Standard Enthalpies

The standard enthalpy of formation ($\triangle H^\circ_f$) is defined as the change in enthalpy for the formation of one mole of a compound from its elements at standard conditions.

To use standard enthalpies of formation we need to define standard conditions:
Standard temperature is 25°C, for gasses the standard pressure is 1 atm, for a solution the standard concentration is a 1.0 molar solution.

By defining a standard enthalpy and measuring that value for a large number of compounds we can calculate the enthalpy change for any chemical reaction by calculating the sum of the products minus the sum of the reactants.

$$\Delta H^\circ_{reaction} = \sum n_p \Delta H^\circ_f(products) - \sum n_r \Delta H^\circ_f(reactants)$$

$2Na_{(s)} + CO_{2(g)} \text{---> } Na_2O_{(s)} + CO_{(g)}$

$\sum[\text{products}]-\sum[\text{reactants}]$

$[\Delta H_{f(Na2O)}+\Delta H_{f(CO)}]-[2\Delta H_{f(Na)}+\Delta H_{f(CO2)}]$

[-416kJ/mol+-110.5kJ/mol]-[2•0+-292.5kJ/mol]

ΔH=-809kJ/mol

Ex:

Bond Energies

Another way to calculate the enthalpy change for a chemical reaction is to understand what is happening at the atomic level. It takes energy to break a chemical bond, this energy is stored and released when a new bond is formed. We can therefore use bond energy information to calculate $\triangle$H.

$$\Delta H^{\circ}_{reaction} = \sum Energy\ Bonds\ Broken_{(reactants)} - \sum Energy\ Bonds\ Formed_{(products)}$$