N3 – Thermochemistry – Hess's Law

Definitions
Hess's Law "In going from a particular set of reactants to a particular set of products, the change in enthalpy is the same whether the reaction takes place in one step or a series of steps." **Add Reactions** *+ ΔH's* **Multiplying a Rxn by a factor** *x ΔH by the factor* **Reversing a Rxn** *- ΔH* *(opposite sign, not necessarily a negative value)*
Standard State • Pure gas at 1 atm pressure • Pure solid or liquid in its most stable form at 1 atm, and temp of interest (usually 25°C) • Substances in a solution with a [ ] of 1M

Hess's Law #1

#	Reaction	ΔH°
1	$C + 2H_2 \rightarrow CH_4$	-74.80 kJ
2	$C + O_2 \rightarrow CO_2$	-393.50 kJ
3	$H_2 + ½\ O_2 \rightarrow H_2O$	-285.83 kJ

Hess's Law #2

Rxn #1) $\frac{1}{2}\ N_2\ (g) + \frac{1}{2}\ O_2\ (g) \rightarrow NO\ (g)$
$\Delta H = 90.3$ kJ

Rxn #2) $NO\ (g) + \frac{1}{2}\ Cl_2\ (g) \rightarrow NOCl\ (g)$
$\Delta H = -38.6$ kJ

Hess's Law #3

Rxn #1) $3Fe_2O_3 + CO\ (g) \rightarrow 2Fe_3O_4 + CO_2\ (g)$
$\Delta H° = -47$ kJ

Rxn #2) $Fe_2O_3 + 3CO\ (g) \rightarrow 2Fe\ (s) + 3CO_2\ (g)$
$\Delta H° = -25$ kJ

Rxn #3) $Fe_3O_4 + CO\ (g) \rightarrow 3FeO\ (s) + CO_2\ (g)$
$\Delta H° = 19$ kJ

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