**CHAPTER 16 REVIEW**

*Reaction Energy*

**SECTION 1**

**SHORT ANSWER** Answer the following questions in the space provided.

1. For elements in their standard state, the value of $\Delta H_f^0$ is __0__.

2. The formation and decomposition of water can be represented by the following thermochemical equations:

   \[
   \text{H}_2(g) + \frac{1}{2}\text{O}_2(g) \rightarrow \text{H}_2\text{O}(g) + 241.8 \text{ kJ/mol}
   \]

   \[
   \text{H}_2\text{O}(l) + 241.8 \text{ kJ/mol} \rightarrow \text{H}_2(g) + \frac{1}{2}\text{O}_2(g)
   \]

   a. Is energy being taken in or is it being released as liquid H$_2$O decomposes?
   
   **positive**

   b. What is the appropriate sign for the enthalpy change in this decomposition reaction?

**PROBLEMS** Write the answer on the line to the left. Show all your work in the space provided.

3. **70°C** If 200. g of water at 20°C absorbs 41 840 J of energy, what will its final temperature be?

4. **-28.9 kJ** Aluminum has a specific heat of 0.900 J/(g·°C). How much energy in kJ is needed to raise the temperature of a 625 g block of aluminum from 30.7°C to 82.1°C?

5. The products in a reaction have an enthalpy of 458 kJ/mol, and the reactants have an enthalpy of 658 kJ/mol.

   **-200. kJ/mol** a. What is the value of $\Delta H$ for this reaction?
SECTION 1 continued

b. Which is the more stable part of this system, the reactants or the products?

6. The enthalpy of combustion of acetylene gas is $-1301.1 \text{ kJ/mol}$ of C$_2$H$_2$.

   a. Write the balanced thermochemical equation for the complete combustion of C$_2$H$_2$.
   
   
   $$ \text{C}_2\text{H}_2(g) + \frac{5}{2}\text{O}_2(g) \rightarrow 2\text{CO}_2(g) + \text{H}_2\text{O}(l) + \text{heat energy} $$
   
   320 kJ

   b. If 0.25 mol of C$_2$H$_2$ reacts according to the equation in part a, how much energy is released?
   
   78 g

   c. How many grams of C$_2$H$_2$ are needed to react, according to the equation in part a, to release 3900 kJ of energy?

7. $-850. \text{ kJ/mol}$ Determine the $\Delta H$ for the reaction between Al and Fe$_2$O$_3$, according to the equation $2\text{Al} + \text{Fe}_2\text{O}_3 \rightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$. The enthalpy of formation of Al$_2$O$_3$ is $-1676 \text{ kJ/mol}$. For Fe$_2$O$_3$ it is $-826 \text{ kJ/mol}$.

8. $-196.0 \text{ kJ/mol}$ Use the data in Appendix Table A-14 of the text to determine the $\Delta H$ for the following equation.
   
   $$ 2\text{H}_2\text{O}_2(l) \rightarrow 2\text{H}_2\text{O}(l) + \text{O}_2(g) $$