

## **Inorganic Review**

Based on Core Curriculum Requirements for Inorganic Chemistry published by the American Chemical Society Committee on Professional Training

### Atomic Structure

- Hydrogen wavefunctions (angular and radial)
- Quantum numbers
- Ionization energy and trends
- Electron affinity and trends
- Shielding and penetration
- Effective nuclear charge
- Spectroscopy of multi-electron atoms and ions
- Electronegativity and trends

### Ionic Substances

- Close-packing and structures of common ionic compounds
- Obtaining formula unit from unit cell
- Ionic radii trends
- Lattice energy and calculations (Born-Haber cycle, Born-Landé equation, Madelung constants)
- Correlation of lattice energy to properties (solubility, hardness, etc.)

### Covalent Molecular Substances

- Assign molecules to symmetry point groups
- Lewis dot structures (draw and know when they are applicable) including resonance, formal charge (oxidation number) and Electroneutrality Principle
- VSEPR theory (predict geometries from Lewis dot structures, know when applicable)
- Valence bond theory (hybridization, types of bonds and where it is applicable)
- Molecular orbital theory
- Bond energies and trends

### Metallic Substances

- Close-packing
- Metallic bonding and relationship to properties (reflectivity, conductivity, hardness, etc.)
- Band theory

### Acids and Bases

- Definitions of acid, base and amphoteric in Brønsted-Lowry and Arrhenius models
- Hard/soft acid/base in Lewis definition, implications for transition metal chemistry

### Transition Metal Chemistry

- Nomenclature of simple compounds and complex ions
- Common geometries
- Isomerism and stereochemistry

- Ligand field (crystal field theory) and MO theory
- Electronic spectroscopy (Tanabe-Sugano and Orgel diagrams, term symbols) and predicting the spectra of complex ions (energies and intensities)
- Spectrochemical series and other factors that influence energy of electronic transitions in transition metal complex ions
- Formation constants (definition and manipulation)
- Ligand field stabilization energy and its affect on complex stability
- Irving-Williams series
- Chelate, macrocycle and sepulchrates effects
- Jahn-Teller effect (when should you see it and what does it do)
- Kinetic aspects of chelate effect, etc.
- Reactions and mechanisms of transition metal compounds
- Trans*- effect (what it is, why it works and its implications to synthesis)
- Labile and inert (know who is what and why)
- Stereochemical nonrigid and fluxional

#### Other Topics

- NMR (be able to predict number of peaks that should be observed by coupling identical and non-identical nuclei with varying natural abundances)
- Pourbaix diagrams (explain what they show and extract information from them)
- Electrochemical cells, manipulation of half-reactions, use of electrochemical cells to measure stability constants and  $K_{sp}$
- Be able to determine whether simple organometallic compounds obey the Eighteen-Electron rule