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Enthalpy

⇒ Enthalpy → denoted by 'H' → it means energy content of a substance

ΔH = Change in Enthalpy

= $H_{products} - H_{reactants}$

ex. 400 kJ - 600 kJ

= ⊖200kJ

The minus sign means Exothermic.

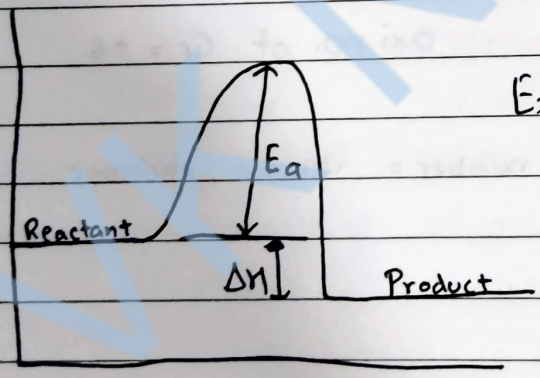
ex. $H_{products} - H_{reactants}$

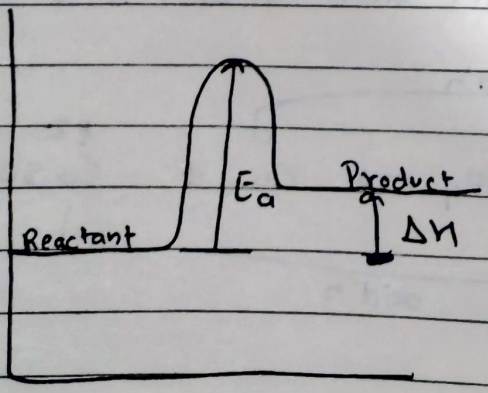
700 kJ 600 kJ

= ⊕ 100 kJ

The plus sign means Endothermic.

⇒ Activation Energy





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⇒ Standard enthalpy change

ΔH° → symbol
→ Temp = 25°C or 298 k
→ Pressure = 101 KPa

ex. $CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O$
$\Delta H^\circ = -800\ kJ$

This reaction is combustion reaction so
$\Delta H^\circ_c = -800\ kJ$
here the 'c' means combustion

ex. $C(s) + 2H_2(g) \longrightarrow$ Methane $CH_4(g)$
$\Delta H^\circ_f = -X\ kJ/mol$
ΔH°_f = Standard enthalpy change of formation

ex. $H_2(g) + \frac{1}{2}O_2(g) \longrightarrow H_2O(\ell)$
$\Delta H^\circ_f = -300\ kJ$

ex. $H_2SO_4 + 2NaOH \longrightarrow Na_2SO_4 + 2H_2O$
$\Delta H^\circ = -114\ kJ$

This is a neutralisation reaction
ΔH°_n = Standard enthalpy change of neutralisation
= condition is that one mole of water should be formed

In the reaction above there are 2 moles of water so to find ΔH°_n we have to divide ΔH° by 2
∴ $\Delta H^\circ_n = -57\ kJ$

Q. NaOH $50 cm^3$ and $1 mol/dm^3$

HCl $50 cm^3$ and $1 mol/dm^3$

Initial temp = 21.3°C

Final temp = 27.8°C

$\Delta t = 27.8 - 21.3 = 6.5$

Energy Released = $\Delta H = -mc\Delta t$ (c: specific heat capacity; m: mass; Δt: temp change)

density of soln = $1 g/cm^3$

so 1g per $1 cm^3$

if $50 cm^3$ then 50g

so total 50 + 50 = 100g

$m = 100$

$c = 4.18$

$\Delta t = 6.5$

$100 \times 4.18 \times 6.5$

$= -2717$

this is for 0.05 moles as $n = cxv = 0.05$

0.05	-2717
1	x

$\frac{-2717 \times 1}{0.05} = x$

⟹ Hess's Law

→ if you perform any reaction, ex. A + B → C. The enthalpy is -100 kJ.

→ if you perform same reaction but ~~first~~ in another way ex. A+B → D → E → C, the total enthalpy will still remain the same. A+B $\xrightarrow{-80}$ D $\xrightarrow{-10}$ E $\xrightarrow{-10}$ C, this still gives -100

→ This is done because sometimes A+B cannot directly be converted to C.

⇒ Bond Energy

Example: $H - Cl \rightarrow H + Cl$

$O_2 \rightarrow O + O$

$CH_4 \rightarrow C + HH$

Example question: $N_2 + 3H_2 \rightarrow 2\ N\text{-}H_3$

$E(N \equiv N) = 945kJ$ $E(H\text{-}H) = 436$ $E(N\text{-}H) = 391$

$945 + 3(436) = 6(391)$

$2253 - 2346 = -93kJ$ (Exothermic)