

Name: KEY

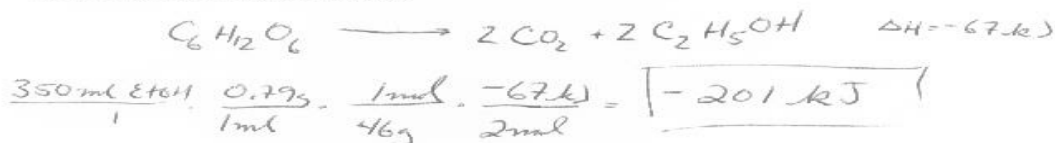
## Honors Chemistry Worksheet: Heats of Reaction

/ 15 Pts.

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

$$\frac{355 \text{ g S}}{1} \cdot \frac{1 \text{ mol S}}{32 \text{ g S}} \cdot \frac{-296 \text{ kJ}}{1 \text{ mol S}} = \boxed{-3.10 \times 10^3 \text{ kJ}}$$

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.



3. Given:  $C_3H_{8(g)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(l)}$   $\Delta H = -2221 \text{ kJ}$ . 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?

$$\frac{35 \times 10^3 \text{ kJ}}{1} \cdot \frac{1 \text{ mol } C_3H_8}{-2221 \text{ kJ}} \cdot \frac{22.4 \text{ L } C_3H_8}{1 \text{ mol } C_3H_8} = \boxed{350 \text{ L } C_3H_8}$$

$$\frac{350 \text{ L } C_3H_8}{1} \cdot \frac{5 \text{ mol } O_2}{1 \text{ mol } C_3H_8} = \boxed{1750 \text{ L } O_2}$$

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?  $Q = C_p \cdot m \cdot \Delta T$ ,  $C_{pH_2O} = 4.18 \text{ J/g} \cdot ^\circ\text{C}$

$$\frac{20.0 \text{ g } C_3H_8}{44 \text{ g/mol}} = \frac{70.0 \text{ g } O_2}{32 \text{ g/mol}} \quad \swarrow O_2 \text{ L.R.}$$

$$0.455 \text{ mol} \quad 2.19 \text{ mol}$$

$$\left(\frac{5}{1}\right) \rightarrow 2.28 \text{ mol } O_2 \text{ needed}$$

$$\frac{2.19 \text{ mol } O_2}{5 \text{ mol } O_2} \cdot \frac{-2221 \text{ kJ}}{1} = 973000 \text{ J} = \frac{4.18 \text{ J}}{g \cdot ^\circ\text{C}} \cdot 5000 \text{ g} \cdot \Delta T$$

$$\Delta T = 46.5^\circ\text{C}$$

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