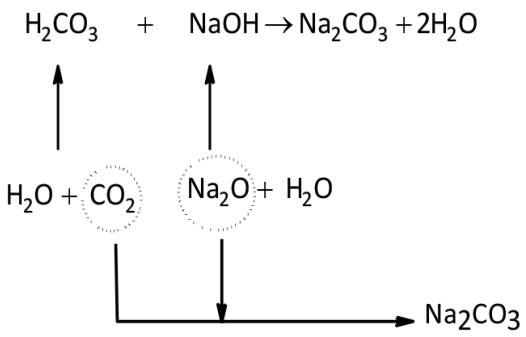
Thermal Stability of salt



Q. **Arrange following salts according to their decreasing thermal stability**

Li_2CO_3, Na_2CO_3, K_2CO_3, Rb_2CO_3, CS_2SO_3

Ans.

$Li_2CO_3 \rightarrow Li_2O + CO_2$

$Na_2CO_3 \rightarrow Na_2O + CO_2$

$K_2CO_3 \rightarrow K_2O + CO_2$

$Rb_2CO_3 \rightarrow Rb_2O + CO_2$

$CS_2CO_3 \rightarrow CS_2O + CO_2$

Decomposition Trends of different salts

1. Carbonates:

Case-1:

Na_2CO_3
K_2CO_3
Rb_2CO_3
Cs_2CO_3

$\xrightarrow{\Delta}$ no effect

Case-2:

$Ag_2CO_3 \rightarrow 2Ag + ½\ O_2 + CO_2$

$HgCO_3 \rightarrow Hg + ½\ O_2 + CO_2$

Case-3:

$Li_2CO_3 \rightarrow Li_2O + CO_2$

$CaCO_3 \rightarrow CaO + CO_2$

Case-4: $(NH_4)_2\ CO_3 \rightarrow 2NH_3 + CO_2 + H_2O$

Q. Calculate the residue obtained on strongly heating 2.76 g of Ag_2CO_3 ?

Sulphate

Case 1:

$$\left.\begin{matrix} Na_2SO_4 \\ K_2SO_4 \\ Rb_2SO_4 \\ Cs_2SO_4 \end{matrix}\right] \xrightarrow{\Delta} \text{no effect}$$

Case 2:

$Ag_2SO_4 \rightarrow Ag + O_2 + SO_3$

$HgSO_4 \rightarrow Hg + O_2 + SO_3$

Case 3:

$Li_2SO_4 \rightarrow Li_2O + SO_3$

$ZnSO_4 \rightarrow ZnO + SO_3$

Case-4: $(NH_4)_2\,SO_4 \rightarrow 2NH_3 + SO_3 + H_2O$

* $2FeSO_4 \rightarrow Fe_2O_3 + SO_2 + SO_3$

Nitrate

Case-1:

$$\left.\begin{matrix} NaNO_3 \\ KNO_3 \\ RbNO_3 \\ CsNO_3 \end{matrix}\right] \xrightarrow{\Delta} MNO_2 + O_2$$

Note:

$$\left.\begin{matrix} NaNO_3 \\ KNO_3 \\ RbNO_3 \\ CsNO_3 \end{matrix}\right] \xrightarrow[T > 800\,^{\circ}C]{\Delta} M_2O + N_2 + O_2$$

Case-2: $AgNO_3 \rightarrow Ag + NO_2 + ½\ O_2$

$Hg\,(NO_3)_2 \rightarrow Hg + 2NO_2 + O_2$

Case-3: $2LiNO_3 \rightarrow Li_2O + 2NO_2 + ½\ O_2$

$Mg(NO_3)_2 \rightarrow MgO + 2NO_2 + ½\ O_2$

Case-4: $NH_4NO_3 \rightarrow N_2O + 2H_2O$

Nitrite

Case-1: $NaNO_2$, KNO_2, $RbNO_2$, $CsNO_2$ $\xrightarrow{\Delta}$ no effect

Case-2:

$AgNO_2 \rightarrow Ag + NO_2$

$Hg(NO_2)_2 \rightarrow Hg + 2NO_2$

Case-3:

$2LiNO_2 \rightarrow Li_2O + NO_2 + NO$

$Mg(NO_2)_2 \rightarrow MgO + NO_2 + NO$

Case-4: $NH_4NO_2 \rightarrow N_2 + 2H_2O$

Q. $PbCl_2$ is insoluble in cold water, but soluble in hot water.

Q. Which is more soluble in aqueous medium

A. $NaHCO_3$

B. $KHCO_3$

C. $RbHCO_3$

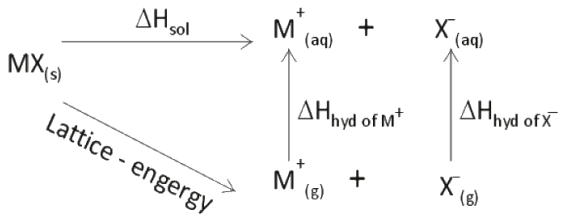
D. $CsHCO_3$

Q. Arrange CaC_2O_4, SrC_2O_4, BaC_2O_4 According to there increasing order of solubility.

Q. Anhydrous $AlCl_3$ is covalent. From the data given below, predict whether it would remain covalent or become ionic in aqueous solution. (Ionization energy for $AlCl_3$ = 5137 kj mol^{-1}; $\Delta H_{Hydration}$ for Al^{3+} = -4665 kj mol^{-1} ; $\Delta H_{Hydration}$ for Cl^- = -381 kj mol^{-1})

Solubility

The molar heat of solution (ΔHsoln) of a substance is the heat absorbed or released when one mole of the substance is dissolved in water.



According to hess' law :

$$\Rightarrow \Delta H_{sol} = L.E_{MX} - |\Delta H_{hyd}|_{M^+} - |\Delta H_{hyd}|_{X^-}$$

$$\Rightarrow \Delta H_{sol} = L.E_{MX} - |\Delta H_{hyd}|_{MX}$$

Dissolution of salt in water:

$\Rightarrow \Delta G = \Delta H - T\Delta S$

Generally, for dissolution of salt , $\Delta S > 0$

Case 1:

If dissolution of salt is exothermic in nature ($\Delta H < 0$ **),**

Then, ΔG is always less than zero.

These type of salts is always soluble in water at any temperature.

Case 2:

If dissolution of salt is endothermic in nature ($\Delta H > 0$ **),**

Then, value of ΔG depends on temperature

(i). at low temperature

$|\Delta H| > |T\Delta S|$

$|\Delta G > 0,$

Insoluble at low temperature.

(ii). at high temperature

$|\Delta H| < |T\Delta S|$

$\Delta G < 0,$

soluble at high temperature.

Solubility of salt = f^n(Lattice energy & ΔH_{hyd})

Trends of solubility:

Case 1:generally, Solubility of salts of Group1 and group 2 metals containing

SO_4^{2-}, CO_3^{2-}, HCO_3^-, HSO_4^-, CO_3^{2-}, CrO_4^{2-}, $Cr_2O_7^{2-}$, NO_3^-, $C_2O_4^{2-}$, MnO_4^-, $S_2O_3^{2-}$, I^- *etc.*

decreases on moving down the group.

Exception:

Solubility of SO_4^{2-}, CO_3^{2-}, HCO_3^-, HSO_4^- **of alkali metal and** $C_2O_4^{2-}$ **of alkaline earth metal increases down the group.**

Case 2: generally, Solubility of salts of Group1 and group 2 metals containing

OH^-, F^- & O^{2-} *etc.* **increases on moving down the group.**