Hess's Law Worksheet

1. Calculate ΔH for the reaction: C_2H_4 (g) + H_2 (g) --> C_2H_6 (g), from the following data.

C_2H_4 (g) + 3 O_2 (g) --> 2 CO_2 (g) + 2 H_2O (l)	ΔH = -1411. kJ
C_2H_6 (g) + 3½ O_2 (g) --> 2 CO_2 (g) + 3 H_2O (l)	ΔH = -1560. kJ reverse
H_2 (g) + ½ O_2 (g) --> H_2O (l)	ΔH = -285.8 kJ

-1411. + 1560. - 285.8 ans: ΔH = -136KJ

2. Calculate ΔH for the reaction 4 NH_3 (g) + 5 O_2 (g) --> 4 NO (g) + 6 H_2O (g), from the following data.

N_2 (g) + O_2 (g) --> 2 NO (g)	ΔH = +180.5 kJ x 2
N_2 (g) + 3 H_2 (g) --> 2 NH_3 (g)	ΔH = -91.8 kJ x 2 (reverse)
2 H_2 (g) + O_2 (g) --> 2 H_2O (g)	ΔH = -483.6 kJ x 3

361 + 183.6 - 1450.8 ans: ΔH = -906.2KJ

3. Find ΔH° for the reaction 2H_2(g) + 2C(s) + O_2(g) --> C_2H_5OH(l), using the following thermochemical data.

C_2H_5OH (l) + 2 O_2 (g) --> 2 CO_2 (g) + 2 H_2O (l)	ΔH = -875. kJ reverse
C (s) + O_2 (g) --> CO_2 (g)	ΔH = -394.51 kJ x 2
H_2 (g) + ½ O_2 (g) --> H_2O (l)	ΔH = -285.8 kJ x 2

875. - 789.02 - 571.6 = ans. ΔH = -486KJ

4. Calculate ΔH for the reaction CH_4 (g) + NH_3 (g) --> HCN (g) + 3 H_2 (g), given:

N_2 (g) + 3 H_2 (g) --> 2 NH_3 (g)	ΔH = -91.8 kJ
C (s) + 2 H_2 (g) --> CH_4 (g)	ΔH = -74.9 kJ
H_2 (g) + 2 C (s) + N_2 (g) --> 2 HCN (g)	ΔH = +270.3 kJ

45.9 + 74.9 + 135.15 ΔH = 255.9 KJ (or 256.0KJ)

5. Calculate ΔH for the reaction 2 Al (s) + 3 Cl_2 (g) --> 2 $AlCl_3$ (s) from the data.

depends on rounding

2 Al (s) + 6 HCl (aq) --> 2 $AlCl_3$ (aq) + 3 H_2 (g)	ΔH = -1049. kJ
HCl (g) --> HCl (aq)	ΔH = -74.8 kJ x 6
H_2 (g) + Cl_2 (g) --> 2 HCl (g)	ΔH = -1845. kJ x 3
$AlCl_3$ (s) --> $AlCl_3$ (aq)	ΔH = -323. kJ x 2 (reverse)

-1049 -448.8 -5535 +646

ans. ΔH = -6387KJ