

Chap02, Chapter 2

Multiple Choice

1. What are the six most common elements needed in large amounts in living things?

- A. Carbon, hydrogen, nitrogen, oxygen, phosphorus and sulfur
- B. Carbon, hydrogen, oxygen, sodium, calcium and nitrogen
- C. Carbon, hydrogen, nitrogen, oxygen, potassium and sodium
- D. Hydrogen, copper, zinc, oxygen, iron, manganese and sodium

Ans: A

2. The smallest indivisible part of an element is the

- A. atom.
- B. isotope.
- C. electron.
- D. neutron.

Ans: A

3. The mass number of an atom is determined by adding the number of

- A. protons and electrons.
- B. neutrons and protons.
- C. isotopes and protons.
- D. electrons and neutrons.

Ans: B

4. All the following are components of an atom *except*

- A. electrons.
- B. neutrons.
- C. lipids.
- D. protons.

Ans: C

5. What is the densest part of an atom that has the greatest amount of the mass of the atom?
- A. Electron cloud
 - B. Electron shell
 - C. Atomic nucleus
 - D. Orbit

Ans: C

6. What makes up the atomic number of an element?
- A. Electrons + protons.
 - B. Protons.
 - C. Neutrons.
 - D. Neutrons + protons.

Ans: B

7. What makes up the atomic weight of an element?
- A. Electrons + neutrons.
 - B. Protons.
 - C. Electrons.
 - D. Neutrons + protons.

Ans: D

8. How many electrons are in a neutral atom?
- A. The same number as the neutrons in the atom
 - B. The same number as the protons in the atom
 - C. The same number as the neutrons plus the protons
 - D. You can't tell, it varies from one atom to the next.

Ans: B

9. What is the difference between a sodium ion and a sodium atom (or for any element)?
- A. Number of electrons they possess
 - B. Placement of their neutrons
 - C. Number of neutrons they possess

D. Number of protons in the atomic nucleus

Ans: A

10. What do you get when an atom gains an electron?

- A. An isotope
- B. A cation
- C. An anion
- D. An ionic bond

Ans: C

11. Carbon enters into an enormous number and variety of chemical combinations partly because

- A. it has four electrons in its outer shell.
- B. it has no protons in its nucleus.
- C. it is part of a protein molecule.
- D. it forms isotopes.

Ans: A

12. What is an inert element?

- A. An element where the proton number and neutron number are equal
- B. An element where the atomic number is higher than its atomic weight
- C. An element that forms ions occurs readily
- D. An element where the outer shell will not hold additional electrons, so it is stable

Ans: D

13. The formation of a chemical bond that combines atoms in molecules depends in large measure on the

- A. number of neutrons.
- B. number of electrons in the shells.
- C. presence of organic matter in the environment.
- D. proton configuration of the nucleus.

Ans: B

14. What happens in the formation of an ionic bond?

- A. The addition of neutrons
- B. A loss of protons
- C. A transfer of electrons
- D. All of the above are correct.

Ans: C

15. What happens when one atom has electrons that end up in the electron orbit of another atom?

- A. They form a covalent bond.
- B. They form a hydrogen bond.
- C. They form an ionic bond.
- D. They form a strong bond.

Ans: C

16. What is the chemical bond formed between two hydrogens and one oxygen?

- A. A covalent bond
- B. A hydrogen bond
- C. A biological bond
- D. An ionic bond

Ans: D

17. What is the result of two or more atoms joining together?

- A. An isomer
- B. An isotope
- C. An ionic bond
- D. A molecule

Ans: D

18. What kind of bond is found in water, H₂O?

- A. It has a hydrogen bond.
- B. It has a polar covalent bond.

- C. It has a nonpolar covalent bond.
- D. It has an ionic bond.

Ans: B

19. Which one of the following statements does *not* apply to hydrogen bonds?

- A. They form between water molecules.
- B. They involve H and O atoms.
- C. They are very strong bonds.
- D. They are important in the formation of proteins and nucleic acids.

Ans: C

20. All the following characterize hydrogen bonding *except*

- A. a strong and stable chemical force.
- B. an attraction between nitrogen and hydrogen atoms.
- C. the force between water molecules.
- D. the shaping of proteins and nucleic acids.

Ans: A

21. In the chemical reaction $A + B \Rightarrow AB$, which are the reactants?

- A. A
- B. B
- C. AB
- D. A and B

Ans: D

22. What happens in a dehydration or synthesis reaction?

- A. Water is removed in the formation of a covalent bond.
- B. Monosaccharides are produced from polysaccharides.
- C. Water is incorporated into a molecule.
- D. Water is removed from a bacterial cell.

Ans: A

23. An acid is a chemical substance that
- A. releases protons in solution.
 - B. has a sour taste.
 - C. has a lower pH value.
 - D. All the above are correct.

Ans: D

24. A substance whose pH is 8 contains
- A. more hydroxyl ions than water.
 - B. less protein than water.
 - C. no hydrogen ions.
 - D. more hydrogen ions than water.

Ans: A

25. Why is a buffer important?
- A. It maintains a neutral pH inside the cells.
 - B. It maintains a neutral pH outside the cells.
 - C. It maintains a stable pH in living things.
 - D. It isn't really very important, most cells don't have it.

Ans: C

26. Which one of the following *is not* an organic molecule?
- A. Table salt
 - B. Nucleic acids
 - C. Glucose
 - D. Deoxyribose

Ans: A

27. The carboxyl group is important biologically. What is its chemical formula?
- A. —OH.
 - B. —COOH.
 - C. —CHO.
 - D. —NH₂.

Ans: B

28. What is a functional group symbolized by -NH_2 known as?

- A. Hydroxyl group
- B. Phosphate group
- C. Amino group
- D. Carboxyl group

Ans: C

29. What is an important difference between monosaccharides and polysaccharides?

- A. The number of nitrogen atoms in the molecule
- B. The presence of glycerol in monosaccharides
- C. The number of carbohydrate monomers in the molecule
- D. The specific amino acids present

Ans: C

30. Carbohydrates are so named because

- A. they contain carbon and hydrogen.
- B. the numbers of carbon and hydrogen atoms are the same.
- C. they react readily with water.
- D. they can be hydrolyzed by the enzymes contained in water.

Ans: A

31. Glucose units may be linked in chains of hundreds or thousands in

- A. proteins.
- B. nucleic acids such as DNA.
- C. polysaccharides.
- D. disaccharides.

Ans: C

32. Fatty acids that contain many double bonds and have fewer hydrogen atoms are commonly said to be
- A. saturated.
 - B. glycerol.
 - C. denatured.
 - D. polyunsaturated.

Ans: D

33. Guanine and cytosine are important constituents of
- A. most acid solutions.
 - B. nucleic acids.
 - C. most protein molecules.
 - D. the cellular membrane.

Ans: B

34. All the following are components of a RNA molecule *except*
- A. cytosine.
 - B. ribose.
 - C. thymine.
 - D. uracil.

Ans: C

35. Nucleic acids are composed of all the following *except*
- A. phosphate.
 - B. carbohydrate.
 - C. amino acids.
 - D. nitrogenous bases.

Ans: C

36. What nucleotide is a universal form of energy for cells?
- A. ATP
 - B. Glucose
 - C. Ribose
 - D. Deoxyribose

Ans: A

37. The peptide bond is a type of covalent bond that forms
- A. in DNA.
 - B. only if ions are present.
 - C. between amino acids.
 - D. within water molecules.

Ans: C

38. In the formation of proteins, _____ react with one another to form a linkage called a(n) _____.
- A. fatty acids; peptide bond
 - B. glycerol molecules; ionic bond
 - C. amino acids; ionic bond
 - D. amino acids; peptide bond

Ans: D

39. Which one of the following *is not* associated with proteins?
- A. Nitrogen-containing amino acids
 - B. Peptide bonds
 - C. Primary and secondary structures
 - D. Saturated fatty acids

Ans: D

40. There are _____ amino acids that build proteins.
- A. four
 - B. twelve
 - C. twenty
 - D. sixty four

Ans: C

41. The sequence of amino acids in a protein is referred to as its
- A. primary structure.
 - B. secondary structure.
 - C. tertiary structure.
 - D. quaternary structure.

Ans: A

42. Which one of the following *is not* found in the secondary structure of proteins?
- A. Random coil
 - B. Pleated sheet
 - C. Disulfide bridge
 - D. Alpha helix

Ans: C

43. The tertiary structure of a protein is determined by the folding back on itself and forming of ionic and hydrogen bonds between the
- A. amino groups.
 - B. R groups.
 - C. phosphate groups.
 - D. carboxyl groups.

Ans: B

44. A denatured protein is one that
- A. has lost its three dimensional structure.
 - B. has reverted to a carbohydrate.
 - C. lacks amino acids.
 - D. lacks covalent bonds.

Ans: A

45. Which of the following organic elements is the most abundant in microorganisms?
- A. Carbohydrates
 - B. Lipids
 - C. Protein
 - D. Nucleic acids

Ans: C

Matching

46. Select one of the following four organic compounds to correctly complete each statement below.

- _____ 1. has primary, secondary and tertiary structure.
- _____ 2. contains both nitrogen and phosphorus.
- _____ 3. is the genetic material in a bacterial cell.
- _____ 4. contains ribose or deoxyribose.
- _____ 5. has saturated or unsaturated hydrocarbon chains.
- _____ 6. contains the three-carbon molecule glycerol.
- _____ 7. is composed of chains of amino acids.
- _____ 8. includes glucose, lactose, and sucrose.
- _____ 9. is made of monomers held together by peptide bonds.
- _____ 10. contains guanine, cytosine, uracil, and adenine.
- _____ 11. is a type of lipid.
- _____ 12. can be stored as glycogen.
- _____ 13. functions as structural materials and enzymes.

- A. Fat
- B. Nucleic acid
- C. Protein
- D. Carbohydrate

Ans: 1. C; 2. B; 3. B; 4. B; 5. A; 6. A; 7. C; 8. D; 9. C; 10. B; 11. A; 12. D; 13. C

47. Match each term with its correct description.

- _____ 1. Reactant
- _____ 2. Product
- _____ 3. Hydrogen bond
- _____ 4. Covalent bond
- _____ 5. Ionic bond
- _____ 6. pH
- _____ 7. Acid
- _____ 8. Base
- _____ 9. Peptide bond
- _____ 10. Nucleotide
- _____ 11. Nitrogenous base

- A. The sharing of electrons between two atoms generates this type of linkage.
- B. A molecule such as adenine and guanine.
- C. The result of one atom donating its outer electron(s) to another atom.
- D. The starting substance(s) in a chemical reaction.
- E. A substance that accepts H^+ from a solution.
- F. A weak linkage between hydrogen and an oxygen or nitrogen atom.
- G. The linkage between two amino acids in a protein.
- H. A reference to the relative concentration of protons in a solution.
- I. A substance that donates H^+ to water or to a solution.
- J. The building block of nucleic acids.
- K. The ending substance in a chemical reaction.

Ans: 1. D; 2. K; 3. F; 4. A; 5. C; 6. H; 7. I; 8. E; 9. G; 10. J; 11. B

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48. Match each term with its correct description.

- _____ 1. Isotope
- _____ 2. Atom
- _____ 3. Molecule
- _____ 4. Compound
- _____ 5. Element

- A. The smallest part of a compound having the properties of the compound.
- B. An atom with a different number of neutrons.
- C. The smallest part of matter that can't be broken into smaller substances or chemically destroyed.
- D. A unit of matter that cannot be subdivided further by ordinary chemical means.
- E. Formed when two or more elements interact to achieve stability.

Ans: 1. B; 2. C; 3. A; 4. E; 5. D

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True/False

For each of the following statements, decide if the statement is true or false. If false, correct the statement to be true.

49. True or false? A protein is a series of connected amino acids.

Ans: True

50. True or false? Carbohydrates may be as simple as the three-carbon molecule glycerol, or as extremely complex as the polysaccharide cellulose.

Ans: True

51. True or false? Isotopes vary according to the number of electrons in the outer shell of the atom.

Ans: False

Response: [...number of neutrons in the nucleus...]

52. True or false? Sodium chloride is typical of a compound in which the chemical bond is the covalent bond.

Ans: False

Response: [...is the ionic bond.]

53. True or false? Hydrogen bonds and sulfur bridges hold amino acids together in a chain, forming the primary structure of the protein.

Ans: False

Response: [Covalent (or peptide) bonds hold...]

54. True or false? Saturated fatty acids are those in which hydrogen atoms are missing and double bonds form between adjacent carbon atoms.

Ans: False

Response: [...Unsaturated fatty acids...]

55. True or false? A cation is a charged atom that forms when a neutron is released from the atom.

Ans: False

Response: [...when an electron is released...]

56. True or false? All chemical reactions in organisms occur in liquid water.

Ans: True

57. True or false? An atom whose outer shell has seven electrons would be expected to form an ionic bond with another atom that has one electron in the outer shell.

Ans: True

58. True or false? The tertiary structure of a protein forms when the protein folds back on itself much like a telephone cord folded on a table.

Ans: True

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59. True or false? Acids usually have a bitter taste, while bases generally have a sour taste.

Ans: False

Response: [Bases usually ... while acids have ...]

60. True or false? In writing a chemical reaction, the reactants are placed to the left of the arrow and the products are placed to the right.

Ans: True

61. True or false? The DNA nucleotides are held together by ionic bonds.

Ans: False

Response: [...by hydrogen bonds.]

62. True or false? An oxygen atom (atomic number 8) has seven electrons in its outermost electron shell.

Ans: False

Response: [...has six electrons...]

63. True or false? The ions in sodium chloride are held together by covalent bonds.

Ans: False

Response: [...by ionic bonds.]

64. True or false? A decomposition reaction in which water serves as an intermediary is a hydrolysis reaction.

Ans: True

65. True or false? The building blocks for disaccharides and polysaccharides are glycerol and fatty acids.

Ans: False

Response: [...for lipids are...]

66. True or false? Sucrose, lactose, and maltose are all examples of disaccharides.

Ans: True

67. True or false? A chemical reaction is a process in which atoms or molecules interact to form new bonds.

Ans: True

Essay

68. Describe the fundamental differences between an atom, an isotope, and an ion.

Ans: Answers will vary.

Bloom: Comprehension

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69. Distinguish between the following pairs:

Ionic bonding and covalent bonding

Saturated fatty acids and unsaturated fatty acids

Monosaccharide and polysaccharide

Ans: Answers will vary.

Bloom: Analysis

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70. Construct a table showing the important uses of carbohydrates, fats, proteins, and nucleic acids in microorganisms.

Ans: Answers will vary.

Bloom: Synthesis

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71. Distinguish between the primary, secondary, and tertiary structures of proteins.

Ans: Answers will vary.

Bloom: Analysis

Page: 22, 23

72. Explain what is meant by the statement, "A solution is buffered at a pH of 6.0."

Ans: Answers will vary.

Bloom: Comprehension

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73. Propose a reason why carbon atoms can form the broad variety of covalent bonds found in carbohydrates, lipids, proteins, and nucleic acids.

Ans: Answers will vary.

Bloom: Synthesis

Page: 7, 9

74. Name and describe the chemical reactions that:

A. link macromolecule monomers together and

B. break macromolecule polymers apart.

Ans: Answers will vary.

Bloom: Knowledge

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75. Assess hydrogen bonds and covalent bonds with respect to formation, use, and strength.

Ans: Answers will vary.

Bloom: Evaluation

Page: 9 - 11

76. Write a descriptive comparison of acids and bases.

Ans: Answers will vary.

Bloom: Application

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77. Compare RNA and DNA with respect to their chemical composition and use.

Ans: Answers will vary.

Bloom: Analysis

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78. Evaluate how cell function would differ without the features of water molecules.

Ans: Answers will vary.

Bloom: Evaluation

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79. Why is it important to have an understanding of chemistry for microbiology?

Ans: Answers will vary.

Bloom: Evaluation

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Fill in-the-Blank

80. A solution of pH 10 is _____ times more basic than a solution of pH 7.

Ans: 1000