

Module 2: Basic Chemistry

Comprehension & Critical Thinking Questions

Part 1: Understanding Core Concepts

1. Atomic Structure

- Identify the three subatomic particles (protons, neutrons, electrons). Describe their location within the atom, relative mass, and electrical charge.
- What determines the "identity" of an atom (i.e., which element it is)?

2. Chemical Bonding

- Define the **Octet Rule**. Why do atoms form bonds?
- Differentiate between the three major types of bonds in biological systems: **Ionic**, **Covalent** (polar and non-polar), and **Hydrogen** bonds.

3. Properties of Water

- Explain why water is considered a "polar" molecule. How does this polarity lead to hydrogen bonding?
- List four distinct properties of water that are critical for life (e.g., cohesion, high specific heat).

Part 2: Applying Biological Principles

1. pH and Buffers

- The pH scale is logarithmic. Mathematically, how much more acidic is a solution with pH 3 compared to pH 6?
- Explain the role of **buffers** in biological systems (like human blood). What happens if a biological system's pH shifts too drastically?

2. Isotopes in Biology

- **Scenario:** A paleontologist finds a fossil and wants to know its age.
- **Apply:** How can **radioactive isotopes** (like Carbon-14) be used to solve this problem? What is "half-life"?

Part 3: Analyzing & Evaluating

1. Reactivity and Stability

- Analyze the relationship between an atom's electron shell configuration and its chemical reactivity. Why are "Noble Gases" (like Helium or Neon) generally unreactive?

2. Water in Ecosystems

- Water becomes less dense when it freezes (ice floats). Analyze how this specific property affects aquatic life in a lake during winter. What would happen if ice sank?