Name: KEY / 15 Pts.

Honors Chemistry Worksheet: Heats of Reaction

1. For the reaction of $S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$ $\Delta H = -296$ kJ
How much heat is evolved when 355 grams of sulfur is burned in excess oxygen?

$$\frac{335\text{ g S}}{1} \cdot \frac{1\text{ mol S}}{32\text{ g S}} \cdot \frac{-296\text{ kJ}}{1\text{ mol S}} = \boxed{-3.10\times10^{3}\text{ kJ}}$$

2. In the fermentation of glucose, $C_6H_{12}O_6$, ethanol (C_2H_5OH) and carbon dioxide gas formed. If each mole of glucose yields 67 kJ, how much energy would have been released when 350. ml of pure ethanol is formed. Density of ethanol is 0.79 g/ml.

$$C_6H_{12}O_6 \longrightarrow 2CO_2 + 2C_2H_5OH \qquad \Delta H = -67\text{ kJ}$$

$$\frac{350\text{ ml EtOH}}{1} \cdot \frac{0.79\text{ g}}{1\text{ ml}} \cdot \frac{1\text{ mol}}{46\text{ g}} \cdot \frac{-67\text{ kJ}}{2\text{ mol}} = \boxed{-201\text{ kJ}}$$

3. Given: $C_3H_{8(g)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(l)}$ $\Delta H = -2221$ kJ. The combustion of a sample of propane, C_3H_8, released 35 MJ of heat. What volume of C_3H_8 and O_2 gas were required at STP?

$$\frac{35\times10^{3}\text{ kJ}}{1} \cdot \frac{1\text{ mol } C_3H_8}{-2221\text{ kJ}} \cdot \frac{22.4\text{ L } C_3H_8}{1\text{ mol } C_3H_8} = \boxed{350\text{ L } C_3H_8}$$

$$\frac{350\text{ L } C_3H_8}{1} \cdot \frac{5\text{ mol } O_2}{1\text{ mol } C_3H_8} = \boxed{1800\text{ L } O_2}$$

4. *Using the information above in question #3.* 20.0 grams of propane reacted with 70.0 grams of oxygen. If all of this heat was transferred to 5.0L of water at 12.0°C what would the final temperature of the water be?
Recall Calorimetry? $Q = C_p \cdot m \cdot \Delta T$, $C_{pH2O} = 4.18\text{J/g.°C}$

$$\frac{20.0\text{ g } C_3H_8}{44\text{ g/mol}} = 0.455\text{ mol} \qquad \frac{70.0\text{ g } O_2}{32\text{ g/mol}} = 2.19\text{ mol} \leftarrow O_2 \text{ L.R.}$$

$$0.455\text{ mol} \cdot \left(\frac{5}{1}\right) \rightarrow 2.28\text{ mol Needed}$$

$$2.19\text{ mol } O_2 \cdot \frac{-2221\text{ kJ}}{5\text{ mol } O_2} = 973000\text{ J} = \frac{4.18\text{ J}}{g\cdot°C} \cdot 5000\text{ g} \cdot \Delta T \quad (5.0\text{ L} \rightarrow 5000\text{ g})$$

$$\Delta T = 46.5\text{ °C}$$

$$T_2 = 12.0\text{ °C} + 46.5\text{ °C} = \boxed{58.5\text{ °C}}$$