# Homework 7

October 14, 2022

Weekly homework assignments are posted approximately one week prior to the due date. Collaborations are encouraged and students must report all collaborators in writing on each assignment. All external sources (websites, books) must be properly cited. Additional problems are listed at the end of each assignment. This week's assignment is due *Friday, Oct 21st at 11:59pm.*

Conservation of Energy

1. Consider two isolated systems containing water illustrated below. The system on the left is at 100°C and the other (right) is at room temperature of 20°C. The isolated systems are allowed to come into contact reaching thermal equilibrium and without losing energy to the surrounding. What is the final temperature? Describe in words, mathematical equations and/or illustrations what happened. (2 pts)

H   L
Different temperatures
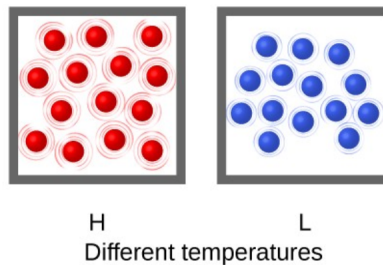
2. Suppose a system is in thermal equilibrium with a heat bath (source of heat that maintains at a constant temperature). Suppse the temperature of the heat bath increases, describe in words and/or illustrations what happens to the temperature of the system. (2 pts)

Limiting Reagent

3. For the complete combustion of liquid propanol (C_3H_7OH), it produces gaseous carbon dioxide (CO_2) and water (H_2O).

a) Write the balanced and complete chemical equation.

b) Suppose there is 10.g CH_3H_7OH and 10.g O_2 available. Which is the limiting reagent? And how much CO_2 is produced in g? Report to 2 significant figures.

4. An important step in the refining of aluminum metal is the manufacture of cryolite, Na_3AlF_6, from ammonium fluoride, sodium aluminate, and sodium hydroxide in aqueous solution:

$$6NH_4F(aq) + Na[Al(OH)_4](aq) + 2NaOH(aq) \rightarrow Na_3AlF_6(s) + 6NH_3(aq) + 6H_2O(l)$$
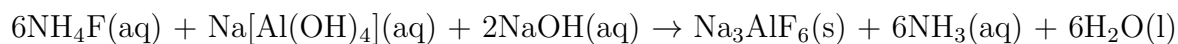
Unfortunately, by-products can form, reducing the yield. In a laboratory investigation of the process, 100.0g of NH_4F was mixed with 82.60g of $Na[Al(OH)_4]$ and 80.00g of NaOH. The mass of Na_3AlF_6 produced was 75.00g. What was the percentage yield of the reaction? Report to 4 significant figures. (3 pts)

Energy Changes

5. How much heat has to be added to 250g solid Fe at 22.5°C to raise the temperature to 250°C? The specific heat of solid Fe is 0.448 J/(g °C). Report to 3 significant figures (1 pt)

Optional Textbook Problems: Ch. 6- $6.29 - 6.49$ odd, $6.63 - 6.93$