Module 2: Basic Chemistry

Keys to Success & Study Guide

Learning Objectives

By the end of this module, you should be able to: 1. **Describe** the structure of an atom and the properties of its subatomic particles. 2. **Compar** and **contrast** ionic, covalent, and hydrogen bonds. 3. **Explain** the unique life-supporting properties of water resulting from its polarity. 4. **Interpret** the pH scale and explain the importance of buffers in homeostasis.

Key Terminology Checklist

Define these terms in your own words to ensure mastery. - [ ] **Matter**: Anything that has mass and takes up space. - [ ] **Isotope**: Atoms of the same element with different numbers of neutrons. - [ ] **Valence Shell**: The outermost electron shell; determines reactivity. - [ ] **Cation vs. Anion**: Positively charged ion vs. negatively charged ion. - [ ] **Electronegativity**: A measure of an atom's ability to attract shared electrons. - [ ] **Solute vs. Solvent**: The substance being dissolved vs. the dissolving medium (usually water). - [ ] **Hydrophilic vs. Hydrophobic**: Water-loving vs. water-fearing.

Concept Check

1. Atomic Math

- **Question**: How are Atomic Number and Atomic Mass calculated?
- **Deep Dive**: If an atom has an Atomic Number of 6 and a Mass Number of 12, how many neutrons does it have? What if the Mass Number is 14? (Hint: This is an isotope).

2. Bonding Basics

- **Question**: How do ionic and covalent bonds differ?
- **Deep Dive**: Why is Sodium Chloride (NaCl) an ionic bond, while Water (H2O) is a covalent bond? Think about what the electrons are doing (transferred vs. shared).

3. The Power of pH

- **Question**: What regions of the pH scale relate to acids, bases, and neutral substances?
- **Deep Dive**: Why is "acid rain" harmful to forests and lakes? Connect this back to the sensitivity of biological molecules to pH changes.

Study Tips

- **CHNOPS**: Remember the six most common elements in life: Carbon, Hydrogen, Nitrogen, Oxygen, Phosphorus, Sulfur.
- **Draw it out**: Sketch a water molecule. Label the Oxygen (delta negative) and Hydrogen (delta positive) and draw dotted lines to neighboring water molecules to represent Hydrogen bonds. Visualizing this makes "polarity" makes sense.
- **The "Shell" Game**: When looking at the Periodic Table, look at the columns (Groups). Group 1 atoms have 1 valence electron (highly reactive). Group 8 (Noble gases) have full shells (inert).