Module 2: Basic Chemistry

Comprehension & Critical Thinking Questions

Part 1: Core Concepts

1. **Atomic Structure**
    - Identify the three subatomic particles (protons, neutrons, electrons). Describe their location, relative mass, and charge.
    - What determines the identity of an element?
2. **Chemical Bonding**
    - Define the Octet Rule. Why do atoms form bonds?
    - Differentiate between ionic bonds, covalent bonds (polar and non-polar), and hydrogen bonds.
3. **Properties of Water**
    - Explain why water is a polar molecule. How does polarity lead to hydrogen bonding?
    - List four properties of water critical for life: cohesion, adhesion, high specific heat, solvent properties.

Part 2: Application

1. **pH and Buffers**
    - The pH scale is logarithmic. How much more acidic is a solution with pH 3 compared to pH 6?
    - Explain the role of buffers in biological systems. What happens if blood pH shifts from 7.4 to 6.8?

2. **Isotopes in Biology**

    - **Scenario**: A paleontologist discovers a fossil and wants to determine its age.
    - **Apply**: Explain how radioactive isotopes (e.g., Carbon-14) and half-life calculations are used in radiometric dating.

Part 3: Analysis & Evaluation

1. **Reactivity and Stability**

    - Analyze the relationship between electron configuration and chemical reactivity.
    - Why are noble gases (He, Ne, Ar) largely unreactive?

2. **Water in Ecosystems**

    - Ice floats because solid water is less dense than liquid water.
    - Analyze how this property affects aquatic ecosystems in winter. What would happen if ice sank?