CHEM 101A – Chapter 6 Enthalpy and Stoichiometry

1. What mass of ice would be required to cool 355 grams of water from 25°C to 0°C? (specific heat capacity water = 4.184 J/g·°C and ΔH_{fusion} for ice = 6.020 kJ/mol.

2. Consider the acid-base reaction below:

$$HCl(aq) + Ba(OH)_2(aq) \rightarrow BaCl_2(aq) + 2H_2O(l) \quad \Delta H = -118 \text{ kJ}$$

a. What quantity of heat is released when 100.0 mL 0.500 *M* HCl are mixed with 300.0 mL 0.100 *M* $Ba(OH)_2(aq)$.

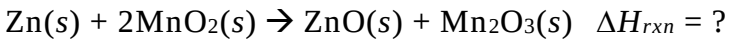
b. Assuming the temperature of both solutions was initially 25.0°C, and the final mixture has a mass of 400.0 g, calculate the final temperature of the product mixture (assume dilute aqueous solutions have a specific heat capacity of 4.184 J/g·°C).

3. Natural gas (CH_4) as well as octane (C_8H_{18}) are used as fuels for internal combustion engines. Calculate the enthalpy of combustion for each of these fuels in (kJ/mole fuel) and (kJ/gram fuel).

Substance	$\Delta H_f°$ (kJ/mol)
$CH_4(g)$	–74.6
$C_8H_{18}(l)$	–208.5
$CO_2(l)$	–393.5
$H_2O(l)$	–285.8

Fuel	**$\Delta H_{combustion}$ (kJ/mol)**	**$\Delta H_{combustion}$ (kJ/gram)**
CH_4		
C_8H_{18}		

4. For the reaction below:



$$Zn(s) + 2MnO_2(s) \rightarrow ZnO(s) + Mn_2O_3(s) \quad \Delta H_{rxn} = ?$$

   a. Using the enthalpy of formation data in the appendix (or on saplinglearning.com), calculate the enthalpy for the reaction.

   b. Is the reaction endothermic or exothermic?

   c. What mass MnO_2 would be required to produce 50.0 J of heat?