Formation Reactions:

This reactions starts with elements only as reactants.
The reactants will form compounds as products.

elements ⇒compound

Ex. $C_{(s)} + 2H_{2(g)} \rightarrow CH_{4(g)}$ $\Delta H_f =$

The molar enthalpy symbol for a formation reaction is $\mathbf{H_f}$.

Simple Decomposition Reactions:

This reaction starts as a compound, which decomposes into its elements.
(opposite of a formation reaction)

compound ⇒elements

Ex. $CH_{4(g)} \rightarrow C_{(s)} + 2H_{2(g)}$ $\Delta H_{SD} =$

The molar enthalpy symbol is $\mathbf{H_{SD}}$. $\Delta H_r =$

Combustion Reactions:

The reaction of a substance with excess oxygen to produce an oxide.

Ex. $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$ $\Delta H_c = ?$

The molar enthalpy symbol is $\mathbf{H_c}$.

(b) Molar Enthalpies
$\mathbf{H_f}$ - molar enthalpies of formation is the quantity of heat released or absorbed when one mole of a substance forms from its elements.

$\mathbf{H_c}$ - molar enthalpies of combustion is the quantity of heat released or absorbed when one mole of a substance reacts with oxygen.

$\mathbf{H^o}$ - standard molar enthalpy is the quantity of heat released or absorbed when one mole of a substance reacts at SATP

ΔH_r - Enthalpy change is the quantity of heat released or absorbed when a reaction occurs. This may also be called "Heat of Reaction" or "Change in Heat".
⇒must know the number of moles of a substance reacting to determine the enthalpy change

Molar enthalpy may be determined from the enthalpy change as long as the number of moles (n) are known.

$\Delta H_r = nH_r$

$\Delta H_r = nH_r$

Ex. $2SO_{2(g)} + O_{2(g)} \longrightarrow 2SO_{3(g)}$

$H^o = -98.79 kJ/mol$

How do we find the change in enthalpy of $SO_{2(g)}$??

$\Delta Hr = nHr$

$\Delta Hr = (2mol)(-98.79\ kJ/mol)$

$\Delta Hr = -197.58\ kJ$

$H_r = \Delta H_r / n$

COMMUNICATING ENTHALPY CHANGES

Using ΔH_r notation:
- for chemical reactions not well known, the chemical equation must accompany the enthalpy change. The molar enthalpy of reaction (or change in enthalpy) follows the equation. **For exothermic reactions the $\Delta H_r < 0$.**

Ex. $Mg_{(s)} + 1/2\ O_{2(g)} \Longrightarrow MgO_{(s)}$ $\Delta H_r = -601.6kJ$

The Enthalpy Change **(ΔH_r)** may be included as a term in the balanced equation:

(i) In endothermic reactions - energy is reported as a reactant and is transformed in the reaction.

Ex. $H_2O_{(l)} + 285.8kJ \Rightarrow H_{2(g)} + 1/2O_{2(g)}$

(ii) In exothermic reactions - energy is reported as a product since it is being produced.

Ex. $Mg_{(s)} + 1/2\ O_{2(g)} \Rightarrow MgO_{(s)} + 601.6kJ$