Fall 3 Study Guide

The exam will cover Chapter 3.7 (empirical formula – see experiment 10), Chapter 10 (all), parts of chapter 4 (section 3), and parts of chapter 11 (sections 1, 3-7) in the textbook. I have summarized the material below. A BAD way to study for the exam is just to look at this study guide, check things off and think you are ready for the exam. A GOOD way to study for the exam is to look at this study guide and find the appropriate sections in your notes and/or the textbook to go over the material in detail. Also, you MUST work problems for each section in order to succeed on the exam! Be able to do the problems without looking at the solutions. It’s a good idea to rework the class examples without looking at the solutions.

Note: You must bring your own non-programmable, scientific calculator. Sharing of calculators during the exam will not be allowed. You will also need a pen/pencil, but will not need any other materials.

Keys to studying chemistry

 ✓ Be sure to review notes and your text.
 ✓ Be able to work all pertinent problems from homework assignments, book problems, lecture problems, lab calculations, and example problems in the textbook
 ✓ Use frequent but short study periods, rather than long hours just before an exam
 ✓ Practice! Chemistry uses lots of terms and can seem like a foreign language. Practice problems in writing, do old homework or other exercises in the text to check your answers.
 ✓ Read each problem carefully to determine what is being asked, make a plan for solving the problem, check the answer to see if it is reasonable!

Below are some guidelines of what will be emphasized but you should be prepared for anything from the chapters, lectures, or labs unless otherwise specified.

- Chapter 3.7: Formulas
  o Know the difference an empirical formula and molecular formula
  o Be able to determine empirical formulas given data
  o Be able to determine the molecular formula from the empirical formula and the molar mass of the compound

- Chapter 10: Liquids and Solids
  o IMFs
    ▪ Know what an IMF is and how it differs from a bond
    ▪ Understand the 3 different phases and the properties of those phases including
      • Particle proximity, shape and volume, kinetic energy and the strength of the kinetic energy compared to the IMF strength
Know the 3 types of IMFs
Understand how IMFs influence boiling point and melting points for molecular matter

- **The Liquid State – basic properties**
  - Understand the term surface tension
    - Know which liquid would have the highest surface tension (the one with the strongest attractive forces)
  - Understand the term capillary action
    - Know that water is very attracted to glass (SiO₂)
  - Understand the term viscosity
    - Know which liquid would have the viscosity (the one with the strongest attractive forces)

- **The Solid State**
  - Know the 2 broad categories of solids and their properties
  - Know the 6 types of crystalline solids discussed in class along with their general properties (attractive forces holding solid together, general MPs and BPs, Water solubility, and electrical conductivity)
  - Be able to identify the category for each solid and the forces holding the solid together
  - Be able to rank solids in terms of MPs
    - Know specifically what affects the MPs (and BPs) for each type of solid and be able to apply it (The rules are different for each type of solid, so make sure to know how to rank ionic compounds and polar compounds, etc.)
  - Understand the solid state lab activity
    - Know what is meant by the term “unit cell”
    - Understand the differences in the types of packing in atoms
    - Know the 3 unit cell types and their properties (# of atoms/unit cell, edge length, and relative packing efficiency)
    - Be able to do calculations involving unit cells (i.e. calculate density, radius, edge length, # of atoms/unit cell . . .)
  - Understand the band diagrams for insulators, conductors, and semiconductors
    - Be able to draw band diagrams for these materials
    - Be able to label all the important parts of the band diagrams
    - Know the difference between the band structures for conductors, semiconductors, and insulators
  - Know the 2 different types of doped semiconductors and how they are different
    - Understand that the doped semiconductors have increased conductivity
    - Be able to draw/label band diagrams for the doped semiconductors
    - Know what atoms to pick to make an n or p type semiconductor
  - Know how to determine the number of ions/unit cell and the formula using a diagram or picture
  - Know how to determine the basic unit cell type adopted by one of the ions in the unit cell
Vapor Pressure and Changes of State
- Know what the term vapor pressure means
- Know what it means to be at dynamic equilibrium
- Understand how both temperature and IMF strength affects the vapor pressure
- Understand what it means to boil
- Understand and know the following terms
  - Evaporation (vaporization)
  - Condensation
  - Sublimation
  - Deposition
  - Boiling Point and Normal Boiling Point
  - Melting Point and Normal Melting Point
  - Freezing Point and Normal Freezing Point
- Understand heating diagrams for molecules
  - Be able to calculate the heat involved during phase changes and temperature changes

Phase Diagrams
- Know the 3 different regions on a phase diagram and what the lines mean
- Know the following terms and where to find them on the phase diagram:
  - Triple Point
  - Critical Point
  - Normal Boiling Point
  - Normal Freezing Point
- Be able to determine the phase change that is taking place as the pressure or temperature is changed

Chapter 4 — Solutions
- Know the difference between the solute, solvent, solution and the definition of molarity
- Be able to solve problems involving molarity including but not limited to:
  - determining the molarity from the grams of solute and volume of the solution
  - determining the amount of solution needed to get a certain mass of solute
  - determining molarity of ions in solution
- Be able to do dilution problems \( M_i V_i = M_f V_f \) (I won’t give you this equation)
  - Understand what it means to dilute a solution

Chapter 11 - Solutions
- Know the following concentration units and how to convert between them
  - Molarity
  - Molality
  - Normality
  - Mole Fraction
  - Mass Percent
- Understand the adage “like dissolves like” and how to apply it to predicting solubility
- Know what concentration unit changes with temperature
- Understand how vapor pressure changes when a nonvolatile solute is added to a solvent
  \[ P_{\text{soln}} = X_{\text{solvent}} P^*_{\text{solvent}} \text{ (given)} \]
- Understand how vapor pressure changes when a volatile solute is added to a solvent
  \[ P_{\text{total}} = X_{\text{solvent}} P^*_{\text{solvent}} + X_{\text{solute}} P^*_{\text{solute}} \text{ (given)} \]
Know the 4 colligative properties

- Know general definition for colligative properties, that it is HOW MUCH solute you add that determines the observed effect, not the chemical identity of the solute
- Understand Boiling Point **Elevation** \( \Delta T_b = i K_b \cdot m \) (given)
- Understand Freezing Point **Depression** \( \Delta T_f = i K_f \cdot m \) (given)
- Understand Osmotic Pressure \( \Pi = i MRT \) (given)
- Understand why \( I \) (van’t Hoff factor) is not always as predicted

**Given Information:**

- \( R = 0.08206 \text{ L atm / mol K} \)
- \( 1 \text{ atm} = 760 \text{ torr} \) (defined)
- periodic table

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\]

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