

FA 25 Exam 4 Study Plan

Course Overview

This study guide covers topics from sections 3.8 through 4.7, including electron configurations, periodic trends, chemical bonding, molecular geometry, and gas laws. Use this document to organize your preparation and track your progress.

Chapter 3: Atomic Structure and Chemical Bonding

3.8 Electron Configurations and Diagrams

Key Concepts to Master:

- Understand and apply electron configurations for chemical reactivity
- Know the spin quantum number (m_s)
- Understand the Pauli exclusion principle and sublevels
- Depict electron configurations, valence electrons, and core electrons
- Identify s, p, d, and f blocks on the periodic table
- Use the periodic table to predict electron configurations
- Write complete and abbreviated electron configurations
- Draw orbital diagrams with proper electron spin notation

3.9 Periodic Trends (including Electronegativity)

Key Concepts to Master:

- Predict periodic trends in atomic size
- Understand effective nuclear charge (Z_{eff})
- Compare metallic character across periods and groups
- Predict ionic radii trends
- Understand ionization energy trends
- Apply electron affinity concepts
- Compare electronegativity values
- Identify paramagnetic vs. diamagnetic atoms/ions

3.10 Ionic Bonding

Key Concepts to Master:

- Define ionic, covalent, and metallic bonding
- Understand Lewis dot theory
- Apply the octet rule
- Draw Lewis structures for ionic compounds
- Understand lattice energy and its relationship to ion charge and size

3.11 Covalent Bonding

Key Concepts to Master:

- Draw Lewis structures for covalent compounds and polyatomic ions
- Understand bond polarity, dipole moment, and partial charge
- Define and draw resonance structures
- Calculate formal charge for atoms in Lewis structures
- Determine magnitude and location of formal charge
- Depict single, double, and triple bonds correctly

Chapter 4: Molecular Geometry and Gases

4.1 VSEPR Theory

Key Concepts to Master:

- Understand VSEPR theory fundamentals
- Know the five basic shapes: linear (2), trigonal planar (3), tetrahedral (4), trigonal bipyramidal (5), octahedral (6)
- Memorize bond angles for each basic shape
- Distinguish between electron geometry and molecular geometry
- Understand effects of lone pairs on shape, bond angle, and polarity
- Recognize and draw correct molecular geometries
- Predict bond angles in polyatomic molecules

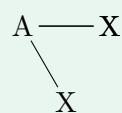
Five Basic Molecular Geometries:

Linear (2 electron groups) Bond angle: 180°



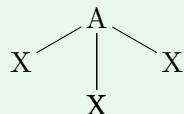
Example: CO₂, BeH₂

Trigonal Planar (3 groups) Bond angles: 120°



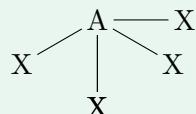
Example: BF₃, SO₃

Tetrahedral (4 groups) Bond angles: 109.5°



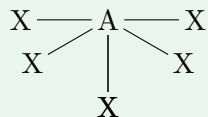
Example: CH₄, NH₄⁺

Trigonal Bipyramidal (5 groups) Angles: 120° (eq), 90° (ax)



Example: PCl₅, PF₅

Octahedral (6 electron groups) Bond angles: 90°



Example: SF₆, PF₆⁻

4.2 Valence Bond Theory

Key Concepts to Master:

- Define hybridization and the role of atomic orbitals
- Understand common hybridizations: sp^3 , sp^2 , and sp
- Know expanded octet hybridizations: sp^3d and sp^3d^2
- Recognize hybridization of atoms in polyatomic molecules
- Distinguish between sigma (σ) and pi (π) bonds

4.3 Molecular Polarity

Key Concepts to Master:

- Understand molecular polarity as a function of bond polarity and geometry
- Relate physical properties to molecular polarity
- Know types of intermolecular forces (IMF): London dispersion, dipole-dipole, hydrogen bonding
- Rank physical properties based on molecular formula and IMF strength

4.4 Gases and Ideal Gas Laws

Key Concepts to Master:

- Understand and apply Boyle's Law ($P_1V_1 = P_2V_2$)
- Understand and apply Charles's Law ($\frac{V_1}{T_1} = \frac{V_2}{T_2}$)
- Understand and apply Avogadro's Law
- Apply the Ideal Gas Law ($PV = nRT$)
- Solve problems using various gas law equations

4.5 STP

Key Concepts to Master:

- Define standard temperature and pressure (STP)
- Know molar volume of an ideal gas (22.4 L/mol at STP)
- Understand relationship between molar volume, molar mass, and density
- Calculate gas density from molar mass and vice versa

4.6 Dalton's Law and Partial Pressure

Key Concepts to Master:

- Define partial pressure of gaseous components in a mixture
- Apply Dalton's Law of Partial Pressures ($P_{total} = P_1 + P_2 + \dots$)
- Define and calculate mole fraction of components
- Interconvert between partial pressure and mole fraction

4.7 Effusion and Diffusion

Key Concepts to Master:

- Understand Graham's Law of Effusion
- Relate molecular velocity to molar mass and temperature
- Interconvert between molar mass, gas density, and average molecular velocity
- Compare rates of effusion/diffusion for different gases

Study Tips and Schedule

Recommended Approach:

1. Review one topic box per study session (2-3 hours each)
2. Work through practice problems immediately after reviewing concepts
3. Create summary sheets for each section with key equations and concepts
4. Focus extra time on topics involving calculations (gas laws, formal charge)
5. Practice drawing structures and geometries repeatedly
6. Form study groups to quiz each other on trends and definitions
7. Review all material 2-3 days before the exam