Enthalpy Changes

Q-1) What is enthalpy?

> Enthalpy is the energy exchanged within a chemical reaction.

$$\Delta H = H_P - H_R$$

Standard conditions:

* Temperature : 298 K or 25°C.
* Pressure : 10^5 Pa or 101 KPa.
* All substances should be in their standard (natural) physical state.

Q-2) What are exothermic and endothermic reactions?

Exothermic reactions release energy to the surroundings

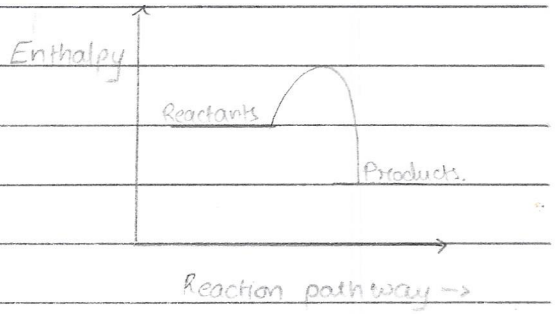
negative (-ve) answer for ΔH

eg:

→ combustion of fuels.

→ respiration

→ water + calcium oxide.



Endothermic reactions absorb energy from the surroundings

positive (+ve) answer

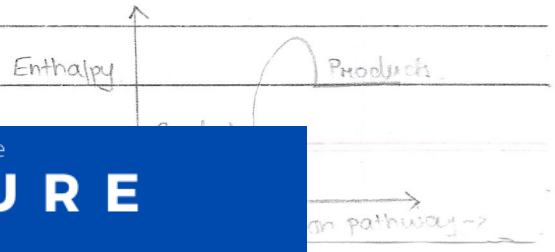
eg:

→ thermal decomposition

↳ decomposition of limestone by heating.

→ photosynthesis.

→ dissolving certain ammonium salts in water.



Q-3) Standard enthalpy change of reaction.?

> ΔH_r°

↳ It's the enthalpy change when the amount of reactants are converted into products according to the given equation under standard conditions.

compulsory statement for all *

The reactants and products must be in their standard states.

Q-4) Standard enthalpy change of formation.?

> ΔH_f°

↳ It's the enthalpy change when 1 mole of a compound is formed from the elements in standard conditions.

*Q-3.

eg: $H_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow 1\ H_2O_{(l)}$

Q-5) Standard enthalpy change of combustion?

(always -ve) ΔH_c° (always negative)

↳ It's the enthalpy change when 1 mole of a substance is burnt in excess oxygen under standard conditions.

*Q-3.

eg: $1\ C_{(g)} + O_{2(g)} \longrightarrow CO_{2(g)}$

Q-6) Standard enthalpy change of neutralisation.?

> ΔH_n° ~~(always negative)~~

(always -ve)

↳ It's the enthalpy change when 1 mole of water is formed when an acid reacts with an alkali under standard conditions.

eg: $HCl_{(aq)} + NaOH_{(aq)} \longrightarrow NaCl_{(aq)} + 1\ H_2O$.

$H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O_{(l)}$.

Q-7) Standard enthalpy change of solution?

> $\Delta H_{sol}^{\ominus}$

↳ It's the enthalpy change when 1 mole of solute is dissolved in a solvent to give an infinitely dilute solution under standard conditions.

An infinitely dilute solution is completely surrounded by water, so it does not produce any enthalpy change when more solvent is added.

eg: $1\,NaOH(s) + aq \longrightarrow NaOH(aq)$

Q-8) Standard enthalpy change of atomisation?

> $\Delta H_{at}^{\ominus}$ (always positive)

(always +ve)

↳ It is the enthalpy change when 1 mole of gaseous atoms is formed from its elements under standard conditions.

eg: $\frac{1}{2}\,Cl_2(g) \longrightarrow 1\,Cl(g)$

$Na(s) \longrightarrow 1\,Na(g)$

Q-9) Standard enthalpy change of hydration of an anhydrous salt?

> it's the enthalpy change when 1 mole of hydrated salt is formed from the anhydrous salt under standard conditions.

(always -ve)

eg: $Na_2S_2O_3(s) + 5H_2O(l) \longrightarrow 1\,Na_2S_2O_3 \cdot 5H_2O(s)$

water of crystalisation.

Q-10) Calorimetry enthalpy change.

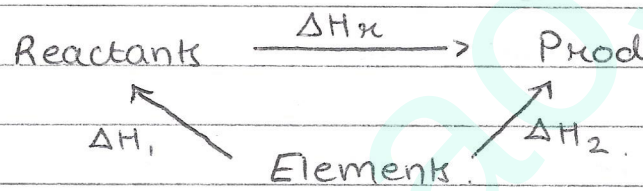
$$Q = m \times C \times \Delta T$$

Q: enthalpy change; m: mass of H_2O; C: specific heat capacity; ΔT: change in temperature.

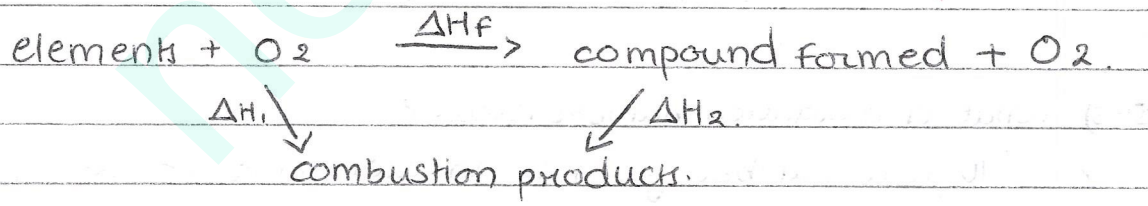
* $1\,cm^3 = 1\,g$
* Specific heat capacity = $4.18\,Jg^{-1}{}^{\circ}C^{-1}$ for all.

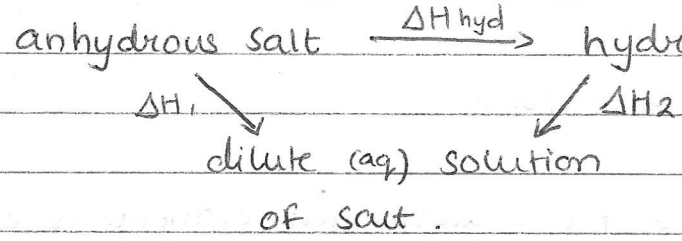
Q-11) What is the Hess' Law?

> Hess' Law states that 'the total enthalpy change in a chemical reaction is independant of the route by which the chemical reaction takes place, as long as the initial and final conditions are the same.'



$\Delta H_{RC} = \Delta H_P - \Delta H_R$. $(\Delta H_2 - \Delta H_1)$





Q-12) Bond energy?

> It is the amount of energy required to break 1 mole of bonds (covalent bonds) in a gaseous molecule.

Average bond energy is the average taken from the same bond in different molecules / environment