CHEM 1310: Review

List of major topics
Chapter 1: Atomic Nature of Matter

- Atomic theory of matter
- Atomic masses
- Moles
- Elemental analysis
- Volume & density
Chapter 2: Stoichiometry

- Balancing equations
- Limiting reagents & percent yields
- Stoichiometry
- Molarity
Chapter 3: Chemical Periodicity & Formation of Simple Compounds

- Groups of elements
- Periodic table
- Ions & ionic compounds & polyatomic ions
- Covalent bonds & Lewis structures
- Naming compounds
- VSEPR model
- Dipole moments
- Elements forming more than one ion (formal charges, oxidation states)
- Coordination complexes
Chapter 4: Types of Chemical Reactions

- Dissolution & precipitation reactions. Solubility. Predicting solubility.
- Electrolytes and non-electrolytes
- Acids & bases (weak & strong)
- Oxidation/reduction
- Titrations
Chapter 5: Gaseous state

- Pressure
- Absolute temperature
- Ideal gas law
- Mixtures of gases
- Kinetic theory of gases
- Real gases
Chapter 6: Condensed Phases & Phase Transitions

• Intermolecular forces (dipole/induced-dipole, dispersion, etc…)
• Phase transitions (melting/freezing, deposition/sublimation, boiling/condensation)
• Boiling/melting points; triple point
• Molality
• Colligative properties: boiling point elevation/freezing point depression
• Vapor pressure & Henry’s law
• Colloids
Chapter 7: Chemical Equilibrium

• Chemical reactions and equilibrium
• Equilibrium constants
• Reaction quotients (Q)
• Gas-phase equilibria
• Le Chatelier’s Principle
• Extraction and separation processes
Chapter 8: Acid-Base Equilibria

• Bronsted-Lowry Acids and Bases
• The pH scale
• Strengths of acids and bases
• Equilibria for weak acids and bases
• Buffer solutions
• Acid-base titration curves
• Polyprotic acids
• Lewis acids and bases
Chapter 9: Dissolution and Precipitation Equilibria

- Solubility equilibria
- Solubility of ionic solids
- Precipitation and the solubility product
- The effects of pH on solubility
- Common ion effect and its effect on solubility
- Complex ions and solubility
Chapter 10: Thermochemistry

- Heat
- Calorimetry
- Enthalpy
- Standard enthalpies of reaction
- Bond enthalpies
- Work
- First law of thermodynamics
Chapter 11: Spontaneous Change and Equilibrium

- Enthalpy
- Spontaneous Reactions
- Entropy
- Second Law of Thermodynamics
- Third Law of Thermodynamics
- Gibbs Energy of Chemical Reactions
- Gibbs Energy and Equilibrium Constants
- Temperature Dependence of Equilibrium Constants
Chapter 12: Redox Reactions and Electrochemistry

- Balancing Redox Reactions
- Half-reactions
- Electrochemical Cells
- Current and Charge
- Stoichiometry in Electrochemical Cells
- Metallurgy
- Electrorefining
- Electroplating
Chapter 13: Electrochemistry and Cell Voltage

- Gibbs Energy and Cell Voltage
- Electrical Work
- Half-cell Potentials
- Oxidizing and Reducing Agents
- Nernst Equation
- Concentration and Electrochemical Cells
- Equilibrium Constants
- Batteries and Fuel Cells
- Corrosion
Chapter 14: Chemical Kinetics

- Rates of Chemical Reactions
- Concentrations and Reaction Rates
- Order of a Reaction
- Concentration versus Time
- Reaction Mechanism
- Elementary Reactions
- Rate Laws
- Temperature Dependence of Reactions
- Catalysis
Chapter 16: Quantum Mechanics and the Hydrogen Atom

- Waves and Light
- Paradoxes in Classical Physics
- Planck, Einstein, and Bohr
- Waves, Particles, and the Schrödinger Equation
- The Hydrogen Atom
Chapter 17: Many-Electron Atoms and Chemical Bonding

- Many-Electron Atoms and the Periodic Table
- Quantum Numbers
- Aufbau Principle
- Hund’s Rule
- Orbital Energies
- Size of Atoms and Ions
- Properties of the Chemical Bond
- Ionic and Covalent Bonds
- Oxidation States and Chemical Bonding
Chapter 18: Molecular Orbitals

• Molecular Orbitals for Diatomics
• Molecular Orbitals for Polyatomics
• Correlation Diagrams
• Bond Orders