Chapter 02
Chemical Composition of the Body

Multiple Choice Questions

1. In an atom, the number of
A. Protons always equals the number of neutrons
B. Of protons always equals the number of electrons
C. Of neutrons always equals the number of electrons
D. Both protons always equals the number of neutrons and of protons always equals the number of electrons are correct
E. All of the choices are correct

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

2. An atom's identity is directly determined by
A. The number of electrons it has
B. The number of neutrons it has
C. The number of protons it has
D. The number of bonds it can form
E. Its atomic weight

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

3. Carbon-12 and carbon-14 are isotopes. They differ in the number of
A. Protons
B. Neutrons
C. Electrons
D. Chemical bonds they can form
E. All of the choices are correct

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

4. A covalent bond between two atoms is
A. Formed when each atom shares one of its inner-orbit electrons with the other atom
B. Formed when each atom shares one of its outer-orbit electrons with the other atom
C. The strongest of the chemical bonds
D. Formed when each atom shares one of its inner-orbit electrons with the other atom and the strongest of the chemical bonds
E. Formed when each atom shares one of its outer-orbit electrons with the other atom and the strongest of the chemical bonds

Bloom's Level: 1. Remember
Section 2.02
Topic: Chemistry

5. Ions are
A. Electrically neutral
B. Electrically charged
C. Formed by the gain or loss of protons from the nucleus
D. Electrically charged and formed by the gain or loss of protons from the nucleus
E. None of the choices are correct

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

6. When magnesium loses electrons to become an ion it forms
A. A covalent bond
B. A cation
C. An anion
D. A new element

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

7. If a sports beverage advertises that it replaces the body's electrolytes, it will replace
A. Sugars that were broken down for energy
B. Ionic forms of mineral elements
C. Lipids that form the membranes of cells
D. Oxygen and gases used by metabolism
E. Vitamins

Bloom's Level: 3. Apply
Section 2.01
Topic: Chemistry

8. Of the major ions in the body, the only one that carries a negative charge is
A. Chloride
B. Sodium
C. Potassium
D. Hydrogen
E. Calcium

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

9. Free radicals
A. React rapidly with other atoms
B. Include hydroxyl radical and nitric oxide
C. Contain two electrons in the outermost orbital
D. React rapidly with other atoms and include hydroxyl radical and nitric oxide are correct
E. All of the choices are correct

Bloom's Level: 1. Remember
Section 2.02
Topic: Chemistry

10. If a free radical reacts with another molecule the free radical will
A. Remove electrons from the other molecule
B. Form an unbreakable bond with the other molecule
C. Remove protons from the other molecule
D. Stabilize the other molecule
E. None of the choices are correct

Bloom's Level: 1. Remember
Section 2.02
Topic: Chemistry

11. Electrolytes
A. Are ions
B. Conduct electricity when dissolved in water
C. Are found in pure water
D. Both are ions and conduct electricity when dissolved in water are correct
E. All of the choices are correct

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

12. Which of the following is *not* true of a polar chemical bond?
A. It is covalent
B. It is ionized
C. It has opposite electrical charge at each end
D. It has no net electrical charge
E. None of the choices are false

Bloom's Level: 2. Understand
Section 2.02
Topic: Chemistry

13. A polar molecule
A. Contains a significant proportion of polar bonds relative to nonpolar bonds
B. May contain ionized groups
C. Can form hydrogen bonds with other polar molecules
D. Contains a significant proportion of polar bonds relative to nonpolar bonds and may contain ionized groups are correct
E. All of the choices are correct

Bloom's Level: 1. Remember
Section 2.02
Topic: Chemistry

14. Hydrolysis
A. Involves removal of water molecules from larger molecules
B. Involves breaking of covalent bonds within water molecules and transfer of the resulting ions to other molecules
C. Results in the breakdown of large molecules in the body
D. Both involves removal of water molecules from larger molecules and involves breaking of covalent bonds within water molecules and transfer of the resulting ions to other molecules are correct
E. Both involves breaking of covalent bonds within water molecules and transfer of the resulting ions to other molecules and results in the breakdown of large molecules in the body are correct

Bloom's Level: 1. Remember
Section 2.03
Topic: Chemistry

15. Consider the adage familiar to anyone who has observed oil spills in the ocean or has made a salad dressing: "Oil and water do not mix." Which of the following helps explain this observation?
A. Oil is hydrophobic
B. Oil is nonpolar
C. Oil is composed largely of carbon and hydrogen
D. Water is hydrophilic
E. All of the choices are correct

Bloom's Level: 2. Understand
Section 2.03
Topic: Chemistry

16. Molecules that have properties of both polar and nonpolar molecules are called
A. Hydrophobic
B. Hydrophilic
C. Amphipathic
D. All of the choices are correct
E. None of the choices are correct

Bloom's Level: 1. Remember
Section 2.03
Topic: Chemistry

17. Compounds A, B and C have molecular weights of 10, 50 and 100 respectively. If 5 grams of each compound were put into 1 liter of water, which compound will have the greatest molar concentration?
A. Compound A
B. Compound B
C. Compound C
D. All will have the same molar concentration

Bloom's Level: 3. Apply
Section 2.03
Topic: Chemistry

18. The pH of a solution
A. Is a measure of the concentration of H atoms in solution
B. Is a measure of the concentration of bound H^+ ions in solution
C. Is a measure of the concentration of free H^+ ions in solution
D. Increases as the acidity of the solution increases
E. Both is a measure of the concentration of free H^+ ions in solution and increases as the acidity of the solution increases are correct

Bloom's Level: 1. Remember
Section 2.03
Topic: Chemistry

19. Most of the body weight of an average young adult male is
A. Water
B. Protein
C. Minerals
D. Lipids
E. Carbohydrates

Bloom's Level: 1. Remember
Section 2.03
Topic: Chemistry

20. Organic molecules
A. Always contain oxygen
B. Always contain carbon
C. Are always macromolecules
D. Both always contain oxygen and always contain carbon are correct
E. Both always contain carbon and are always macromolecules are correct

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

21. Carbohydrates are
A. Composed of equal parts of C atoms and water molecules
B. The major organic molecules of the body
C. Nonpolar
D. Composed of equal parts of C atoms and water molecules and the major organic molecules of the body
E. All of the choices are correct

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

22. Glucose is a
A. Monosaccharide
B. Disaccharide
C. Polysaccharide
D. Glycoprotein
E. Phospholipid

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

23. Carbohydrates are stored in the liver and muscles in the form of
A. Cellulose
B. Starch
C. Triacylglycerol
D. Glycogen
E. All of the choices are correct

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

24. Relative to carbohydrates, lipids
A. Contain fewer carbon atoms per molecule
B. Contain fewer oxygen atoms per molecule
C. Are more hydrophilic
D. Are less abundant in the body

Bloom's Level: 2. Understand
Section 2.04
Topic: Chemistry

25. Which of the following lipids have regulatory roles in the body?
A. Steroids
B. Eicosanoids
C. Triacylglycerols
D. Both steroids and eicosanoids are correct
E. All of the choices are correct

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

26. Proteins are
A. Critically important for physiological processes
B. Composed of fatty acids
C. Composed of nucleic acids
D. Macromolecules with subunits linked by polypeptide bonds
E. Critically important for physiological processes and macromolecules with subunits linked by polypeptide bonds

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

27. Protein conformation is
A. Independent of the sequence of subunits forming the protein
B. Dependent upon a combination of covalent and noncovalent bonds
C. Affected by interactions with water molecules
D. Independent of the sequence of subunits forming the protein and affected by interactions with water molecules
E. Dependent upon a combination of covalent and noncovalent bonds and affected by interactions with water molecules

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

28. Which of the following correctly describes the strength of the chemical bonds important in protein conformation, from strongest to weakest?
A. Covalent, ionic, hydrogen, van der Waals
B. Ionic, covalent, hydrogen, van der Waals
C. Van der Waals, hydrogen, ionic, covalent
D. Covalent, hydrogen, ionic, van der Waals
E. Covalent, ionic, van der Waals, hydrogen

Bloom's Level: 1. Remember
Section 2.02
Topic: Chemistry

29. The covalent bond formed between two amino acids is called a(n)
A. Glycosidic bond
B. Peptide bond
C. Phosphodiester bond
D. Ester bond
E. Hydrolytic bond

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

30. Hydrogen bonding is very important in maintaining the structure of
A. Lipids
B. Nucleic acids
C. Proteins
D. Nucleic acids and proteins
E. All of the choices are correct

Bloom's Level: 2. Understand
Section 2.04
Topic: Chemistry

31. Nucleic acids are
A. Macromolecules
B. Composed of nucleotides
C. Distinguished from each other in part by the composition of the sugar they contain
D. Macromolecules and composed of nucleotides
E. All of the choices are correct

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

32. Adenosine triphosphate is a(n)
A. Carbohydrate
B. Lipid
C. Protein
D. Nucleotide
E. Amino acid

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

33. The function of adenosine triphosphate is
A. To transfer energy in a cell
B. Catalyze chemical reactions
C. Store large amounts of energy within the cell
D. Act as a template for synthesizing lipids
E. All of the choices are correct

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

True / False Questions

34. An atom is electrically neutral.
TRUE

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

35. The mass of an atom is the sum of its protons and electrons.
FALSE

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

36. The atomic number of an element is given by the number of electrons in the atom.
FALSE

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

37. An atomic nucleus is electrically neutral.
FALSE

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

38. Protons and neutrons have roughly the same mass.
TRUE

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

39. The atomic number of an element refers to the number of particles in its atomic nucleus.
FALSE

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

40. Twelve grams of C contains the same number of atoms as one gram of H.
TRUE

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

41. The four most common elements in the body are hydrogen, carbon, calcium and oxygen.
FALSE

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

42. Important mineral elements in the body include Na, Ca and K.
TRUE

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

43. Trace elements such as zinc and manganese are found in minute quantities in the body but do not serve any known function.
FALSE

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

44. The number of covalent bonds that can be formed by a given atom depends upon the number of electrons present in the outermost orbit.
TRUE

Bloom's Level: 1. Remember
Section 2.02
Topic: Chemistry

45. Nitrogen atoms can form a maximum of four covalent bonds with other atoms.
FALSE

Bloom's Level: 1. Remember
Section 2.02
Topic: Chemistry

46. The shape of a molecule may change as atoms rotate about their covalent bonds.
TRUE

Bloom's Level: 1. Remember
Section 2.02
Topic: Chemistry

47. All of the physiologically important atoms of the body readily form ions.
FALSE

Bloom's Level: 1. Remember
Section 2.01
Topic: Chemistry

48. Water molecules can form covalent bonds with other water molecules.
FALSE

Bloom's Level: 1. Remember
Section 2.03
Topic: Chemistry

49. In a molecule of water, an oxygen atom forms a double bond with each of two hydrogen atoms.
FALSE

Bloom's Level: 1. Remember
Section 2.03
Topic: Chemistry

50. The carboxyl ion is an anion.
TRUE

Bloom's Level: 1. Remember
Section 2.02
Topic: Chemistry

51. NaCl is a molecule formed by the covalent bonding of a sodium atom to a chlorine atom.
FALSE

Bloom's Level: 1. Remember
Section 2.02
Topic: Chemistry

52. All covalent bonds are polar.
FALSE

Bloom's Level: 1. Remember
Section 2.02
Topic: Chemistry

53. During hydrolysis, hydrogen ions and hydroxyl groups are formed.
TRUE

Bloom's Level: 1. Remember
Section 2.03
Topic: Chemistry

54. In general, polar molecules will dissolve in polar solvents, while nonpolar molecules cannot.
TRUE

Bloom's Level: 1. Remember
Section 2.03
Topic: Chemistry

55. Solutes that do not dissolve in water are called hydrophilic.
FALSE

Bloom's Level: 1. Remember
Section 2.03
Topic: Chemistry

56. Molecules with both polar and nonpolar regions are called ambidextrous.
FALSE

Bloom's Level: 1. Remember
Section 2.03
Topic: Chemistry

57. The molarity of a solution is a measure of the concentration of the solute.
TRUE

Bloom's Level: 1. Remember
Section 2.03
Topic: Chemistry

58. A solution with a pH of 8 is more acidic than one with a pH of 3.
FALSE

Bloom's Level: 1. Remember
Section 2.03
Topic: Chemistry

59. Organic chemistry is the study of oxygen-containing compounds.
FALSE

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

60. Polysaccharides are polymers of sugar molecules.
TRUE

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

61. Sucrose is called "blood sugar" because it is the most abundant carbohydrate in the blood.
FALSE

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

62. Triacylglycerol is one subclass of lipid molecules.
TRUE

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

63. Saturated fats contain carbon atoms linked by double bonds.
FALSE

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

64. Cholesterol is a phospholipid.
FALSE

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

65. Glycoproteins are protein molecules with molecules of glycogen attached to the amino acid side chains.
FALSE

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

66. The sequence of amino acids in a protein is known as the secondary structure.
FALSE

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

67. Protein molecules may consist of more than one polypeptide chain.
TRUE

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

68. Substitution of one amino acid for another in a given protein will inevitably alter the conformation of that protein to a significant degree.
FALSE

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

69. In DNA, thymine binds with adenine and cytosine binds with uracil.
FALSE

Bloom's Level: 1. Remember
Section 2.04
Topic: Chemistry

Fill in the Blank Questions

Use this table to answer the question:

	Protons	Neutrons	Electrons
Hydrogen (H)	1	0	1
Carbon (C)	6	6	6
Oxygen (O)	8	8	8
Sodium (Na)	11	12	11
Potassium (K)	19	20	19
Calcium (Ca)	20	20	20

Bloom's Level: 2. Understand
Section 2.01
Topic: Chemistry

70. What is the atomic mass of H?
1

Bloom's Level: 2. Understand
Section 2.01
Topic: Chemistry

71. What is the atomic mass of Na?
23

Bloom's Level: 2. Understand
Section 2.01
Topic: Chemistry

72. What is the total (net) charge of an atom of K?
0

Bloom's Level: 2. Understand
Section 2.01
Topic: Chemistry

73. What is the gram atomic mass of C?
12g

Bloom's Level: 2. Understand
Section 2.01
Topic: Chemistry

In the reaction R-COOH → $R\text{-}COO^- + H^+$
COOH is the carboxyl group

Bloom's Level: 2. Understand
Section 2.02
Topic: Chemistry

74. COO^- is the _____ _____.
carboxyl ion

Bloom's Level: 2. Understand
Section 2.02
Topic: Chemistry

75. H^+ represents the _____ _____.
hydrogen ion

Bloom's Level: 2. Understand
Section 2.02
Topic: Chemistry

76. R refers to the _____.
remainder of the molecule

Bloom's Level: 2. Understand
Section 2.02
Topic: Chemistry

77. The symbol → indicates that the process is (reversible/irreversible).
reversible

Bloom's Level: 2. Understand
Section 2.02
Topic: Chemistry

78. A neutral solution has a pH of _____.
7.0

Bloom's Level: 1. Remember
Section 2.03
Topic: Chemistry