Chemistry Fall Semester Essential Skills Review

Unit 1 – Atomic Structure & Nuclear Chemistry

1-1. Describe the basic structure of an atom by: a) Knowing the part that contains most of the mass & the part that contains most of the volume in an atom. B) Understanding how "electrostatic forces" and "nuclear forces" hold an atom together.

a. Complete the following chart:

Subatomic particle	Location in atom	Charge	Size (mass)
Proton			
Neutron			
Electron			

b. Which subatomic particles account for most of an atom's mass? Volume?

c. Name and describe the force that keeps the electrons confined in the space surrounding the nucleus.

d. Name and describe the force that keeps the nucleus from breaking apart.

1-2. Using the periodic table, determine the number of protons, neutrons, electrons and the atomic mass of any element.

Complete the following chart:

Hyphen notation	*Atomic number*	*Mass number*	*P⁺*	*E⁻*	*N⁰*
		32	16		
				20	24
Zn- 64					
	9				10

1-3. For alpha, beta, and gamma radiation: a) Describe how the nucleus changes b) describe the different types of damage they can do in matter c) the different types of penetration

a. Write the symbol used to denote alpha, beta, and gamma radiation and give their mass and charge.

Greek Symbol	*Name of symbol*	*Particle released in Nuclear Rxn*	*Nuclear Notation*	*Charge*	*Penetration*
α					
β					
γ					

b. Fill in the missing part and name the type of decay

1. $^{226}_{88}Ra \rightarrow {}^{4}_{2}He + \_\_\_\_\_$

2. $^{99}_{43}Tc \rightarrow {}^{99}_{44}\mathrm{Ru} + \_\_\_\_\_$

3. $\_\_\_\_\_ \rightarrow {}^{0}_{-1}e + {}^{237}_{93}Np + 8\gamma$

1-4. Describe how energy released during nuclear reaction (fusion/ fission) is much greater than chemical reactions (as calculated by $E = mc^2$)- mass defect.

a. Explain how a nuclear reaction differs from a chemical reaction?

b. Differentiate between nuclear fission and nuclear fusion. Which is most commonly used on our planet?

c. What is the connection between mass defect and E = mc2?

1-5. Explain how some isotopes of elements are radioactive, as are the ones formed in nuclear reactions.

a. What determines whether an atom will be radioactive? b. Explain how unstable atoms gain stability.

Unit 2 – Measurements, Math & The Mole

2-1. Know that 1 mole is set by defining 1 mole of Carbon-12 atoms weighs 12 grams.

2-2. Know that one mole equals 6.02×10^{23} particles (atoms or molecules)

2-3. Know how to determine the molar mass of a molecule from its chemical formula and a table of atomic masses
Calculate the molar mass of the following:

1. Ca 2. Cl_2 3. CO_2 4. $Ca(OH)_2$

2-4. Convert the mass of a substance to the number of moles and the number of particles.

a. Convert the following to moles: Use Sig Figs

1. 824g of NH_3 2. 43.6g of O_2 3. 9.03×10^{23} molecules of $CaCl_2$

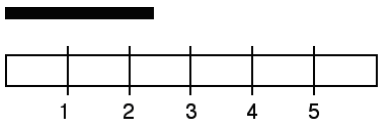
b. Given 4.50 g of CO_2, how many molecules do you have? Use Sig Figs

2-5. Perform calculations using scientific notation.
Perform the calculations; report your answers in both regular & sci. notation with sig figs.

a. $(6.1 \times 10^3\ g)(2.0 \times 10^5\ g) =$ b. $\dfrac{9 \times 10^6\ cm}{8 \times 10^4\ cm} =$

2-6. Be able to use the correct number of Significant Figures for Lab measurements and for mathematical calculations.

a. Record the measurement indicated with the correct number of sig. figs (both are in cm).



b. Perform the calculations; report your answers in both regular & sci. notation with sig figs.

1. (5400s)(3.5s)= 2. $\dfrac{34.95\ g}{11.169\ cm3} =$

Unit 3 – Electron Configuration & Periodic Trends

3-1. Students know how to relate the position of an element in the periodic table to its quantum electron configuration and to its reactivity with other elements in the table.

a. Complete the following table:

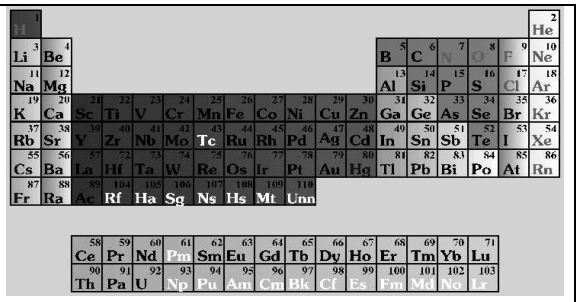
Noble Gas Config.	# valence electrons	period	block	Group number	Ion it will form	Element name
$[Ne]3s^2 3p^5$					Cl^{-1}	
$[Xe]6s^2 4f^{14} 5d^{10} 6p^3$						
						Br
						K
						Po

b. Why do the elements in the groups (columns) behave so similar to each other even if they have great differences in their number of protons?

3-2. Students know how to use the periodic table to identify metals, semimetals, nonmetals, halogens, alkali metals, alkaline earth metals, and transition metals.

a. Identify/ label the following things on the periodic table:

a. metals	b. alkali metals
c. metalloids	d. alkaline earth metals
e. transition metals	f. halogens
g. nonmetals	h. noble gases
i. Periods	j. Groups/ families
k. Identify groups/columns that have the following # of valence electrons: 1,2,3,4,5,6,7,8	



3-3. Solve Students know how to use the periodic table to identify the following trends: ionization energy, electronegativity, and the relative sizes of ions and atoms (this includes knowing the following terms: ionization energy, electronegativity, cation, and anion).

a. If Explain the following terms in your own words **&** give an example of 2 elements that are extreme examples of each term:

1. Ionization energy (def & 2 ex's) 2. Electronegativity (def & 2 ex's) 3. Atomic radius (def & 2 ex's):

b. How Identify the largest to smallest atoms based on atomic radius.

1. Ti, P, Cs, Ne
largest: smallest:

2. Li, O, Cu, K
largest: smallest:

c. Identify the elements that have the highest & lowest ionization energy.

1. Na, Cl, Mg, P
highest: lowest:

2. K, Na, Rb, Li
highest: lowest:

d. Identify the most & least electronegative elements .

1. Na, Ne, O, Al
most: least:

2. Ca, Cu, F, Ar
most: least:

Unit 4 – Chemical Bonding & Molecules

4-1. Know how to use the periodic table to determine the number of electrons available for bonding.

a. Draw the Lewis Dot Structures for each of the following:

1. Na 2. Cl 3. I 4. S 5. C

4-2. Know atoms combine to form molecules by sharing electrons to form **covalent** or **metallic bonds** or by exchanging electrons to form **ionic bonds** and how **electronegativity** and **ionization energy** relate to bond formation.

a. Complete the following chart:

Elements to bond	S & O	Cl & Cl	Mg & O	Na & F	Ag & Au
Bond Type					
How do you know?					

b. How does the **electronegativity** of the two elements bonding influence the **bond type?** (ex: 2 strongly electronegative elements bond vs. 1 strong & 1 weak).

4-3. Know salt crystals, such as NaCl, are repeating patterns of positive and negative ions held together by electrostatic attraction.

a. Describe the ionic structure of a salt. (you may draw a picture)

b. What is the connection between electrostatic attraction (aka electromagnetic) and ionic bonds?

4-4. Know chemical bonds between atoms in molecules such as H_2, CH_4, NH_3, H_2CCH_2, N_2, Cl_2, and many large biological molecules are covalently bonded.

4-5. Know how to draw Lewis dot structures.

a. See 4-1

4-6. Know large molecules **(polymers),** such as proteins, nucleic acids, and starch, are formed by repetitive combinations of simple subunits (**monomers**). Know the name of the monomers that make up each of these polymers.

a. Complete the following chart:

Class	Polymer	Mononmer	2 common exs:
Carbohydrates			Starches & _____
Nucleic Acids	Poly- nucleotide		
Protein	Poly- Peptide		
Lipids	Tri-glyceride	Glycerol & fatty acids	

4-7. Know the bonding characteristics of carbon that result in the formation of a large variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules.

a. Why is the **carbon** atom the backbone to so many large, complex biological molecules (proteins, carbohydrates, lipids, and nucleic acids)?