

## 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 atoms 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  $R-COOH \rightarrow R-COO^- + H^+$   
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  $\rightleftharpoons$  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*