(#9-2)

Thermodynamic Equations and Calculations

1. 5.0g of H_2 is burned in excess O_2 causing 2000g of water to increase 85C.
   a. Write the balanced equation.

   $2H_2 + O_2 \rightarrow 2H_2O$

   How much energy did the water gain?

   $q = m \cdot \Delta T \cdot C \quad 2000 \cdot 85 \cdot 4.18 = 710600 J \ (710 kJ)$

   b. How many moles of H_2 is being consumed?

   $5g \cdot \frac{1 mol}{2 g} = 2.5 mol$

   c. What is the energy per mole of the H_2 being burned?

   $\frac{710600 J}{2.5 mol} = 284240 J/mol$ (284 kJ/mol)

   d. What is the enthalpy in Kilojoules?

   $2 \cdot 284 = 568 kJ/Rxn$

   e. 25g of H_2 is burned, how much energy is produced?

   $25g \cdot \frac{1 mol}{2 g} = 12.5 mol \cdot \frac{568 kJ}{2 mol} = 3550 kJ$

2. $2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O \quad \Delta H = -1452kJ$
   a. How much energy is produced when 2 moles of methanol is burned?

   -1452

   b. How much energy is produced when 1 mole of methanol is burned?

   $1 mol \cdot \frac{-1452 kJ}{2 mol} = -726$

   c. How much is produced when 16g of methanol is burned?

   $16g \cdot \frac{1 mol}{32 g} = 0.5 mol \cdot \frac{1452 kJ}{2 mol} = 363 kJ$

   d. How much would 100g of water increase in temperature if ~~20g~~ 16g of methanol is burned heating the water?

   $q = m \cdot \Delta T \cdot c$

   $363000 J = 100 \cdot \Delta T \cdot 4.18$

   $\Delta T = 868°C$ Boil

3. 50g of methane (CH_4) is burned producing 2.78kJ of energy.
   a. Write out the reaction and determine the enthalpy for the combustion of methane.
   b. How much energy would be released if 36g of water was produced via combustion of methane?

   $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

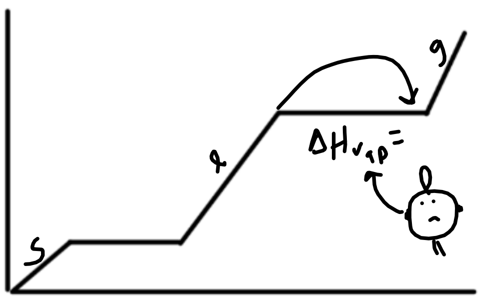
   $\Delta H = -890 J/mol$

   $50g \cdot \frac{1 mol}{16 g} = 3.12 mol$

   $\frac{g}{mol} = \frac{2.78}{3.12}$ 0.89 kJ/mol

   $\frac{50g}{2.78} = \frac{36}{2 kJ}$

4. Ethanol requires energy to be vaporized from a liquid to a gas. A 1000g sample of ethanol has 100g evaporate away, how much cooler is the remaining ethanol?



$C_2H_5OH(l) \rightarrow C_2H_5OH(g) \ \Delta H = 38.5 kJ/mol$

$100g \cdot \frac{1 mol}{46 g} \cdot \frac{38.5 kJ}{1 mol} = 83.6 kJ$

$q = m \cdot \Delta T \cdot C$

$83.6 \quad 83600 J = 900 \cdot \Delta T \cdot 2.4$

$38.7°C$