THERMOCHEMISTRY

1. **Enthalpy of Chemical Reaction**

$$H = E + PV$$

The change in Enthalpy:

$$\Delta H = \Delta E + \Delta(PV)$$

If the pressure is held constant:

$$\Delta H = \Delta E + P\Delta V$$

Enthalpy of Reaction
- Because most reactions are constant-pressure process, we can equate the heat change in these cases to the change in enthalpy.

$$\text{reaction} \longrightarrow \text{products}$$

$\rightarrow$ The change in enthalpy, called the **Enthalpy of Reaction,**ΔH.

$$\Delta H = H(products) - H(reactants)$$

- $\Delta H > 0$, the reaction is an endothermic process.
- $\Delta H < 0$, the reaction is an exorthermic process.

Thermochemical Equations
$H_2O\,(s) \longrightarrow H_2O\,(l)$
Δ H = 6.01 kJ/mol.
A comparison of ΔH and ΔE:

2. **The change of internal energy:**

$$\Delta E = \Delta H - P\Delta V \tag{1}$$
$$\Delta E = \Delta H - \Delta(PV) \tag{2}$$
$$= \Delta H - \Delta(nRT) \tag{3}$$
$$= \Delta H - RT\Delta n \tag{4}$$

3. **Enthalpy of Formation** (ΔH°)
$aA + bB \longrightarrow cC + dD$
Hess's law
- When reaction are converted to products, the change in enthalpy is the **same** wheither the reaction takes place in one step or in the series of steps.ΔH depends only on the initial and final state.
- We have a reaction:

$$\mathrm{CO\,(g)} + \frac{1}{2}\,\mathrm{O_2(g)} \longrightarrow \mathrm{CO_2(g)} \tag{5}$$

$$\Delta H = -283.0 kJ/mol \tag{6}$$

Then we inverse the equation: (7)

$$\mathrm{CO_2(g)} \longrightarrow \mathrm{CO\,(g)} + \frac{1}{2}\,\mathrm{O_2(g)} \tag{8}$$

$$\Delta H = +283.0 kJ/mol. \tag{9}$$