

REVIEW TOPICS: CHEM 141 PLACEMENT EXAM

1. Chemistry: An Introduction

- Scientific Method: Solving problems using scientific approach; observations, hypothesis, theory and laws
- Measurements: Metric system, Fundamental units, Uncertainty of measurement and Significant figures, Rounding-off numbers, Scientific notation, Derived units (eg: density), Temperature Conversions, Dimensional analysis.

2. Matter and Energy

- Definition of matter
- Classification: elements and compounds; mixtures and pure substances.
- Properties: physical and chemical properties; extensive and intensive properties; physical and chemical changes
- Energy: Types of energy (kinetic energy and potential energy)

3. The Periodic Table

- History: Introduction to periodic table and natural states of elements
- Symbols
- Periods and groups
- Metals, non-metals and metalloids

4. Atomic Structure

- Sub-atomic particles
- Atomic mass
- Isotopes
- Law of conservation of mass; Law of multiple proportions; Law of constant composition
- Dalton's atomic theory
- Formulas of compounds (define and interpret formulas)

5. Nomenclature

- Differentiate ionic and covalent bonding
- Ions (anions and cations) and naming ions
- Compounds and naming compounds (naming type I and type II ionic compounds)
- Naming covalent molecular species
- Polyatomic ions and naming compounds containing polyatomic ions.
- Naming acids and bases
- Writing formulas and names

6. Types of Reactions

- Evidence for a chemical reaction and chemical equation
- Writing and balancing chemical reactions
- Dissolution of compounds
- Acid-Base reactions
- Classification/recognizing chemical reactions.

7. Chemical Composition and Chemical Quantities

- Counting by weighing: atomic mass (counting atoms by weighing)
- The mole concept: molar mass; percent composition
- Formulas of compounds (formula masses, percent composition)
- Understanding empirical and molecular formulas
- Information given by a chemical equation;
- Mole-mole calculations and concept of limiting reagents

8. Electronic Configuration

- Bohr Theory of Structure of an atom.
- Modern concept of atomic structure: shells, subshells and orbitals, shapes of orbitals
- Electronic Configurations

9. Chemical Bonding

- Chemical Formulas and types of chemical bonds
- Ionic bonding: stable electronic configurations and charges on ions; ionic bonding and structure of ionic compounds
- Covalent bonding; double and triple bonds
- Electronegativity and bond polarities and dipole moments
- Electron dot diagrams: Lewis dot structures for atoms, molecules and ions and polyatomic ions; formal charge
- Molecular structure and VSEPR model

10. Gases

- Kinetic molecular theory of gases
- Gas Pressure
- Pressure to volume relationship (Boyle's Law)
- Volume to temperature relationship (Charles' Law),
- Volume to mole relationship (Avogadro's Law)
- Relationship between P, V, T and amount of substance (Ideal Gas Law)
- Dalton's Law of Partial Pressures: mixtures of gases and partial pressures

11. Solution Chemistry

- Solubility of substances
- Solution composition: mass percent and molarity
- Solution stoichiometry
- Dilution of solutions
- Neutralization reactions and molarities of ions
- Electrolytes: properties of ionic compounds in aqueous solution

12. Liquids and Solids

- Changes in states of matter and energy requirements
- Properties of water
- Molecular polarity and intermolecular forces (**IMF**)
- Dissolution of substances in water and types forces involved
- Evaporation and vapor pressure

13. Acids and Bases

- Definition of acids and bases
- Strength of an acid or a base
- Water as an acid and base
- pH scale;
- Calculating pH of strong acid/base solutions
- Buffers and importance of buffer solutions in sustaining life

14. Energy and Energy Changes in Chemical Reactions

- Concept of energy and units of energy
- Temperature changes and molecular/atomic motions
- Specific heat of substances
- Concept of chemical energy
- Energy changes in chemical reactions and conservation of energy