

Chapter 02 - The Chemistry of Life

**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

*Bloom's Level: 1. Remember*  
*Section: 02.01*  
*Topic: Atomic Structure*

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*  
*Section: 02.02*  
*Topic: Atomic Structure*

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*  
*Section: 02.01*  
*Topic: Atomic Structure*

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*

*Section: 02.01*

*Topic: Atomic Structure*

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*

*Section: 02.01*

*Topic: Atomic Structure*

6. Electrons possess energy of position, also known as \_\_\_\_\_ energy.

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

*Bloom's Level: 1. Remember*

*Section: 02.01*

*Topic: Atomic Structure*

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*

*Section: 02.02*

*Topic: Atomic Structure*

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

- A. It takes 5,730 years for half of  $^{14}\text{C}$  to be converted to  $^{14}\text{N}$ .
- 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*

*Section: 02.02*

*Topic: Atomic Structure*

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*

*Section: 02.03*

*Topic: Chemical Bonds*

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*  
*Section: 02.03*  
*Topic: Chemical Bonds*

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*  
*Section: 02.03*  
*Topic: Chemical Bonds*

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*  
*Section: 02.04*  
*Topic: Properties of Water*

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*  
*Section: 02.05*  
*Topic: Acids and Bases*

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*  
*Section: 02.01*  
*Topic: Atomic Structure*

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*  
*Section: 02.01*  
*Topic: Atomic Structure*

16. The first shell in any atom contains one orbital which may contain as many as

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

*Bloom's Level: 1. Remember*

*Section: 02.01*

*Topic: Atomic Structure*

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*

*Section: 02.01*

*Topic: Atomic Structure*

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*

*Section: 02.01*

*Topic: Atomic Structure*

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*  
*Section: 02.04*  
*Topic: Chemical Bonds*  
*Topic: Properties of Water*

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*  
*Section: 02.04*  
*Topic: Chemical Bonds*  
*Topic: Properties of Water*

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*  
*Section: 02.04*  
*Topic: Properties of Water*

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*

*Section: 02.04*

*Topic: Properties of Water*

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*

*Section: 02.05*

*Topic: Acids and Bases*

### **True / False Questions**

24. Hydrogen bonds exist within a water molecule.

**FALSE**

*Bloom's Level: 1. Remember*

*Section: 02.04*

*Topic: Chemical Bonds*

*Topic: Properties of Water*



25. Nonpolar molecules are water soluble.

**FALSE**

*Bloom's Level: 2. Understand*

*Section: 02.03*

*Topic: Properties of Water*

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

**TRUE**

*Bloom's Level: 2. Understand*

*Section: 02.05*

*Topic: Acids and Bases*

### **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*

*Section: 02.01*

*Topic: Atomic Structure*

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

**protons, neutrons**

*Bloom's Level: 1. Remember*

*Section: 02.01*

*Topic: Atomic Structure*

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

\_\_\_\_\_.  
**isotopes**

*Bloom's Level: 2. Understand*

*Section: 02.02*

*Topic: Atomic Structure*

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

**hydrophobic**

*Bloom's Level: 1. Remember*

*Section: 02.03*

*Topic: Chemical Bonds*

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

**hydroxide**

*Bloom's Level: 1. Remember*

*Section: 02.05*

*Topic: Acids and Bases*

*Topic: Properties of Water*

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

**pH**

*Bloom's Level: 1. Remember*

*Section: 02.05*

*Topic: Acids and Bases*

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

**acidic**

*Bloom's Level: 1. Remember*

*Section: 02.05*

*Topic: Acids and Bases*

34. Cells contain chemical substances called \_\_\_\_\_ that minimize changes in concentrations of  $\text{H}^+$  and  $\text{OH}^-$ .

**buffers**

*Bloom's Level: 1. Remember*

*Section: 02.05*

*Topic: Acids and Bases*

35. The chemical bond within a water molecule is a \_\_\_\_\_ bond.

**covalent**

*Bloom's Level: 1. Remember*

*Section: 02.04*

*Topic: Chemical Bonds*

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

**less**

*Bloom's Level: 2. Understand*

*Section: 02.04*

*Topic: Chemical Bonds*

*Topic: Properties of Water*

37. A substance that increases the concentration of  $\text{H}^+$  is called a(n) \_\_\_\_\_.

**acid**

*Bloom's Level: 1. Remember*

*Section: 02.05*

*Topic: Acids and Bases*

## **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  
Section: 02.04  
Topic: Properties of Water*

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  
Section: 02.02  
Topic: Atomic Structure*

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  
Section: 02.03  
Topic: Chemical Bonds*

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  
Section: 02.05  
Topic: Acids and Bases*

Chapter 02 - The Chemistry of Life

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*

*Section: 02.01*

*Topic: Atomic Structure*