Name KEY Date _____ Class _____

Hess's Law Practice Problems

1. From the following enthalpy changes,

add together

$C(s) + \frac{1}{2}O_2(g) \rightarrow CO(g)$ $\Delta H° = -110.5$ kJ

$CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$ $\Delta H° = -283.0$ kJ

calculate the value of $\Delta H°$ for the reaction $C(s) + O_2(g) \rightarrow CO_2(g)$.

$\Delta H° = -110.5 + -283.0 =$ **−393.5 kJ**

2. From the following enthalpy changes,

reverse; ÷2

$2P(s) + 3Cl_2(g) \rightarrow 2PCl_3(l)$ $\Delta H° = +640$ kJ ÷2

÷2

$2P(s) + 5Cl_2(g) \rightarrow 2PCl_5(s)$ $\Delta H° = -886$ kJ ÷2

calculate the value of $\Delta H°$ for the reaction $PCl_3(l) + Cl_2(g) \rightarrow PCl_5(s)$.

$\Delta H° = \frac{640}{2} + \frac{-886}{2} = \frac{-246}{2} =$ **−123 kJ**

3. From the following enthalpy changes,

$C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(g)$ $\Delta H° = -1234.7$ kJ

reverse; $CH_3OCH_3(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(g)$ $\Delta H° = +1328.3$ kJ

calculate the value of $\Delta H°$ for the reaction $C_2H_5OH(l) \rightarrow CH_3OCH_3(l)$.

$\Delta H° = -1234.7 + 1328.3 =$ **93.6 kJ**

4. From the following enthalpy changes,

reverse; $Cu(s) + Cl_2(g) \rightarrow CuCl_2(s)$ $\Delta H° = -206$ kJ

$2Cu(s) + Cl_2(g) \rightarrow 2CuCl(s)$ $\Delta H° = -136$ kJ

calculate the value of $\Delta H°$ for the reaction $CuCl_2(s) + Cu(s) \rightarrow 2CuCl(s)$.

$\Delta H° = 206 + -136 =$ **70 kJ**

5. From the following enthalpy changes,

2x $H_2(g) + F_2(g) \rightarrow 2HF(g)$ $\Delta H° = -542.2$ kJ (2x)

reverse: $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$ $\Delta H° = +571.6$ kJ

calculate the value of $\Delta H°$ for the reaction $2F_2(g) + 2H_2O(l) \rightarrow 4HF(g) + O_2(g)$.

$\Delta H = 2(-542.2) + 571.6$

$=$ **−512.8 kJ**

6. From the following enthalpy changes,

reverse; ÷2

$Xe(g) + F_2(g) \rightarrow XeF_2(s)$ $\Delta H° = +123$ kJ

$Xe(g) + 2F_2(g) \rightarrow XeF_4(s)$ $\Delta H° = -262$ kJ

calculate the value of $\Delta H°$ for the reaction $XeF_2(s) + F_2(g) \rightarrow XeF_4(s)$.

$\Delta H° = 123 + -262 =$ **−139 kJ**

7. From the following enthalpy changes,

$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(l)$ $\Delta H° = -1170$ kJ ÷2

rev; ÷2

$4NH_3(g) + 3O_2(g) \rightarrow 2N_2(g) + 6H_2O(l)$ $\Delta H° = +1530$ kJ ÷2

calculate the value of $\Delta H°$ for the reaction $N_2(g) + O_2(g) \rightarrow 2NO(g)$.

$\frac{-1170}{2} + \frac{1530}{2} = \frac{360}{2} =$ **180 kJ**

8. From the following enthalpy changes,

$2Al(s) + \frac{3}{2}O_2(g) \rightarrow Al_2O_3(s)$ $\Delta H° = -1601$ kJ

rev; $2Fe(s) + \frac{3}{2}O_2(g) \rightarrow Fe_2O_3(s)$ $\Delta H° = +821$ kJ

calculate the value of $\Delta H°$ for the reaction $2Al(s) + Fe_2O_3(s) \rightarrow 2Fe(s) + Al_2O_3(s)$.

$\Delta H = -1601 + 821 =$ **−780 kJ**

9. From the following enthalpy changes,

$H_2O_2(l) \rightarrow H_2O(l) + \frac{1}{2}O_2(g)$ $\Delta H° = -94.6$ kJ

$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$ $\Delta H° = -286.0$ kJ

calculate the value of $\Delta H°$ for the reaction $H_2(g) + H_2O_2(l) \rightarrow 2H_2O(l)$.

$\Delta H = -94.6 + -286.0 =$ **−380.6 kJ**

10. From the following enthalpy changes,

$C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta H° = -393.5$ kJ (×2)

$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$ $\Delta H° = -285.8$ kJ

reverse; ÷2

$2C_2H_2(g) + 5O_2(g) \rightarrow 4CO_2(g) + 2H_2O(l)$ $\Delta H° = +2598.8$ kJ ÷2

calculate the value of $\Delta H°$ for the reaction $2C(s) + H_2(g) \rightarrow C_2H_2(g)$.

$2(-393.5) + \frac{2598.8}{2} + -285.8 =$ **226.6 kJ**