fibrous or globular.
B) a polypeptide chain.
C) an R group.
D) an isozyme.
E) nucleic acid.
Answer: C
Learning Outcome: 2-11
Bloom's Taxonomy: Knowledge

110) The alpha-helix and beta sheet are examples of _____ protein structure.
A) primary
B) secondary
C) tertiary
D) quaternary
E) pentanary
Answer: B
Learning Outcome: 2-11
Bloom's Taxonomy: Knowledge

111) Interaction between individual polypeptide chains to form a protein complex is _____ structure.
A) primary
B) secondary
C) tertiary
D) quaternary
E) pentagonal
Answer: D
Learning Outcome: 2-11
Bloom's Taxonomy: Knowledge

112) Glycoproteins and proteoglycans are combinations of amino acids and
A) carbohydrates.
B) fatty acids.
C) lipids.
D) nucleic acids.
E) inorganic compounds.
Answer: A
Learning Outcome: 2-11
Bloom's Taxonomy: Knowledge

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113) 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: 2-11
Bloom's Taxonomy: Knowledge

114) The maximum rate of an enzyme reaction
A) occurs during dehydration.
B) occurs during hydrolysis.
C) occurs during synthesis.
D) is reversible.
E) occurs at the saturation limit.
Answer: E
Learning Outcome: 2-11
Bloom's Taxonomy: Knowledge

115) How would the lack of a cofactor for an enzyme affect that enzyme's function?
A) The enzyme's function would not be altered.
B) The enzyme would function more slowly.
C) The enzyme would function more quickly.
D) The enzyme would not be able to function.
E) The enzyme would cease to function after reaching a maximum rate.
Answer: D
Learning Outcome: 2-11
Bloom's Taxonomy: Comprehension

116) Identify the correct statement regarding the process of denaturation.
A) It is affected by low temperatures.
B) It is unaffected by changes in pH.
C) It is the loss of protein structure.
D) It is an increase in enzyme activity.
E) It results in decreased substrate availability.
Answer: C
Learning Outcome: 2-11
Bloom's Taxonomy: Knowledge

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117) Which of the following are organic substances?
A) lipids
B) nucleic acids
C) proteins
D) lipids and proteins
E) lipids, nucleic acids, and proteins
Answer: E
Learning Outcome: 2-12
Bloom's Taxonomy: Knowledge

118) Molecules that store and process genetic information are the
A) proteins.
B) nucleic acids.
C) carbohydrates.
D) lipids.
E) steroids.
Answer: B
Learning Outcome: 2-12
Bloom's Taxonomy: Knowledge

119) An amino acid is to a protein as a _____ is to a nucleic acid.
A) purine
B) nucleotide
C) protein
D) proton
E) neutron
Answer: B
Learning Outcome: 2-12
Bloom's Taxonomy: Knowledge

120) A nucleotide consists of a
A) five-carbon sugar and phosphate group.
B) five-carbon sugar and a nitrogenous base.
C) phosphate group and a nitrogenous base.
D) five-carbon sugar, a nitrogenous base, and a phosphate group.
E) five-carbon sugar and an amino acid.
Answer: D
Learning Outcome: 2-12
Bloom's Taxonomy: Knowledge

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121) According to the rules of complementary base pairing in nucleic acids, cytosine would pair with the base
A) thymine.
B) adenine.
C) uracil.
D) cytosine.
E) guanine.
Answer: E
Learning Outcome: 2-12
Bloom's Taxonomy: Knowledge

122) 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: 2-12
Bloom's Taxonomy: Knowledge

123) 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: 2-12
Bloom's Taxonomy: Knowledge

124) 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: 2-13
Bloom's Taxonomy: Knowledge

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125) 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) phosphate groups 1 and 2 and between phosphate groups 2 and 3.
Answer: E
Learning Outcome: 2-13
Bloom's Taxonomy: Knowledge

126) The phosphorylation of adenosine forms
A) ADP.
B) ATP.
C) AMP.
D) 2ATP.
E) ribose.
Answer: C
Learning Outcome: 2-13
Bloom's Taxonomy: Application

127) Identify the product formed from the phosphorylation of ADP.
A) adenosine diphosphate
B) adenine
C) adenosine triphosphate
D) deoxyribonucleic acid
E) ribose
Answer: C
Learning Outcome: 2-13
Bloom's Taxonomy: Knowledge

128) AMP + P →
A) ADP.
B) 2ADP.
C) DNA.
D) ATP.
E) adenine.
Answer: A
Learning Outcome: 2-13
Bloom's Taxonomy: Knowledge

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129) The average time between synthesis and breakdown is known as the _____ time.
A) metabolism
B) anabolism
C) catabolism
D) specificity
E) turnover
Answer: E
Learning Outcome: 2-14
Bloom's Taxonomy: Knowledge

130) Muscle proteins are destroyed after 17 days and then replaced. This is an example of
A) metabolic turnover.
B) surveillance.
C) surface tension.
D) disease.
E) specificity.
Answer: A
Learning Outcome: 2-14
Bloom's Taxonomy: Knowledge

131) Continuous breakdown and replacement of cellular molecules is termed
A) metabolism.
B) metabolic turnover.
C) anabolic turnover.
D) catabolic turnover.
E) organic chemistry.
Answer: B
Learning Outcome: 2-14
Bloom's Taxonomy: Knowledge

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Multiple Choice Questions: Section Two

1) A(n) _____ is a pure substance composed of atoms of only one kind.
A) element
B) molecule
C) ion
D) isotope
E) compound
Answer: B
Learning Outcome: 2-1
Bloom's Taxonomy: Knowledge

2) The center of an atom is called the
A) core.
B) hub.
C) middle point.
D) nucleus.
E) focus.
Answer: D
Learning Outcome: 2-1
Bloom's Taxonomy: Knowledge

3) Electrons whirl around the center of the atom at high speed, forming a(n)
A) spiral.
B) figure 8.
C) cylinder.
D) electron cloud.
E) helix.
Answer: D
Learning Outcome: 2-1
Bloom's Taxonomy: Knowledge

4) Electrons in an atom occupy an orderly series of electron shells or
A) energy levels.
B) electron clouds.
C) energy circles.
D) electron lanes.
E) energy fields.
Answer: A
Learning Outcome: 2-1
Bloom's Taxonomy: Knowledge

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5) The actual mass of an atom is known as its
A) chemical weight.
B) atomic weight.
C) atomic mass.
D) chemical mass.
E) chemical force.
Answer: B
Learning Outcome: 2-1
Bloom's Taxonomy: Knowledge

6) Atoms of the same element whose nuclei contain the same number of protons, but different numbers of neutrons, are called
A) isotonics.
B) heterotopes.
C) isotopes.
D) homotopes.
E) heterotonics.
Answer: C
Learning Outcome: 2-1
Bloom's Taxonomy: Knowledge

7) The _____ of a radioactive substance is the time required for 50 percent of a given amount of radioisotope to decay.
A) decay-point
B) mid-life
C) deterioration point
D) half-life
E) entropy
Answer: D
Learning Outcome: 2-1
Bloom's Taxonomy: Knowledge

8) Ions with a negative charge are called
A) cations.
B) anions.
C) radicals.
D) positrons.
E) isotopes.
Answer: B
Learning Outcome: 2-2
Bloom's Taxonomy: Knowledge

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9) The three familiar states of matter are solids, liquids, and
A) globules.
B) fibroids.
C) gases.
D) crystals.
E) vapors.
Answer: C
Learning Outcome: 2-2
Bloom's Taxonomy: Knowledge

10) Kinetic energy is stored as _____ energy when a spring is stretched.
A) potential
B) possible
C) plausible
D) probable
E) positive
Answer: A
Learning Outcome: 2-3
Bloom's Taxonomy: Knowledge

11) Chemical reactions that absorb energy are called
A) exergonic.
B) endergonic.
C) equilibrial.
D) decomposition.
E) exchange.
Answer: B
Learning Outcome: 2-4
Bloom's Taxonomy: Knowledge

12) Chemical reactions that occur in the body are accelerated by
A) vitamins.
B) cofactors.
C) hormones.
D) electrons.
E) enzymes.
Answer: E
Learning Outcome: 2-4
Bloom's Taxonomy: Knowledge

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13) In living cells, complex metabolic reactions proceed in a series of steps called
A) maneuvers.
B) degrees.
C) pathways.
D) increments.
E) cascades.
Answer: C
Learning Outcome: 2-4
Bloom's Taxonomy: Knowledge

14) Compounds that contain carbon as the primary structural atom are called _____ molecules.
A) carbonic
B) organic
C) inorganic
D) catabolic
E) anabolic
Answer: B
Learning Outcome: 2-5
Bloom's Taxonomy: Knowledge

15) Compounds that do not usually contain carbon and hydrogen atoms as the primary structural ingredients are called _____ molecules.
A) non-carbonic
B) organic
C) hydro-carbonic
D) metabolic
E) inorganic
Answer: E
Learning Outcome: 2-5
Bloom's Taxonomy: Knowledge

16) Soluble inorganic compounds whose solutions will conduct an electric current are called
A) electrolytes.
B) ions.
C) isotopes.
D) free radicals.
E) metabolites.
Answer: A
Learning Outcome: 2-6
Bloom's Taxonomy: Knowledge

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17) A(n) _____ is a homogeneous mixture containing a solvent and a solute.
A) emulsion
B) blend
C) compound
D) infusion
E) solution
Answer: E
Learning Outcome: 2-6
Bloom's Taxonomy: Knowledge

18) Molecules that do not readily interact with water are called
A) inert.
B) stable.
C) hydrophobic.
D) unstable.
E) hydrophilic.
Answer: C
Learning Outcome: 2-6
Bloom's Taxonomy: Knowledge

19) The _____ of a solution is the negative logarithm of the hydrogen ion concentration expressed in moles per liter.
A) charge
B) pH
C) solubility
D) acidity
E) basicity
Answer: B
Learning Outcome: 2-7
Bloom's Taxonomy: Knowledge

20) All fatty acids contain a functional group at one end called the _____ acid group.
A) linoleic
B) ribonucleic
C) hydroxyl
D) glycosidic
E) carboxylic
Answer: E
Learning Outcome: 2-10
Bloom's Taxonomy: Knowledge

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21) Individual steroids differ in the _____ attached to the carbon rings.
A) side chains
B) glycerol molecules
C) hydrophobic tails
D) hydrophilic heads
E) fatty acids
Answer: A
Learning Outcome: 2-10
Bloom's Taxonomy: Knowledge

22) Molecules with two fatty acid chains and a phosphate group that form biological membranes are called
A) diglycerides.
B) disaccharides.
C) dipeptides.
D) prostaglandins.
E) phospholipids.
Answer: E
Learning Outcome: 2-10
Bloom's Taxonomy: Knowledge

23) In water, phospholipids tend to form tiny droplets with hydrophobic tails buried inside called
A) micelles.
B) chylomicrons.
C) glycocalyces.
D) eicosanoids.
E) hydroceles.
Answer: A
Learning Outcome: 2-10
Bloom's Taxonomy: Knowledge

24) The molecule DNA contains a five-carbon sugar called
A) glucose.
B) fructose.
C) maltose.
D) ribose.
E) deoxyribose.
Answer: E
Learning Outcome: 2-12
Bloom's Taxonomy: Knowledge

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25) The three structural components of a nucleotide are a pentose, a phosphate group, and a _____ base.
A) nucleic
B) hydrophilic
C) hydrochloric
D) nitrogenous
E) sulfuric
Answer: D
Learning Outcome: 2-12
Bloom's Taxonomy: Knowledge

26) The purines found in DNA are _____ and guanine.
A) cytosine
B) adenine
C) thymine
D) uracil
E) niacin
Answer: B
Learning Outcome: 2-12
Bloom's Taxonomy: Knowledge

27) The pyrimidine bases found in DNA are _____ and cytosine.
A) cytosine
B) adenine
C) thymine
D) uracil
E) niacin
Answer: C
Learning Outcome: 2-12
Bloom's Taxonomy: Knowledge

28) A(n) _____ bond is a covalent bond that stores an unusually large amount of energy.
A) forceful
B) charged
C) excitable
D) power
E) high-energy
Answer: E
Learning Outcome: 2-13
Bloom's Taxonomy: Knowledge

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29) In the process of _____ a phosphate group is transferred to a molecule.
A) ionization
B) buffering
C) amination
D) dissociation
E) phosphorylation
Answer: E
Learning Outcome: 2-13
Bloom's Taxonomy: Knowledge

30) The hydrolysis of ATP yields ADP, phosphate ion, and
A) AMP.
B) H_2O.
C) energy.
D) adenosine
E) nuclease.
Answer: C
Learning Outcome: 2-13
Bloom's Taxonomy: Knowledge

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Essay Questions

1) The element sulfur has an atomic number of 16 and mass number of 32. How many neutrons are in the nucleus of a sulfur atom? If sulfur forms covalent bonds with hydrogen, how many hydrogen atoms can bond to one sulfur atom?
Answer: The number of neutrons in an atom is equal to the mass number minus the atomic number. Thus, sulfur has 32 - 16 = 16 neutrons. The atomic number indicates the number of protons, so a neutral sulfur atom contains 16 protons plus 16 electrons to balance the protons electrically. The electrons would be distributed as follows: 2 in the first electron shell, 8 in the second, and the remaining 6 in the third. To achieve a full 8 electrons in the third (outermost) electron shell, the sulfur atom can accept 2 electrons in an ionic bond or can share 2 electrons in a covalent bond. Because hydrogen atoms can share one electron in a covalent bond, the sulfur atom can form two covalent bonds with hydrogen, one with each of two hydrogen atoms. In chemical notation, this is H_2S.
Learning Outcome: 2-2
Bloom's Taxonomy: Application

2) What role do buffer systems play in the human body?
Answer: Buffer systems help maintain pH within normal limits by removing or replacing hydrogen ions as needed.
Learning Outcome: 2-7
Bloom's Taxonomy: Comprehension

3) Blood has a very narrow normal pH range but urine has a very broad normal pH range. What does that indicate about the physiology of pH?
Answer: Homeostasis requires that the pH of body fluids be maintained almost constant to avoid disruptions of healthy function. To accomplish this, the urinary system eliminates or retains hydrogen ion as needed. These actions cause the pH of urine to vary widely, depending on whether there is too much or not enough hydrogen ion in the body.
Learning Outcome: 2-7
Bloom's Taxonomy: Application

4) Explain the role of water molecules in polysaccharide formation.
Answer: Water molecules are removed in the dehydration synthesis of polysaccharides.
Learning Outcome: 2-9
Bloom's Taxonomy: Comprehension

5) How does the DNA molecule control the appearance and function of a cell?
Answer: The DNA molecule controls the synthesis of enzymes and structural proteins. By controlling the synthesis of structural proteins, the DNA is able to influence the physical appearance of a cell. By controlling the production of enzymes, the DNA is able to control all aspects of cellular metabolism and thus control the activity and biological functions of the cell.
Learning Outcome: 2-12
Bloom's Taxonomy: Application

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