

CH 151 Problem Set #4 - Chapter 4 & 6

- * **Complete problem set on separate pieces of paper** showing all work, circling final answers, etc.
 - * **Section 01:** Self correct problem set during recitation (**July 18, 8 AM**) before turning in to the instructor
 - * **Section W1:** Watch recitation video here: <http://mhchem.org/t/d.htm> Self correct your work while watching
Email problem set (mike.russell@mhcc.edu) by **11:59 PM Wed, July 19**
- Important Tables and/or Constants: periodic table (<http://mhchem.org/pertab>)
-

- For the chemical reaction: $4 \text{FeS}_2(\text{s}) + 11 \text{O}_2(\text{g}) \rightarrow 2 \text{Fe}_2\text{O}_3(\text{s}) + 8 \text{SO}_2(\text{g})$
 - How many moles of O_2 are needed to produce 3.50 moles of SO_2 ?
 - How many moles of Fe_2O_3 will be produced from 1.02 mole of FeS_2 ?
 - How many moles of FeS_2 are needed to react with 5.40 moles of O_2 ?
 - How many moles of Fe_2O_3 are produced at the same time that 0.908 moles of SO_2 are produced?
- In the atmosphere, the air pollutant nitrogen dioxide (NO_2) reacts with water to produce nitric acid (HNO_3). The reaction for the formation of nitric acid is:
 $3 \text{NO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightarrow 2 \text{HNO}_3(\text{aq}) + \text{NO}(\text{g})$
 - How many grams of NO_2 are needed to react with 2.30 moles of H_2O ?
 - How many grams of NO are produced when 2.04 moles of H_2O react?
 - How many grams of HNO_3 are produced at the same time that 0.500 mole of NO are produced?
 - How many grams of NO_2 must react in order to produce 1.23 moles of HNO_3 ?
- Potassium thiosulfate, $\text{K}_2\text{S}_2\text{O}_3$, is used to remove any excess chlorine from fibers and fabrics that have been bleached with that gas. The reaction:
 $\text{K}_2\text{S}_2\text{O}_3 + 4 \text{Cl}_2 + 5 \text{H}_2\text{O} \rightarrow 2 \text{KHSO}_4 + 8 \text{HCl}$
 - How many moles of $\text{K}_2\text{S}_2\text{O}_3$ must react to produce 2.500 g of HCl ?
 - How many grams of Cl_2 must react to produce 20.00 g of KHSO_4 ?
 - How many molecules of HCl are produced at the same time that 2.000 g of KHSO_4 is produced?
 - How many milliliters of H_2O are consumed as 12.50 g of Cl_2 reacts? $d(\text{H}_2\text{O}) = 0.9978 \text{ g/mL}$
- If 70.0 g of TiCl_4 and 16.0 g of Ti are present in a reaction mixture, determine how many grams of each reactant will be left unreacted upon completion of the following reaction:
 $3 \text{TiCl}_4 + \text{Ti} \rightarrow 4 \text{TiCl}_3$
- Aluminum and oxygen react to form aluminum oxide. In a certain experiment, 125 g of Al_2O_3 are produced from 75.0 g of Al and 200.0 g of O_2 . What is the theoretical yield and percent yield of Al_2O_3 ? The equation: $4 \text{Al} + 3 \text{O}_2 \rightarrow 2 \text{Al}_2\text{O}_3$
- For each of the following sets of elements, choose the two that would be expected to have similar chemical properties.
 - $_{11}\text{Na}$, $_{14}\text{Si}$, $_{23}\text{V}$, $_{55}\text{Cs}$
 - $_{13}\text{Al}$, $_{19}\text{K}$, $_{32}\text{Ge}$, $_{50}\text{Sn}$
 - $_{37}\text{Rb}$, $_{38}\text{Sr}$, $_{54}\text{Xe}$, $_{56}\text{Ba}$
 - $_{2}\text{He}$, $_{6}\text{C}$, $_{8}\text{O}$, $_{10}\text{Ne}$

Problem Set #4 continues on the next page

Problem Set #4, Continued from previous page

7. Give the maximum number of electrons that can occupy each of the following electron **subshells**.
 - a. $6p$
 - b. $1s$
 - c. $5f$
 - d. $4d$
8. Give the maximum number of electrons that can occupy each of the following electron **orbitals**.
 - a. $1s$
 - b. $3d$
 - c. $5p$
 - d. $4d$
9. Which of the following electron subshell and electron orbital designations is not allowed?
 - a. $2d$ subshell
 - b. $4s$ orbital
 - c. $3p$ subshell
 - d. $2f$ orbital
10. With the help of an Aufbau diagram, write the complete electron configuration for each of the following atoms.
 - a. ${}^6\text{C}$
 - b. ${}^{10}\text{Ne}$
 - c. ${}^{15}\text{P}$
 - d. ${}^{36}\text{Kr}$
11. With the help of an Aufbau diagram, write the complete electron configuration for each of the following atoms.
 - a. ${}^{31}\text{Ga}$
 - b. ${}^{38}\text{Sr}$
 - c. ${}^{48}\text{Cd}$
 - d. ${}^{88}\text{Ra}$
12. Based on total number of electrons present, identify the neutral element represented by each of the following electron configurations.
 - a. $1s^2 2s^2 2p^2$
 - b. $1s^2 2s^2 2p^6 3s^2 3p^3$
 - c. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
 - d. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$
13. Determine how many unpaired electrons there are in an atom of the following elements. Indicate whether the elements are **paramagnetic** or **diamagnetic**.
 - a. lithium
 - b. aluminum
 - c. calcium
 - d. bromine
14. Using the periodic table as a guide, indicate the number of:
 - a. $3s$ electrons and valence electrons in a ${}_{12}\text{Mg}$ atom
 - b. $4p$ electrons and valence electrons in a ${}_{32}\text{Ge}$ atom
 - c. $3d$ electrons in a ${}_{47}\text{Ag}$ atom
 - d. $4p$ electrons and valence electrons in a ${}_{15}\text{P}$ atom
15. How many elements are there that have the following generalized condensed electron configurations?
 - a. $[\text{noble gas}]ns^1$
 - b. $[\text{noble gas}]ns^2 np^2$
16. Write the electron configuration for each of the following ions.
 - a. S^{2-}
 - b. P^{3-}
 - c. Be^{2+}
 - d. Na^{+1}