**AP Chemistry – Fall Final Exam Review**

We have covered the following chapters:

Chapter 1 Matter, Energy and Measurement (All Sections)

Chapter 2 Atoms, Molecules and Ions (Sections 1-8)

Chapter 3 Chemical Reactions and Reaction Stoichiometry (All)

Chapter 4 Reactions in Aqueous Solutions (All)

Chapter 6 Electronic Structure in Atoms (All, except NO quantum

numbers)

Chapter 7 Periodic Properties of Elements (All)

Chapter 8 Basic Concepts of Chemical Bonding (All)

Chapter 9 Molecular Geometry and Bonding Theories (Sections 1-6)

Chapter 10 Gases (Sections 1-8)

Chapter 11 Intermolecular Forces and Liquids (Sections 1-5)

Chapter 12 Solids (Select sections – Types of Solids)

Chapter 14 Kinetics

In order to prepare for your final, there are several things you could do:

1. Go over any Unit Study Guides or Student Objectives that you were given. Work any practice problems that you did not understand the first time around.
2. Look over any old tests/quizzes you have.
3. Read through all your notes.
4. Study all labs.
5. Work the problems on the Final Exam Review.
6. Make a list of formulas that you need to memorize – not the ones on the equation sheet.
7. Flip through each chapter and look at the graphs. What relationship is represented by the graph?
8. At the end of each chapter there is a **Chapter Summary and Key Terms** and a section called **Learning Outcomes**. Also look at the **Key Equations**. There is a short description of what the equation is used to calculate. Just don’t get confused as there are some sections/material that we do not cover.

***The questions on this study guide are just a variety of questions intended to help you review many of the concepts we have learned this semester. These are not exactly like the questions that will be on your exam, nor do they include all the concepts you need to know. For example: REDOX is not on this study guide!***

**Your test will consist of 50 multiple choice questions and 2 free response questions.**

**A Review of First Semester Topics**

**Atomic Structure and Periodicity**

1. Calculate the energy of electromagnetic radiation with a wavelength of 310 nm.
2. Carbon absorbs energy at a wavelength of 150. nm. The total amount of energy emitted by a carbon sample is 1.98 x 105 J. Calculate the number of carbon atoms in the sample, assuming that each atom emits one photon.
3. A carbon-carbon double bond in a certain organic molecule absorbs radiation that has a frequency of 6.0 x 1013s-1.
   1. What is the wavelength of this radiation?
   2. What is the energy of this radiation per photon? Per mole of photons?
4. Use the periodic table and other information concerning atomic structure and bonding to explain the following observations:
   1. The radii of Cl- ions are larger than the radii of Cl atoms.
   2. The electron affinity of fluorine is higher than the electron affinity of oxygen.
   3. Explain the trend in electronegativity from P to S to Cl.
   4. Explain the trend in electronegativity from Cl to Br to I.
   5. Rank the following atoms from smallest to largest and explain your choice. Al, Mg, Na, Si
   6. Place the following in order of increasing first ionization energy and explain your choice. Mg, Ca, Si, Al
   7. Why is the second ionization energy of Ca greater than the first ionization energy of Ca?
5. Correctly state the following in your own words.
   1. Hund’s Rule
   2. Heisenberg Uncertainty Principle
   3. Pauli Exclusion Principle
   4. Aufbau Principle
6. A. What are isotopes?

B. The atomic mass of rhenium is 186.2. Given that 37.1% of natural rhenium is

rhenium-185, what is the other stable isotope?

**Bonding and Intermolecular Forces**

1. A. An ionic compound is one in which the attractions between atoms is electrostatic and obeys Coulomb’s Law. What is Coulomb’s Law (the equation)? What do the symbols in the equation represent?

B. Use Coulomb’s Law to explain more energy is required to break up a CaO(s) crystal into

ions than a KF(s) crystal.

1. Complete the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Compound (Needs, Available, Shared – if you need to)** | **Lewis structure** | **Structural formula** | **Name of the shape of the molecule** | **Hybridization of the central atom** |
| PCl3 |  |  |  |  |
| OF2 |  |  |  |  |
| BrF5 |  |  |  |  |
| BF3 |  |  |  |  |
| ICl3 |  |  |  |  |

1. The nitrate ion exhibits resonance. What is resonance? Draw the resonance Lewis structures for the polyatomic ion.
2. Intermolecular forces are the forces of attraction between molecules. What are the three types of intermolecular forces? Which is weakest? Which is strongest? When and how are each formed? Give and example of each.
3. Use the principles of bonding and molecular structure to explain the

following statements:

1. The boiling point of argon is -186°C, whereas the boiling point of neon is -246°C.
2. Solid sodium melts at 98°C, but solid potassium melts at 64°C.
3. HCl has a lower boiling point than either HF or HBr.

**Solutions – Measuring Concentration**

1. What is the molarity of a solution when 1.00 g of HCl is completely dissolved in water to make 500. mL of solution?
2. How would you prepare 200.0 mL of 0.100M NaCl solution from solid NaCl?
3. How would you prepare 1.0 L of .20M HNO3 from an 18M stock solution?

**Gases**

1. A 4.0 L elastic weather balloon travels from sea level, at 1.0 atm pressure, to a higher altitude, where the pressure is 0.20 atm. What is the new volume of the balloon?
2. A gas occupies 2.0 L at 300. K. What is the volume of the gas at

200. K, assuming the pressure is constant?

1. A gas in a rigid container exerts 6.0 atm at 300.K. What is the pressure that the gas exerts at 500.K?
2. A rigid container holds a combination of nitrogen and oxygen gas at a total pressure of 2.4 atm. If the mole fraction of nitrogen gas is 0.16, what is the partial pressure exerted by the nitrogen gas?
3. Suppose you were given 8.00 moles of a gas occupying a volume of 4.00 L at constant pressure and temperature. What volume of gas would 16.0 moles occupy at the same temperature and pressure?
4. What is the pressure exerted by 3.0 moles of gas a 17.0°C in a 2.0 liter container?
5. A gas with a density of 1.67g/L exerts a pressure of 2.0 atm at a temperature of 299 K. What is the molar mass of the gas?
6. A mixture of helium and carbon dioxide form a mixture in a rigid container. A small leak is created in the container; how much faster will the helium exit the container than the carbon dioxide?
7. Ideal gases are gases that behave according to the following assumptions:
   1. The volume of the gas molecule is negligible compared to the space between the molecules.
   2. There is negligible intermolecular attraction between the gas molecules.

Most of the time gases behave as ideal gases, but under extreme conditions gases can deviate from ideal behavior. Under what conditions do gases deviate from ideal behavior?

**Stoichiometry and Types of Reactions**

1. A. In the following reaction, a 12.8 L sample of CO at 2.0 atm and 27°C is combined with 6.33 g of Fe2O3. How many liters of carbon dioxide are formed at the same temperature, and which is the limiting reactant?

Fe2O3(s) + 3CO(g) 🡪 2Fe(s) + 3CO2(g)

B. How many grams of the excess reaction remain?

1. A. What is the empirical formula of the hydrocarbon that contains 85.7% carbon?

B. Vapor pressure calculations determine that the molar mass of the hydrocarbon is 28.0 g/mole. What is the molecular formula of the compound?

1. How do you calculate the percent yield of a reaction?
2. Write balanced equations for the following reactions. Include phases.
   1. Solid sodium bicarbonate is gently heated
   2. Solid sodium chlorate is gently heated
   3. Solid sodium hydroxide is gently heated
   4. Solid sodium is placed in water
   5. Chlorine gas is bubbled through a solution of potassium bromide
   6. Sodium chloride solution is mixed with silver nitrate solution
   7. Ethane (C2H6) is burned
   8. Hydrochloric acid solution is added to a solution of calcium hydroxide
   9. Zinc metal is placed in a solution of copper sulfate