CHAPTER 12 REVIEW ☺

1. Hydrogen peroxide decomposes according to the following thermochemical reaction:
$H_2O_2(l) \rightarrow H_2O(l) + 1/2\ O_2(g)$; $\Delta H = -98.2$ kJ
Calculate the change in heat when 1.00 g of hydrogen peroxide decomposes. (answer: -2.89 kJ)

$1.00\ g\ H_2O_2 \times \frac{1\ mol\ H_2O_2}{34.0\ g} \times \frac{-98.2}{1\ mol} = -2.89\ kJ$

Exo

2. How much heat will be released if 9.75g of Aluminum reacts with excess ammonium nitrate according to the equation below. (answer: -367 kJ)
$2\ Al + 3\ NH_4NO_3 \rightarrow 3N_2 + 6H_2O + Al_2O_3 \quad \Delta H = -2030$ kJ

$9.75\ g\ Al \times \frac{1\ mol}{27.0} \times \frac{-2030}{2\ mol} = -367\ kJ$

3. Calculate ΔH for the reaction $C + 2H_2 \rightarrow CH_4$ (answer: 25.3 kJ/mol)

x2 $2\ H_2(g) + 0.5\ O_2(g) \rightarrow H_2O(l) \quad \Delta H = -285.8$ -571.6
$C(graphite) + O_2(g) \rightarrow CO_2(g) \quad \Delta H = -293.5$
~~$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l) \quad \Delta H = -890.4$~~

flip $CO_2 + 2H_2O \rightarrow CH_4 + 2O_2 \quad \Delta H = 890.4$

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4. Calculate ΔH for the reaction $SO_2(g) + {}^1/_2\ O_2 \rightarrow SO_3$ (answer: -99KJ/mol)

$SO_2(g) \rightarrow S(s) + O_2(g)$ $\quad \Delta H = 297$ kJ

$S(s) + {}^3/_2\ O_2 \rightarrow SO_3$ $\quad \Delta H = -396$ kJ

$\Delta H = 297 - 396 =$ **-99 kJ**

5. When a 1.000 g sample of the rocket fuel hydrazine, N_2H_4, is burned in a bomb calorimeter which contains 1200 g of water, the temperature rises from 24.62°C to 28.16°C. Calculate ΔH for the process (answer: -569.7 kJ)

① $Q = (1200)(4.184)(28.16 - 24.62) = 17774$ J

② $Q = -17774$ J

③ $1.000\text{g } N_2H_4 \times \frac{1\text{ mol}}{32.0\text{g}} = 0.0313$

④ $\Delta H = -17774 / 0.0313 = -567859$ J or -567.9 KJ

6. If a 348 g sample of mercury in 546g of water at 127°C is cooled to 103°C, calculate ΔH for the system. (31.7 kJ)

① $Q = (546)(4.184)(103 - 127) = -54827$ J

② $Q = 54{,}827$ J

③ $348\text{g Hg} \times \frac{1\text{ mol}}{200.6} = 1.73$ mol

④ $54827 / 1.73 = 31{,}692$ J or 31.7 KJ

7. An 18.7g sample of Platinum metal increases in temperature by 2.3C when 5.7J of heat are added. What is the specific heat of platinum? (0.133 J/(g C)

$c = \frac{Q}{m\Delta T} = \frac{5.7}{(18.7)(2.3)} = 0.133$ J/g°