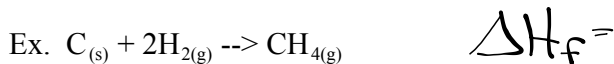


Formation Reactions:

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

elements  $\Rightarrow$  compound



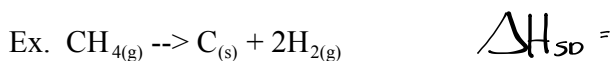
The molar enthalpy symbol for a formation reaction is  $H_f$

Simple Decomposition Reactions:

This reaction starts as a compound, which decomposes into its elements.

(opposite of a formation reaction)

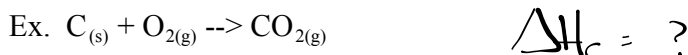
compound  $\Rightarrow$  elements



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

Combustion Reactions:

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



The molar enthalpy symbol is  $H_c$ .

## (b) Molar Enthalpies

$H_f$  - molar enthalpies of formation is the quantity of heat released or absorbed when one mole of a substance forms from its elements.

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

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

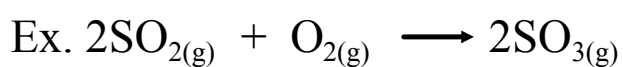
$\Delta H_r$  - Enthalpy change is the quantity of heat released or absorbed when a reaction occurs. This may also be called "Heat of Reaction" or "Change in Heat".

$\Rightarrow$  must know the number of moles of a substance reacting to determine the enthalpy change

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

$$\Delta H_r = n H_r$$

$$\Delta H_r = nH_r$$



$$H^\circ = -98.79 \text{ kJ/mol}$$

**How do we find the change in enthalpy of SO<sub>2(g)</sub>??**

$$\Delta H_r = nH_r$$

$$\Delta H_r = (2 \text{ mol})(-98.79 \text{ kJ/mol})$$

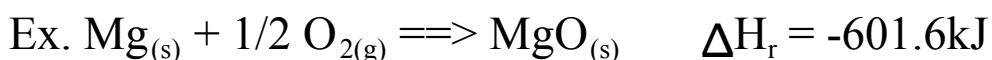
$$\Delta H_r = -197.58 \text{ kJ}$$

$$H_r = \Delta H_r / n$$

## COMMUNICATING ENTHALPY CHANGES

Using  $\Delta H_r$  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  $\Delta H_r < 0$ .**



The Enthalpy Change ( $\Delta H_r$ ) 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.



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

