1. Carbon disulfide burns in air according to the equation:

\[ \text{CS}_2(l) + 3\text{O}_2(g) \rightarrow \text{CO}_2(g) + 2\text{SO}_2(g) \quad \Delta H = -1075 \text{ kJ} \]

What is \( \Delta H \) for the following equation:

\[ \frac{1}{2} \text{CS}_2(l) + \frac{3}{2} \text{O}_2(g) \rightarrow \frac{1}{2} \text{CO}_2(g) + \text{SO}_2(g) \]

2. With a platinum catalyst, ammonia will burn in oxygen to give nitrogen oxide:

\[ 4 \text{NH}_3(g) + 5 \text{O}_2(g) \rightarrow 4 \text{NO}(g) + 6 \text{H}_2\text{O}(g) \quad \Delta H = -906 \text{ kJ} \]

What is the enthalpy change for the following reaction:

\[ \text{NO}(g) + \frac{3}{2} \text{H}_2\text{O}(g) \rightarrow \text{NH}_3(g) + \frac{5}{4} \text{O}_2(g) \]

3. Ammonia burns in the presence of copper catalyst, to form nitrogen gas:

\[ 4 \text{NH}_3(g) + 3 \text{O}_2(g) \rightarrow 2 \text{N}_2(g) + 6 \text{H}_2\text{O}(g) \quad \Delta H = -1267 \text{ kJ} \]

What is the enthalpy change to burn 35.8 g of ammonia?

4. Propane burns according to the equation:

\[ \text{C}_3\text{H}_8(g) + 5 \text{O}_2(g) \rightarrow 3 \text{CO}_2(g) + 4 \text{H}_2\text{O}(g) \quad \Delta H^o = -2044 \text{ kJ} \]

Calculate how many grams of propane you will need to produce 369 kJ of heat.

5. Acetic acid, CH₃COOH, is the sour constituent of vinegar. In an experiment, 3.58 g of acetic acid was burned according to the equation:

\[ \text{CH}_3\text{COOH} (l) + 2 \text{O}_2 (g) \rightarrow 2 \text{CO}_2 (g) + 2 \text{H}_2\text{O} (l) \]

and 52.0 kJ of heat was evolved. Write the complete thermochemical equation for the above reaction.
6. A 19.6-g sample of a metal was heated to 61.67 °C. When the metal was placed into 26.7 g of water, the temperature of the water increased from 25.00 °C to 30.00 °C. What is the specific heat of the metal? (Hint: Specific heat of water is 4.184 J/g °C)

7. In the reaction below a hydrocarbon, known as ethylene, reacts with hydrogen to produce another hydrocarbon, ethane, according to the equation:

$$C_2H_4 (g) + H_2 (g) \rightarrow C_2H_6 (g)$$

Calculate the enthalpy change for this reaction, using the following combustion data:

- $$C_2H_4 (g) + 3 O_2 (g) \rightarrow 2 CO_2 (g) + 2 H_2O (l) \quad \Delta H = - 1401 kJ$$
- $$2 C_2H_6 (g) + 7 O_2 (g) \rightarrow 4 CO_2 (g) + 6 H_2O (l) \quad \Delta H = - 3100 kJ$$
- $$2 H_2 (g) + O_2 (g) \rightarrow 2 H_2O (l) \quad \Delta H = - 572 kJ$$

8. Consider the reaction:

$$4 CO (g) + 2 NO_2 (g) \rightarrow 4 CO_2 (g) + N_2 (g)$$

Using the following information, determine ΔH for the reaction:

- $$\text{NO (g)} \quad \Delta H_f^o = + 90.2 \text{ kJ/mol}$$
- $$\text{CO}_2 (g) \quad \Delta H_f^o = - 393.5 \text{ kJ/mol}$$
- $$2 \text{ NO (g)} + \text{ O}_2 (g) \rightarrow 2 \text{ NO}_2 (g) \quad \Delta H = - 114.0 \text{ kJ/mol}$$
- $$2 \text{ CO (g)} + \text{ O}_2 (g) \rightarrow 2 \text{ CO}_2 (g) \quad \Delta H = - 566.0 \text{ kJ/mol}$$