CH 221 Fall 2025: **Problem Set #6** *Instructions*

Step One:

• Learn the material for Problem Set #6 by reading Chapter 6 and Chapter 7 (sections 7.1 - 7.2 only) of the textbook and/or by watching the videos found on the website (https://mhchem.org/221video)

• **Try the problems** for Problem Set #6 found on the next pages on your own first. Write your answers in the space provided or write your answers on separate paper (your choice.) Include your name on your problem set!

Step Two:

Watch the recitation video for Problem Set #6:

http://mhchem.org/1/6

Self correct *all* **of the problems** while viewing the video. Mark correct problems with a star (or other similar mark), and correct all incorrect problems (show the correct answer and the steps required to achieve it.)

Step Three:

Turn the Problem Set in at the beginning of recitation to the instructor on Monday, December 1 (section L1), Tuesday, December 2 (section L2) Wednesday, December 3 (section L3) or Friday, December 5 (section L4) The graded problem set will be returned to you the following week during recitation.

Do not include this page to avoid a point penalty; your front page should be page II-6-3.

If you have any questions regarding this assignment, please email (mike.russell@mhcc.edu) the instructor! Good luck on this assignment!

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CH 221 Problem Set #6

<u>Name</u>:

Complete the problem set on your own first using these sheets for your work or separate paper (your choice.) Self correct your work (*all problems!*) using the recitation video for this problem set, found here: http://mhchem.org/1/6

* Covering: Chapter Six and Chapter 7 (7.1-7.2 only) and Chapter Guide Six

* *Important Tables and/or Constants:* periodic table (http://mhchem.org/pertab), **Solubility Table** (in the "Net Ionics" lab or here: **https://mhchem.org/sol**) - *Use the Net Ionics solubility table when answering questions about solubility in CH 221*)

1. Calculate the weight percent of iron in Fe₂O₃, iron(III) oxide. What mass of iron (in grams) is present in 25.0 g of Fe₂O₃?

2. An organic compound has the empirical formula C_2H_4NO . If its molar mass is 116.1 g/mol, what is the molecular formula of the compound?

3. Fluorocarbonyl hypofluorite is composed of 14.6% C, 39.0% O and 46.3% F. If the molar mass of the compound is 82 g/mol, determine the empirical *and* molecular formulas for the compound.

4. What is the mass of solute, in grams, in 125 mL of a 1.023 x 10⁻³ M solution of Na₃PO₄? What are the molar concentrations of Na⁺ and PO₄³⁻ ions?

5. Twelve (12.0) mL of a 0.125 M BaCl₂ solution is diluted with 9.0 mL of water to a total volume of 21.0 mL. What is the concentration (M) of the new solution? What is the concentration (M) of Cl⁻¹ in the final solution? How many grams of BaCl₂ are in the final solution?

6. Balance the following equations:

- a. $Cr(s) + Cl_2(g) \rightarrow CrCl_3(s)$
- b. $Fe(s) + H_2O(g) \rightarrow Fe_3O_4(s) + H_2(g)$
- c. $SF_4(g) + H_2O(\ell) \rightarrow SO_2(g) + HF(\ell)$
- d. $NH_3(aq) + O_2(aq) \rightarrow NO(g) + H_2O(\ell)$

Note: For solubility questions, use the **solubility table** found in the "**Net Ionic Reactions**" Lab, available in the Chemistry 221 Companion or here (https://mhchem.org/sol).

7. Decide whether each of the following is water-soluble. If soluble, tell what ions are produced.

Soluble in water? (Y/N) Ions produced?

- a. NiCl₂
- b. Cr(NO₃)₃
- c. ethanol
- d. ammonia
- e. BaSO₄
- 8. Predict the products of each reaction. Balance the completed equation, and then write the net ionic equation.

a. $Pb(NO_3)_2(aq) + KBr(aq) \rightarrow (precipitation reaction)$

b. $Mg(OH)_2(s) + HCl(aq) \rightarrow$ (acid-base reaction)

c. HNO₃(aq) + CaCO₃(s) \rightarrow (gas forming reaction)

- 9. Determine the oxidation number of each element in the following ions or compounds.
 - a. $O_2(g)$
 - b. CuO
 - c. UO²⁺
 - $d. \ H_2AsO_4 \text{-}1$
 - $e. \quad OF_2$
 - f. XeO42-
- 10. Which of the following reactions are oxidation-reduction reactions? Explain your answer briefly. Classify the remaining reactions.
 - a. $CdCl_2(aq) + Na_2S(aq) \rightarrow CdS(s) + 2 NaCl(aq)$
 - b. $2 \operatorname{Ca}(s) + \operatorname{O}_2(g) \rightarrow 2 \operatorname{CaO}(s)$
 - c. 4 Fe(OH)₂(aq) + 2 H₂O(ℓ) + O₂(g) \rightarrow 4 Fe(OH)₃(aq)
 - d. MgCO₃(s) + 2 HCl(aq) \rightarrow MgCl₂(aq) + H₂O(ℓ) + CO₂(g)