Stoichiometry and Heat Capacity

1. Calculate the heat evolved (kJ) for the reaction in which 9.00 g of $C_6H_{12}O_6$ is fermented to form ethyl alcohol
(Atomic weights: C = 12.01, H = 1.008, O = 16).

$$C_6H_{12}O_6(s) \longrightarrow 2\ C_2H_5OH(l) + CO_2(g)$$
$$\Delta H^o = -67.0\ kJ$$

2. Calculate the heat energy (kJ) released when 15 g of Fe_3O_4 reacts with excess Al according to the following reaction.
(Atomic weights: Fe = 55.85, Al = 26.98, O = 16.00).

$$3\ Fe_3O_4(s) + 8\ Al(s) \longrightarrow 4\ Al_2O_3(s) + 9\ Fe(s)$$
$$\Delta H^o = -3347.6\ kJ$$

3. What quantity of heat is liberated by a reaction that produces 50.0 g of SO_2 in the following reaction? (Atomic weights: Ni = 58.69, O = 16.00, S = 32.06).

$$2\ NiS(s) + 3\ O_2(g) \longrightarrow 2\ NiO + 2\ SO_2(g)$$
$$\Delta H^o = -936.2\ kJ$$

4. A 25.0 g piece of copper at 25.0°C is put into an insulated vessel containing 100 g of water at 40.0°C. What will be the final temperature (°C) of the water? The specific heat of copper and water are 0.385 J/g°C and 4.18 J/g°C respectively.

5. How much heat energy (kJ) must be supplied to heat 400.0 g of isopropyl alcohol from 20.0°C to
60.0°C in a stainless steel vessel weighing 550.0 g. The specific heat of isopropyl alcohol and stainless steel are 2.58 J/g°C and 0.51 J/g°C respectively.

6. A sheet of 10.0 g of copper at 22.0°C is placed on a 20.0 g sheet of aluminum at 75.0°C. What is the
final temperature of the two metals assuming that no heat is lost to the surroundings. The specific heats of copper and aluminum are 0.385 J/g°C and 0.900 J/g°C respectively.