CHEM 103
R&R 8
11 June 2024
Adapted from a 14 June 2021 document

1. Suppose a piece of iron (specific heat capacity = 0.449 J $(g \cdot K)^{-1}$) with a mass of 21.5 g at a temperature of 100.0 °C is dropped into an insulated container of water. The mass of the water is 132.0 g and its temperature before adding the iron is 20.0 °C. What will be the final temperature of the system once thermal equilibrium is reached? (specific heat capacity of water is 4.184 J $(g \cdot K)^{-1}$.)

2. What mass of ice can be melted with the same quantity of heat as required to raise the temperature of 3.50 mol H_2O (l) by 50.0 °C? (ΔH_{fusion} for H_2O (s) = 6.01 kJ mol^{-1})

3. Menthol, the substance we can smell in mentholated cough drops, is composed of C, H, and O. A 0.1005 g sample of menthol is combusted, producing 0.2829 g CO_2 and 0.1159 g H_2O. What is the empirical formula of menthol? If menthol has a molar mass of 156 g mol^{-1}, what is its molecular formula?

4.

a. You have a stock solution of 14.8 M NH_3. How many milliliters of this solution should you dilute to make 1000.0 mL of 0.250 M NH_3?

b. If you take a 10.0 mL portion of the stock solution and dilute it to a total volume of 0.500 L, what will be the concentration of the final solution?

5. A solution of 100.0 mL of 0.200 M KOH is mixed with a solution of 200.0 mL of 0.150 M $NiSO_4$.

a. Write the balanced chemical equation for the reaction that occurs.

b. What precipitate forms? Write the net ionic equation.

c. How many grams of this precipitate form?

d. What is the concentration of each ion that remains in solution?