**First Semester Final Exam Study Guide**

*you get a 1-page cheat sheet (one side only) must be hand written*

**Know the structure of the atom.**

1. Define atom, neutron, proton, electron, atomic number, and atomic mass.
2. How would you determine how many protons an atom has? Electrons? Neutrons?
3. Which two sub-atomic particles make up the atomic mass of an atom?
4. Where are the protons, neutrons, and electrons found in an atom?
5. What do all atoms of the same element have in common? (What must never change for the same atom?)
6. How many protons, neutrons, and electrons does Ni have?
7. How many protons, neutrons, and electrons does Au-197 have?

**Know the significant scientists, experiments, and finds for the history of the atom.**

Know the scientists that contributed to the development of atomic structure and their significant contributions.

1. Rutherford
2. Bohr
3. Schrodinger
4. J.J. Thomson

**Know the difference between ion and isotope.**

1. Define ion, anion, cation, and isotope.
2. What can change between an atom and ion of the same element?
3. What can change between an atom and isotope of the same element?
4. Lithium will become a cation or anion? So, it will gain or lose electrons?
5. How do you find the average atomic mass?
6. Why is the average atomic mass different from a normal average?
7. If there are three isotopes of one element that are fairly common. One has a mass of 28.965 and is found 65.5% of the time. Another has a mass of 23.96 and is found 10.1% of the time. The final isotope has a mass of 27.11 and is found 24.4% of the time. Find the average atomic mass of this element.

**Know how to classify matter**.

1. Know key terms like: matter, atom, element, mixture, pure substance, compound
2. Identify each as either an element or a compound. Put an E for element and a C for compound.

\_\_\_\_\_ Au \_\_\_\_\_H2O \_\_\_\_\_NaCl \_\_\_\_\_He

1. Describe the difference between an element and a compound.

**Know the difference between physical and chemical properties and changes.**

1. Define physical change and chemical change.
2. What are the five indicators of a chemical change?
3. Identify each of the examples as a physical (P) or chemical (C) change.

\_\_\_\_\_ glass breaking \_\_\_\_\_ burning toast \_\_\_\_\_frying an egg

\_\_\_\_\_ a nail rusting \_\_\_\_\_ making salt water \_\_\_\_\_ mowing the lawn

1. Identify each of the examples as a physical (P) or chemical (C) property.

\_\_\_\_\_\_ color \_\_\_\_\_ taste \_\_\_\_\_ ability to dissolve

\_\_\_\_\_\_ ability to rust \_\_\_\_\_ flammability \_\_\_\_\_ density

**Know how to identify elements from the periodic table as metals, nonmetals, and metalloids.**

1. Describe the main characteristics and properties of each type of element: metal, nonmetal, metalloid/semi-metal.
2. Identify each of the elements below as metals (M), nonmetals (N), or metalloid/semi-metal (S).

\_\_\_\_\_ Si \_\_\_\_\_ F \_\_\_\_\_ Li \_\_\_\_\_ Ag \_\_\_\_\_ C

1. If an element is shiny, good conductor of electricity it is probably a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Know the organization of the periodic table.**

1. What are the vertical columns called? Horizontal rows?
2. Where are the alkali metals? Alkaline earth metals? Halogens? Noble gases?

**Know the periodic trends: atomic radius, ionization energy, and electronegativity**

1. Define atomic radius, ionization energy, and electronegativity.
2. What is the trend for atomic radius going across the periodic table? Ionization? Electronegativity?
3. What is the trend for ionization energy going down the periodic table? Ionization? Electronegativity?
4. Why does ionization energy increase going across a period?
5. Why does electronegativity increase going across a period?
6. Is a sulfur atom or sulfur ion bigger? Why?
7. Is a potassium atom or potassium ion bigger? Why?

**Know the three types of bonds.**

1. What types of elements are involved in ionic bonds? What happens to the electrons? What are the properties for ionic bonds?
2. What types of elements are involved in covalent bonds? What happens to the electrons? What are the properties of covalent bonds?
3. What types of elements are involved in metallic bonds? What happens to the electrons? What are the properties of metallic bonds?
4. Why do elements bond?
5. What is the octet rule? What do we use it for?
6. What type of bond would magnesium and fluorine make?
7. What type of bond would silicon and sulfur make?
8. What type of bond would lithium and sulfur make?
9. What type of bond would potassium and chlorine make?

**Know how to determine valence electrons.**

1. What are valence electrons?
2. How do we determine valence electrons?
3. Why are valence electrons important?
4. How many valence electrons does sulfur have? Does it become a cation or anion? Did it gain or lose electrons?
5. How many valence electrons does magnesium have? Does it become a cation or anion? Did it gain or lost electrons?

**Know how to name compounds and write chemical formulas.**

1. How do you determine if a compound is ionic or molecular?
2. What do you need to keep in mind when writing chemical formulas for ionic compounds?
3. What do you need to keep in mind when naming molecular compounds?
4. When a polyatomic ion is involved, what type of bond is occurring?
5. Write the chemical formulas for the following compounds. \*You should identify if they are ionic or molecular first\*

copper (I) bromide magnesium oxide

ammonium sulfate diphosphorous trioxide

sulfur trichloride manganese (III) cyanide

1. Write the names for the following compounds. \*You should identify if they are ionic or molecular first\*

AlF3 Fe(ClO4)3

NO3 Li(OH)

Sr(NO2)2 CI5

**Know how to draw Lewis dot structures for atoms, ions, ionic and covalent structures.**

1. What do you need to know in order to draw Lewis dot structures?
2. Draw the Lewis dot structure for calcium, xenon, and silicon.
3. Draw the Lewis dot structure for a calcium ion and silicon ion.
4. Draw the Lewis dot structure for potassium bromide.
5. Draw the Lewis dot structure for carbon tetrahydride.

**Know how to determine if a covalent bond or polar molecule.**

1. What is happening when a bond is polar?
2. How do you determine if a bond is polar?
3. How do you determine if a molecule is polar?
4. Draw (in a Lewis dot) CBr4. Include partial charges and determine if the molecule is polar or nonpolar.
5. Draw (in a Lewis dot) NF3. Include partial charges and determine if the molecule is polar or nonpolar.

**Know the difference between the three intermolecular forces.**

1. What is an intermolecular force?
2. When would a molecular experience dipole-dipole forces? London dispersion? Hydrogen bonding?
3. Which is the strongest IMF?
4. Which is the weakest IMF?
5. For a hydrogen bond to form, what three elements must be involved?

**Know the difference between fission, fusion, and radiation.**

1. What happens during fission?
2. What happens during fusion?
3. Give an example where fusion is happening
4. List the symbols for alpha particles, gamma particles, and beta particles.
5. List the symbols from most penetrating to least penetrating.

**Know how to balance nuclear equations**.

1. Complete and balance the following nuclear reactions. Label the type of radiation (alpha, beta, gamma, electron capture, positron emission)
2. What is happen to the protons and neutrons in alpha decay? Beta decay? Gamma decay?
3. Using a band of stability, could you identify if a radioactivity isotope would undergo alpha decay, beta decay, or electron capture?
4. The alpha decay of iridium-174
5. The beta decay of plantinum-199
6. 21483Bi 🡪 0-1β + \_\_\_\_\_
7. 23090Th 🡪 42α + \_\_\_\_\_
8. 239 92 U + 0-1β 🡪 \_\_\_\_
9. \_\_\_\_ 🡪 42 α + 23490Th + 2 00γ

**Know about waves and light behavior.**

1. Be able to label and use the electromagnetic spectrum. (from gamma rays to radio waves)
2. What is the photoelectric effect? How does the frequency of light influence the photoelectric effect?
3. Using the bright line spectra, what can you tell about how much energy an electron is releasing?
4. How do electrons release light?
5. What color of light is said to have the most energy? Least energy?
6. Draw a model that explain how an atom give off light/color.
7. How are wavelength and frequency related? How are energy and frequency related?
8. How do you measure the wavelength? Frequency?

**Know about the Big Bang and Stars.**

1. What did the universe look like before the big bang?
2. What evidence do we have that supports the big bang? Explain.
3. According to the Big Bang Theory, how long ago did the universe form?
4. What is the single factor that determines the life cycle of a star?
5. All stars begin with the same three stages, list and define them.
6. Why are stars so important to understand in terms of chemistry?
7. Main sequence stars fuse \_\_\_\_\_\_\_\_\_\_ to form \_\_\_\_\_\_\_\_\_\_\_.
8. Red giants fuse \_\_\_\_\_\_\_\_\_ to form \_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_ fuses to form \_\_\_\_\_\_\_\_\_\_\_\_.
9. Stars can fuse elements up to \_\_\_\_\_\_\_\_\_\_\_. The other elements in the universe are formed from \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
10. Using an H-R diagram, what color represents the hottest star? Coldest?

**Know about the layers of the Sun**

1. What are three inner zones?
2. What are the three outer zones? What are the nicknames for each?
3. What type of heat transfer is happening in the convective zone? Radiative zone?
4. What is happening in the core of the Sun?
5. What elements are most abundant on the Sun?

**Know and be able to solve for molar mass, gram to mole, and % composition.**

1. What is the molar mass of HNO3? NaCl? KBr?
2. What is a mole?
3. What is mass of 1.49 mols of hydrogen gas (H2)?
4. How many moles are in 321 grams of dinitrogen trihydride?
5. What is the percentage composition of nitrogen in the compound HNO3?
6. An 8.20 grams piece of Mg combines completely with 5.40 grams of O to form a compound. What is the percentage composition on Mg and O in this compound? *\*Hint: write out compound and find molar mass\**
7. 9.03 grams of Mg combines completely with 3.48 grams of N to form a compound. What is the percentage composition of Mg and N in the compound? *\*Hint: write out compound and find molar mass\**

**Know how to translate chemical reactions, balance equations, and predict chemical reactions.**

Write the following chemical reactions into chemical formulas and a full chemical equation.

1. Sulfur burns in oxygen gas to produce sulfur dioxide.
2. Sulfuric acid (H2SO4) and sodium hydroxide reaction together for form sodium sulfate and water.
3. Sodium oxide reacts with water to produce sodium hydroxide.
4. Zinc sulfide reacts with oxygen gas to produce zinc oxide and sulfur dioxide.

Balance the following chemical equations and identify the reaction types

1. \_\_\_N2 + \_\_\_H2 🡪 \_\_\_NH3
2. \_\_\_Zn + \_\_\_MoO3 🡪 \_\_\_Mo2O3 + \_\_\_ZnO
3. P(OH)2 🡪 PO + H2O
4. \_\_\_\_Cd(NO3)2 + \_\_\_\_Na2S 🡪 \_\_\_CdS + \_\_\_\_NaNO3
5. \_\_\_\_\_Na2O + \_\_\_\_H2O 🡪 NaOH

**Know how to use a balanced equation and a mole map to convert from one substance to another (stoichiometry).**

Cr + CuSO4 🡪 Cu + Cr2(SO4)3**You need to balance this first!!**

1. How many grams of copper would be produced from 49.48 grams of chromium?
2. How many grams of chromium are required to react with 125 mL of CuSO4?

ZnS + O2 🡪 ZnO + SO2**You need to balance this first!!**

1. How many liters of sulfur dioxide are created when 12.6 L of oxygen gas reacts with zinc sulfide?
2. If 3.45 x 1018 atoms of zinc sulfide react with oxygen gas, much many moles of zinc oxide are produced?
3. When 54 grams of oxygen gas react with zinc sulfide, how many atoms of sulfur dioxide are produced?

NaClO3 🡪 NaCl + O2**You need to balance this first!!**

1. What is the mole ratio between NaClO3 and NaCl?
2. 12 moles of NaClO3 will produce how many grams of O2?
3. If you have 24.7 grams NaClO3 how many grams of NaCl will be produced?
4. If you have 10 grams NaClO3, how many liters of oxygen gas will be produced?

**Know how to calculate the percentage composition of a substance.**

1. What is the percentage composition of nitrogen in the compound HNO3?
2. An 8.20 grams piece of Mg combines completely with 5.40 grams of O to form a compound. What is the percentage composition on Mg and O in this compound? *\*Hint: write out compound and find molar mass\**
3. 9.03 grams of Mg combines completely with 3.48 grams of N to form a compound. What is the percentage composition of Mg and N in the compound? *\*Hint: write out compound and find molar mass\**