N3 – Thermochemistry – Hess’s Law

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| **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** *+ ∆H’s*  **Multiplying a Rxn by a factor** *x ∆H by the factor*  **Reversing a Rxn -** *∆H  (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**

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| **#** | **Reaction** | **ΔHo** |
| 1 | C + 2H2 🡪 CH4 | -74.80 kJ |
| 2 | C + O2 🡪 CO2 | -393.50 kJ |
| 3 | H2 + ½ O2 🡪 H2O | -285.83 kJ |

**Hess’s Law #2**

**Rxn #1) ½ N2 (*g*) + ½ O2 (*g*) → NO (*g*)   
 Δ*H* = 90.3 kJ  
  
Rxn #2) NO (*g*) + ½ Cl2 (*g*) → NOCl (*g*)   
 Δ*H* = –38.6 kJ**

**Hess’s Law #3**

**Rxn #1) 3Fe2O3 + CO (g) 🡪 2Fe3O4 + CO2 (g)**

**ΔH°= -47 kJ  
  
Rxn #2) Fe2O3 + 3CO (g) 🡪 2Fe (s) + 3CO2 (g)**

**ΔH°= -25 kJ  
  
Rxn #3) Fe3O4 + CO (g) 🡪 3FeO (s) + CO2 (g)**

**ΔH°= 19 kJ**

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