CORE COURSE: INORGANIC CHEMISTRY

Module 1: Acid-Base theories

1. Define and differentiate between Arrhenius and Bronsted-Lowry acid-base concepts.
2. Analyze the theory of solvent system for H2O, NH3, SO2, and HF.
3. Compare the relative strengths of acids based on Pauling's rules.
4. Evaluate the Lux-Flood concept and its significance in acid-base theories.
5. Explain the Lewis concept of acids and distinguish the characteristics of Lewis acids.
6. Analyze solvent leveling and differentiating effects in acid-base reactions.
7. Apply thermodynamic acidity parameters and understand the Drago-Wayland equation.
8. Discuss superacids, gas phase acidity, and proton affinity in the context of acid-base chemistry.
9. Apply the HSAB principle to predict acid-base reactions.

Module 2: Ionic bonding

1. Analyze the general characteristics of ionic bonding and types of ions involved.
2. Calculate the unit cell, lattice, and basis in ionic crystals.
3. Explain crystal plane, Weiss and Miller indices, and diffraction in ionic solids.
4. Evaluate the size effects and limitations of the radius ratio rule.
5. Derive and apply the Born-Landé equation and understand the importance of the Kapustinskii expression for lattice energy.
6. Discuss the Madelung constant, Born-Haber cycle, and its applications in ionic bonding.
7. Analyze solvation energy and its impact on ionic solubility.
8. Describe defects in solids and their influence on the properties of ionic compounds.

Module 3: Covalent Bonding-II

1. Describe the molecular orbital concept of bonding and its approximations.
2. Apply the linear combination of atomic orbitals (LCAO) approach to molecular orbital theory.
3. Analyze sigma and pi-bonds, as well as delta interactions in covalent bonds.
4. Understand the concept of orbital designations such as gerade, ungerade, HOMO, and LUMO.
5. Interpret MO diagrams for various diatomic molecules like H2, Li2, Be2, etc.
6. Evaluate the bonding properties including bond orders and bond lengths in molecular orbitals.
7. Discuss heteronuclear molecular orbitals in molecules like CO, NO, and HF.
8. Analyze multiple bonding and orbital mixing in covalent compounds.