Thermochemistry – Ch. 11

1. A 75.0 g piece of Ag metal is heated to 80.0°C and dropped into 50.0 g of water at 23.2°C. The final temperature of the Ag-H_2O mixture is 27.6°C. What is the specific heat of silver?

2. A piece of stainless steel (sp. ht. = 0.50 J $g^{-1}°C^{-1}$) is transferred from an oven at 183°C into 125 mL of water at 23.2°C. The water temperature rises to 51.5°C. What is the mass of the steel?

3. Brass has a density of 8.40 g/cm^3 and a specific heat of 0.385 J $g^{-1}°C^{-1}$. A 15.2 cm^3 piece of brass at an initial temperature of 163 °C is dropped into an insulated container with 150.0 g water initially at 22.4 °C. What will be the final temperature of the brass-water mixture?

4. 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? [$\Delta H°_{fusion}$ = 6.01 kJ/mol for $H_2O(s)$]

5. *A coffee-cup calorimeter contains 100.0 mL of 0.300 M HCl at 20.3°C. When 1.82 g Zn(s) is added, the temperature rises to 30.5°C. What is the heat of reaction in kilojoules *per mol* Zn reacted? Assume the specific heat and density of HCl the same as water. (*Hint*: First figure out if you should determine the heat of reaction based on amount of Zn or amount of HCl. How would you figure that out?)

$$Zn(s) + 2\ H^+(aq) \rightarrow Zn^{2+}(aq) + H_2(g)$$

6. Calculate the quantity of work, in joules, associated with the compression of a gas from 5.62 L to 3.37 L by a constant pressure of 1.23 atm.

7. Find the change in internal energy, ΔU, for the following situations:
   a. Absorbs 58 J of heat and does 58 J of work

   b. Absorbs 125 J of heat and does 687 J of work

   c. Evolves 280 cal of heat and has 1.25 kJ work done on it

8. Use Hess's law to determine $\Delta H°$ for the reaction $C_3H_4(g) + 2H_2(g) \rightarrow C_3H_8(g)$ given that

$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$ $\quad \Delta H° = -285.8$ kJ

$C_3H_4(g) + 4O_2(g) \rightarrow 3CO_2(g) + 2H_2O(l)$ $\quad \Delta H° = -1937$ kJ

$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$ $\quad \Delta H° = -2219.1$ kJ