Dougherty Valley HS AP Chemistry
Thermochemistry – Extra Practice Hess's Law

WORKSHEET #2*

Name: **Date:** **Period:** **Seat #:**

Show all work

[1] Find the ΔH for the reaction below, given the following reactions and subsequent ΔH values:
N_2 (g) + 2O_2 (g) → 2NO_2 (g)

N_2 (g) + 3H_2 (g) → 2NH_3 (g) ΔH = – 115 kJ
2NH_3 (g) + 4H_2O (*l*) → 2NO_2 (g) + 7H_2 (g) ΔH = –142.5 kJ
H_2O(*l*) → H_2 (g) + O_2 (g) ΔH = –43.7 kJ
Answer = –83 kJ

[2] Find the ΔH for the reaction below, given the following reactions and subsequent ΔH values:
CO_2 (g) → C(s) + O_2 (g)

H_2O (*l*) → H_2 (g) + $\frac{1}{2}O_2$ (g) ΔH = 643 kJ
C_2H_6 (g) → 2C (s) + 3H_2 (g) ΔH = 190.6 kJ
2CO_2 (g) + 3H_2O (*l*) → C_2H_6 (g) + $\frac{7}{2}O_2$ (g) ΔH = 3511.1 kJ
Answer = 886 kJ

[3] Find the ΔH for the reaction below, given the following reactions and subsequent ΔH values:
N_2H_4 (*l*) + CH_4O(*l*) → CH_2O(g) + N_2 (g) + 3H_2 (g)

2NH_3 (g) → N_2H_4 (l) + H_2 (g) ΔH = 22.5 kJ
2NH_3 (g) → N_2 (g) + 3H_2 (g) ΔH = 57.5 kJ
CH_2O (g) + H_2 (g) → CH_4O (*l*) ΔH = 81.2 kJ
Answer = – 46.2 kJ

[4] Find the ΔH for the reaction below, given the following reactions and subsequent ΔH values:
$\frac{1}{2}H_2$ (g) + $\frac{1}{2}Cl_2$ (g) → HCl(g)

$COCl_2$ (g) + H_2O (*l*) → CH_2Cl_2 (*l*) + O_2 (g) ΔH = 47.5 kJ
2HCl (g) + $\frac{1}{2}O_2$ (g) → H_2O (l) + Cl_2 (g) ΔH = 105 kJ
CH_2Cl_2 (*l*) + H_2 (g) + $\frac{3}{2}O_2$ (g) → $COCl_2$ (g) + 2H_2O (*l*) ΔH = –402.5 kJ
Answer = – 230 kJ

[5] Find the ΔH for the reaction below, given the following reactions and subsequent ΔH values:
C_2H_2 (g) + $\frac{5}{2}O_2$ (g) → 2CO_2 (g) + H_2O(g)

C_2H_6 (g) → C_2H_2 (g) + 2H_2 (g) ΔH = 283.5 kJ
H_2 (g) + $\frac{1}{2}O_2$ (g) → H_2O (g) ΔH = –213.7 kJ
2CO_2 (g) + 3H_2O (g) → C_2H_6 (g) + $\frac{7}{2}O_2$ (g) ΔH = 849 kJ
Answer = –705 kJ

[6] Find the ΔH for the reaction below, given the following reactions and subsequent ΔH values:

$HCl\ (g) + NaNO_2\ (s) \rightarrow HNO_2\ (l) + NaCl\ (s)$

$2NaCl\ (s) + H_2O\ (l) \rightarrow 2HCl\ (g) + Na_2O\ (s)$	$\Delta H = 507$ kJ
$NO\ (g) + NO_2\ (g) + Na_2O\ (s) \rightarrow 2NaNO_2\ (s)$	$\Delta H = -427$ kJ
$NO\ (g) + NO_2\ (g) \rightarrow N_2O\ (g) + O_2\ (g)$	$\Delta H = -43$ kJ
$2HNO_2\ (l) \rightarrow N_2O\ (g) + O_2\ (g) + H_2O\ (l)$	$\Delta H = 34$ kJ

Answer = –78 kJ

[7] Find the ΔH for the reaction below, given the following reactions and subsequent ΔH values:

$Zn(s) + \frac{1}{8}S_8\ (s) + 2O_2\ (g) \rightarrow ZnSO_4\ (s)$

$Zn(s) + \frac{1}{8}S_8\ (s) \rightarrow ZnS(s)$	$\Delta H = -183.92$ kJ
$2ZnS(s) + 3O_2\ (g) \rightarrow 2ZnO(s) + 2SO_2\ (g)$	$\Delta H = -927.54$ kJ
$2SO_2\ (g) + O_2\ (g) \rightarrow 2SO_3\ (g)$	$\Delta H = -196.04$ kJ
$ZnO(s) + SO_3\ (g) \rightarrow ZnSO_4\ (s)$	$\Delta H = -230.32$ kJ

Answer = –976.03 kJ

These problems involve using heat of formation values that are found in the appendix of your textbook

[8] What is the enthalpy of the following reactions? Use equation from Equation Sheet – [Products minus reactants]

(a) $SiF_4\ (g) \rightarrow Si\ (s) + 2F_2\ (g)$

(b) $SiF_4\ (g) \rightarrow Si\ (g) + 2F_2\ (g)$

(c) $SO_3\ (g) + H_2O\ (g) \rightarrow H_2SO_4\ (aq)$

(d) $3K_2O_2\ (s) + 3H_2O\ (l) \rightarrow 6KOH(aq) + O_3\ (g)$

(e) $Fe_3O_4\ (s) + 8HCl\ (g) \rightarrow 2FeCl_3\ (s) + FeCl_2\ (s) + 4H_2O\ (g)$

SiF_4 - $\Delta H_f = -1615.0$ KJ/mol

$FeCl_2$ - $\Delta H_f = -341.8$ KJ/mol

$FeCl_3$ - $\Delta H_f = -399.5$ KJ/mol

Fe_3O_4 - $\Delta H_f = -1118.4$ KJ/mol

SO_3 - $\Delta H_f = -454.5$ KJ/mol

Si(g) - $\Delta H_f = 450$ KJ/mol