American Chemical Society (A.C.S.) General Chemistry Exam

75 multiple choice questions, 110 minutes
Bring a scantron, calculator and pencil(s)

I. States of Matter
- Ideal Gas Law: PV = nRT, PM = dRT, deviations from ideal (high P, low T)
- Ionic Solids: sc, fcc, bcc
- Phase Diagrams: Pressure versus Temperature
- Intermolecular Forces: ion-dipole, hydrogen bonding, etc.

II. Stoichiometry and Thermochemistry
- Hess' Law & Enthalpy: "standard states" have $\Delta H = 0$
- Percent Composition: %C, %H, etc.
- Limiting Reactant(s)
- Stoichiometry

III. Atomic Structure and Periodicity
- Oxidation States of "Main group" elements (Li, Be, B, etc.)
- Oxidation Numbers
- Atomic orbital configurations & relation to groups on periodic table (ns^2np^5 = halogens)
- Periodic Trends: Electronegativity, atomic radii
- Nuclear chemistry: mass number, atomic number

IV. Molecular Structure
- Modes of bonding: ionic, covalent (both polar and nonpolar)
- Lewis Dot, VSEPR, polarity, bond angles, resonance structures

V. Solutions
- Molarity: mol solute / L solution; also calculating molarity, $C_1V_1 = C_2V_2$
- Net ionic equations
- Percent dissociation in water (electrolyte strength)
- Molality: mol solute / kg solvent
- Freezing Point Depression $\Delta T = k_f m$

VI. Acids, Bases and Ionic Equilibria
- Know the "inert" acid/base ions: Cl^{-1}, NO_3^{-1}, Na^{+1}, etc.
- Know general reactions for WA + SB, WB + SA, SB + SA
- Equivalence point, finding unknown concentrations
- Buffer: what makes a buffer, what a buffer is, etc.
- pH: calculate pH of WB + SA, SB + WA, pure WB, pure WA

VII. Chemical Equilibrium - Molecular
- General equilibrium expressions: know how to find K
- Precipitation reactions
- Effect of heat upon endothermic / exothermic reactions

VIII. Kinetics
- Rate of disappearance, rate of formation; Catalysis in mechanisms
- Rate law and half life from experimental data; Energy of activation

IX. Thermodynamics
- Enthalpy, entropy, free energy
- Relation of free energy to equilibrium constants

X. Electrochemistry and Redox
- E values for electrochemical cells; E values for electrolysis cells
- Balancing acidic redox reactions
- Best reducing agents, oxidizing agents; definitions of oxidized and reduced

XI. Descriptive Chemistry
- Nuclear chemistry: particle(s) emitted which result in increase of atomic number
- Elemental reactivity: with water, oxygen, bases, acid, etc.
- Organic chemistry: know alkenes, alkanes, etc.; also isomers
- Coordination chemistry: coordination numbers around central metal
- Ionization energy periodic trends
- General nomenclature

XII. Laboratory
- Effect of improper drying on mass measurements
- Methods for finding $[Cl^{-1}]$