SCH4U1 Name:
ER03 Date:

Hess' Law and the Additivity of Heats

Hess' Law: The value of ΔH for any reaction that can be written in steps equals the sum of the values of ΔH for the individual steps.

Method 1: Additivity of Heats

1. Identify the target equation and balance it (if not given).

2. Identify the individual step equations. These are provided or are found on a Table of Heats of Formation on the back of your Periodic Table.

3. Reverse any step equations so that the position of reactants/products matches that of the target equation. If an equation is reversed, also reverse the sign of Δ*H* for the step equation.

4. Multiply the step equations by the appropriate coefficient to match those in the target equation. Also multiply the Δ*H* by the same coefficient.

5. Add up the modified step equations and their Δ*H* values. The sum of the modified individual step equation should be identical to the target equation.

Example: Determine Δ*H* for the following reaction:

methane (g) + oxygen (g) ⟶ carbon dioxide (g) + water (g)

Method 2: Summation of Heats
Identify the ΔH_f for each product and reactant and solve using the equation:

$$\Delta H = \Sigma(n\Delta H_f(products)) - \Sigma(n\Delta H_f(reactants))$$

Example: Determine ΔH for the following reaction:

ammonia (g) + oxygen (g) ⟶ nitrogen dioxide (g) + water (g)

NH_3 (g) + $\frac{7}{4}O_2$ ⟶ NO_2 (g) + $\frac{3}{2}H_2O$ (g)