Chapter 02 The Chemistry of Life

Multiple Choice Questions

1. The nucleus of an atom is composed of two subatomic particles, _____ and _____.

   A. protons; neutrons
   B. protons; electrons
   C. neutrons; electrons

2. Atoms that bear a positive or negative charge are known as:

   A. magnetic
   B. electrically neutral
   C. ions
   D. lacking nuclei

3. The _____ of atoms determine how atoms will react with each other.

   A. protons
   B. neutrons
   C. nuclei
   D. electrons

4. In an atom, protons are always:

   A. equal to the electrons
   B. never equal to the electrons
   C. equal to the neutrons
   D. combined with the electrons to calculate the atomic mass

5. The volume of space around a nucleus where an electron is most likely to be located is called the _____ of that electron.

   A. energy level
   B. spin
   C. pathway
   D. orbital

6. Electrons possess energy of position, also known as _____ energy.

   A. kinetic
   B. latent
   C. potential
   D. opposition

7. Most elements in nature exist as:

   A. solitary unreactive atoms
   B. mixtures of different isotopes
   C. mixtures of gases
   D. mixtures of liquids

8. What is true about the half-life of ^{14}C?

A. It takes 5,600 years for half of ^{14}C to be converted to ^{14}N.
B. The half-life never changes over time.
C. It can be employed in the radioisotopic dating of fossils.
D. All of these are correct.

9. When an electron is transferred from one atom to the next, and the two atoms are then electrically attracted to one another, the type of bond is a(n) _____ bond.

A. hydrogen
B. covalent
C. kinetic
D. ionic

10. The type of bond that forms between two atoms when electrons are shared is a(n) _____ bond.

A. hydrogen
B. covalent
C. kinetic
D. ionic

11. _____ bonds are needed for complex shapes of large organic molecules.

A. Directional
B. Nondirectional
C. Stationary
D. Ionic
E. Covalent

12. What property of water is NOT attributable to hydrogen bonding between water molecules?

    A. Heat storage
    B. Ice formation
    C. Polarity
    D. Cohesion

13. A solution with a pH of 4 has _____ the concentration of H^+ present compared to a solution with a pH of 5.

    A. 10 times
    B. 100 times
    C. 2 times
    D. 1000 times

14. The mass number of an atom is the:

    A. number of neutrons only.
    B. the number of electrons plus the number of protons.
    C. the number of protons only.
    D. the number of protons plus the number of neutrons.
    E. the number of electrons, plus the number of neutrons, plus the number of protons.

15. The atomic number of an atom is the:

    A. number of neutrons only
    B. number of electrons plus the number of protons
    C. number of protons only
    D. number of protons plus the number of neutrons
    E. number of electrons, plus the number of neutrons, plus the number of protons

16. The first shell in any atom contains one orbital which contains:

    A. 2 electrons
    B. 8 protons
    C. 8 electrons
    D. 4 neutrons
    E. 2 neutrons

17. The second shell in an atom contains _____ orbitals and holds up to _____ electrons.

    A. 4; 4
    B. 3; 2
    C. 4; 8
    D. 3; 8
    E. 8; 24

18. If an element has an atomic number of 6 and a mass number of 14, how many neutrons does it have?

    A. 6
    B. 14
    C. 7
    D. 8
    E. Impossible to determine

19. Which is *not* correct about water molecules?

    A. Hydrogen is more electronegative than oxygen.
    B. Water is a polar molecule.
    C. Covalent bonds exist within a water molecule.
    D. Hydrogen bonds exist between water molecules.
    E. Hydrogen bonds are weak bonds.

20. Which type of chemical bond exists within a water molecule?

    A. Hydrogen
    B. Ionic
    C. Covalent
    D. It depends on the temperature of the water.
    E. Weak

21. Water moving up into a paper towel is attributable to:

    A. heat storage
    B. high heat of vaporization
    C. electronegativity
    D. cohesion
    E. adhesion

22. The high surface tension of water that allows some insects to literally walk on water is due to:

A. high heat of vaporization
B. cohesion
C. adhesion
D. polar covalent bonds
E. heat storage

23. Which statement is *incorrect* about acid rain?

A. It comes from the tall stacks of coal-burning power plants.
B. Its effects have been more devastating to the Southeast than the Northeast.
C. Sulfuric acid in the atmosphere is carried back to earth with rain.
D. It has resulted in lakes becoming devoid of life.
E. In 1989, rain and snow in the Northeast often had a pH as low as 2.

True / False Questions

24. Hydrogen bonds exist within a water molecule.

True False

25. Nonpolar molecules are water soluble.

True False

26. A solution of pH 3 is 100 times more acidic than a solution of pH 5.

True False

Fill in the Blank Questions

27. The number of protons in the nucleus of an atom is called the _____.

    _____

28. Atomic mass refers to the numbers of _____ and _____ of an atom.

    _____

29. Atoms that have the same number of protons but differ in their number of neutrons are _____.

    _____

30. Nonpolar compounds are said to be _____ because they shrink away from contact with water.

    _____

31. When water ionizes, the negatively charged OH fragment is the _____ ion.

    _____

32. We use the _____ scale to measure concentrations of hydrogen ions in a solution.

    _____

33. A solution with a pH of 3 is said to be highly _____.

    _____

34. Cells contain chemical substances called _____ that minimize changes in concentrations of H^+ and OH^-.

_____

35. The chemical bond within a water molecule is a _____ bond.

_____

36. Due to hydrogen bonding, ice is _____ dense than water.

_____

37. A substance that increases the concentration of H^+ is called a(n) _____.

_____

Essay Questions

38. What are two of the characteristics of water that make it so important in living organisms?

39. What are some of the uses of radioactive isotopes?

40. Discuss the difference between covalent, ionic and hydrogen bonds.

41. What is acid rain and how does it affect forests and lakes?

42. Describe the structure of an atom, and include how the number of electrons in the outer shell will affect an atom's tendency to interact with other atoms.

Chapter 02 The Chemistry of Life Key

Multiple Choice Questions

1. The nucleus of an atom is composed of two subatomic particles, _____ and _____.

A. protons; neutrons
B. protons; electrons
C. neutrons; electrons

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.01
Topic: Chemistry

2. Atoms that bear a positive or negative charge are known as:

A. magnetic
B. electrically neutral
C. ions
D. lacking nuclei

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.02
Topic: Chemistry

3. The _____ of atoms determine how atoms will react with each other.

A. protons
B. neutrons
C. nuclei
D. electrons

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.01
Topic: Chemistry

4. In an atom, protons are always:

A. equal to the electrons
B. never equal to the electrons
C. equal to the neutrons
D. combined with the electrons to calculate the atomic mass

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.01
Topic: Chemistry

5. The volume of space around a nucleus where an electron is most likely to be located is called the _____ of that electron.

A. energy level
B. spin
C. pathway
D. orbital

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.01
Topic: Chemistry

6. Electrons possess energy of position, also known as _____ energy.

A. kinetic
B. latent
C. potential
D. opposition

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.01
Topic: Chemistry

7. Most elements in nature exist as:

A. solitary unreactive atoms
B. mixtures of different isotopes
C. mixtures of gases
D. mixtures of liquids

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.02
Topic: Chemistry

8. What is true about the half-life of ^{14}C?

A. It takes 5,600 years for half of ^{14}C to be converted to ^{14}N.
B. The half-life never changes over time.
C. It can be employed in the radioisotopic dating of fossils.
D. All of these are correct.

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.02
Topic: Chemistry

9. When an electron is transferred from one atom to the next, and the two atoms are then electrically attracted to one another, the type of bond is a(n) _____ bond.

A. hydrogen
B. covalent
C. kinetic
D. ionic

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.03
Topic: Chemistry

10. The type of bond that forms between two atoms when electrons are shared is a(n) _____ bond.

A. hydrogen
B. covalent
C. kinetic
D. ionic

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.03
Topic: Chemistry

11. _____ bonds are needed for complex shapes of large organic molecules.

A. Directional
B. Nondirectional
C. Stationary
D. Ionic
E. Covalent

Bloom's Level: 2. Understand
Johnson - Chapter 02

Section: 02.03
Topic: Chemistry

12. What property of water is NOT attributable to hydrogen bonding between water molecules?

A. Heat storage
B. Ice formation
C. Polarity
D. Cohesion

Bloom's Level: 3. Apply
Johnson - Chapter 02
Section: 02.04
Topic: Chemistry

13. A solution with a pH of 4 has _____ the concentration of H^+ present compared to a solution with a pH of 5.

A. 10 times
B. 100 times
C. 2 times
D. 1000 times

Bloom's Level: 3. Apply
Johnson - Chapter 02
Section: 02.05
Topic: Chemistry

14. The mass number of an atom is the:

A. number of neutrons only.
B. the number of electrons plus the number of protons.
C. the number of protons only.
D. the number of protons plus the number of neutrons.
E. the number of electrons, plus the number of neutrons, plus the number of protons.

Bloom's Level: 1. Remember

Johnson - Chapter 02
Section: 02.01
Topic: Chemistry

15. The atomic number of an atom is the:

A. number of neutrons only
B. number of electrons plus the number of protons
C. number of protons only
D. number of protons plus the number of neutrons
E. number of electrons, plus the number of neutrons, plus the number of protons

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.01
Topic: Chemistry

16. The first shell in any atom contains one orbital which contains:

A. 2 electrons
B. 8 protons
C. 8 electrons
D. 4 neutrons
E. 2 neutrons

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.01
Topic: Chemistry

17. The second shell in an atom contains _____ orbitals and holds up to _____ electrons.

A. 4; 4
B. 3; 2
C. 4; 8
D. 3; 8
E. 8; 24

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.01
Topic: Chemistry

18. If an element has an atomic number of 6 and a mass number of 14, how many neutrons does it have?

A. 6
B. 14
C. 7
D. 8
E. Impossible to determine

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.01
Topic: Chemistry

19. Which is *not* correct about water molecules?

A. Hydrogen is more electronegative than oxygen.
B. Water is a polar molecule.
C. Covalent bonds exist within a water molecule.
D. Hydrogen bonds exist between water molecules.
E. Hydrogen bonds are weak bonds.

Bloom's Level: 2. Understand

Johnson - Chapter 02
Section: 02.04
Topic: Chemistry

20. Which type of chemical bond exists within a water molecule?

A. Hydrogen
B. Ionic
C. Covalent
D. It depends on the temperature of the water.
E. Weak

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.04
Topic: Chemistry

21. Water moving up into a paper towel is attributable to:

A. heat storage
B. high heat of vaporization
C. electronegativity
D. cohesion
E. adhesion

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.04
Topic: Chemistry

22. The high surface tension of water that allows some insects to literally walk on water is due to:

A. high heat of vaporization
B. cohesion
C. adhesion
D. polar covalent bonds
E. heat storage

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.04
Topic: Chemistry

23. Which statement is *incorrect* about acid rain?

A. It comes from the tall stacks of coal-burning power plants.
B. Its effects have been more devastating to the Southeast than the Northeast.
C. Sulfuric acid in the atmosphere is carried back to earth with rain.
D. It has resulted in lakes becoming devoid of life.
E. In 1989, rain and snow in the Northeast often had a pH as low as 2.

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.05
Topic: Chemistry

True / False Questions

24. Hydrogen bonds exist within a water molecule.

FALSE

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.04

Topic: Chemistry

25. Nonpolar molecules are water soluble.

FALSE

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.03
Topic: Chemistry

26. A solution of pH 3 is 100 times more acidic than a solution of pH 5.

TRUE

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.05
Topic: Chemistry

Fill in the Blank Questions

27. The number of protons in the nucleus of an atom is called the _____.

atomic number

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.01
Topic: Chemistry

28. Atomic mass refers to the numbers of _____ and _____ of an atom.

protons, neutrons

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.01
Topic: Chemistry

29. Atoms that have the same number of protons but differ in their number of neutrons are _____.

isotopes

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.02
Topic: Chemistry

30. Nonpolar compounds are said to be _____ because they shrink away from contact with water.

hydrophobic

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.03
Topic: Chemistry

31. When water ionizes, the negatively charged OH fragment is the _____ ion.

hydroxide

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.05
Topic: Chemistry

32. We use the _____ scale to measure concentrations of hydrogen ions in a solution.

pH

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.05
Topic: Chemistry

33. A solution with a pH of 3 is said to be highly _____.

acidic

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.05
Topic: Chemistry

34. Cells contain chemical substances called _____ that minimize changes in concentrations of H^+ and OH^-.

buffers

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.05
Topic: Chemistry

35. The chemical bond within a water molecule is a _____ bond.

covalent

Bloom's Level: 1. Remember
Johnson - Chapter 02
Section: 02.04
Topic: Chemistry

36. Due to hydrogen bonding, ice is _____ dense than water.

less

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.04
Topic: Chemistry

37. A substance that increases the concentration of H^+ is called a(n) _____.

acid

Bloom's Level: 1. Remember

Johnson - Chapter 02
Section: 02.05
Topic: Chemistry

Essay Questions

38. What are two of the characteristics of water that make it so important in living organisms?

Water is a polar molecule, and can form hydrogen bonds. These two characteristics are responsible for the properties of high polarity, heat-storing ability, high heat of vaporization, low density of ice, and cohesion.

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.04
Topic: Chemistry

39. What are some of the uses of radioactive isotopes?

Will vary, but should include medical tests and fossil dating.

Bloom's Level: 3. Apply
Johnson - Chapter 02
Section: 02.02
Topic: Chemistry

40. Discuss the difference between covalent, ionic and hydrogen bonds.

Covalent bonds involve sharing electrons between atoms. Ionic bonds occur when oppositely charged ions are attracted to each other. Hydrogen bonds occur when polar molecules are attracted by opposite partial charges on different molecules.

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.03
Topic: Chemistry

41. What is acid rain and how does it affect forests and lakes?

Will vary, but should include the emissions of coal-burning power plants and the effect of sulfuric acid on the pH of rain and snow. Also, answers should include acid rain's effect on biodiversity, forests, and lakes.

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.05
Topic: Chemistry

42. Describe the structure of an atom, and include how the number of electrons in the outer shell will affect an atom's tendency to interact with other atoms.

Atoms contain protons (positively charged), and neutrons (neutral) in their nucleus. Electrons are in electron shells around the nucleus. Each orbital holds a maximum of 2 electrons and atoms try to fill their outer shells with electrons.

Bloom's Level: 2. Understand
Johnson - Chapter 02
Section: 02.01
Topic: Chemistry

Chapter 02 The Chemistry of Life Summary

Category	*# of Questions*
Bloom's Level: 1. Remember	20
Bloom's Level: 2. Understand	19
Bloom's Level: 3. Apply	3
Johnson - Chapter 02	42
Section: 02.01	13
Section: 02.02	5
Section: 02.03	6
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Section: 02.05	9
Topic: Chemistry	42