Midterm 2 Review WS

Sowmya’s Section:

1. Which of the following sets of quantum numbers are allowed
   a. n=7, l=7, ml= 0
   b. n=7, l=0, ml=1
   c. n=7, l=5, ml=-3
   d. n=3, l=-1, ml=0
   e. n=0, l=0, ml=0

2. Draw atomic orbital diagrams representing the ground-state electron configuration for each of the following elements.
   a. Na
   b. Co
   c. Kr
3. Use the building-up principle to obtain the configuration for the ground state of the gallium atom (Z = 31). Give the configuration in complete form. What is the valence-shell configuration?

4. Consider the ground-state electron configurations for Li, N, Ni, Ba, and Hg. Which of these atoms would be expected to be paramagnetic and how many unpaired electrons are present in each paramagnetic ion?

5. Write the electron configuration for each ion
   a. \( O^{2-} \)
   
   b. \( Br^- \)
c. \( Sr^{2+} \)

d. \( Co^{3+} \)

6. Predict the charge of the ion formed by Potassium and write the electron configuration of the ion.

7. In the ground state of Mercury,
   a. How many electrons occupy atomic orbitals with \( n=3 \)?
   b. How many electrons occupy \( d \) atomic orbitals?
   c. How many electrons occupy \( pz \) atomic orbitals?
   d. How many electrons have spin up (\( m_s = +1/2 \))?
Lecture Review: Periodic Trends

Atomic Radii

1. Consider the following elements: N, Mg, O, F, Al. Arrange the elements in order of decreasing atomic radius
2. Given the elements Cl, Ge, and K alongside three values of possible first ionization energies (418, 1255, and 784 kJ/mol), match the atoms with their appropriate ionization energies.

3. Consider the following elements: C, N, O. Arrange the elements in order of increasing first ionization energy.

Electron Affinity
4. Choose the element with the more negative electron affinity in each pair.
   
   a. Na or Rb
   
   b. C or N

Metallic Character

5. Arrange these elements in order of increasing metallic character: Fr, Sb, In, S, Ba, Se.

6. Which of the following would be properly classified as a set of covalent molecules?
   
   a. NaClO₄, C₄H₁₀, NH₃
   
   b. NaCl, CH₄, S₈
   
   c. CO₂, HCN, O₂
   
   d. CO₂, NH₃Cl, C₂H₆
   
   e. AgCl, ScF₃, P₄
Lecture Review: Nomenclature Rules

Ionic Compounds

7. Name the following compounds based on their molecular formula:

   a. \( \text{Na}_2\text{O} \)

   b. \( \text{CaCl}_2 \)

   c. \( \text{KI} \)

Transition Metal Compounds
8. Write the molecular formula for the following compounds:

   a.  *Iron (III) Chloride*

   b.  *Chromium (III) Sulfide*

   c.  *Copper (II) Iodide*

9. Write the molecular formula for the following compounds:

   a.  *Carbon Monoxide*

   b.  *Tetranitrogen Tetraselenide*

   c.  *Bromine Pentachloride*
10. Name the following compounds based on their molecular formula:

   a. $\text{CoSO}_4 \cdot 7\text{H}_2\text{O}$
   
   b. $\text{NaBrO}_4$
   
   c. $\text{Ba(NO}_3\text{)}_2$
Megan’s Section:

1. Determine the mass % of each element in aspirin, \( C_9H_8O_4 \).

2. How many oxygen atoms are there in 5.02 g of iron (III) sulfate?

3. How many cations are there in g of 30.00 g of magnesium nitrate?
4. A sample of Tylenol \((C_8H_9NO_2)\) contains 3.00 g of oxygen.
   
a) How many moles of Tylenol are in the sample?

b) How many grams of carbon are in the sample?

c) Determine the mass percentage of nitrogen in Tylenol.
5. Determine the empirical formula if a compound consists of 21.2% nitrogen, 6.1% hydrogen, 24.2% sulfur, and 48.5% oxygen.

6. The empirical formula for hexane is $C_3H_7$. Its molecular weight is 86.2 amu. What is the molecular formula of hexane?

7. Vitamin C is composed of carbon, hydrogen, and oxygen and has $\text{MW} = 176.12$ g. When a 1.00 g sample of vitamin C is burned in a combustion apparatus, 1.50 g of $\text{CO}_2$ and 0.410 g of $\text{H}_2\text{O}$ are produced. Determine the empirical and molecular formula of Vitamin C.
Steps for Converting Grams/Moles/Molecules

1. **Grams** → **Moles**
2. **Moles** → **Molecules**
3. **Molecules** → **Atoms/Ions**

Steps for Calculating Empirical Formula

1. **Mass of A atoms** → **Moles of A atoms** (Divide by molar mass)
2. **Mass of X atoms** → **Moles of X atoms** (Divide by molar mass)
3. **Moles of A atoms** → **A to X mole ratio** (Divide by lowest number of moles)
4. **Moles of X atoms** → **Convert ratio to lowest whole numbers**
5. **A to X mole ratio** → **Empirical formula**