Hess's Law

1. Calculate ΔH for the following reaction

$Zn\ (s) + ½\ O_2\ (g) \rightarrow ZnO\ (s)$ $\quad \Delta H = ?$

using the following data.

$Zn\ (s) + 2\ HCl\ (aq) \rightarrow ZnCl_2\ (aq) + H_2\ (g)$ $\quad \Delta H = -152.4\ kJ$

$ZnO\ (s) + 2\ HCl\ (aq) \rightarrow ZnCl_2\ (aq) + H_2O\ (l)$ $\quad \Delta H = -90.2\ kJ$

$2\ H_2\ (g) + O_2\ (g) \rightarrow 2\ H_2O\ (l)$ $\quad \Delta H = -571.6\ kJ$

$Zn\ (s) + 2\ HCl\ (aq) \rightarrow ZnCl_2\ (aq) + H_2\ (g)$ $\quad \Delta H = -152.4\ kJ$

$ZnCl_2\ (aq) + H_2O\ (l) \rightarrow ZnO\ (s) + 2\ HCl\ (aq)$ $\quad \Delta H = +90.2\ kJ$

$H_2\ (g) + 1/2\ O_2\ (g) \rightarrow H_2O\ (l)$ $\quad \Delta H = ½\ (-571.6\ kJ)$

$Zn\ (s) + ½\ O_2\ (g) \rightarrow ZnO\ (s)$

$\Delta H = -152.4\ kJ + 90.2\ kJ + 1/2\ (-571.6\ kJ) =$ **$-347.6\ kJ$**

2. Calculate ΔH for the following reaction

$C_2H_4\ (g) + 6\ F_2\ (g) \rightarrow 2\ CF_4\ (g) + 4\ HF\ (g)$ $\quad \Delta H = ?$

using the following data.

$H_2\ (g) + F_2\ (g) \rightarrow 2\ HF\ (g)$ $\quad \Delta H = -537\ kJ$

$C\ (s) + 2\ F_2\ (g) \rightarrow CF_4\ (g)$ $\quad \Delta H = -680\ kJ$

$2\ C\ (s) + 2\ H_2\ (g) \rightarrow C_2H_4\ (g)$ $\quad \Delta H = +52.3\ kJ$

$2\ H_2\ (g) + 2\ F_2\ (g) \rightarrow 4\ HF\ (g)$ $\quad \Delta H = 2 \times (-537\ kJ)$

$2\ C\ (s) + 4\ F_2\ (g) \rightarrow 2\ CF_4\ (g)$ $\quad \Delta H = 2 \times (-680\ kJ)$

$C_2H_4\ (g) \rightarrow 2\ C\ (s) + 2\ H_2\ (g)$ $\quad \Delta H = -52.3\ kJ$

$C_2H_4\ (g) + 6\ F_2\ (g) \rightarrow 2\ CF_4\ (g) + 4\ HF\ (g)$

$\Delta H = 2 \times (-537\ kJ) + 2 \times (-680\ kJ) + 52.3\ kJ =$ **$-2.49 \times 10^3\ kJ$**