CH 222 Practice Problem Set #1

This is a **practice problem set** and not the actual graded problem set that you will turn in for credit. Answers to each problem can be found at the end of this assignment.

Covering: Chapter Seven (*mostly* 7.3 - 7.5) and Chapter Guide One *Important Tables and/or Constants: none*

1. Like many metals, aluminum reacts with a halogen to give a metal halide. $2 \operatorname{Al}(s) + 3 \operatorname{Br}_2(l) \rightarrow \operatorname{Al}_2\operatorname{Br}_6(s)$

What mass of Br_2 , in grams, is required for complete reaction with 2.56 g of Al? What mass of white, solid Al_2Br_6 is expected?

2. Aluminum chloride, AlCl₃, is made by treating scrap aluminum with chlorine.

$$2 \operatorname{Al}(s) + 3 \operatorname{Cl}_2(g) \rightarrow 2 \operatorname{AlCl}_3(s)$$

- If you begin with 2.70 g of Al and 4.05 g of Cl₂,
- a. Which reactant is limiting?
- b. What mass of AlCl₃ can be produced?
- c. What mass of the excess reactant remains when the reaction is completed?
- 3. The deep blue compound Cu(NH₃)₄SO₄ is made by the reaction of copper(II) sulfate and ammonia: CuSO₄(aq) + 4 NH₃(aq) → Cu(NH₃)₄SO₄(aq)
 a. If you use 10.0 g of CuSO₄ and excess NH₃, what is the theoretical yield of Cu(NH₃)₄SO₄?
- b. If you isolate 12.6 g of Cu(NH₃)₄SO₄, what is the percent yield of Cu(NH₃)₄SO₄?
 4. A sample of limestone and other soil materials is heated, and the limestone decomposes to give calcium oxide and carbon dioxide: CaCO₃(s) → CaO(s) + CO₂(g)

A 1.506 g sample of limestone-containing material gives 0.558 g of CO₂, in addition to CaO, after being heated at a high temperature. What is the mass percent of CaCO₃ in the original sample?

- 5. Styrene, the building block of polystyrene, consists of only C and H. If 0.438 g of styrene is burned in oxygen and produces 1.481 g of CO_2 and 0.303 g of H₂O, what is the empirical formula of styrene?
- 6. Nickel forms a compound with carbon monoxide, $Ni_x(CO)_y$. To determine its formula, you carefully heat a 0.0973 g sample in air to convert the nickel to 0.0426 g of NiO and the CO to 0.100 g of CO₂. What is the empirical formula of $Ni_x(CO)_y$?
- 7. Benzoquinone, a chemical used in the dye industry and in photography, is an organic compound containing only C, H and O. What is the empirical formula of the compound if 0.105 g of the compound gives 0.257 g of CO₂ and 0.0350 g of H₂O when burned completely in oxygen? What is the molecular formula if the molar mass of the compound = 108 g/mol?

Answers to the Practice Problem Set:

- 1. 22.7 g Br₂; 25.3 g Al₂Br₆
- 2. a. Cl₂ b. 5.09 g c. 1.67 g Al
- 3. a. 14.3 g b. 88.3%
- 4. 84.3%
- 5. CH
- 6. Ni(CO)₄
- 7. $C_6H_4O_2$