# s-Block Elements

The elements in which the last electron enters the outermost s-orbital are called s-block elements. As the s-orbital can accommodate only two electrons, two groups 1 and 2 belong to the s-block.

# Flame Test

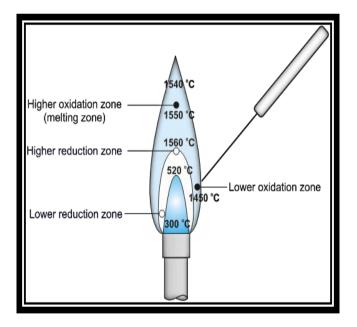
The alkali metals and alkaline earth metals and their salts impart characteristic colour to an oxidizing flame.

**<u>Reason</u>**: This is because the heat from the flame excites the outermost orbital electron to a higher energy level. When they drop back to the ground state, there is emission of radiation in the visible region.

The electrons in beryllium and magnesium are too strongly bound (due to small size) to get excited by flame. Hence, these elements do not impart any colour to the flame.

| Metal  | Li          | Na     | К              | Rb         | Cs   |
|--------|-------------|--------|----------------|------------|------|
| Colour | Crimson red | Yellow | Violet / Lilac | Red violet | Blue |

| Metal  | Ве        | Mg        | Са        | Sr          | Ва          |
|--------|-----------|-----------|-----------|-------------|-------------|
| Colour | No colour | No colour | Brick red | Crimson red | Apple green |



| Property  | Lithium<br>Li        | Sodium<br>Na         | Potassium<br>K       | Rubidium<br>Rb       | Caesium<br>Cs        | Francium<br>Fr               |
|---|----------------------|----------------------|----------------------|----------------------|----------------------|------------------------------|
| Atomic number   | 3                    | 11                   | 19                   | 37                   | 55                   | 87                           |
| Atomic mass (g moΓ¹)  | 6.94                 | 22.99                | 39.10                | 85.47                | 132.91               | (223)                        |
| Electronic<br>configuration                                   | [He] 2s <sup>1</sup> | [Ne] 3s <sup>1</sup> | [Ar] 4s <sup>1</sup> | [Kr] 5s <sup>1</sup> | [Xe] 6s <sup>1</sup> | [Rn] 7 <i>s</i> <sup>1</sup> |
| Ionization<br>enthalpy / kJ mol <sup>-1</sup>                 | 520                  | 496                  | 419                  | 403                  | 376                  | ~375                         |
| Hydration<br>enthalpy/kJ mol <sup>-1</sup>                    | -506                 | -406                 | -330                 | -310                 | -276                 | -                            |
| Metallic<br>radius / pm                                       | 152                  | 186                  | 227                  | 248                  | 265                  | -                            |
| Ionic radius<br>M <sup>+</sup> / pm                           | 76                   | 102                  | 138                  | 152                  | 167                  | (180)                        |
| m.p. / K  | 454                  | 371                  | 336                  | 312                  | 302                  | -                            |
| b.p / K   | 1615                 | 1156                 | 1032                 | 961                  | 944                  | -                            |
| Density / g cm <sup>-3</sup>                                  | 0.53                 | 0.97                 | 0.86                 | 1.53                 | 1.90                 | -                            |
| Standard potentials $E^{\Theta}$ / V for (M <sup>+</sup> / M) | -3.04                | -2.714               | -2.925               | -2.930               | -2.927               | -                            |
| Occurrence in<br>lithosphere <sup>†</sup>                     | 18*                  | 2.27**               | 1.84**               | 78-12*               | 2-6*                 | ~ 10 <sup>-18</sup> *        |

 $\frac{Group-1^{st}(IA)}{Atomic and Physical properties of the Alkali metals}$ 

\*ppm (part per million), \*\* Percentage by weight

| Property  | Beryllium<br>Be      | Magnesium<br>Mg      | Calcium<br>Ca        | Strontium<br>Sr      | Barium<br>Ba         | Radium<br>Ra         |
|---|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Atomic number                                     | 4                    | 12                   | 20                   | 38                   | 56                   | 88                   |
| Atomic mass (g mo $\Gamma^1$ )                    | 9.01                 | 24.31                | 40.08                | 87.62                | 137.33               | 226.03               |
| Electron<br>configuration                         | [He] 2s <sup>2</sup> | [Ne] 3s <sup>2</sup> | [Ar] 4s <sup>2</sup> | [Kr] 5s <sup>2</sup> | [Xe] 6s <sup>2</sup> | [Rn] 7s <sup>2</sup> |
| Ionization<br>enthalpy (I) / kJ mol <sup>-1</sup> | 899                  | 737                  | 590                  | 549                  | 503                  | 509                  |
| Ionization<br>enthalpy (II) /kJ mol <sup>-1</sup> | 1757                 | 1450                 | 1145                 | 1064                 | 965                  | 979                  |
| Hydration enthalpy<br>(kJ/mol)                    | - 2494               | - 1921               | -1577                | - 1443               | - 1305               | -                    |
| Metallic<br>radius / pm                           | 112                  | 160                  | 197                  | 215                  | 222                  | -                    |
| Ionic radius<br>M²+ / pm                          | 31                   | 72                   | 100                  | 118                  | 135                  | 148                  |
| m.p. / K  | 1560                 | 924                  | 1124                 | 1062                 | 1002                 | 973                  |
| b.p / K   | 2745                 | 1363                 | 1767                 | 1655                 | 2078                 | (1973)               |
| Density / g cm⁻³                                  | 1.84                 | 1.74                 | 1.55                 | 2.63                 | 3.59                 | (5.5)                |

| S.No. | Atomic Properties                                     | Alkali metal  | Alkaline earth metals  |
|-------|---|---|--|
| 1.    | Outer Electronic<br>configuration                     | ns <sup>1</sup>   | ns <sup>2</sup>  |
| 2.    | Oxidation number<br>and valency                       | (i)These elements easily form<br>univalent +ve ion by losing loosely<br>solitary ns <sup>1</sup> electron due to low IP<br>value.   | The $IP_1$ of these metals are much lower than $IP_2$ and thus it appears that these metals should form univalent ion rather than divalent ions but in actual practice, all these give bivalent ion.   |
| 3.    | Atomic and Ionic<br>radii                             | Increase down the group, because<br>value of n (principal quantum<br>number) increases. Order = Li < Na<br>< K < Rb < Cs.   | The atomic and ionic radii of the alkali earth metal are<br>smaller than corresponding alkali metals.<br>Reason<br>higher nuclear charge (Zeff)<br>On moving down the group size increase, as value of n<br>increases.<br>Be < Mg < Ca < Sr < Ba   |
| 4.    | Ionisation Energy                                     | As size increases, I.E. decreases<br>down the group (so Cs have lowest<br>I.P.)<br>Order = Li > Na > K > Rb > Cs  | Down the group IE decreases due to increase in size. Be > Mg > Ca > Sr > Ba<br>IE <sub>1</sub> of Alkali metal < IE <sub>1</sub> of Alkaline earth metal<br>IE <sub>2</sub> of Alkali metal > IE <sub>2</sub> of Alkaline earth metal<br>Reason<br>IE <sub>1</sub> of Alkaline earth metal is large due to increased nuclear<br>charge in Alkaline earth metal as compared to Alkali metal<br>but IE <sub>2</sub> of Alkali metal is large because second electron in<br>Alkali metal is to be removed from cation which has<br>already acquired noble gas configuration |
| 5.    | Electropositive<br>character or metallic<br>character | Alkali metals are strongly<br>electropositive and metallic. Down<br>the group electropositive nature<br>increase so metallic nature also<br>increases.<br>i.e. $M \rightarrow M^+ + e^-$<br>Metallic Nature : Electropositive<br>character $\infty 1$ /I.P.<br>Order = Li < Na < K < Rb < Cs.   | Due to low IE they are strong electropositive but not as<br>strong as Alkali metal because of comparatively high IE.<br>The electropositive character increase down the group.<br>Order = Be < Mg < Ca < Sr < Ba   |
| 6.    | Hydration of ions                                     | (i) Hydration represents for the dissolution of a substance in water to get absorb water molecule by weak valency forces Hydration of ions in the process when ions on dissolution in water get hydrated.<br>(ii) Hydration energy $\infty$ charge density on ion<br>Degree of hydration $\infty$ 1/Cation size $\infty$ charge $\infty$ 1/ionic mobility $\infty$ 1/conductivity<br>Hydration energy = Li <sup>+</sup> > Na <sup>+</sup> > K <sup>+</sup><br>> Rb <sup>+</sup> > Cs <sup>+</sup><br>(iii) Li <sup>+</sup> being smallest in size has maximum degree of hydration and that is why lithium salts are mostly hydrated and moves very slowly under the influence of electric field.<br>e.g : LiCl.2H <sub>2</sub> O. | Hydration energy = Be <sup>2+</sup> > Mg <sup>2+</sup> > Ca <sup>2+</sup> > Sr <sup>2+</sup> >Ba <sup>2+</sup>   |
| 7.    | Photoelectric effect                                  | The phenomenon of emission of<br>electrons when electromagnetic<br>rays strikes<br>against them is called photoelectric<br>effect; Alkali metal have low I.P. so<br>show<br>photoelectric effect. Cs and K are<br>used in Photoelectric cells.  | <ul> <li>(i) Their electronegativities are also small but are higher than that of alkali metals</li> <li>(ii) Electronegativity decrease from Be to Ba</li> </ul>  |
| 8.    | Electronegativity                                     | <ul> <li>(i)These metals are highly electopositive and there by possess low values of electro negativities.</li> <li>(ii)Electronegativity of alkali metals decreases down the group.</li> <li>Order = Li &gt; Na &gt; K &gt; Rb &gt; Cs</li> </ul>   |  |

| S.No. | Physical Property                        | Alkali metal   | Alkaline earth metals  |
|-------|--|--|--|
| 1.    | Density                                  | <ul> <li>(i)All are light metals.</li> <li>(ii) Density increase down the group but K is lighter than Na.</li> <li>Order = Li &lt; K &lt; Na &lt; Rb &lt; Cs</li> </ul>  | <ul> <li>(i) Heavier than alkali metals.</li> <li>(ii) Density decrease slightly up to Ca after which it increases.</li> <li>(iii) Density of Mg is greater than Ca.</li> </ul>  |
| 2.    | Hardness<br>Final Action of Sodium metal | <ul> <li>(i) All are silvery white metals.</li> <li>(ii) Light soft, malleable and ductile metals with metallic luster.</li> <li>(iii) Diamagnetic and colour less in form of ions.</li> <li>(iv) These metals are very soft and can be cut with a knife. Lithium is harder than any other alkali metal. The hardness depends upon cohensive energy.</li> <li>Cohensive energy ∞ Force of attraction between atoms.</li> </ul> | Relatively soft but harder than Alkali metals.   |
| 3.    | Melting points/ Boiling<br>points        | <ul> <li>(i) Lattice energy decreases from Li to Cs<br/>and thus Melting points and Boiling<br/>points also decrease from Li to Cs.</li> <li>M.P. = Li &gt; Na &gt; K &gt; Rb &gt; Cs</li> <li>B.P. = Li &gt; Na &gt; K &gt; Rb &gt; Cs</li> </ul>   | They have low Melting points and Boiling points but<br>are higher than corresponding value of group I.<br>Reason<br>They have two valence electrons which may<br>participate in metallic bonding compared with only<br>one electron in Alkali metal. Consequently group II<br>elements are harder and have higher cohesive<br>energy and so, have much higher Melting points /<br>Boiling points than Alkali metal.<br>M.P. = Be > Ca > Sr > Ba > Mg ,B.P. = Be > Ba > Ca<br>> Sr > Mg |
| 4.    | Specific heat                            | It decreases from Li to Cs. Li > Na > K ><br>Rb > Cs (*need not to memorise)   | values are lesser than that of alkali metals, decreases down the group.<br>*need not memorise.   |

| S.No. | Chemical<br>Property        | Alkali metals   | Alkaline earth metals  |
|-------|-----------------------------|---|--|
| 1.    | Action with $O_2$ and $N_2$ | (i) They generally form oxides and peroxides.<br>$M+O_2 \longrightarrow M_2O (Oxide) \xrightarrow{O_2} M_2O_2 (Peroxide)$<br>The alkali metals tarnish in dry air due to the<br>formation of their oxides on their surface.<br>$4M + O_2 \longrightarrow 2M_2O$<br>They react vigorously in oxygen forming following<br>oxides.<br>$4 \text{ Li} + O_2 \longrightarrow 2 \text{ Li}_2O (Monoxide)$<br>$2 \text{ Na} + O_2 \longrightarrow 2 \text{ Li}_2O (Peroxide)$<br>$M + O_2 \longrightarrow MO_2 (Superoxide) where M = K, Rb, Cs$<br>Principal Combustion Product (Minor Product)<br><u>Metal</u> <u>Oxide</u> <u>Peroxide</u> <u>Superoxide</u><br>Li <u>Li_2O (Li_2O_2)</u><br><u>Na (Na_2O) Na_2O_2</u><br><u>K</u> <u>KO_2(Orange/Yellow Crystalline)</u><br><u>Rb</u> <u>Cs</u> <u>Corange/Yellow Crystalline}</u><br>The oxides and peroxides are colourless when pure.<br>(ii) All super oxide are paramagnetic and peroxides are diamagnetic in nature.<br>(iii) The increasing stability of the peroxide or superoxide as the size of the metal ion increases is due to the stabilisation of large anions by larger cations through lattice energy effect.<br>(iv) Since all the alkali metals are highly reactive towards air ; they are kept in kerosene oil. Reactivity increases from Li to Cs.<br>(v) <b>Only Lithium</b> reacts with N <sub>2</sub> (at room temperature) to form ionic lithium nitride Li_3N because Li being strongest reducing agent converts N <sub>2</sub> into N <sup>3-</sup> .<br><b>3Li + 1/2N_2</b> | <ul> <li>(i) Be and Mg are kinetically inert towards oxygen becasue of formation of a film of oxide on their surface. However powdered Be burn brilliantly.</li> <li>2Be + O<sub>2</sub> (air) → 2BeO(amphoteric) ; 3Be + N<sub>2</sub> (air) → Be<sub>3</sub>N<sub>2</sub></li> <li>(ii) Mg is more electropositive and burns with dazzling brilliance in air give MgO and Mg<sub>3</sub>N<sub>2</sub>.</li> <li>Mg + O<sub>2</sub> (air) → MgO ; Mg + N<sub>2</sub>(air) → Mg<sub>3</sub>N<sub>2</sub></li> <li>Peroxides are coloured due to lattice defect.</li> <li>(Similar property with Li because both shows diagonal relation.)</li> <li>(iii) Ba gives BaO<sub>2</sub> not BaO.</li> <li>(iv) Calcium, strontium and barium are readily attacked by air to form the oxide and nitride. They also react water with increasing vigour even in cold to form hydroxides.</li> <li>(v) BeO, MgO are used as refractory, because they have high M.P.</li> <li>(vi) Other metals (Ba or Sr form peroxide)</li> <li>M + O<sub>2</sub> A MO<sub>2</sub></li> </ul> |
| 2.    | Action with                 | (i) Alkali metals decompose water to form the   | (i) Ca , Sr , Ba and Ra decompose cold water readily   |

# CHEMISTRY FOR NEET

# s-Block Elements

| $\frac{1}{10} \text{ Market metals} = \frac{1}{2} \text{ Market metals} =$   | $2M + 2H_0 \longrightarrow 2MOH (q_0) + H_2(q) (M = An akain metal,a fikk in metal,(0) Li decompose water slowly, sodium reacts with watervigorously.(ii) It may be noted that although lithium has mostnegative En value (In below table), its reaction with waterwater is less vigorous that had of sodium within hasand were yight hydration to metal or serve vapourise and so moresurface area is exposed to the water and kineticallyreaction is faster than that of sodium within hasa more surface area is exposed to the water and kineticallyreaction is faster than that of sodium within hasa more surface area is exposed to the water and kineticallyreact with probon donors such asalcohol gaseous ammonia and terminal alkynesevolution of hydrogen.2014 + 2C+4COH$   | 2M + 2H-C<br>alkal metals2MCH (a), + H; (a) (M = An<br>alkal metals).(M + 2H; C<br>- MCH; + H;<br>(i) Lidecompose water slowly, sodium reacts with<br>water quickly K. Bia and C. react with a social<br>in a staticked by water even at high temperatures<br>and the pair to be order that albough bithum has most<br>regative C value (in bobugh table), is recalled to the small size<br>and very high hydration ensomp the alkal metals.<br>This behaviour of thrium is attributed to its small size<br>and very high hydration ensomp the alkal metals.<br>This behaviour of thrium is attributed to its small size<br>and very high hydration ensomp the alkal metals.<br>This behaviour of thrium is attributed to its small size<br>and very high hydration ensomp the alkal metals.<br>This behaviour of thrium is attributed to its small size<br>and very high hydration ensomp the alkal metals.<br>This behaviour of thrium is attributed to its small size<br>and very discuss animonia and the water and internal alkynes<br>evolution.<br>(i) They also react with proton donors such as<br>attributed with the group. Incel very discuss animonia and the group. Incel very discuss and very high discuss animonia and the group. Incel very discuss and the  |    | water    | hydroxides having the formula MOH and dihydrogen.   | with evolution of hydrogen.  |
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| alkali metal).(i) Guocompose water slowly, sodium reacts with<br>water quickly, K, Rb, and Cz react with water<br>vajorously.(ii) Magnesium decomposes builty temperatures<br>as its oxidation potential is lower than the other<br>members(iii) It may be noted that although lithium has most<br>negative E <sup>+</sup> value (In blook table), its reaction with<br>water is less vigorous than that of sodium which has<br>the least negative E <sup>+</sup> value (In blook table), its reaction with<br>water is less vigorous than that of sodium which has<br>the least negative E <sup>+</sup> value (In blook table), its reaction with<br>water is less vigorous than that of sodium which has<br>the negative E <sup>+</sup> value (In blook table), its reaction with<br>water is less vigorous ammonia and terminal alkynes<br>ovolution if hydrogen.<br>20.4 + 20.4 + CH(i) Except Be, all alkaline earth metals form hydrides<br>(MH) on heating directly with H<br>(MH) and H<br>(MH) an   | alkali metal).<br>(i) Li decompose water slowly, sodium reacts with<br>water quickly K, Bb and Ca react with water<br>vigorous), concet that alkhough Hintin has reacts with water<br>explance E* value (in below table), its reaction with<br>water is explanation less<br>in Kinetica, mesade derive year own at high temperatures<br>as its oxidation potential is lower than the other<br>mambers(ii) Magnesium decomposes boiling varies of K, NG, Ca is<br>is service area is exposed to the water and kinetically<br>reaction is faster than lithin. Other metals of the<br>group react explosively with water.(iii) The alkali metals fraction of by organic<br>service dractard decreases from CA and the service of hydrogen.<br>224 + 2CH_COM = H_2.(iii) The alkali metals fraction of hydrogen.<br>(iii) The alkali metals from hydrides with<br>hydride decreases from CA and the mater is by the action of LaNet all thousdo<br>thydride decreases from CA and the service of hydrogen.<br>(iii) The alkali metals fractive group hydrogen.<br>(iiii) The alkali metals fractive group hydrogen.<br>(iiii) The alkali metals fractive group hydrogen.<br>(iii) The alkali metals fractive group hydrogen to<br>in creations fractive try opposite the alter.<br>(iii) The alkali metals fractive group hydrogen to<br>fractions fractive try opposite the alter of the hydrogen to<br>in creations fractive try opposite with hydrogen to<br>fractions fractive try opposite the alter of the hydrogen to<br>in creations fractive try opposite of and creative try opposite of and creative try opposite the alter of<br>the hydrogen to the fraction of the hydrogen to<br>in creatis hydrogen tractive try opposite of and creat   | alkali metal).(i) Magnesium decomposes bairs grave the derivation of the interval of  |    | mator    |   |  |
| water guicklyK, Rb and Ca react with water<br>ingoitously.and Ca react with water<br>in the least although lithium has most<br>measure of value (in bolow table), its reaction with<br>water is less vigorous than that of sodum which has<br>the least negative $\mathbb{P}^{4}$ value (in bolow table), its reaction with<br>water is less vigorous than that of sodum which has<br>and very high hydraton energy. It's explanation lies<br>in Kinetics, released energy in case of K, Rb, Cs is<br>sufface area is exposed to the vater and kinetically<br>orgoup react explosively with water.(ii) The solution of the second to the<br>group react with proton donors such as<br>alcohol metal activate and so more<br>sourface area is exposed to the vater and kinetically<br>orgoup react with proton donors such as<br>alcohol Metal ethoxide(i) Except Be, all alkaline earth metals form hydrides<br>(III) BeH, is propared by the action of LMH, on BeCly.<br>EBCly Hull, $\rightarrow 2EH_{2} + U(-A CL)$<br>BCL + Hull, $\rightarrow 2EH_{2} + U(-A $  | water quickly K, Bb and Cs react with water<br>vigorously.as the outdother is lower than the other<br>meghner E value (in bower that disough lithium has most<br>meghner E value (in bower table), is reaction to<br>water is lass vigorous than that of sodium which has<br>and very high hydration energy. Its explanation les<br>in Kinetics, released energy in case of K. R.C.S is<br>sufficient to melt or even vapourise and so more<br>surface area is exposed to the water and interactivity<br>reaction is faster them lithium. Other metals of the<br>group react explosible with water.(I) Encept Be, all abaline earth metals form. hydrides<br>(III) the water and interactivity is a solution with the<br>solution of hydrogen.<br>$2M + 2Q_2H_CM =2Q_2H_CM + H_2$ 3.(i) They also react with proton donors such as<br>alcohol, gaseous ammonia and terminal adkynes<br>evolution hydrogen.<br>$2M + 2Q_2H_CM =2Q_2H_CM + H_2$ 4.(i) The value in the group, increation is<br>electropositive character decreases from Cs to Li.<br>$2M + H_C =2MH^+$ 3.(ii) The metal hydrides react with water to give MOH<br>and H, (at as reducing agent)<br>$M + H_C =2MH^+$ 4.(iii) The atla hydrides react with water to give MOH<br>and H, (at as reducing agent)<br>$M + H_C =2MH^+$<br>$M + H_C =2MH^+$ 4.(iii) The akali metals react vigorously with halopens to<br>form incic haldes MX:<br>$M + H_C =2MH^+$<br>$M + H$  | water quickly K, Bb ard Cb react with water<br>vigorously.are the content of the second particular is content of potential is lower than the other<br>members(ii) It may be noted that although lithium has most<br>megative EV value (in bower) table, its rescale to the second particular is submitted to its smallaxe<br>and very high hydration energy. Its explanation lies<br>in Kinetics, relassed energy in case of K, RC is is<br>sufficient to melt or even vapourise and so more<br>precision is faster than lithium. Other motios of the<br>generation is faster than lithium. Other motios of the<br>generation is passens amonia and terminal alky rese<br>evolution of hydrogen.<br>$20 \pm 22, H_0OM + H_2$<br>Ethy alcohol Metal altocide<br>$(M+)$ on heating frectly with H.<br>$(M+)$ on heating frectly with H.<br>$(M+)$ on heating frectly with H.<br>$(M+)$ on heating directly with H.<br>$(M+)$ on h   |    |          | alkali metal).  | (ii) Magnesium decomposes boiling water but beryllium                                      |
| $\frac{\operatorname{vigrously.}}{\operatorname{vigrously.}} = \frac{\operatorname{vigrously.}}{\operatorname{vigrously.}} = \operatorname{$   | $ \begin{array}{ c c c } \hline \begin{tabular}{l c c c } \hline \begin{tabular}{l c c c } \hline \hline \begin{tabular}{l c c } \hline \hline \begin{tabular}{l c c } \hline \begin{tabular}{l c c } \hline \begin{tabular}{l c c } \hline \begin{tabular}{l c c c } \hline \hline \begin{tabular}{l c c } \hline tab$   | $\frac{    }{    }                           $  |    |          |   |  |
| negative $E^{in}$ value (in below table), its reaction with<br>water is less vigoous than that of solution which<br>has the least negative $E^{in}$ value among the alkali metals.<br>This behaviour of ithium is attributed to its small size<br>and very high hydration energy in case of K, Rb, Cs is<br>sufficient to met or even vapourise and so more<br>surface area is exposed to the water and kinetically<br>reaction is faster than lithium. Other metals of the<br>group react explosively with water.(iv) They also react with proton denors such as<br>alcohol, gaseous armonis and terminal alkynes<br>evolution of typoden.<br>$2M + 2C_{1}+R_{2}OH \longrightarrow 2C_{2}+R_{2}OM + H_{2}$<br>Ethyl alcohol Metal athoxide(i) Except Be, all alkaline earth metals form hydrides<br>(MH-) on heating directly with H.<br>(MH-) on heating directly with H.<br>$MH + H_{2} \longrightarrow 2M + H_{2$   | Image: Provide Constraints<br>water is the surgeous that hat of solution with the<br>set is surgeous that that of solution with the<br>set is surgeous that and solution with the<br>set is adjusted to the water and kinetically<br>reaction is faster than thillion. Other metals of the<br>group react explosively with water.The behavior of filtium constraints of the<br>group react explosively with water.The behavior of filtium constraints of the<br>group react explosively with water.The behavior of hydrogen.The behavior of hydrogen.201Ya CH-(OH — 2 CH-(OM + H)<br>Ethyl acohd Metal ethoxide3.(i) They also react with proton donors such as<br>electropositive character discusses from Cs to Li.<br>201 + H, acohd Metal ethoxide3.(i) The value character discusses from Cs to Li.<br>201 + H, acohd Metal ethoxide4.(i) The value react with proton donors such as<br>electropositive character discusses from Cs to Li.<br>201 + H, acohd Metal ethoxide4.(i) The value fracter discusses from Cs to Li.<br>201 + H, $\rightarrow 200$ + H<br>(ii) The metal hydrides tracter structure have high<br>in the care structure green in<br>MH + H;O $\longrightarrow MOH$ + H;4.(ii) The alkali metals fract vigorously with halogens to<br>in creates from Cs (C). So due to increase<br>in creates from Cs (C). So due to increase<br>in the reactive to increase in<br>certerity towards F;<br>Li > Na K > Rb > Cs<br>(iii) (I) Healkali metals halides (C). Be, h, lo formation is<br>electropositive character.<br>(iii) (I) Halides having tonic capability of Unition tonic<br>(iii) (I) Halides having tonic capability of Unition tonic<br>in crease from Cs (C) cs due to increase in<br>electropositive character.<br>(iii) (I) Halides having tonic capability of Unition tonic<br>increase from Cs (C) cs due to increase<br>in the high poi  | aImage and the first of the set of the s  |    |          | vigorously.   |  |
| water is less vigorous than that of sodium which has<br>the least negative $\mathbb{P}^{int}$ value among the alkali metals.<br>This behaviour of lithium is attributed to its small size<br>and very high hydration energy. It's explanation lies<br>is sufficient to mel or even vapourise and so more<br>surface area is exposed to the water and kinetically<br>reaction is faster than lithium. Other metals of the<br>group react explosively with water. $\mathbb{P}^{int}$ $\mathbb{P}^{int}$ $\mathbb{P}^{int}$ $\mathbb{P}^{int}$ $\mathbb{P}^{int}$ $(w)$ They also react with proton donors such as<br>alcohol, gaseous ammonia and terminal alkynes<br>evolution of hydrogen.<br>$\mathbb{P}^{int}$ $\mathbb{P}^{int}$ $\mathbb{P}^{int}$ $(w)$ They react with $\mathbb{P}_{1}$ formula MH wich are of ionic nature.<br>torm the relath hydrides mode to the stability of hydrides decreases from Be to Ra.<br>$\mathbb{P}^{int}$ (i) They react with $\mathbb{P}_{2}$ 3.(i) (They react with $\mathbb{P}_{2}$ $\mathbb{P}^{int} \mathbb{P}^{int}$ (ii) BeH_1 is prepared by the action of LiAHL, on BeCl_2.<br>$\mathbb{P}^{int} \mathbb{P}^{int} \mathbb$   | water is less vigoous than that of sodium which has<br>the least negative E <sup>*</sup> value among the alkali metals.<br>This behaviour of lithium is attributed to its small size<br>and vary high hydration energy. Its sognation lies<br>in this water.Image: the intermediation of the value and the alkaline table of the value and the source and the value and the value and the source and the value and the source and the value and the source and the value and   | where is less vigorous than that of sodium which has<br>the less trengive E <sup>4</sup> value among the alkali metals.<br>This behaviour of liftium is attributed to its small size<br>and very high hydridice among the alkaline integration.<br>Its and the series is exposed to the water and its initiation.<br>The metal hydridice with water.Image: Second  |    |          |   |  |
| the least negative E <sup>n</sup> value among the alkali metals.<br>This behaviour of thim is attributed to its small size<br>and very high hydration energy in case of K, Rb, Cs is<br>sufficient to melt or even vapourise and so more<br>surface area is exposed to the water and kinetically<br>reaction is faster than lithium. Other metals of the<br>group react explosively with water.Image: the intermed to the water and kinetically<br>reaction is faster than lithium. Other metals of the<br>group react explosively with water.Image: the intermed to the water and kinetically<br>react explosively with water.Image: the intermed to the water and iterminal alkynes<br>evolution of hydrogen.<br>20 + 2C+H_OH $\longrightarrow 2C_{2}H_OM + H_2$<br>Ethyl alcohol Metal ethoxideImage: the interminal alkynes<br>evolution of hydrogen.<br>20 + 2C_{2}H_OM + H_2<br>Ethyl alcohol Metal ethoxideImage: the interminal interminal alkynes<br>evolution of hydrogen.<br>20 + 2C_{2}H_OH $\longrightarrow 2C_{2}H_{2}OM + H_2$<br>Ethyl alcohol Metal ethoxideImage: the interminal alkynes<br>evolution of hydrogen.<br>20 + 2C_{2}H_OM + H_2<br>Ethyl alcohol Metal ethoxideImage: the interminal interminal alkynes<br>evolution of hydrogen.<br>20 + 42 + 2C_{2}H_OH $\longrightarrow 2C_{2}H_{2}OM + H_2$<br>$2M + 42 - 2M > C = MOH + H_2$ Image: the interminal alkynes<br>evolution the interminal alkynes<br>evolution and interminal alkynes<br>evolution and interminal alkynes<br>evolution incluster KY $\sim$<br>$2M + 42 - 4M > C \rightarrow MOH + H_2$ Image: the interminal alkynes<br>evolution healing KY $\sim$<br>$2M + 42 - 2M > C = $   | In the least negative E <sup>N</sup> value among the alkali metals.<br>This behaviour of thium is attributed to its small size<br>and very high hydration energy. It's explanation lies<br>is sufficient to metric or even vapouses and so more<br>reaction is faster than thitm. Other metals of the<br>group react explosively with water.Image: Image:   | In the least negative $\mathbb{C}^{*}$ value among the alkali metals.<br>This behaviour of lithuin is attributed to its small size<br>and very high hydration energy. It's explanation lies<br>is sufficient to met or even vapouses and so more<br>transaction is factor than lithuin. Other metals of the<br>group react explosively with water. $\mathbb{T}^{*}$ $\mathbb{T}^{*}$ $\mathbb{T}^{*}$ $\mathbb{R}^{*}$ $\mathbb{R}^{*}$ $\mathbb{R}^{*}$ $\mathbb{T}^{*}$ $\mathbb{T}^{*}$ $\mathbb{R}^{*}$ $\mathbb{R}^{$   |    |          |   |  |
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| (i) They also react with proton donors such as<br>alcohol, gaseous armonia and terminal alkynes<br>evolution of hydrogen.<br>$2M + 2\zeta_{14}OH = -2\zeta_{14}OM + H_{2}$<br>Ethyl alcohol Metal ethoxide(i) Except Be, all alkaline earth metals form hydrides<br>(MH_2) on heating directly with H_2.<br>(ii) The yreact with H_2 forming metal hydride with<br>formula MH which are of ionic nature. Stability of<br>hydride decreases down the group. since the<br>electorpositive character decreases from Cs to Li.<br>$2M + H_2 \longrightarrow 2M^{2}H^{\circ}$<br>(iii) The metal hydrides react with water to give MOH<br>and H_2. (act as reducing agent).<br>$MH + H_2O \longrightarrow MOH + H_2$ (i) Except Be, all alkaline earth metals form hydrides<br>(MH_2) on heating directly with H_2.<br>(ii) The metal hydrides react with water to give MOH<br>and H_2. (act as reducing agent).<br>$MH + H_2O \longrightarrow MOH + H_2$ (i) Except Be, all alkaline earth metals form hydrides<br>(MH_2) on heating directly with H_2.<br>(ii) The metal hydrides react with water to give MOH<br>and H_2. (act as reducing agent).<br>$MH + H_2O \longrightarrow MOH + H_2$ 4.(i) The alkali metals react vigorously with halogens to<br>form ionic halides M'X_2<br>$2M + X_2 \longrightarrow 2M'X^{\circ}$<br>(ii) Alkali metals halides (Cl <sub>2</sub> , Br <sub>2</sub> , l <sub>2</sub> ) formation is<br>increases form Li to Cs due to increase in<br>electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > CS<br>(iii) LiX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules).<br>(iv) Halides having ionic nature have high metting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(v) Halides of potassium, rubidum and ceasium<br>have property of combining with extra haloge<br>atoms forming polyhalides.<br>$KI + l_2 \longrightarrow Kl_5$ Be(H_2O)_1/Cl_2 heat<br>(ii) Except for beryllium halides, all other halides of<br>alkaline earth metals are io  | 4.<br>(i) The aikali metals react vigorously with halogers to form inoic halides MX:<br>(ii) The aikali metals react vigorously with halogers to form inoic halides MX:<br>(iii) The aikali metals react vigorously with halogers to form a chloro-<br>(iii) The aikali metals react vigorously with halogers to form a chloro-<br>(iii) The aikali metals react vigorously with halogers to form a chloro-<br>(iii) The aikali metals react vigorously with halogers to form a chloro-<br>(iii) The aikali metals react vigorously with halogers to form a chloro-<br>(iii) The aikali metals react vigorously with halogers to form a chloro-<br>(iii) The aikali metals react vigorously with halogers to form a chloro-<br>(iii) The aikali metals react vigorously with halogers to form a chloro-<br>(iii) The aikali metals react vigorously with halogers to form a chloro-<br>(iii) The aikali metals react vigorously with halogers to form a chloro-<br>(iii) The aikali metals react vigorously with halogers to form a chloro-<br>(iii) The aikali metals react vigorously with halogers to form a chloro-<br>(iii) The aikali metals fract vigorously with halogers to form a chloro-<br>(iii) The aikali metals fract vigorously with halogers to form a chloro-<br>(iii) The aikali metals fract vigorously with halogers to form a chloro-<br>(iii) The aikali metals fract vigorously with halogers to form a chloro-<br>(iii) The aikali metals fract vigorously with halogers to form a chloro-<br>(iii) The aikali metals fract vigorously with halogers to form a chloro-<br>(iii) The aikali metals fract vigorously with halogers to form a chloro-<br>(iii) The aikali metals fract vigorously with halogers to form a chloro-<br>(iii) The aikali metals fract vigorously with a thalogers to form a chloro-<br>(iii) The aikali metals react vigorously with extra haloger (for form) the vigor form a chloro-<br>(iii) The aikali metals react vigorously with extra haloger (for form) the vigor form a chloro to form a chloro-<br>(iii) The aikali so to a chaloger (for form) and form a chloro-<br>(iii) The aikali metals react vigorously with e  | $ \begin{array}{c c c c c c c c c c c c c c c c c c c $   |    |          | Standard  |  |
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| alcohol, gaseous ammonia and terminal alkynes<br>evolution of hydrogen.<br>$2M + 2C_2H_0OH \longrightarrow 2C_2H_5OM + H_2$<br>Ethyl alcohol Metal ethoxide3.(i) They react with $H_2$ forming metal hydride with<br>formula MH which are of ionic nature. Stability of<br>hydride decreases down the group. since<br>electropositive character decreases from Cs to Li.<br>$2M + H_2 \longrightarrow 2M^{H}P^{0}$<br>(iii) The metal hydrides react with water to give MOH<br>and $H_2$ (act as reducing agent)<br>$MH + H_2O \longrightarrow MOH + H_2$ (i) Except Be, all alkaline earth metals are dut on of LiAH_4, on BeCl_2.<br>BeCl_2 + LiAH_4, $\longrightarrow 2BeH_2 + LiCl + AlCl_3$<br>BeH_2 & MgH_2 is covalent and polymeric but other are<br>incic.4.(i) The alkali metals react vigorously with halogens to<br>increases form Li to CS due to increase in<br>electropositive character.<br>Order of reactivity towards $F_2$<br>Li > Na × K > Rb > CS<br>(ii) LX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules).<br>(iv) Halides having ionic nature have high metiting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(iv) Halides having ionic nature have high metiting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(iv) Halides having ionic nature have high metiting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(iv) Halides of potassium, rubidium and ceasium<br>have property of combining with extra halogen<br>atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ (i) Except Be, all alkaline earth metals are conton in attrue. Beryllium<br>halides are essentially covalent and soluble in organic<br>solverts. Beryllium chloride has a chain structure in the<br>solid is tate as shown below:<br>$CI_1$ and the property of combining with extra halogen<br>at matels are c  | alcohol, gaseous ammonia and terminal alkynes<br>evolution of hydrogen.<br>$2M + 2C_3H_0OH \longrightarrow 2C_2H_4OH + H_2$<br>Ethyl alcohol Metal ethoxide(i) Except Be, all alkaline earth metals form hydrides<br>(MH_3) on heating directly with H_2.<br>(ii) They react with H_2 forming metal hydride with<br>tormula MH which are of ionic nature. Stability of<br>hydride decreases form Cs to Li.<br>$2M + H_2 \longrightarrow 2M^{H+p}$<br>(iii) The metal hydrides react with water to give MOH<br>and H_2. (act as reducing agent)<br>MH + H_2O $\longrightarrow$ MOH + H_2(i) Except Be, all alkaline earth metals form hydrides<br>(iii) Beh_1 is prepared by the action of LiAH_4 on BeCl2.<br>BeCl2 +LiAH_4 $\longrightarrow$ 22M+LOC<br>BeH_4 Big CH_4 LiAH_5 and<br>BeCl2 +LiAH_4 $\longrightarrow$ 22M+LOC<br>in (i) Beh_2 (act as reducing agent)<br>MH + H_2O $\longrightarrow$ MOH + H_24.(i) The alkali metals react vigorously with halogens to<br>increases form Li to Cs due to increase i<br>electropositive character f.<br>(ii) Alkali metals halides (Cls, Br, Is) formation is<br>increases form Li to Cs due to increase i<br>electropositive character f.<br>Cor for reactivity towards F_2<br>Li > Na > K > Rb > Cs<br>(iii) LX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajari srules)).<br>(ii) Halides of conductor of current in fused<br>state. These are readily soluble in water.<br>(iii) Except for beryllium halides, all other halides of<br>alked are good conductor of current in fused<br>state. These are readily soluble in water.<br>(iii) Except for beryllium chinde has a chain structure in the<br>solid state as shown below:<br>$CI=BeCl$<br>$CI = Be (Cl, Cl, Cl, Cl) = Berl (Cl, Cl, Cl) = ClCl = Berl (Cl, Cl, Cl) = Berl (Cl, Cl) (Cl) (Cl) (Cl) (Cl) (Cl) (Cl) (Cl) $   | alcohol, gaseous ammonia and terminal alkynes<br>evolution of hydrogen.<br>$2M + 2C_1H_0OH \longrightarrow 2C_1H_0OH + H_2$<br>Ethyd alcohol Metal at hoxide(i) Except Be, all alkaline earth metals form. hydrides<br>$(M+_2)$ on heating directly with $H_5$ .<br>$(M+_2)$ on heating the directly of LiAlH_4 on 22BH_2 + LiCl + ALO1.<br>$BH_2$ & MBH_1 is covalent and polymeric but other are<br>ionic.<br>$BH_2$ & MBH_1 is covalent and polymeric but other are<br>ionic.<br>$BH_2$ & MBH_1 is covalent and polymeric but other are<br>ionic haldes MX.<br>$(M+_2)$ Def $M_1$ and the directly combine with<br>haldges no heating to give metal halides MX.<br>$(M+_3)$ Alkali metals react vigorously with halogens to<br>increases form Li to Cs due to increase in<br>electropositive character.<br>$(M+_3)$ As $K > D > Cs$ .<br>$(M+_3)$ As $K > D > $   |    |          |   |  |
| evolution of hydrogen.<br>$2M + 2C_2H_5OH \longrightarrow 2C_2H_5OM + H_2Ethyl alcohol(i) Except Be, all alkaline earth metals form hydrides(MH_2) on heating directly with H_2.3.(i) They react with H_2 forming metal hydride withtormula MH which are of ionic nature. Stability ofhydride decreases down the group. since theelectropositive character decreases from Cs to Li.2M + H_2 \longrightarrow 2M^{HP}(iii) The metal hydrides react with water to give MOHand H_2. (act as reducing agent)MH + H_2O \longrightarrow MOH + H_2(i) Except Be, all alkaline earth metals form hydrides(iii) The stability of hydrides decreases from Be to Ra.(iii) The stability of hydrides decreases from Be to Ra.(iii) The stability of hydrides decreases from Be to Ra.(iii) The stability of hydrides decreases from Be to Ra.(iii) The stability of hydrides decreases from Be to Ra.(iii) The stability of hydrides decreases from Be to Ra.(iii) The stability of hydrides decreases from Be to Ra.(iii) The stability of hydrides decreases from Be to Ra.(iii) The stability of hydrides decreases from Be to Ra.(iii) The stability of hydrides decreases from Be to Ra.(iii) The stability of hydrides decreases from Be to Ra.(iii) The alkali metals reducing agent)MH + H_2O \longrightarrow MOH + H_24.(i) The alkali metals react vigorously with halogens toform ionic halides M*X^:2M + X_2 \longrightarrow 2M^*X^*(ii) Alkali metals halides (Cl_2, Br, l_2) formation isincreases form Li to C S due to increase ielectropositive character.Order of reactivity towards F_2Li > Na x (x Pb > CB(iii) LiX have more covalent character (It is becauseof the high polarisation capability of Lithium ion(fajan's rules)).(iii) Hialdes having ionic nature have high mettingpoint and are good conductor of current in fusedstate. These are readity soluble in water.(iii) Except for beryli$  | evolution of hydrogen.<br>$2M + 2C_1+Ch - 2C_1+LOM + H_2$<br>Ethyl alcohol Metal ethoxide(i) Except Be, all alkaline earth metals form hydrides<br>(M+4) on heating directly with H_2.<br>(M+4) on heating directly with H_2.<br>(B+4) is prepared by the action of LMH4 on BeCl_2.<br>BeCl_2+LiAlH $\rightarrow$ 2BeH_3 + LICH AICl_3.<br>BeCl_2+LiAlH $\rightarrow$ 2BeH_3 + LICH AICl_3.<br>BeH_4 is prepared by the action of LMH4 on BeCl_2.<br>BeH_4 is prepared by the action of LMH4 on BeCl_3.<br>H_4 is prepared by the action of LMH4 on BeCl_3.<br>BeH_4 is prepared by the action of LMH4 on BeCl_3.<br>BeH_4 is prepared by the action of LMH4 on BeCl_3.<br>BeH_4 & MgH_2 is covalent and polymeric but other are<br>ionic.<br>2M + X_2 $\rightarrow 2$ MrX-<br>(ii) Alkali metals neater vigorously with halogens to<br>increases form L to CS due to increase i<br>electropositive character.<br>COrder of reactivity lowards F_2<br>Li > Na > K > R> CS<br>(iii) The alkaline that alta form the oxide.<br>BeCl_2 + CO<br>Anhydrous beryllum halde can not be obtained from<br>materials made: and from the oxide.<br>BeCl_2 + CO<br>Anhydrous beryllum halde can not be obtained from<br>materials made: in aqueous solution because the<br>hydrate in aqueous phase B  | evolution of hydrogen.<br>$2M + 2C_2H_0OH = h_2$<br>$Ethyl alcoholMetal ethoxide3.(i) They react with H_1 forming metal hydride withhydride decreases down the group, since theelectropositive character decreases from Cs to Li2M + H_2 \longrightarrow 2M^+H^-(iii) The metal hydrides react with water to give MOHand H_2 (act as reducing agent)(i) Except Be, all alkaline earth metals form hydrides(BHL_2) on heating directly with H_3.(iii) The metal hydrides react with water to give MOHand H_2 (act as reducing agent)(ii) The value data of LiAH_4 on BeCl_2.BeCl_4 + LiCH_AOL_5BeCl_4 + LiCH_AOL_5BeCl_4 + LiCH_AOL_5BeCl_4 + LiCH_AOL_5BeCl_4 + LiCH_AOL_6Core of reactivity towards F_2Li > NA > K > RO > MOH + H_24.(i) The alkalit metals react vigorously with halogens toincreases form Li to Cs due to increase inelectropositive character.Order of reactivity towards F_2Li > Na > K > RO > CS(iii) LX have more covalent character (It is becauseof the high polarisation capability of Lithiumpoint and are good conductor of current in fusedstate. These are readily soluble in water.(iii) Halides of conductor of current in fusedstate. These are readily soluble in water.(iii) Halides of conductor of current in fusedstate. These are readily soluble in water.(iii) Except for berylium halides and soluble in organicsolvents Berylium chiorde has a chain structure in thesolid state as a low below:CL=BeClHalidesKI + I_2 — KI_3$   |    |          | (iv) They also react with proton donors such as   |  |
| $2M + 2C_2H_5OH \longrightarrow 2C_2H_5OM + H_2$<br>Ethyl alcohol Metal ethoxide3.(i)They react with H_5 forming metal hydride with<br>forming metal hydride with<br>forming metal hydride set of ionic nature. Stability of<br>hydride decreases from Cs to Li.<br>$2M + H_2 \longrightarrow 2M^{+H^{\circ}}$<br>(iii)The metal hydrides react with water to give MOH<br>and H_2. (act as reducing agent)<br>$MH + H_2O \longrightarrow MOH + H_2$ (i) Except Be, all alkaline earth metals form hydrides<br>(Hi)The stability of hydrides decreases from Be to Ra.<br>(iii)BeH_2 is prepared by the action of LiAH_4 on BeCl_2.<br>BeCl_2 +LiAH_4 $\longrightarrow 2BeH_2 + LiCl + AICl_5$<br>BeH_2 & MgH_2 is covalent and polymeric but other are<br>ionic.4.(i)The alkali metals react vigorously with halogens to<br>form ionic halides M'X .<br>$2M + X_2 \longrightarrow 2M'X'$<br>(ii) Alkali metals halides Cl_2. Br_2, l_2 formation is<br>increases form Li to Cs due to increase in<br>electropositive character.<br>Order of reactivity towards F_2<br>Li > Na > K > Rb > Cs<br>(iii) LX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv) Halides having jonic nature have high meting<br>point and are good conductor of current in fused<br>state. These are readity soluble in water.<br>(v) Halides having jonic nature have high meting<br>point and are good conductor of current in fused<br>state. These are readity soluble in water.<br>(v) Halides of potassium, rubidium and ceasium<br>have property of combining with extra halogen<br>atoms forming polyhalides.<br>$KI + I_2 \longrightarrow Kl_3$ (I) Except for berylium halides, all other halides of<br>hydride berylium halides as shown below:<br>CI-Be-CI<br>$CIL_{2}$  | $\frac{2M + 2C_{2}H_{2}OH + H_{2}}{\text{Ethyl alcohol} Metal ethoxide}}$ 3.<br>(i) They react with H_{2} forming metal hydride with tormula MH which are of ionic nature. Stability of hydrides decreases from Be to Ra. (ii) Beth_{2} is prepared by the action of LiAH_{4} on BeCl_{2}. BeCl_{2} + LiAH_{4} - D = 2M^{R+P} (iii) The metal hydrides react with water to give MOH and H_{2} (act as reducing agent) MH + H_{2} D $\rightarrow$ MOH + H_{2}<br>(iii) The metal hydrides react vigorously with halogens to form ionic haldes MX_{2}. 2M + H_{2} $\rightarrow$ 2M + H_{2} $\rightarrow$ MOH + H_{2}<br>(iv) The alkali metals react vigorously with halogens to form ionic haldes MX_{2}. 2M + X_{2} $\rightarrow$ 2M × (iii) The metal halides (Cl <sub>2</sub> , Br <sub>2</sub> , b) formation is increases form Li to Cs due to increase i electropositive character. Order of reachivity lowards F_{2}. Li > Na > K > Rb > Cs (iii) Li X have more covalent character (It is because of the high polarisation capability of Lithium ion (fajan s rules)). (iv) Halides of conductor of current in fused state. These are readily soluble in water. (iv) Halides of combining with exita halogens. KI + L_{2} $\rightarrow$ KI <sub>3</sub>   | $\frac{2M + 2C_{1}^{+}QOH + H_{2}}{Ethyl alcohol Metal ethoxide}$ 3.<br>(i) They react with H_{2} forming metal hydride with formula MH which are of ionic nature. Stability of hydrides decreases form Be to Ra. (ii) BeH_{2} is prepared by the action of LiAH_{4} on BeCl_{2}. BeCl_{3} + LiAH_{4} - 32M^{+}H^{-} (iii) The metal hydrides react with water to give MOH and H_{2} (act as reducing agent)<br>(iii) The metal hydrides react with water to give MOH and H_{2} (act as reducing agent)<br>(iii) The metal hydrides react with water to give MOH and H_{2} (act as reducing agent)<br>(iii) The metal hydrides react with water to give MOH and H_{2} (act as reducing agent)<br>(iv) The alkali metals react vigorously with halogens to form ionic haldes MX_2<br>(iv) The alkali metals naides (Cl_{2}, Br_{2}, b) formation is increases form Li to Cs due to increase i electropositive character.<br>Order of reactivity towards F_2<br>Li > Na > K > Rb > Cs<br>(iii) Li Na we more covalent character (It is because of the high polarisation capability of Lithium ion (reases form Li to Cs due to increase i na quecus solution because the hydride ions [Be(H_{2}O)]/2 is formed to ingle metals are ionic in fature areadity soluble in water.<br>(iv) Halides of occusium, rubidim and casaium in fue as a consist form indices, and occusient form the assist are ionic in nature. Beryllium halides and to the builde in organic solution because the hydride is eas shown below.<br>(iv) Halides of construction capasiting All + L_2 → Kl_3<br>Halides<br>Halides<br>Halides  |    |          | alcohol, gaseous ammonia and terminal alkynes   |  |
| <ul> <li>3.</li> <li>3.</li> <li>(i) They react with H₂ forming metal hydride with formius MH which are of ionic nature. Stability of hydride decreases from Be to Ra. (MH₂) on heating directly with H₂. (MH₂) on heating directly with M₂. (MH₂) on heating direct</li></ul>  | Image: Second state in the se  | Ethyl alcohol3.(i) They react with H2, forming metal hydride with<br>hydride decreases from Cs to Li.<br>$2M + H_2 \rightarrow 2M^{4}H^{2}$<br>(iii) The metal hydrides react with water to give MOH<br>and H2, (act as reducing agent)(i) Except Be, all alkaline earth metals form hydrides<br>BeCl_++LiCH_Lit  |    |          |   |  |
| 4.(i)The alkali metals react vigorously with halogens of<br>form incir haldes having one covalent character (It is because<br>increases form Li to Cs due to increase<br>of the high polarisation capability of Lithium ion<br>(fijan's rules)).(ii)The alkali metals halides<br>(Cl_2, Br_2, I_2) formation is<br>increases form Li to Cs due to increase<br>of the high polarisation capability of Lithium ion<br>(fijan's rules)).(iii) The metal hydrides can not be obtained from<br>halides for the high polarisation capability of Lithium ion<br>(fijan's rules)).(iii) The alkali metals react vigorously with halogens to<br>form onic halides MX-<br>2M + X_2   | $ \begin{array}{c c c c c c c c c c c c c c c c c c c $  | $ \begin{array}{c} \text{formula} MH \ \text{which are of ionic nature.} Stability of M(H_{2}) on heating directly with H_{2}, \ \text{MH}_{2}) \ \text{manual} directly with H_{2}, \ \text{MH}_{2} \ \text{manual} directly with H_{2}, \ \text{manual} directly with directly with H_{2}, \ \text{manual} direct$  |    |          |   |  |
| hydride decreases down the group, since the<br>electropositive character decreases from Cs to Li.<br>$2M + H_2 \longrightarrow 2M^{H/P}$<br>(iii) The metal hydrides react with water to give MOH<br>and H <sub>2</sub> . (act as reducing agent)<br>$MH + H_2O \longrightarrow MOH + H_2$ (iii) The stability of hydrides decreases from Be to Ra.<br>(iii) BeH, is prepared by the action of LiAH4, on BeCl2.<br>BeCl2 + LiAH4, $\longrightarrow 2BeH_2 + LiCl + AlCl3$<br>BeH, & MgH2 is covalent and polymeric but other are<br>ionic.4.(i) The alkali metals react vigorously with halogens to<br>form ionic halides M*X<br>$2M + X_2 \longrightarrow 2 M^*X^-$<br>(ii) Alkali metals halides (Cl2, Br2, 12) formation is<br>increases form Li to Cs due to increase in<br>electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > CS<br>(iii) Li X have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv) Halides having ionic nature have high melting<br>point and are good conductor of current in fuset<br>state. These are readily soluble in water.<br>(v) Halides having polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ Ne HalidesHalidesHalidesKI + I2KI + I2KI + I2KI + I2KI + I2KI + I2KI3   | Hydridehydride decreases drown the group, since the<br>electropositive character decreases from Cs to Li.<br>$2M + H_2 \longrightarrow 2M^{3}H^{3}$<br>(iii) The metal hydrides react with water to give MOH<br>and H <sub>2</sub> . (act as reducing agent)<br>$MH + H_2O \longrightarrow MOH + H_2$ (iii) The metal hydrides react with water to give MOH<br>and H <sub>2</sub> . (act as reducing agent)<br>$MH + H_2O \longrightarrow MOH + H_2$ (iii) The metal hydrides react with water to give MOH<br>and H <sub>2</sub> . (act as reducing agent)<br>$MH + H_2O \longrightarrow MOH + H_2$ (iii) The metal hydrides react with water to give MOH<br>and H <sub>2</sub> . (act as reducing agent)<br>$MH + H_2O \longrightarrow MOH + H_2$ (iii) The metal hydrides of Ca, Sr, Ba liberate H <sub>2</sub> at<br>anode and metal at cathode.4.(i) The alkali metals react vigorously with halogens to<br>form ionic halides MX <sup>2</sup> .<br>$2M + X_2 \longrightarrow 2 M^{1}X^{2}$<br>(iii) Alkali metals halides (CL, Br2, L_2) formation is<br>increases form Li to Cs due to increase in<br>electropositive character.<br>Order of reactivity towards F <sub>2</sub><br>Li > Na > K > Rb > Cs<br>(iii) LiX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajans rules)).<br>(iv) Halides having jonic nature have high meting<br>polari and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(V) Halides of potassium, rubidium and ceasium<br>have property of combining with extra halogen<br>atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ BeO - Cl - Be - Cl<br>Cl - Be - Cl - Be - C   | hydride decreases down the group. since the<br>electropositive character decreases from Cs to Li<br>2M + H2 → 2M <sup>2</sup> H <sup>40</sup><br>(iii) The metal hydrides react with water to give MOH<br>and H2, (act as reducing agent)<br>MH + H2O → MOH + H2(iii) The stability of hydrides decreases from Be to Ra.<br>(iii) BeH2 is prepared by the careases from Be Cl2.<br>BeCl2 + LIAIH→ 2BeH3 + LICI+ AICl3<br>BeH2 is covalent and polymeric but other are<br>ionc.4.(i) The alkali metals react vigorously with halogens to<br>form ionic halides M*X:<br>2M + X2 → 2 M*X^-<br>(iii) Alkali metals halides Cl2. BF2, bJ formation is<br>increases form Li to Cs due to increase in<br>electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > Cs<br>(iii) LIX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(rajan's rules)).<br>(iv) Halides for polarisation capability of Lithium ion<br>have property of combining with extra halogen<br>atoms forming polyhalides.<br>KI + I2 → KI3He composition of (NH4); BeF4 is the best<br>route for the preparation of BeF2, and BeC12 is<br>conveniently made from the coxide.<br>BeO + C + Cl<br>= declydation, hydridyosis takes place.<br>(iv) Halides faving ionic nature have high meting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(v) Halides of polassium, rubidium and ceasium<br>have property of combining with extra halogen<br>atoms forming polyhalides.<br>KI + I2 → KI3Heat<br>BeC - Cl → BeC - Cl<br>Cl → BeC - Cl → Be - Cl<br>   | 3. |          | () · ·  |  |
| 4.(i) The alkali metals react vigorously with halogens to<br>form ionic halides MX:<br>$2M + H_2 \longrightarrow 2M^{\oplus}H^{\oplus}$<br>and H <sub>2</sub> . (act as reducing agent)<br>$MH + H_2O \longrightarrow MOH + H_2$ (ii) BeH <sub>2</sub> is prepared by the action of LiAlH <sub>4</sub> on BeCl <sub>2</sub> .<br>BeCl <sub>2</sub> + LiAlH <sub>4</sub> $\longrightarrow 2BeH_2 + LiCl + AlCl_3$<br>BeH <sub>2</sub> & MgH <sub>2</sub> is covalent and polymeric but other are<br>ionic.4.(i) The alkali metals react vigorously with halogens to<br>form ionic halides MX:<br>$2M + X_2 \longrightarrow 2M^{+}X^{-}$<br>(ii) Alkali metals halides (Cl <sub>2</sub> , Br <sub>2</sub> , l <sub>2</sub> ) formation is<br>increases form Li to Cs due to increase<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).(i) The alkali metals react vigorously with halogens to<br>form onic halides MX:<br>$2M + X_2 \longrightarrow 2M^{+}X^{-}$<br>(iii) Alkali metals halides (Cl <sub>2</sub> , Br <sub>2</sub> , l <sub>2</sub> ) formation is<br>increases form Li to Cs due to increase<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).(ii) The alkaline earth metals directly combine with<br>halogens on heating to give metal halides MX <sub>2</sub><br>(X=F_Cl,Br.I)HalidesHalidesKI + l <sub>2</sub> $\longrightarrow Kl_3$ BeO + C + Cl $\frac{602401K}{2000000000000000000000000000000000000$  | Hydrideselectropositive character decreases from Cs to Li.<br>$2M + H_2 \longrightarrow 2M^{0}H^{0}$<br>(iii) The metal hydrides react with water to give MOH<br>and H <sub>2</sub> . (act as reducing agent)<br>$MH + H_2O \longrightarrow MOH + H_2$ (iii) BeH_2 is prepared by the action of LIAIH_4 on BeCl_2.<br>$BeCl_2 + LIAH_4 \longrightarrow 2BeH_2 + LICI + AICl_3$<br>$BeH_2$ & MgH_3 is covalent and polymeric but other are<br>ionic.<br>$MH + H_2O \longrightarrow MOH + H_2$ 4.(i)The alkali metals react vigorously with halogens to<br>form ionic halides M*X :<br>$2M + X_2 \longrightarrow 2M^{*X}$<br>(ii) Alkali metals halides (Cl_2, Br_2, I_3) formation is<br>increases form Li to CS due to increase in<br>electropositive character.<br>Order of reactivity towards F_2<br>LI > Na > K > Rb > CS<br>(iii) LiX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv) Halides having ionic nature have high metting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(V) Halides of potasistum, rubidium and ceasium<br>have property of combining with extra halogen<br>atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ (ii) Except The Pale $CI$ and $CI$ an   | 4.(i) The alkali metals react vigorously with water to give MOH and H <sub>2</sub> . (act as reducing agent)<br>MH + H <sub>2</sub> O $\longrightarrow$ MOH + H <sub>2</sub> (ii) BeH <sub>2</sub> is prepared by the action of LIAIH, on BeCl <sub>2</sub> .<br>BCl <sub>2</sub> + LIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + LIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + LIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + LIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + LIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + LIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + LIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + LIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + LIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + LIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + CIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + CIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + CIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + CIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + CIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + CIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + CIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + CIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + CIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + CIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + CIAIH, $\rightarrow$ 2BeH <sub>2</sub> + LICI+ AlCl <sub>3</sub><br>BeCl <sub>2</sub> + COAIH, All + A  |    |          |   |  |
| Hydrides(iii)The metal hydrides react with water to give MOH<br>and H2. (act as reducing agent)<br>MH + H2O $\longrightarrow$ MOH + H2BeH2 & MgH2 is covalent and polymeric but other are<br>ionic.4.(i)The alkali metals react vigorously with halogens to<br>form ionic halides M*X.<br>$2M + X_2 \longrightarrow 2 M^*X^-$<br>(ii) Alkali metals halides (Cl2, Br2, I2) formation is<br>increases form Li to Cs due to increase i<br>electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > Cs<br>(iii) LiX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajar's rules)).(i) The alkaline earth metals directly combine with<br>halogens on heating to give metal halides MX2<br>(X = F(CI,Br,I)Halides(ii) Alkali metals halides (Cl2, Br2, I2) formation is<br>increases form Li to Cs due to increase i<br>electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > Cs<br>(iii) LiX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajar's rules)).<br>(iv)Halides having jonic nature have high melting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(v) Halides of potassium, rubidue in water.<br>(v) Halides of potassium, rubidue in water.<br>(v) Halides of potassium, rubidue and accessium<br>have property of combining with extra halogen<br>atoms forming polyhalides.<br>KI + I2 $\longrightarrow$ KI3Be(H2O)_4 Cl2 $\_$ heat<br>heat halodes of beryllium halides are ionic in nature. Beryllium<br>halides are essentially covalent and soluble in organic<br>solvents. Beryllium chloride has a chain structure in the<br>solid state as shown below:<br>CLBe-Cl   | Hydrides(iii)The metal hydrides react with water to give MOH<br>and H2, (act as reducing agent)<br>MH + H2O $\longrightarrow$ MOH + H2BeH2 & MgH2 is covalent and polymeric but other are<br>ionic.4.(i)The alkali metals react vigorously with halogens to<br>form ionic halides M*X.<br>$2M + X_2 \longrightarrow 2 M*X'$<br>(ii) Alkali metals haldes (Cl2, Br2, I2) formation is<br>increases form Li to CS due to increase in<br>electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > CS<br>(iii) LX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv) Halides having ionic nature have high melting<br>point and are good conductor of current in fused<br>state. These are readity soluble in water.<br>(v) Halides of potassium, rubidum and ceasuid<br>atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ BeH2 & MgH2 is is covalent and polymeric but other are<br>ionic.Halides(i)The alkali metals react vigorously with halogens to<br>active tharacter.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > CS<br>(iii) LX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv) Halides having ionic nature have high melting<br>point and are good conductor of current in fused<br>atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ Be(H2 O).]CI2<br>the metals are ionic in nature. Beryllium<br>halides are essentially covalent and soluble in organic<br>solvents. Beryllium halides, all other halides of<br>alkaline earth metals are cloric in nature. Beryllium<br>halides are essentially covalent and soluble in organic<br>solvents. Beryllium halides and chain structure in the<br>solid state as shown below:<br>CI = BeC CI<br>CI = BeC CI<br>CI = BeC CI = BeC_1 = CI<br>CI = BeC_1 = BeC_1 = C  | Hydrides(iii)The metal hydrides react with water to give MOH<br>and H2, (act as reducing agent)<br>MH + H2 0 $\longrightarrow$ MOH + H2BeH2 & MgH2. is covalent and polymeric but other are<br>ionic.<br>H $H_2$ & MgH2. is covalent and polymeric but other are<br>lonic.<br>H $H_2$ & MgH2. is covalent and polymeric but other are<br>lonic.<br>H $H_2$ & MgH2. is covalent and polymeric but other are<br>lonic.<br>H $H_2$ & MgH2. is covalent and polymeric but other are<br>lonic.4.(i)The alkali metals react vigorously with halogens to<br>form ionic halides MX2.<br>$2M + X_2 \longrightarrow 2MYX^-$<br>(ii) Alkali metals halides (C2, B2, b2, b2) formation is<br>increases form Li to CS due to increase in<br>electropositive character.<br>Order of reactivity towards F2.<br>Li > Na × K > Rb > CS<br>(iii) LX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajans rules)).<br>(iv)Halides having ionic nature have high metting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(V) Halides of polassium, rubidium and ceasium<br>have property of combining with extra halogen<br>atoms forming polyhalides.<br>KI + l2 $\longrightarrow$ Kl3Be(D + C + CI $= \frac{600,800K}{C} = Be(C)$<br>Or dehydration, hydrolysis takes place.<br>[Be(H2O),]Cl2 $= \frac{1000}{C} = \frac{10000}{C} = \frac{100000}{C} = \frac{1000000}{C} = \frac{1000000}{C} = \frac{1000000}{C} = \frac{1000000}{C} = \frac{1000000}{C} = \frac{10000000}{C} = \frac{10000000}{C} = \frac{10000000}{C} = \frac{100000000}{C} = \frac{100000000}{C} = \frac{1000000000000000}{C} = 1000000000000000000000000000000000000$   |    |          | electropositive character decreases from Cs to Li.  |  |
| Hydridesand H2. (act as reducing agent)<br>MH + H2O $\longrightarrow$ MOH + H2During its extended in the polymetric during register of the property of reactivity towards F2<br>Li > Na > K > Rb > Cs<br>(iii) LiX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv) Halides dave property of combining with extra haloge<br>atoms forming polyhalides.Imaging its extended in the polymetric during register<br>increases form Li to Cs due to increase in<br>electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > Cs<br>(iii) LiX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv) Halides faving joint and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(v) Halides of potassium, rubidium and ceasium<br>have property of combining with extra haloge<br>atoms forming polyhalides.<br>KI + I2 $\longrightarrow$ KI3During its evolution and polymetric during register of the property of combining with extra haloge<br>atoms forming polyhalides.HalidesHalidesKI + I2 $\longrightarrow$ KI3Col and the condition of the property of combining with extra haloge<br>atoms forming polyhalides.Except for beryllium halides, and chain structure in the<br>solid state as shown below:<br>CI-Be-CI   | Hydridesand H_2. (act as reducing agent)<br>MH + H_2O $\longrightarrow$ MOH + H_2Bor y at bother and polynome but due for<br>inic.4.(i) The alkali metals react vigorously with halogens to<br>form ionic halides M'X'.<br>$2M + X_2 \longrightarrow 2M'X'$<br>(ii) Alkali metals halides (Cl2, Br2, b) formation is<br>electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > Cs<br>(iii) LX have more covalent character (It is because<br>of the high polarisation capability of Lithium<br>in (fajan's rules)).(ii) The alkaline earth metals directly combine with<br>halogens on heating to give metal halides MAZ<br>(iii) The metals halides Cl2, Br2, b) formation is<br>electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > Cs<br>(iii) LX have more covalent character (It is because<br>of the high polarisation capability of Lithium<br>in (fajan's rules)).(ii) The alkaline earth metals deromposition of (NHa)zBeF4 is the best<br>route form the oxide.<br>BeO + C + Cl $\frac{60000K}{2000K}$ BeCl2 + CO<br>Anhydrous beryllium halide can not be obtained from<br>materials made in aqueous solution because the<br>hydrated ions [Be(H_2O)]4 <sup>Cl2</sup> is formed. i.e. [Be(H_2O)]4 <sup>Cl2</sup> .<br>On dehydration, hydrolysis takes place.<br>Do dehydration, hydrolysis takes place.<br>(iii) Except for beryllium halides, all other halides of<br>alkaline earth metals are ionic in nature. Beryllium<br>halides as a chain structure in the<br>solvents. Beryllium chloride has a chain structure in the<br>solvents  | Hydridesand H_2. (act as reducing agent)<br>MH + H_2O $\longrightarrow$ MOH + H_2Bor $\downarrow$ of the mark $\downarrow$ is contain and polynomic on during the form on the second metal at cathode.4.(i) The alkali metals react vigorously with halogens to form ionic halides M*X:<br>$2M + X_2 \longrightarrow 2 M^* X$<br>(ii) Alkali metals halides Cl2, Br2. b) formation is<br>electropositive character.<br>Order of reactivity towards $F_2$<br>Li $\ge Na > K > Rb > Cs$<br>(iii) LiX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fagan's rules)).(i) The alkali metals directly combine with<br>halogens on heating to give metal halides MX_2<br>(B) Thermal decomposition of (NHa) <sub>2</sub> BeF4 is the best<br>route for the preparation of BeF2, and BeCl2 is<br>conveniently made from the oxide.<br>BeO + C + Cl $\frac{500-800 K}{1000000000000000000000000000000000000$   |    |          |   |  |
| Hydraed $MH + H_2O \longrightarrow MOH + H_2$ $MH + H_2O \longrightarrow MOH + H_2$ $MH + H_2O \longrightarrow MOH + H_2$ 4.(i) The alkali metals react vigorously with halogens to<br>form ionic halides M*X^.<br>$2M + X_2 \longrightarrow 2 M^*X^-$<br>(ii) Alkali metals halides (Cl <sub>2</sub> , Br <sub>2</sub> , l <sub>2</sub> ) formation is<br>increases form Li to Cs due to increase in<br>electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > Cs<br>(iii) LX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv)Halides having ionic nature have high melting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(v) Halides of potassium, rubidium and ceasium<br>have property of combining with extra halogen<br>atoms forming polyhalides.(i) The alkaline earth metals a directly combine with<br>halogens on heating to give metal halides MX2<br>(X=F, Cl, Br, I)<br>(ii) Thermal decomposition of (NH4) <sub>2</sub> BeF4 is the best<br>route for the preparation of BeF2, and BeCl2 is<br>conveniently made from the oxide.<br>BeO + C + Cl $\stackrel{60D-800 K}{=}$ BeCl2 + CO<br>Anhydrous beryllium halide can not be obtained from<br>materials made in aqueous solution because the<br>hydrated ions [Be(H <sub>2</sub> O) <sub>4</sub> ]Cl2 $\stackrel{heat}{=}$ Be(OH) <sub>2</sub> + 2HCI<br>(ii) Except for beryllium halides, all other halides of<br>alkaline earth metals are ionic in nature. Beryllium<br>halides are shown below:<br>Cl-Be-ClHalidesKI + I <sub>2</sub> $\longrightarrow$ KI <sub>3</sub> Cl >  | $\begin{array}{ c c c c c c c c c c c c c c c c c c c$   | $\begin{array}{ c c c c c c c c c c c c c c c c c c c$  |    | Hydridos |   |  |
| 4.(i) The alkali metals react vigorously with halogens to<br>form ionic halides M*X <sup>-</sup> .<br>$2M + X_2 \longrightarrow 2 M^*X^-$<br>(ii) Alkali metals halides (Cl <sub>2</sub> , Br <sub>2</sub> , l <sub>2</sub> ) formation is<br>increases form Li to Cs due to increase in<br>electropositive character.<br>Order of reactivity towards F <sub>2</sub><br>Li > Na > K > Rb > Cs<br>(iii) LiX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv) Halides having ionic nature have high melting<br>point and are good conductor of current in fuse<br>state. These are readily soluble in water.<br>(v) Halides of potassium, rubidium and ceasium<br>have property of combining with extra halogen<br>atoms forming polyhalides.(i) The alkaline earth metals directly combine with<br>halogens on heating to give metal halides MX <sub>2</sub><br>(X=F,Cl,Br,I)<br>(ii) Thermal decomposition of (NH <sub>4</sub> ) <sub>2</sub> BeF <sub>4</sub> is the best<br>route for the preparation of BeF <sub>2</sub> , and BeCl <sub>2</sub> + CO<br>Anhydrous beryllium halide can not be obtained from<br>materials made in aqueous solution because the<br>hydrated ions [Be(H <sub>2</sub> O) <sub>4</sub> ] <sup>2+</sup> is formed. i.e. [Be(H <sub>2</sub> O) <sub>4</sub> ]Cl <sub>2</sub><br>On dehydration, hydrolysis takes place.<br>[Be(H <sub>2</sub> O) <sub>4</sub> ]Cl <sub>2</sub> <u>heat</u> Be(OH) <sub>2</sub> + 2HCl<br>(iii) Except for beryllium halides, all other halides of<br>alkaline earth metals are ionic in nature. Beryllium<br>halides are essentially covalent and soluble in organic<br>solvents. Beryllium chloride has a chain structure in the<br>solid state as shown below:<br>CI-Be-Cl<br>CI-Be-Cl  | 4.(iv) The ionic hydrides of Ca, Sr, Ba liberate H2 at anode and metal at cathode.4.(ii) The alkali metals react vigorously with halogens to form ionic halides MX2.<br>$2M + X_2 \longrightarrow 2 M^* X^-$<br>(iii) Alkali metals halides (Cl2, Br2, l2) formation is increases form Li to Cs due to increase i electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > Cs<br>(iii) LiX have more covalent character (It is because of the high polarisation capability of Lithium ioni (rajan's rules)).<br>(iv) Halides of potassium, rubidium and ceasium have property of combining with extra halogen atoms forming polyhalides.(i) The alkaline earth metals directly combine with halogens on heating to give metal halides MX2<br>(X=F,CI,Br,I)<br>(ii) Thermal decomposition of (NH4);2BeF4 is the best route for the preparation of BeF2, and BeCl2 is conveniently made from the oxide.(iii) LiX have more covalent character (It is because of the high polarisation capability of Lithium ioni (rajan's rules)).<br>(iv) Halides of potassium, rubidium and ceasium have property of combining with extra halogen atoms forming polyhalides.<br>KI + I2 $\longrightarrow$ KI3Be(H2O), [Cl2 $\xrightarrow{heat}$ Be(OH)2 + 2HCl<br>(iii) Except for beryllium halides, all other halides of atoms as a chain structure in the solid state as shown below:<br>CI-Be-ClHalidesKI + I2 $\longrightarrow$ KI3Cl $\xrightarrow{Be}$ $\xrightarrow{Cl}$ $\xrightarrow{Cl}$ $\xrightarrow{Be}$ $\xrightarrow{Cl}$ $\xrightarrow{Cl}$ $\xrightarrow{Be}$ $\xrightarrow{Cl}$ $\xrightarrow{Cl}$ $\xrightarrow{Be}$ $\xrightarrow{Cl}$ $\xrightarrow{Cl}$ $\xrightarrow{Be}$ $\xrightarrow{Cl}$ $\xrightarrow{El}$ $El$  | 4.(i) The alkali metals react vigorously with halogens to<br>form ionic halides MX:<br>$2M + X_2 \longrightarrow 2M'X'$<br>(ii) Alkali metals halides (Cl <sub>2</sub> , Br <sub>2</sub> , l <sub>2</sub> ) formation is<br>increases form Li to Cs due to increase in<br>electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > CS<br>(iii) Lix have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv) Halides of potassium, rubidum mad ceasim<br>have property of combining with extra halogen<br>atoms forming polyhalides.(iv) The alkaline earth metals directly combine with<br>halagens on heating to give metal halides MX2<br>(X=F Cl,Br.I)HalidesIII > Na > K > Rb > CS<br>(III) Lix have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv) Halides of potassium, rubidum and ceasim<br>have property of combining with extra halogen<br>atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ BeO + C + Cl $\stackrel{SUB401}{=}$ Be(OH)2 + 2HCl<br>(III)<br>(III) Except for beryllium halides, all other halides of<br>alkies are esentially covalent and soluble in organic<br>solvents. Beryllium chloride has a chain structure in the<br>solid state as shown below:<br>CI = Be Cl<br>$Cl = Be Cl_2$ tends to form a chloro-<br>bridged dimer which dissociates into the linear<br>monomer at high temperatures of the order of 1200 K.   |    | riyundes |   |  |
| 4.(i) The alkali metals react vigorously with halogens to<br>form ionic halides M*X <sup>-</sup> .<br>$2M + X_2 \longrightarrow 2 M^*X^-$<br>(ii) Alkali metals halides (Cl <sub>2</sub> , Br <sub>2</sub> , l <sub>2</sub> ) formation is<br>increases form Li to Cs due to increase in<br>electropositive character.<br>Order of reactivity towards F <sub>2</sub><br>Li > Na > K > Rb > Cs<br>(iii) LiX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv) Halides having ionic nature have high melting<br>point and are good conductor of current in fuse<br>state. These are readily soluble in water.<br>(v) Halides of potassium, rubidium and ceasium<br>have property of combining with extra halogen<br>atoms forming polyhalides.(i) The alkaline earth metals directly combine with<br>halogens on heating to give metal halides MX <sub>2</sub><br>(X=F,Cl,Br,I)<br>(ii) Thermal decomposition of (NH <sub>4</sub> ) <sub>2</sub> BeF <sub>4</sub> is the best<br>route for the preparation of BeF <sub>2</sub> , and BeCl <sub>2</sub> + CO<br>Anhydrous beryllium halide can not be obtained from<br>materials made in aqueous solution because the<br>hydrated ions [Be(H <sub>2</sub> O) <sub>4</sub> ] <sup>2+</sup> is formed. i.e. [Be(H <sub>2</sub> O) <sub>4</sub> ]Cl <sub>2</sub><br>On dehydration, hydrolysis takes place.<br>[Be(H <sub>2</sub> O) <sub>4</sub> ]Cl <sub>2</sub> <u>heat</u> Be(OH) <sub>2</sub> + 2HCl<br>(iii) Except for beryllium halides, all other halides of<br>alkaline earth metals are ionic in nature. Beryllium<br>halides are essentially covalent and soluble in organic<br>solvents. Beryllium chloride has a chain structure in the<br>solid state as shown below:<br>CI-Be-Cl<br>CI-Be-Cl  | 4.(iv) The ionic hydrides of Ca, Sr, Ba liberate H2 at anode and metal at cathode.4.(ii) The alkali metals react vigorously with halogens to form ionic halides MX2.<br>$2M + X_2 \longrightarrow 2 M^* X^-$<br>(iii) Alkali metals halides (Cl2, Br2, l2) formation is increases form Li to Cs due to increase i electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > Cs<br>(iii) LiX have more covalent character (It is because of the high polarisation capability of Lithium ioni (rajan's rules)).<br>(iv) Halides of potassium, rubidium and ceasium have property of combining with extra halogen atoms forming polyhalides.(i) The alkaline earth metals directly combine with halogens on heating to give metal halides MX2<br>(X=F,CI,Br,I)<br>(ii) Thermal decomposition of (NH4);2BeF4 is the best route for the preparation of BeF2, and BeCl2 is conveniently made from the oxide.(iii) LiX have more covalent character (It is because of the high polarisation capability of Lithium ioni (rajan's rules)).<br>(iv) Halides of potassium, rubidium and ceasium have property of combining with extra halogen atoms forming polyhalides.<br>KI + I2 $\longrightarrow$ KI3Be(H2O), [Cl2 $\xrightarrow{heat}$ Be(OH)2 + 2HCl<br>(iii) Except for beryllium halides, all other halides of atoms as a chain structure in the solid state as shown below:<br>CI-Be-ClHalidesKI + I2 $\longrightarrow$ KI3Cl $\xrightarrow{Be}$ $\xrightarrow{Cl}$ $\xrightarrow{Cl}$ $\xrightarrow{Be}$ $\xrightarrow{Cl}$ $\xrightarrow{Cl}$ $\xrightarrow{Be}$ $\xrightarrow{Cl}$ $\xrightarrow{Cl}$ $\xrightarrow{Be}$ $\xrightarrow{Cl}$ $\xrightarrow{Cl}$ $\xrightarrow{Be}$ $\xrightarrow{Cl}$ $\xrightarrow{El}$ $El$  | 4.(i) The alkali metals react vigorously with halogens to<br>form ionic halides MX:<br>$2M + X_2 \longrightarrow 2M'X'$<br>(ii) Alkali metals halides (Cl <sub>2</sub> , Br <sub>2</sub> , l <sub>2</sub> ) formation is<br>increases form Li to Cs due to increase in<br>electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > CS<br>(iii) Lix have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv) Halides of potassium, rubidum mad ceasim<br>have property of combining with extra halogen<br>atoms forming polyhalides.(iv) The alkaline earth metals directly combine with<br>halagens on heating to give metal halides MX2<br>(X=F Cl,Br.I)HalidesIII > Na > K > Rb > CS<br>(III) Lix have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv) Halides of potassium, rubidum and ceasim<br>have property of combining with extra halogen<br>atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ BeO + C + Cl $\stackrel{SUB401}{=}$ Be(OH)2 + 2HCl<br>(III)<br>(III) Except for beryllium halides, all other halides of<br>alkies are esentially covalent and soluble in organic<br>solvents. Beryllium chloride has a chain structure in the<br>solid state as shown below:<br>CI = Be Cl<br>$Cl = Be Cl_2$ tends to form a chloro-<br>bridged dimer which dissociates into the linear<br>monomer at high temperatures of the order of 1200 K.   |    |          |   | Be Be  |
| 4.anode and metal at cathode.4.(i)The alkali metals react vigorously with halogens to<br>form ionic halides M*X <sup>-</sup> .<br>$2M + X_2 \longrightarrow 2 M^*X^-$<br>(ii) Alkali metals halides (Cl <sub>2</sub> , Br <sub>2</sub> , l <sub>2</sub> ) formation is<br>increases form Li to Cs due to increase<br>electropositive character.<br>Order of reactivity towards F <sub>2</sub><br>Li > Na > K > Rb > Cs<br>(iii) LiX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).(i)The alkaline earth metals directly combine with<br>halogens on heating to give metal halides $MX_2$<br>( $X=F,Cl,Br,I$ )HalidesHalides(VI) + Alides of potassium, rubidium and ceasium<br>have property of combining with extra halogen<br>atoms forming polyhalides.Be(H <sub>2</sub> O) <sub>4</sub> ]Cl <sub>2</sub> $heat$<br>heat $A$ be(OH) <sub>2</sub> + 2HCl<br>(ii) Except for beryllium halides, all other halides of<br>alkaline earth metals are ionic in nature. Beryllium<br>halides are essentially covalent and soluble in organic<br>solvents. Beryllium chloride has a chain structure in the<br>solid state as shown below:<br>CI -Be-Cl  | 4.anode and metal at cathode.4.(i)The alkali metals react vigorously with halogens to<br>form ionic halides M*X:<br>$2M + X_2 \longrightarrow 2M*X^-$<br>(ii) Alkali metals halides (Cl <sub>2</sub> , Br <sub>2</sub> , I <sub>2</sub> ) formation is<br>increases form Li to Cs due to increase in<br>electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > Cs<br>(ii) LiX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv)Halides having ionic nature have high melting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(V) Halides of potassium, rubidium and ceasium<br>have property of combining with extra haloge<br>atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ image and metal at cathode.<br>(I)The alkaline earth metals are ionic in nature. Beryllium<br>halides are solution to accure the<br>hydrated ions [Be(H2O)] <sup>2+</sup> is formed. i.e. [Be(H2O)] <sup>2</sup><br>(D)]Cl2 heat<br>(D)]Cl2 heat<br>(D)]Cl2 heat<br>(Cl heat)<br>(Cl heat)<br>(Cl heat)HalidesKI + I2 heat<br>Cl heatCl heat<br>Cl heat<br>Cl heatCl heat<br>Cl heat<br>Cl heat<br>Cl heat<br>Cl heat<br>Cl heatCl heat<br>Cl heat<br>Cl heat<br>Cl heat<br>Cl heat<br>Cl heatCl heat<br>Cl heat<br><td>4.anode and metal at cathode.4.(i)The alkali metals react vigorously with halogens to<br/>form ionic halides M*X.<br/><math>2M+X_2 \longrightarrow 2M*X^-</math><br/>(ii) Alkali metals halides (Cl<sub>2</sub>, Br<sub>2</sub>, I<sub>2</sub>) formation is<br>electropositive character.<br/>Order of reactivity towards F2<br/>Li &gt; Na &gt; K &gt; Rb &gt; Cs<br/>(iii) LX have more covalent character (It is because<br/>of the high polarisation capability of Lithium ion<br/>(fajaris rules)).<br/>(iv) Halides of potassium, rubicitum and ceasium<br/>have property of combining with extra halogen<br/>atoms forming polyhalides.(i)The alkaline earth metals directly combine with<br/>halogens on heating to give metal halides MX2<br/>(X=F,CI,Br,I)<br/>(ii) The mated composition of (NH<sub>4</sub>)<sub>2</sub>BeF<sub>4</sub> is the best<br/>route for the preparation of BeF<sub>2</sub>, and BeCl<sub>2</sub> is<br/>conveniently made from the oxide.<br/>BeO + C + Cl <br/>BeO + C + Cl <br/>BeO + C + Cl <br/>BeCl<sub>2</sub> + CO<br/>Anhydrous beryllium halide can not be obtained from<br/>materials made in aqueous solution because the<br/>hydrated ions [Be(H<sub>2</sub>O)<sub>4</sub>]Cl<sub>2</sub> - Meat<br/>Be(CH<sub>2</sub>O)<sub>4</sub>Cl<sub>2</sub> beat<br/>Be(CH<sub>2</sub>O)<sub>4</sub>Cl<sub>2</sub> beat<br/>Be(CH<sub>2</sub>O)<sub>4</sub>Cl<sub>2</sub> beat<br/>Be(CH<sub>2</sub>O)<sub>4</sub>Cl<sub>2</sub> beat<br/>Cl beat<br/>Beat combining with extra halogen<br/>atoms forming polyhalides.<br/>KI + I<sub>2</sub> <math>\longrightarrow</math> KI<sub>3</sub>HalidesKI + I<sub>2</sub> <math>\longrightarrow</math> KI<sub>3</sub>Cl <math>Bee_{1}</math> <math>Cl</math> <math>Cl</math> <math>Bee_{1}</math> <math>Cl</math> <math>Bee_{1}</math> <math>Cl</math> <math>Cl</math> <math>Cl</math> <math>Cl</math> <math>Cl</math> <math>Cl</math> <math>Cl</math> <math>Cl</math></br></td> <td></td> <td></td> <td></td> <td></td>  | 4.anode and metal at cathode.4.(i)The alkali metals react vigorously with halogens to<br>form ionic halides M*X.<br>$2M+X_2 \longrightarrow 2M*X^-$<br>(ii) Alkali metals halides (Cl <sub>2</sub> , Br <sub>2</sub> , I <sub>2</sub> ) formation is<br>  |    |          |   |  |
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Beryllium chloride has a chain structure in the<br>solid state as shown below:<br>CI = Be-Cl   | 4.anode and metal at cathode.4.(i)The alkali metals react vigorously with halogens to<br>form ionic halides M*X:<br>$2M + X_2 \longrightarrow 2M*X^-$<br>(ii) Alkali metals halides (Cl <sub>2</sub> , Br <sub>2</sub> , I <sub>2</sub> ) formation is<br>increases form Li to Cs due to increase in<br>electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > Cs<br>(ii) LiX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv)Halides having ionic nature have high melting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(V) Halides of potassium, rubidium and ceasium<br>have property of combining with extra haloge<br>atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ image and metal at cathode.<br>(I)The alkaline earth metals are ionic in nature. Beryllium<br>halides are solution to accure the<br>hydrated ions [Be(H2O)] <sup>2+</sup> is formed. i.e. [Be(H2O)] <sup>2</sup><br>(D)]Cl2 heat<br>(D)]Cl2 heat<br>(D)]Cl2 heat<br>(Cl heat)<br>(Cl heat)<br>(Cl heat)HalidesKI + I2 heat<br>Cl heatCl heat<br>Cl heat<br>Cl heatCl heat<br>Cl heat<br>Cl heat<br>Cl heat<br>Cl heat<br>Cl heatCl heat<br>Cl heat<br>Cl heat<br>Cl heat<br>Cl heat<br>Cl heatCl heat<br>Cl heat<br><td>4.anode and metal at cathode.4.(i)The alkali metals react vigorously with halogens to<br/>form ionic halides M*X.<br/><math>2M+X_2 \longrightarrow 2M*X^-</math><br/>(ii) Alkali metals halides (Cl<sub>2</sub>, Br<sub>2</sub>, I<sub>2</sub>) formation is<br>electropositive character.<br/>Order of reactivity towards F2<br/>Li &gt; Na &gt; K &gt; Rb &gt; Cs<br/>(iii) LX have more covalent character (It is because<br/>of the high polarisation capability of Lithium ion<br/>(fajaris rules)).<br/>(iv) Halides of potassium, rubicitum and ceasium<br/>have property of combining with extra halogen<br/>atoms forming polyhalides.(i)The alkaline earth metals directly combine with<br/>halogens on heating to give metal halides MX2<br/>(X=F,CI,Br,I)<br/>(ii) The mated composition of (NH<sub>4</sub>)<sub>2</sub>BeF<sub>4</sub> is the best<br/>route for the preparation of BeF<sub>2</sub>, and BeCl<sub>2</sub> is<br/>conveniently made from the oxide.<br/>BeO + C + Cl <br/>BeO + C + Cl <br/>BeO + C + Cl <br/>BeCl<sub>2</sub> + CO<br/>Anhydrous beryllium halide can not be obtained from<br/>materials made in aqueous solution because the<br/>hydrated ions [Be(H<sub>2</sub>O)<sub>4</sub>]Cl<sub>2</sub> - Meat<br/>Be(CH<sub>2</sub>O)<sub>4</sub>Cl<sub>2</sub> beat<br/>Be(CH<sub>2</sub>O)<sub>4</sub>Cl<sub>2</sub> beat<br/>Be(CH<sub>2</sub>O)<sub>4</sub>Cl<sub>2</sub> beat<br/>Be(CH<sub>2</sub>O)<sub>4</sub>Cl<sub>2</sub> beat<br/>Cl beat<br/>Beat combining with extra halogen<br/>atoms forming polyhalides.<br/>KI + I<sub>2</sub> <math>\longrightarrow</math> KI<sub>3</sub>HalidesKI + I<sub>2</sub> <math>\longrightarrow</math> KI<sub>3</sub>Cl <math>Bee_{1}</math> <math>Cl</math> <math>Cl</math> <math>Bee_{1}</math> <math>Cl</math> <math>Bee_{1}</math> <math>Cl</math> <math>Cl</math> <math>Cl</math> <math>Cl</math> <math>Cl</math> <math>Cl</math> <math>Cl</math> <math>Cl</math></br></td> <td></td> <td></td> <td></td> <td>(iv) The ionic hydrides of Ca. Sr. Ba liberate H<sub>2</sub> at</td> | 4.anode and metal at cathode.4.(i)The alkali metals react vigorously with halogens to<br>form ionic halides M*X.<br>$2M+X_2 \longrightarrow 2M*X^-$<br>(ii) Alkali metals halides (Cl <sub>2</sub> , Br <sub>2</sub> , I <sub>2</sub> ) formation is<br>  |    |          |   | (iv) The ionic hydrides of Ca. Sr. Ba liberate H <sub>2</sub> at                           |
| form ionic halides M*X <sup>-</sup> .halogens on heating to give metal halides MX2 $2M + X_2 \longrightarrow 2 M^+X^-$ (ii) Alkali metals halides (Cl2, Br2, I2) formation is<br>increases form Li to Cs due to increase in<br>electropositive character.halogens on heating to give metal halides MX2(iii) Alkali metals halides (Cl2, Br2, I2) formation is<br>increases form Li to Cs due to increase in<br>electropositive character.halogens on heating to give metal halides MX2(iii) Alkali metals halides (Cl2, Br2, I2) formation is<br>increases form Li to Cs due to increase in<br>electropositive character.halogens on heating to give metal halides MX2(iii) LiX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).BeO + C + Cl $\bigcirc 600-800 K$ (iv) Halides having ionic nature have high melting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.Be(H <sub>2</sub> O) <sub>4</sub> ]Cl <sub>2</sub> $\_$ heat<br>heat $>$ Be(OH) <sub>2</sub> + 2HCl(iii) Except for beryllium halides, all other halides of<br>atoms forming polyhalides.KI + I2 $\_$ KI3HalidesKI + I2 $\_$ KI3Cl >   | $Halides \qquad \qquad$   | form ionic halides M*X <sup>-</sup> .<br>$M + X_2 \longrightarrow 2 M^* X^-$ (ii) Alkali metals halides (Cl <sub>2</sub> , Br <sub>2</sub> , I <sub>2</sub> ) formation is<br>increases form Li to Cs due to increase<br>i electropositive character.<br>Order of reactivity towards F <sub>2</sub><br>Li > Na > K > Rb > Cs<br>(iii) LiX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(i) Halides having ionic nature have high melting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(i) Halides of potassium, rubidium and ceasium<br>have property of combining with extra halogen<br>atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ Halides $KI + I_2 \longrightarrow KI_3$ Halides Halides Halides Halides KI + I <sub>2</sub> \lower KI <sub>3</sub> Halides KI + I <sub>2</sub> \lower KI <sub>3</sub> Halides KI + I <sub>2</sub> \lower KI <sub>3</sub> Halides Halides KI + I <sub>2</sub> \lower KI <sub>3</sub> KI + I <sub>2</sub> \lower KI <sub>3</sub> Halides KI + I <sub>2</sub> \lower KI <sub>3</sub> Halides KI + I <sub>2</sub> \lower KI <sub>3</sub> HAII + I <sub></sub>  |    |          |   | anode and metal at cathode.  |
| $\begin{array}{c} 2M + X_2 \longrightarrow 2 M^*X^-\\ (ii) \text{ Alkali metals halides } (Cl_2, Br_2, l_2) \text{ formation is increases form Li to Cs due to increase in electropositive character.}\\ Order of reactivity towards F_2\\ Li > Na > K > Rb > Cs\\ (iii) \text{ LiX have more covalent character (It is because of the high polarisation capability of Lithium ion (fajan's rules)).}\\ (iv) Halides having ionic nature have high melting point and are good conductor of current in fuses state. These are readily soluble in water.\\ (v) Halides of potassium, rubidium and ceasium have property of combining with extra halogen atoms forming polyhalides.\\ KI + I_2 \longrightarrow KI_3 \end{array}$  | $Halides \qquad \begin{array}{c} 2M + X_2 \longrightarrow 2 M^*X^-\\ (ii) Alkali metals halides (Cl_2, Br_2, I_2) formation is increases form Li to CS due to increase in electropositive character.  Order of reactivity towards F_2 Li > Na > K > Rb > CS (                                   $  | $Halides \begin{array}{c} 2M + X_2 \longrightarrow 2 M^*X^- \\ (ii) Alkali metals halides (Cl_2, Br_2, I_2) formation is increases form Li to Cs due to increase in electropositive character.  Order of reactivity towards F_2 \\ Li > Na > K > Rb > CS \\ (iii) LiX have more covalent character (It is because of the high polarisation capability of Lithium ion (fajan's rules)).  (iv) Halides having ionic nature have high melting point and are good conductor of current in fused state. These are readily soluble in water.  (v) Halides of potassium, rubidium and ceasium have property of combining with extra halogen atoms forming polyhalides.  KI + I_2 \longrightarrow KI_3 \\ \end{array}$ Halides $KI + I_2 \longrightarrow KI_3$  | 4. |          |   |  |
| (ii) Alkali metals halides (Cl2, Br2, I2) formation is<br>increases form Li to Cs due to increase in<br>electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > Cs<br>(iii) LiX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).(ii) Thermal decomposition of $(NH_4)_2BeF_4$ is the best<br>route for the preparation of BeF2, and BeCl2 is<br>conveniently made from the oxide.<br>BeO + C + Cl $\underbrace{600-800 \text{ K}}_{000-800 \text{ K}}$ BeCl2 + CO<br>Anhydrous beryllium halide can not be obtained from<br>materials made in aqueous solution because the<br>hydrated ions $[Be(H_2O)_4]^{2^*}$ is formed. i.e. $[Be(H_2O)_4]Cl_2$<br>On dehydration, hydrolysis takes place.<br>$[Be(H_2O)_4]Cl_2 \xrightarrow{heat} Be(OH)_2 + 2HCl$<br>(ii) Except for beryllium halides, all other halides of<br>alkaline earth metals are ionic in nature. Beryllium<br>halides are essentially covalent and soluble in organic<br>solvents. Beryllium chloride has a chain structure in the<br>solid state as shown below:<br>$CI = Be-Cl$   | (ii) Alkali metals halides (Cl2, Br2, I2) formation is<br>increases form Li to Cs due to increase in<br>electropositive character.<br>Order of reactivity towards F2<br>Li > Na > K > Rb > Cs<br>(iii) LX have more covalent character (It is because<br>of the high polarisation capability of Lithium ion<br>(fajan's rules)).<br>(iv)Halides having ionic nature have high melting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(v) Halides of potassium, rubidium and ceasium<br>have poperty of combining with extra halogen<br>atoms forming polyhalides.(ii) Thermal decomposition of (NH4)/2BeF4 is the best<br>route for the preparation of BeF2, and BeCl2 is<br>conveniently made from the oxide.<br>BeO + C + Cl<br>State as not be obtained from<br>materials made in aqueous solution because the<br>hydrated ions (Be(H2O),4]C1 is formed. i.e. [Be(H2O),4]C12<br>On dehydration, hydrolysis takes place.<br>[Be(H2O),4]C12<br>heat to in nature. Beryllium<br>halides are essentially covalent and soluble in organic<br>solvents. Beryllium chloride has a chain structure in the<br>solid state as shown below:<br>CI-Be-ClHalidesKI + I2> KI3   | $Halides \qquad \qquad$  |    |          | $2M + X_2 \longrightarrow 2 M^+X^-$   | 5 5 5  |
| Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Ha  | $Halides \qquad Helectropositive character. Order of reactivity towards F_2 Li > Na > K > Rb > Cs (iii) LiX have more covalent character (It is because of the high polarisation capability of Lithium ion (fajan's rules)). (iv)Halides having ionic nature have high melting point and are good conductor of current in fused state. These are readily soluble in water. (v) Halides of potassium, rubidium and ceasium have property of combining with extra halogen atoms forming polyhalides.  KI + I_2 \longrightarrow KI_3 KI + I_2 \longrightarrow KI_3 KI + I_2 \longrightarrow KI_3 CI = Be CI_2 + CO Anhydrous beryllium halide can not be obtained from materials made in aqueous solution because the hydrated ions [Be(H_2O)_4]CI_2 Be(H_2O)_4]CI_2 = \frac{heat}{Be(H_2O)_4}Be(OH)_2 + 2HCI (iii) Except for beryllium halides, all other halides of alkaline earth metals are ionic in nature. Beryllium halides are essentially covalent and soluble in organic solvents. Beryllium chloride has a chain structure in the solid state as shown below: CI = Be - CI $   | Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Ha   |    |          | (ii) Alkali metals halides (Cl <sub>2</sub> , Br <sub>2</sub> , I <sub>2</sub> ) formation is                     | (ii) Thermal decomposition of (NH <sub>4</sub> ) <sub>2</sub> BeF <sub>4</sub> is the best |
| Halides<br>$Halides$ $\begin{aligned} & \text{Order of reactivity towards } F_2 \\ & \text{Li > Na > K > Rb > Cs} \\ & \text{(iii) LiX have more covalent character (It is because of the high polarisation capability of Lithium ion (fajan's rules)).} \\ & \text{(iv)} Halides having ionic nature have high melting point and are good conductor of current in fused state. These are readily soluble in water.} \\ & \text{(v)} Halides of potassium, rubidium and ceasium have property of combining with extra halogen atoms forming polyhalides.} \end{aligned} \begin{aligned} & \text{Halides} \end{aligned}  \begin{aligned} & \text{Halides} \end{aligned}  \begin{aligned} & \text{Halides} \end{aligned}  \begin{aligned} & \text{Order of reactivity towards } F_2 \\ & \text{Li > Na > K > Rb > Cs} \\ & \text{BeO} + C + Cl \xrightarrow{600-800 \text{ K}} \text{BeCl}_2 + CO \\ & \text{Anhydrous beryllium halide can not be obtained from materials made in aqueous solution because the hydrated ions [Be(H_2O)_4]^{2+1} is formed. i.e. [Be(H_2O)_4]Cl_2 \\ & \text{On dehydration, hydrolysis takes place.} \\ & \text{[Be(H_2O)_4]Cl_2} \xrightarrow{\text{heat}} \text{Be(OH)_2 + 2HCl} \\ & \text{(iii) Except for beryllium halides, all other halides of alkaline earth metals are ionic in nature. Beryllium halides are essentially covalent and soluble in organic solvents. Beryllium chloride has a chain structure in the solid state as shown below: CI-Be-Cl \end{aligned} $  | 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 | $Halides \qquad \qquad$  |    |          | Order of reactivity towards F <sub>2</sub>  |  |
| Halides<br>Halides<br>$(f_{ajan's rules}))$ .<br>(iv) Halides having ionic nature have high melting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(v) Halides of potassium, rubidium and ceasium<br>have property of combining with extra halogen<br>atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$<br>materials made in aqueous solution because the<br>hydrated ions [Be(H <sub>2</sub> O) <sub>4</sub> ] <sup>2+</sup> is formed. i.e. [Be(H <sub>2</sub> O) <sub>4</sub> ]Cl <sub>2</sub><br>On dehydration, hydrolysis takes place.<br>$[Be(H_2O)_4]Cl_2 \xrightarrow{heat} Be(OH)_2 + 2HCI$<br>(iii) Except for beryllium halides, all other halides of<br>alkaline earth metals are ionic in nature. Beryllium<br>halides are essentially covalent and soluble in organic<br>solvents. Beryllium chloride has a chain structure in the<br>solid state as shown below:<br>CI-Be-CI   | $Halides \qquad \qquad$   | $Halides \qquad \qquad$  |    |          |   |  |
| Halides<br>Halides<br>$KI + I_2 \longrightarrow KI_3$ $(iv)$ Halides having ionic nature have high melting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(v) Halides of potassium, rubidium and ceasium<br>have property of combining with extra halogen<br>atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ On dehydration, hydrolysis takes place.<br>$Be(H_2O)_4]CI_2 \xrightarrow{heat} Be(OH)_2 + 2HCI$ (iii) Except for beryllium halides, all other halides of<br>alkaline earth metals are ionic in nature. Beryllium<br>halides are essentially covalent and soluble in organic<br>solvents. Beryllium chloride has a chain structure in the<br>solid state as shown below:<br>CI = Be-CI   | Halides<br>Halides<br>$KI + I_2 \longrightarrow KI_3$ On dehydration, hydrolysis takes place.<br>CI - Be - CI $CI - Be - CI$ $CI$   | Halides(iv)Halides having ionic nature have high melting<br>point and are good conductor of current in fused<br>state. These are readily soluble in water.<br>(v) Halides of potassium, rubidium and ceasium<br>have property of combining with extra halogen<br>atoms forming polyhalides.On dehydration, hydrolysis takes place.<br>$[Be(H_2O)_4]Cl_2 \xrightarrow{heat} Be(OH)_2 + 2HCI$<br>(iii) Except for beryllium halides, all other halides of<br>alkaline earth metals are ionic in nature. Beryllium<br>halides are essentially covalent and soluble in organic<br>solvents. Beryllium chloride has a chain structure in the<br>solid state as shown below:<br>$CI - Be - CI$<br>$CI - Be - CI$<br>$Be - CI$<br>$CI - Be - CI - CI - BE - CI - BE - CI - BE - CI - BE - CI - BE - CI - BE - CI - CI - BE - CI - CI - BE - C$  |    |          |   | materials made in aqueous solution because the   |
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| Halides state. These are readily soluble in water.<br>(v) Halides of potassium, rubidium and ceasium<br>have property of combining with extra halogen<br>atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$<br>$KI = I_2 \longrightarrow KI_3$<br>$KI = I_2 \longrightarrow KI_3$<br>$IBe(H_2O)_4]CI_2 \longrightarrow Be(OH)_2 + 2HCI$<br>(iii) Except for beryllium halides, all other halides of<br>alkaline earth metals are ionic in nature. Beryllium<br>halides are essentially covalent and soluble in organic<br>solvents. Beryllium chloride has a chain structure in the<br>solid state as shown below:<br>CI = Be-CI  | Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Halides<br>Ha 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  |    |          |   |  |
| Halides have property of combining with extra halogen atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ alkaline earth metals are ionic in nature. Beryllium halides are essentially covalent and soluble in organic solvents. Beryllium chloride has a chain structure in the solid state as shown below:<br>CI = Be-CI   | Halides have property of combining with extra halogen atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ $KI + I_2 \longrightarrow KI_3$  | Halides have property of combining with extra halogen atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ $KI + I_2 \longrightarrow KI_3$   |    |          | state. These are readily soluble in water.  |  |
| Halides atoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ halides are essentially covalent and soluble in organic solvents. Beryllium chloride has a chain structure in the solid state as shown below:<br>$CI \rightarrow CI$   | Halidesatoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ halides are essentially covalent and soluble in organic<br>solvents. Beryllium chloride has a chain structure in the<br>solid state as shown below:<br>$CI - Be - CI$ $CI - Be - CI$ $I - Be - CI$ <td>Halidesatoms forming polyhalides.<br/><math>KI + I_2 \longrightarrow KI_3</math>halides are essentially covalent and soluble in organic<br/>solvents. Beryllium chloride has a chain structure in the<br/>solid state as shown below:<br/><math>CI - Be - CI</math><math>CI - Be - CI</math><math>CI - Be - CI</math><math>I - Be - CI</math>&lt;</td> <td></td> <td></td> <td></td> <td></td>  | Halidesatoms forming polyhalides.<br>$KI + I_2 \longrightarrow KI_3$ halides are essentially covalent and soluble in organic<br>solvents. Beryllium chloride has a chain structure in the<br>solid state as shown below:<br>$CI - Be - CI$ $CI - Be - CI$ $CI - Be - CI$ $I - Be - CI$ <  |    |          |   |  |
| solid state as shown below:<br>CI–Be–CI  | solid state as shown below:<br>CI-Be-CI<br>CI - Be<br>CI<br>Be<br>CI<br>Be<br>CI<br>Be<br>CI<br>Be<br>CI<br>Be<br>CI<br>Be<br>CI<br>Be<br>CI<br>CI<br>Be<br>CI<br>Be<br>CI<br>CI<br>Be<br>CI<br>CI<br>Be<br>CI<br>CI<br>Be<br>CI<br>CI<br>Be<br>CI<br>CI<br>Be<br>CI<br>CI<br>Be<br>CI<br>CI<br>Be<br>CI<br>CI<br>Be<br>CI<br>CI<br>Be<br>CI<br>CI<br>Be<br>CI<br>CI<br>Be<br>CI<br>CI<br>Be<br>CI<br>CI<br>CI<br>Be<br>CI<br>CI<br>CI<br>Be<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI<br>CI   | solid state as shown below:<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-Be-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI<br>CI-BE-CI-CI<br>CI-BE-CI-CI<br>CI-BE-CI-CI<br>CI-BE-CI-CI-CI<br>CI-BE-CI-CI-CI-CI-CI-CI-CI-CI-CI-CI-CI-CI-CI-   |    | Halides  | atoms forming polyhalides.  | halides are essentially covalent and soluble in organic                                    |
| CI–Be–CI   | CI-Be-CI $CI-Be$ $CI$ $Be$ $CI$ $CI$ $EE$ $EE$ $EE$ $EE$ $EE$ $EE$ $EE$ $E$  | CI-Be-CI $CI-Be$ $CI$ $Be$ $CI$ $Be$ $CI$ $CI$ $EI$ $EI$ $EI$ $EI$ $EI$ $EI$ $EI$ $E$   |    |          | $KI + I_2 \longrightarrow KI_3$   |  |
| $CI - Be \xrightarrow{CI} Be - CI$   | In the vapour phase BeCl <sub>2</sub> tends to form a chloro-<br>bridged dimer which dissociates into the linear   | $\begin{array}{c} CI \\ \hline \\ Be \\ CI \\ \hline \\ CI \\ CI$   |    |          |   |  |
|  | In the vapour phase BeCl <sub>2</sub> tends to form a chloro-<br>bridged dimer which dissociates into the linear   | $\begin{array}{c} CI \\ \hline \\ Be \\ CI \\ \hline \\ CI \\ CI$   |    |          |   | _ CI   |
|  | In the vapour phase BeCl <sub>2</sub> tends to form a chloro-<br>bridged dimer which dissociates into the linear   | $\begin{array}{c} CI \\ \hline \\ Be \\ CI \\ \hline \\ CI \\ CI$   |    |          |   | CI – Be 🔨 🚬 🕇 Be – Cl  |
|  | In the vapour phase BeCl <sub>2</sub> tends to form a chloro-<br>bridged dimer which dissociates into the linear   | In the vapour phase BeCl <sub>2</sub> tends to form a chloro-<br>bridged dimer which dissociates into the linear<br>monomer at high temperatures of the order of 1200 K.  |    |          |   |  |
|  | In the vapour phase BeCl <sub>2</sub> tends to form a chloro-<br>bridged dimer which dissociates into the linear   | In the vapour phase BeCl <sub>2</sub> tends to form a chloro-<br>bridged dimer which dissociates into the linear<br>monomer at high temperatures of the order of 1200 K.  |    |          |   |  |
|  | In the vapour phase BeCl <sub>2</sub> tends to form a chloro-<br>bridged dimer which dissociates into the linear   | In the vapour phase BeCl <sub>2</sub> tends to form a chloro-<br>bridged dimer which dissociates into the linear<br>monomer at high temperatures of the order of 1200 K.  |    |          |   |  |
|  | bridged dimer which dissociates into the linear  | bridged dimer which dissociates into the linear<br>monomer at high temperatures of the order of 1200 K.   |    |          |   |  |
| bridged dimer which dissociates into the linear  | monomer at high temperatures of the order of 1200 K.   |   |    |          |   | bridged dimer which dissociates into the linear  |
| monomer at high temperatures of the order of 1200 K.   |  | (iv)The ionic character of halides increases from Be to   |    |          |   | monomer at high temperatures of the order of 1200 K.                                       |
|  | (iv)The ionic character of halides increases from Be to  |   |    |          |   | (iv)The jonic character of halides increases from Be to                                    |
| (iv)The ionic character of halides increases from Be to  |  |   | I  |          |   |  |

|    |                                   |   | <ul> <li>Ra.</li> <li>(v)Beryllium halides have covalent character due to small size and high effective nuclear charge and thus do not conduct electricity in molten state.</li> <li>(vi) The fluorides are relatively less soluble than the chlorides owing to their high lattice energies.</li> <li>(vii)The decreases in solubility of halides down the group is due to decrease in hydration energy because of increasing size of metal cation .</li> <li>(viii) The tendency to form halide hydrates gradually decreases (for example, MgCl<sub>2</sub>·6H<sub>2</sub>O, CaCl<sub>2</sub>·6H<sub>2</sub>O, SrCl<sub>2</sub>·6H<sub>2</sub>O and BaCl<sub>2</sub>·2H<sub>2</sub>O) down the group. The dehydration of hydrated chlorides, bromides and iodides of Ca, Sr and Ba can be achieved on heating; however, the corresponding hydrated halides of Be and Mg on heating suffer hydrolysis.</li> <li>(ix) CaCl2 has strong affinity with water and is used as dehydrating agent.</li> </ul> |
|----|-----------------------------------|---|--|
| 5. | Reducing<br>nature                | Property       Li       Na       K       Rb       Cs       Fr         Standard potentials       1 | However, its reducing nature is due to large hydration<br>energy associated with the small size of Be <sup>2+</sup> ion and<br>relatively large value of the atomization enthalpy of the<br>metal.   |
|    | (*need not                        | $M(s) \longrightarrow M(g)$ Sublimation enthalpy  | Property Alkaline earth metals   |
|    | to<br>memorise)                   | <ul> <li>M(g) → M<sup>+</sup>(g) + e<sup>-</sup> lonization enthalpy<br/>M<sup>+</sup>(g) + H<sub>2</sub>O → M<sup>+</sup> (aq) Hydration enthalpy</li> <li>(ii) Lithium is expected to be least reducing agen<br/>due to it's very high I.E. However, lithium has the<br/>highest hydration enthalpy which accounts for its<br/>high negative E<sup>⊕</sup> value and its high reducing power.<br/>Reducing Nature in gas phase<br/>= Li &lt; Na &lt; K &lt; Rb &lt; Cs.<br/>Reducing Nature in aqueous condition</li> </ul>   |  |
| 6. | Basic<br>nature of<br>hydroxide   | i) These oxides are easily hydrolysed by water to<br>form the hydroxides.<br>Thus M <sub>2</sub> O (oxide) + H <sub>2</sub> O → M <sup>⊕</sup> OH <sup>⊕</sup><br>M <sub>2</sub> O <sub>2</sub> (peroxide) + H <sub>2</sub> O → 2M <sup>⊕</sup> OH <sup>⊕</sup> + H <sub>2</sub> O <sub>2</sub><br>MO <sub>2</sub> (superoxide) + H <sub>2</sub> O → 2M <sup>⊕</sup> OH <sup>⊕</sup> + H <sub>2</sub> O <sub>2</sub> +O <sub>2</sub><br>(ii) The Hydroxide which are obtained by the reaction<br>of the oxide. With water all are white crystalline<br>solids. The alkali metal hydroxides are the stronges<br>of all bases and dissolve freely in water with<br>evolution of much heat an account of intense<br>hydration.<br>Basic nature/Solubility in water/Thermal stability<br>= LiOH < NaOH < KOH < RbOH < CsOH  | = Be(OH) <sub>2</sub> <mg(oh)<sub>2&lt; Ca(OH)<sub>2</sub>&lt; Sr(OH)<sub>2</sub> <ba(oh)<sub>2</ba(oh)<sub></mg(oh)<sub>  |
| 7. | Carbonates<br>and<br>bicarbonates | <ul> <li>(i) The carbonates (M₂CO₃) and bicarbonates (MHCO₃) are highly stable to heat, where M as alkal metals.</li> <li>(ii) Group 1 metals are so strongly basic, they (except lithium) also form solid bicarbonates. No other metals form solid bicarbonates. Lithium carbonate is not so stable to heat. Its hydrogencarbonate does not exist as a solid. Although NH₄HCO₃ also exists as a solid.</li> <li>(iii) The stability of these salts increases with the increasing electropositive character from Li to Cs. I is therefore Li<sub>2</sub>CO₃ &lt; K₂CO₃ &lt; Rb₂CO₃ &lt; Cs₂CO₃ LiHCO₃ does not exist in solid form due to higt polarizing power of Li<sup>+</sup> and uncomparable size of Li cation and HCO₃<sup>-</sup> anion.</li> </ul>   | neutral medium but soluble in acids and decompose<br>on red heating.<br>(ii) The stability of carbonates increases with increase<br>in electropositive character of metal.<br>BeCO <sub>3</sub> < MgCO <sub>3</sub> < CaCO <sub>3</sub> < SrCO <sub>3</sub> < BaCO <sub>3</sub><br>(iii) Bicarbonates of alkaline earth metals do not exist<br>in solid state but are known in solution only on heating<br>their solution bicarbonates decomposed to liberate<br>$CO_2$ .<br>$M(HCO_3)_2 \xrightarrow{\Delta} MCO_3+CO_2 + H_2O$ (Solution)<br>(iv)Solubility of carbonates decrease on moving down<br>the group.  |

|     |                             | Δ   |   |
|-----|-----------------------------|---|---|
|     |                             | $Li_2CO_3 \xrightarrow{\Delta} Li_2O + CO_2$  |   |
|     |                             | (iv) Bicarbonates are decomposed at relatively low temperature.   |   |
|     |                             | $2MHCO_3 \xrightarrow{300^{9}C} M_2CO_3 + H_2O + CO_2$<br>(v) Hydrolysis of carbonate   |   |
|     |                             | $Na_2CO_3 + 2H_2O \longrightarrow 2NaOH + H_2CO_3$  |   |
|     |                             | Li <sub>2</sub> CO <sub>3</sub> + 2H <sub>2</sub> O $\longrightarrow$ sparingly soluble<br>(vi) The crystal structures of NaHCO <sub>3</sub> and KHCO <sub>3</sub><br>both show hydrogen bonding, but are different.<br>(a) In NaHCO <sub>3</sub> , the HCO <sub>3</sub> <sup>-</sup> ions are linked into an<br>infinite chain.<br>(b) in KHCO <sub>3</sub> , RbHCO <sub>3</sub> , CsHCO <sub>3</sub> , HCO <sub>3</sub> <sup>-</sup> forms a<br>dimeric anion.<br>Solubility in water NaHCO <sub>3</sub> < KHCO <sub>3</sub> < RbHCO <sub>3</sub> <<br>CsHCO <sub>3</sub>   |   |
|     |                             | (a) $\overset{P}{\overset{H}}$ $\overset{O}{\overset{H}}$ $\overset{O}{\overset{H}}$ $\overset{O}{\overset{H}}$ $\overset{O}{\overset{H}}$ $\overset{O}{\overset{H}}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{H}}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{O}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{O}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{O}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{O}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{O}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{O}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{O}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{O}$ $\overset{O}{\overset{O}}$ $\overset{O}{\overset{O}{\overset{O}}{\overset{O}}$ $\overset{O}{\overset{O}{\overset{O}}{\overset{O}}$ $\overset{O}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}{\overset{O}}{\overset{O}}{\overset{O}}{\overset$ |   |
|     |                             | (b) $0 = C 0 - H 0 C = 0$   |   |
| 8.  | Complex                     | <ul> <li>(i) A metal shows complex formation only when it has following characteristics.</li> <li>(a) Small size, (b) High nuclear charge, (c) Presence</li> </ul>  | $Be^{2+}$ on account of smaller size forms many complexes such as [Be $F_3]^-$ , [BeF_4]^2- Chlorophyll contains $Mg^{2+}$ [Photosynthetic pigment in   |
|     | ion<br>formation            | of empty orbitals in order to accept electron pair<br>from ligand (electron pair donor species).<br>(ii) Due to small size only Lithium in alkali metals,<br>forms a few complex ions. Rest all alkali metals do<br>not possess the tendency to form complex ion.   | plants] (C.No.= 4)<br>$[Be(H_2O)_4]^{2+} + H_2O \longrightarrow [Be(H_2O)_3OH]^{+} + H_3O^{+}$  |
| 9.  | Reaction                    | Reacts vigorously with acids<br>$2M + H_2SO_4 \longrightarrow M_2SO_4 + H_2$  | The alkaline earth metals readily react with acids liberated dihydrogen.  |
|     | with acids                  |   | $M + 2HCI \longrightarrow MCl_2 + H_2$  |
| 10. | Formation<br>of<br>amalgams | <ul> <li>(i) Alkali metals get dissolved in mercury to form<br/>amalgams with evolution of heat and the<br/>amalgamation is highly exothermic.</li> <li>(ii) Alkali metals form alloys themselves as well as<br/>with other metals.</li> </ul>  | Alkaline earth metals get dissolved in mercury to form<br>amalgams with evolution of heat and the<br>amalgamation is highly exothermic.   |
| 11. | Sulphates                   | (i) All these form sulphates of type $M_2SO_4$ .<br>(ii) Except $Li_2SO_4$ rest all are soluble in water.<br>Thermal stability /solubility in water<br>$Li_2SO_4 < Na_2SO_4 < K_2SO_4 < Rb_2SO_4 < Cs_2SO_4$<br>(iii)These sulphates on fusing with carbon form<br>sulphides.<br>$M_2SO_4 + 4C \longrightarrow M_2S + 4CO$  | (i) MSO <sub>4</sub> type sulphates are formed<br>(ii) MSO <sub>4</sub> type sulphates are formed<br>(iii) The solubility of sulphates decreases on moving<br>down the group. The sulphates of the alkaline earth<br>metals are all white solids and stable to heat. BeSO <sub>4</sub> ,<br>and MgSO <sub>4</sub> are readily soluble in water; the solubility<br>decreases from CaSO <sub>4</sub> to BaSO <sub>4</sub> . The greater<br>hydration enthalpies of Be <sup>2+</sup> and Mg <sup>2+</sup> ions overcome<br>the lattice enthalpy factor and therefore their sulphates<br>are soluble in water.<br>Thermal stability<br>BeSO <sub>4</sub> < MgSO <sub>4</sub> < CaSO <sub>4</sub> < SrSO <sub>4</sub> < BaSO <sub>4</sub><br>Solubility in water |
|     |                             |   | $BeSO_4 > MgSO_4 > CaSO_4 > SrSO_4 > BaSO_4$  |
| 12. | Sulphides                   | All metals react with S forming sulphides such as Na2S and Na2Sn (n = 2, 3, 4, 5 or 6). The polysulphide ions are made from zig-zag chains of subput atoms  | (iii) $MSO_4 + 2C \longrightarrow MS + 2CO_2$<br>$M^{2+} + S^{2-} \longrightarrow MS$   |
| 13. |                             | sulphur atoms.         (i) Nitrates of both are soluble in water and decompose on heating.         (ii) LiNO <sub>3</sub> decomposes to give NO <sub>2</sub> and O <sub>2</sub> and rest all give nitrites and oxygen.         2MNO <sub>3</sub> → 2MNO <sub>2</sub> +O <sub>2</sub> (except Li)  | On heating they decompose into their corresponding<br>oxides with evolution of a mixture of nitrogen dioxide<br>and oxygen.<br>$M(NO_3)_2 \longrightarrow MO + 2NO_2 + \frac{1}{2}O_2$ $(M = Be, Mg, Cr, Sr, Ba)$   |
|     | Nitrates                    | $4\text{LiNO}_{3} \longrightarrow 2\text{Li}_{2}\text{O} + 4\text{NO}_{2} + \text{O}_{2}$ $2\text{NaNO}_{3} \xrightarrow{\Delta} 2\text{NaNO}_{2} + \text{O}_{2}$   | (m – 50, mg , 01, 01, 54)   |
|     |                             | $2NaNO_3 \xrightarrow{\Delta} Na_2O + N_2 + N_2 + O_2$  |   |

# CHEMISTRY FOR NEET

|     |         | $2NaNO_3 \longrightarrow Na_2O + N_2 + O_2$  |  |
|-----|---------|--|--|
| 14. | Nitride | $Li_3N + 3H_2O \longrightarrow 3LiOH + NH_3^{\uparrow}$  | $\begin{array}{c} Be_3N_2 + 6H_2O \longrightarrow 3Be(OH)_2 + 2NH_3 \uparrow \\ Mg_3N_2 + 6H_2O \longrightarrow 3Mg(OH)_2 + 2NH_3 \uparrow \end{array}$  |
| 15. | Carbide | $\begin{array}{c} \mbox{When Li is heated with carbon, an ionic carbide $Li_2C_2$} \\ \mbox{is formed.} \\ & 2Li+2C \longrightarrow Li_2C_2 \\ \mbox{Other metals do not react with carbon directly but} \\ \mbox{form carbides when heated with ethyne, or when} \\ \mbox{ethyne is passed through a solution of metal in liquid} \\ \mbox{ammonia.} \\ \mbox{Na} + C_2H_2 \longrightarrow NaH + C_2 \longrightarrow Na_2C_2 \\ \mbox{[C=C-H]}^- \ \mbox{[C=C]}^{2-} \\ \mbox{Na}_2C_2 + 2H_2O \longrightarrow NaOH + C_2H_2 \end{array}$ | The binary compounds of carbon with other elements (less electronegative or of similar electronegativity) are called carbides. They are classified into following 3 categories :<br>(i) lonic (ii) Covalent (iii) Interstitial (or metallic)<br>(i) lonic carbides (or salt like carbides) : Generally formed by the most electropositive elements such as alkali and alkaline earth metals and aluminium (Boron is exception). Based on the product obtained on hydrolysis, they are further sub-classified into three types.<br>(a) Methanides : These give $CH_4$ on reaction with $H_2O$ . |
|     |         |  | $AI_4C_3 + 12H_2O \longrightarrow 4AI(OH)_3 + 3CH_4$ ;   |
|     |         |  | $\begin{array}{llllllllllllllllllllllllllllllllllll$   |
|     |         |  | $CaC_2 + 2H_2O \longrightarrow Ca (OH)_2 + C2H_2$  |
|     |         |  | $AI_2 (C_2)_3 + 6H_2O \longrightarrow 2AI (OH)_3 + 3C2H_2$   |
|     |         |  | $\begin{array}{l} SrC_2 + 2H_2O \longrightarrow Sr (OH)_2 + C_2H_2\\ Such compounds contain C22- ions.\\ (c) Allylides : These give 1-propyne on reaction with H_2O. \end{array}$  |
|     |         |  | $Mg_2C_3 + 4H_2O \longrightarrow 2Mg (OH)_2 + CH_3-C=CH$   |
|     |         |  | Such compounds contain $C_3^{4-}$ [: $C - C \equiv C$ :] <sup>4-</sup> ions.   |
|     |         |  | <b>Covalent carbides</b><br>Molecules like SiC and B <sub>4</sub> C are also examples of<br>covalent carbides.   |
|     |         |  | Interstitial or metallic carbides<br>Such carbides are formed by transition metals and<br>some of the lanthanides and actinides. Interstitial<br>carbides retain many of the properties of metals. They<br>conduct electricity by metallic conduction and have<br>properties of metals (a lusture like a metal). In these<br>compounds carbon atoms occupy octahedral holes in<br>the closed packed metal lattice. These are generally<br>very hard and have very high melting point (e.g. WC).<br>Carbides of Cr, Mn, Fe, Co and Ni are hydrolysed by<br>water or dilute acids.               |

Lattice Energy: Energy change when one mole of crystalline lattice is formed from gaseous ions

eg.  $2AI^{3+} + 3O^{2-} \longrightarrow AI_2O_3 + L.E.$ 

Hydration Energy: It is the energy change when gaseous ions for aqueous ions.

eg.

Na<sup>+</sup> + aq.  $\longrightarrow$  Na<sup>+</sup> + H.E. of Na<sup>+</sup> SO<sub>4</sub><sup>2-</sup> + aq.  $\longrightarrow$  SO<sub>4</sub><sup>2-</sup> + H.E. of SO<sub>4</sub><sup>2-</sup>

## Solutions in liquid NH<sub>3</sub>

Alkali metals dissolve in liquid ammonia (high conc. 3 M) and give blue solution which is conducting, reducing and paramagnetic in nature.

#### Reason

On dissolving Metal in NH3

$$M(s) + NH_{\underline{3}(\ell)} \longrightarrow M^{+}(NH_{3}) + e^{-}(NH_{3})$$

 $M^{+} + x (NH_{3}) \longrightarrow [M (NH_{3})_{X}]^{+} \longrightarrow Ammoniated cation$ 

 $e^{-} + y (NH_3) \longrightarrow [e(NH_3)_V]^{-} \longrightarrow Ammoniated electron$ 

The blue colour is due to  $\longrightarrow$  Ammoniated electron

The paramagnetic nature is due to  $\longrightarrow$  Ammoniated electron

The conducting nature is due to  $\longrightarrow$  Ammoniated M<sup>+</sup> + Ammoniated electron

On standing the colour fades due to formation of amide After liberating hydrogen.

 $M^+ + e^- + NH_3 \longrightarrow MNH_2 (amide) + H_2 (g)$ 

In the absence of impurities like. Fe, Pt, Zn etc, the solutions are stable.

In concentrated solution, the blue colour changes to bronze colour and diamagnetic due to the formation of metal clusters and ammoniated electrons also associate to form electron pairs

$$2 e^{-} (NH_3)y \longrightarrow [e^{-} (NH_3)_y]_2$$

Solutions are of much lower density than the pure solvent, i.e., they occupy for greater volume than that expected from the sum of the volumes of metal and solvent

Peroxide and superoxides of Na & K are widely used as Oxidising agent and air purifiers in space capsules, submarines and breathing mask.

#### Alkaline metal in liq. NH<sub>3</sub>

Like alkali metals, the alkaline earth metals dissolve in liquid ammonia to give deep blue black solutions forming ammoniated ions

 $M + (x + y)NH_3 \longrightarrow [M(NH_3)_x]^{2+} + 2[e(NH_3)_y]^{-}$ 

From these solutions, the hexa-ammoniates  $[M(NH_3)_6]^{2+}$  can be recovered.

#### Uses of alkali metal

(1) Lithium metal is used to make useful alloys,

- with lead to make 'white metal' bearings for motor engines.
- with aluminium to make aircraft parts.
- with magnesium to make armour plates.
- (2) It is used in thermonuclear reactions.
- (3) Lithium is also used to make electrochemical cells.
- (4) Sodium is used to make a Na/Pb alloy needed to make PbEt<sub>4</sub> and PbMe<sub>4</sub>. These organolead compounds were earlier used as anti-knock additives to petrol, but nowadays vehicles use lead-free petrol.
- (5) Liquid sodium metal is used as a coolant in fast breeder nuclear reactors.
- (6) Potassium chloride is used as a fertilizer.
- (7) Potassium hydroxide is used in the manufacture of soft soap. It is also used as an excellent absorbent of carbon dioxide.
- (8) Caesium is used in devising photoelectric cells.

#### Uses of alkaline metal

- (1) Beryllium is used in the manufacture of alloys.
- (2) Copper-beryllium alloys are used in the preparation of high strength springs.
- (3) Metallic beryllium is used for making windows of X-ray tubes.

(4) Magnesium forms alloys with aluminium, zinc, manganese and tin. Magnesium-aluminium alloys being light in mass are used in air-craft construction.

(5) Magnesium (powder and ribbon) is used in flash powders and bulbs, incendiary bombs and signals.

(6) A suspension of magnesium hydroxide in water (called *milk of magnesia*) is used as antacid in medicine.

(7) Magnesium carbonate is an ingredient of toothpaste.

- (8) Calcium is used in the extraction of metals from oxides which are difficult to reduce with carbon.
- (9) Calcium and barium metals, owing to their reactivity with oxygen and nitrogen at elevated temperatures, have often been used to remove air from vacuum tubes.

(10) Radium salts are used in radiotherapy, for example, in the treatment of cancer.

#### **Biological Importance Of Sodium And Potassium:**

Sodium ions are found primarily on the outside of cells, being located in blood plasma and in the interstitial fluid which surrounds the cells. These ions participiate in the transmission of nerve signals, in regulating the flow of water across cell membranes and in the transport of sugars and amino acids into cells. Sodium and potassium, although so similar chemically, differ quantitatively in their ability to penetrate cell membranes, in their transport mechanisms and in their efficiency to activate enzymes. Thus, potassium ions are the most aundant cations within cell fluids, where they activate many enzymes, participate in the oxidation of glucose to produce ATP and, with sodium, are responsible for the transmission of nerve signals

A typical 70 kg man contains about 90 g of Na and 170 g of K compared with only 5 g of iron and 0.06 g of copper.

#### **Biological Importance of Magnesium and Calcium :**

- Monovalent sodium and potassium ions and divalent magnesium and calcium ions are found in large proportions in **biological fluids**. These ions perform important **biological functions** such as maintenance of ion balance and nerve impulse conduction.
- All enzymes that utilise ATP in phosphate transfer require magnesium as the cofactor. The main pigment for the absorption of light in plants is chlorophyll which contains magnesium. About 99 % of body calcium is present in bones and teeth. It also plays important roles in neuromuscular function, interneuronal transmission, cell membrane integrity and blood coagulation.
- The calcium concentration in plasma is regulated at about 100 mgL<sup>-1</sup>. It is maintained by two hormones : calcitonin and parathyroid hormone. Do you know that bone is not an inert and unchanging substance but is continuously being solubilised and redeposited to the extent of 400 mg per day in man? All this calcium passes through the plasma.

An adult body contains about 25 g of Mg and 1200 g of Ca compared with only 5 g of iron and 0.06 g of copper. The daily requirement in the human body has been estimated to be 200–300 mg.

#### ANOMALOUS PROPERTIES OF LITHIUM

The anomalous behavior of lithium is due to the :

(i) Exceptionally small size of its atom and ion,

(ii) High polarising power (i.e., charge/ radius ratio ).

As a result, there is increased covalent character of lithium compound which is responsible for their solubility in organic solvent. Further, lithium shows diagonal relationship to magnesium.

| S.No. | Property              | Li  |  |
|-------|-----------------------|---|--|
| 1.    | Hardness              | Li is much harder.  |  |
| 2.    | M.P and B.P           | Higher M.P and B.P  |  |
| 3.    | Reactivity            | Less reactive   |  |
| 4.    | Reducing agent        | Strong  |  |
| 5.    | Combustion in air     | Li form monoxide (Li <sub>2</sub> O) and nitride (Li <sub>3</sub> N) ; not for other.   |  |
| 6.    | Hydration of ion      | Favored for $Li^{\oplus}$ ; not for other.<br>$Li^{\oplus}$ has maximum degree of hydration for this reason. Lithium salts are mostly hydrated. E.g LiCl.2H <sub>2</sub> O. |  |
| 7.    | Hydrogen<br>Carbonate | Li is not obtained in the solid form while all other elements form solid hydrogen carbonates.   |  |

| 8.  | Ethynide                  | Favored for $Li^{\oplus}$ ; not for other.   |  |
|-----|---------------------------|--|--|
| 9.  | Lithium nitrate           | $4\text{LiNO}_3 \xrightarrow{\Delta} 2\text{Li}_2\text{O} + 4\text{NO}_2 + \text{O}_2$ |  |
|     |                           | Lithium Oxide  |  |
|     |                           | Where as other alkali metal nitrates decompose to give the                             |  |
|     |                           | corresponding nitrite.   |  |
|     |                           | $2NaNO_3 \xrightarrow{\Delta} 2NaNO_2 + O_2$   |  |
|     |                           | Sodium nitrite   |  |
| 10. | LiF and Li <sub>2</sub> O | These are much less soluble in water. Solubility in water is less                      |  |
|     |                           | than the corresponding compounds of other alkali metal.                                |  |
| 11. | Carbide                   | Li reacts directly with carbon to form anionic carbide.                                |  |
| 12. | Hydroxide                 | Lithium hydroxide is less basic $Li_2CO_3$ , $LiNO_3$ and $LiOH$ all form              |  |
|     |                           | the oxides an gentle heating.  |  |
| 13. | Carbonate                 | Less stable.   |  |
| 14. | Nitrite                   | Less stable.   |  |
| 15. | Bicarbonate               | Lithium forms a bicarbonates in solution it does not form a solid                      |  |
|     |                           | bicarbonate.   |  |
|     |                           | Where as the other all forms stable solid Carbonates.                                  |  |
| 16. | Complex ion               | Lithium has a great tendency to form. Complexes not for other.                         |  |
|     | formation                 | Due to small size of Lithium.  |  |
| 17. | Reaction with             | Li when heated in NH3 imide (Li2NH) while other alkali metals                          |  |
|     | NH₃                       | form amides (MNH <sub>2</sub> )  |  |

#### Points of Similarities between Lithium and Magnesium

The similarity between lithium and magnesium is particularly striking and arises because of their similar size: atomic radii, Li = 152 pm, Mg = 160 pm; ionic radii : Li<sup>+</sup> = 76 pm, Mg<sup>2+</sup> = 72 pm. The main points of similarity are :

| S.No. | Properties                        | Li and Mg   |  |
|-------|-----------------------------------|---|--|
| 1.    | Hardness                          | Li and Mg are much harder.  |  |
| 2.    | Density                           | These are lighter than other elements in the respective group.  |  |
| 3.    | Reaction with water               | Both react slowly with water.   |  |
| 4.    | Solubility of hydroxide and oxide | Less soluble and their hydroxides decompose in acid on heating.   |  |
| 5.    | Reaction with N <sub>2</sub>      | By direct combination with nitrogen both form a nitride $Li_3N$ and $Mg_3N_2$ .   |  |
| 6.    | Oxides                            | The oxides Li <sub>2</sub> O and MgO donot combine with excess oxygen to give any superoxide.   |  |
| 7.    | Carbonates                        | Carbonates of both decompose easily on heating to form the oxides and CO <sub>2</sub> . Solid hydrogen carbonates are not formed by Li and Mg.                      |  |
| 8.    | Solubility of halides in ethanol  | Both LiCl and MgCl <sub>2</sub> are soluble.  |  |
| 9.    | Hydration of ion                  | Both LiCl and MgCl <sub>2</sub> are deliquescent and crystallise from aqueous solution as hydrates, LiCl.H <sub>2</sub> O and MgCl <sub>2</sub> .6H <sub>2</sub> O. |  |

### Anamolous Behaviour of Beryllium

The properties of beryllium the first member of the alkaline earth metal, differ from the rest of the member. Its is mainly because of

(i) Its small size and high polarizing power.

(ii) Relatively high electro negativity and ionization energy as compared to other members.

(iii) Absence of vacant d-orbitals in its valence shell.

Some important points of difference between beryllium and other members (especially magnesium) are given below.

| S.No. | Properties           |  |  |
|-------|----------------------|--|--|
| 1.    | Hardness             | Be is harder than other members of its group   |  |
| 2.    | Density              | Be is lighter than Mg  |  |
| 3.    | M.P. and B.P.        | Higher then other members of its group.  |  |
| 4.    | Reaction with water  | Be does not react with water while Mg reacts with boiling water.   |  |
| 5.    | Nature of oxides     | BeO is amphoteric while MgO is weakly basic.   |  |
| 6.    | Nature of compounds  | Be forms covalent compounds whereas other members form ionic compounds.  |  |
| 7.    | Carbide              | Beryllium carbide reacts with water to give methane whereas carbides of other alkaline earth metals gives acetylene gas.<br>$\begin{array}{c} Be_2C+4H_2O \rightarrow 2Be\ (OH)_2+CH_4\\ MgC_2+2H_2O \rightarrow Mg\ (OH)_2+C_2H_2\\ CaC_2+2H_2O \rightarrow Ca\ (OH)_2+C_2H_2\end{array}$ |  |
| 8.    | Hydride              | The beryllium hydride is electron deficient and polymeric, with muti center bonding like aluminium hydride.  |  |
| 9.    | Co-ordination number | Beryllium does not exhibit coordination number more than four as it has four orbitals in the valence shell. The other members of this group has coordination number 6.   |  |
| 10.   | Reaction with Alkali | Be dissolves in alkalies with evolution of hydrogen<br>Be + 2NaOH +2H <sub>2</sub> O→ Na <sub>2</sub> BeO <sub>2</sub> .2H <sub>2</sub> O + H <sub>2</sub><br>(sodium beryllate<br>Other alkaline earth metals don't react with alkalies.  |  |
| L     |                      |  |  |

**Resemblance of Beryllium with Aluminium (Diagonal relationship)** The following points illustrate the anomalous behaviour of Be and its resemblance with Al.

| S.No. | Properties               | Be and Al  |  |  |
|-------|--------------------------|--|--|--|
| 1.    | Nature of compounds      | Unlike groups-2 elements but like aluminium, beryllium forms covalent compounds.   |  |  |
| 2.    | Nature of hydroxide      | The hydroxides of Be, $[Be(OH)_2]$ and aluminium $[AI(OH)_3]$ are amphoteric in nature, whereas those of other elements of group – 2 are basic in nature.  |  |  |
| 3.    | Nature of oxide          | The oxides of both Be and AI i.e. BeO and AI <sub>2</sub> O <sub>3</sub> are high melting insoluble solids.  |  |  |
| 4.    | Polymeric structure      | BeCl <sub>2</sub> and AICl <sub>3</sub> have bridged chloride polymeric structure.   |  |  |
|       |                          | Cl Al Cl Be Cl Be Cl   |  |  |
|       |                          |  |  |  |
| 5.    | Salts                    | The salts of beryllium as well as aluminium are extensively hydrolysed.  |  |  |
| 6.    | Carbides                 | Carbides of both the metal reacts with water liberating methane gas.<br>Be <sub>2</sub> C + 4H <sub>2</sub> O $\rightarrow$ 2Be (OH) <sub>2</sub> + CH <sub>4</sub>  |  |  |
|       |                          | $AI_4C_3 + 12H_2O \rightarrow 4AI(OH)_3 + 3CH_4$   |  |  |
| 7.    | Oxides and<br>hydroxides | The oxides and hydroxides of both Be and Al are amphoteric and dissolve in sodium hydroxide as well as in hydrochloric acid.<br>$\begin{array}{c} BeO+2HCI \rightarrow BeCl_2 + H_2O\\ BeO+2NaOH \rightarrow Na_2BeO_2 + H_2O\\ Al_2O_3 + 6HCI \rightarrow 2AlCl_3 + H_2O\\ Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O \end{array}$ |  |  |
| 8.    | Reaction with acids      | Like Al, Be is not readily attacked by acids because of the presence of an oxide film.   |  |  |

# **GROUP -I & II OXIDES**

#### 1. Sodium Oxide (Na<sub>2</sub>O) Preparation:

| Name of compound    | Name and Brief about the process   | Related chemical reaction                        |
|---------------------|--|--|
|                     | (1) By burning sodium at 180°C in a limited supply of air or oxygen and distilling off the excess of sodium in vacuum. | $2Na + \frac{1}{2}O_2 \xrightarrow{180^0} Na_2O$ |
| Sodium Oxide        | (2) By heating sodium peroxide, nitrate or nitrite with sodium.  | $Na_2O_2 + 2Na \longrightarrow 2Na_2O_2$         |
| (Na <sub>2</sub> O) |  | $2NaNO_3 + 10Na \longrightarrow 6Na_2O + N_2$    |
|                     |  | $2NaNO_2 + 6Na \longrightarrow 4Na_2O + N_2$     |
|                     | (3) Sodium oxide is formed when the mixture of sodium azide and sodium nitrite is heated.                              | $3NaN_3 + NaNO_2 \longrightarrow 2Na_2O + 5N_2$  |

#### **Chemical Properties:**

(1) It is white amorphous substance.

(2) It dissolve violently in water, yielding caustic soda (NaOH) and evolving a large amount of heat. Na<sub>2</sub>O + H<sub>2</sub>O  $\longrightarrow$  2NaOH

Uses : It is used as dehydrating and polymerising agent in organic chemistry.

## 2. Sodium Peroxide (Na<sub>2</sub>O<sub>2</sub>)

Preparation

| Name of compound            | Name and Brief about the process   | Related chemical reaction   |
|-----------------------------|--|---|
| Sodium Peroxides<br>(Na₂O₂) | <ol> <li>By heating the metal in excess of air or<br/>oxygen at 300°, which is free from<br/>moisture and CO<sub>2</sub>.</li> </ol> | $2Na + O_2 (excess) \xrightarrow{300^0 C} Na_2O_2$                      |
|                             | (2) Industrial method :<br>It is a two stage reaction in the presence<br>of excess air.  | $2Na + O_2 \longrightarrow Na_2O$ $Na_2O + O_2 \longrightarrow Na_2O_2$ |

#### Properties:

- (1) It is a pale yellow solid (when impure), becoming white in air from the formation of a film of NaOH and Na<sub>2</sub>CO<sub>3</sub>.
- (2) In cold water (~0°C) produces  $H_2O_2$  but at room temperature produces  $O_2$ . In ice-cold mineral acids also produces  $H_2O_2$ .

$$Na_{2}O_{2} + 2H_{2}O \xrightarrow{-0^{\circ}C} 2NaOH + H_{2}O_{2}$$
$$2Na_{2}O_{2} + 2H_{2}O \xrightarrow{25^{\circ}C} 4NaOH + O_{2}$$
$$Na_{2}O_{2} + H_{2}SO_{4} \xrightarrow{-0^{\circ}C} Na_{2}SO_{4} + H_{2}O_{2}$$

$$2Na_2O_2 + H_2SO_4 \xrightarrow{25^{\circ}C} 2Na_2SO_4 + 2H_2O + O_2$$

(3) It reacts with CO<sub>2</sub>, giving sodium carbonate and oxygen and hence its use for purifying air in a confined space e.g. submarine, ill-ventilated room.

$$2Na_2O_2 + 2CO_2 \longrightarrow 2Na_2CO_3 + O_2$$

$$Na_2O_2 + CO \longrightarrow Na_2CO_3$$

(4) It is an oxidising agent and oxidises charcoal, CO, NH<sub>3</sub>, SO<sub>2</sub>.

 $3Na_2O_2 + 2C \longrightarrow 2Na_2CO_3 + 2Na$  [deposition of metallic Na]

$$CO + Na_2O_2 \longrightarrow Na_2CO_3$$
$$SO_2 + Na_2O_2 \longrightarrow Na_2SO_4$$

- $2NH_3 + 3Na_2O_2 \longrightarrow 6NaOH + N_2$
- (5) Sulphides are oxidised to corresponding sulphates

$$Na_2O_2 \longrightarrow Na_2O + [O]$$
;  $Na_2S + 4[O] \longrightarrow Na_2SO_4$ 

# (6) $Na_2O_2 \longrightarrow Na_2O + [O]$ ; $2AI + 3[O] \longrightarrow AI_2O_3$ ; $AI_2O_3 + Na_2O \rightarrow 2NaAIO_2$ .

<u>Uses</u> :

(1) For preparing  $H_2O_2$ ,  $O_2$ 

- (2) Oxygenating the air in submarines.
- (3) Oxidising agent in the laboratory.

| Oxides of<br>Potassium | K <sub>2</sub> O | K <sub>2</sub> O <sub>2</sub> | K <sub>2</sub> O <sub>3</sub> * | KO <sub>2</sub> | KO₃                 |
|------------------------|------------------|-------------------------------|---------------------------------|-----------------|---------------------|
| Colours                | White            | White                         | Red                             | Bright Yellow   | Orange Red<br>Solid |

#### 3. Potassium sesquioxide (need not memorize).

#### **Preparation:**

| Name of compound         | Name and Brief about the process             | Related chemical reaction  |
|--------------------------|--|--|
| K₂O<br>(Potassium oxide) | By heating potassium nitrate with potassium. | $2KNO_{3} + 10K \xrightarrow{heating} 6K_{2}O + N_{2}$ $K_{2}O \xrightarrow{heating} K_{2}O$ (White) (Yellow) $K_{2}O + H_{2}O \longrightarrow 2KOH$ |

#### Properties of Potassium superoxide (KO<sub>2</sub>)

It is a orange coloured (chrome yellow) powder and reacts with water according to following reaction.

 $2KO_2 + 2H_2O \longrightarrow 2KOH + H_2O_2 + O_2$ 

It reacts directly with CO and CO<sub>2</sub>.

$$2KO_2 + CO \longrightarrow K_2CO_3 + O_2$$
;  $2KO_2 + CO_2 \longrightarrow K_2CO_3 + O_2$ 

If more CO<sub>2</sub>, in presence of moisture is present; then

 $4\mathsf{KO}_2 + 4\mathsf{CO}_2 + 2\mathsf{H}_2\mathsf{O} \longrightarrow 4\mathsf{KHCO}_3 + 3\mathsf{O}_2$ 

On heating with sulphur, it forms potassium sulphate

$$2\mathsf{KO}_2 + \mathsf{S} \longrightarrow \mathsf{K}_2\mathsf{SO}_4$$

<u>Uses</u> : It is used as an oxidising agent and air purifier in space capsules, submarine and breathing mask as it produces O<sub>2</sub> and removes CO<sub>2</sub>.

#### 4. Magnesium Oxide (MgO):

| Name of compound                      | Name and Brief about the process                                      | Related chemical reaction           |  |
|---------------------------------------|---|-------------------------------------|--|
| Magnesium Oxide <u>(</u> MgO <u>)</u> | It is also called magnesia and obtained by heating natural magnesite. | $MgCO_3 \longrightarrow MgO + CO_2$ |  |

#### **Properties :**

- (1) It is white powder.
- (2) It's m.p. is 2850°C. Hence used in manufacture of refractory bricks for furances. And it is acts as basic flux and facilitates the removal of acidic impurities of Si, P and S from steel through slag formation.
   (3) It is vory slightly soluble in water importing alkaling reaction.
- (3) It is very slightly soluble in water imparting alkaline reaction.

#### 5. Calcium Oxide (CaO): Preparation

| Name of compound       | Name and Brief about the process   | Related chemical reaction                             |
|------------------------|--|---|
| Calcium Oxide<br>(CaO) | It is commonly called as quick lime or lime<br>and made by decomposing lime stone at a<br>high temperature about 1000°C. | $CaCO_3 \stackrel{\Delta}{\longleftarrow} CaO + CO_2$ |

\* The Carbon dioxide is removed as soon as it is produced to enable the reaction to proceed to completion.

#### **Chemical Properties :**

(1) It is white amorphous powder of m.p. 2570°C. On exposure to atmosphere; it absorbs moisture and carbondioxide.

 $CaO + H_2O \longrightarrow Ca(OH)_2 \quad ; \quad CaO + CO_2 \longrightarrow CaCO_3$ 

- (2) It emits intense light (lime light), when heated in oxygen-hydrogen flame.
- (3) It combines with limited amount of water to produce slaked lime. This process is called slaking of lime. Quick lime slaked with soda gives solid sodalime (CaO). Being a basic oxide.

$$CaO + H_2O \longrightarrow Ca(OH)_2$$

(4) Soda lime (basic oxide) combines with some acidic oxides at high temperature.

$$CaO + SiO_2 \longrightarrow CaSiO_3$$

$$6CaO + P_4O_{10} \longrightarrow 2Ca_3(PO_4)_2$$

#### <u>Uses</u> :

- (i) It is an important primary material for manufacturing cement and is the cheapest form of alkali.
- (ii) It is used in the manufacture of sodium carbonate from caustic soda.
- (iii) It is employed in the purification of sugar and in the manufacture of dye stuffs.

## **HYDROXIDES**

#### 1. Sodium Hydroxides(Caustic Soda) NaOH: Preparation :

| Name of<br>compound            | Name and Brief about the process   | Related chemical reaction  |
|--------------------------------|--|--|
| Sodium<br>Hydroxides<br>(NaOH) | (1) Electrolysis of Brine :<br>Sodium hydroxide is<br>generally prepared<br>commercially by the<br>electrolysis of sodium<br>chloride in Castner-Kellner<br>cell. A brine solution is<br>electrolysed using a<br>mercury cathode and a<br>carbon anode. Sodium<br>metal discharged at the<br>cathode combines with<br>mercury to form sodium<br>amalgam. Chlorine gas is<br>evolved at the anode.<br>The amalgam is treated<br>with water to give sodium<br>hydroxide and hydrogen<br>gas. | Cathode:Na <sup>+</sup> + e <sup>-</sup> $\xrightarrow{Hg}$ Na-amalgam<br>Anode : Cl <sup>-</sup> $\longrightarrow \frac{1}{2}$ Cl <sub>2</sub> + e <sup>-</sup> |
|                                |  | 2Na-amalgam + 2H <sub>2</sub> O $\longrightarrow$ 2NaOH + 2Hg + H <sub>2</sub>   |
|                                | (2) Caustication of<br>Na <sub>2</sub> CO <sub>3</sub><br>(Gossage's method)   | Na₂CO₃ + Ca(OH)₂ → 2NaOH + CaCO₃↓<br>(suspension)  |
|                                |  | Since the $K_{sp}$ (CaCO <sub>3</sub> ) < $K_{sp}$ (Ca(OH) <sub>2</sub> ), the reaction shifts towards right.  |

# CHEMISTRY FOR NEET

#### **Properties:**

(5)

- (1) Sodium hydroxide is a white, translucent solid. It melts at 591 K. It is readily soluble in water to give a strong alkaline solution. Crystals of sodium hydroxide are deliquescent. The sodium hydroxide solution at the surface reacts with the CO<sub>2</sub> in the atmosphere to form Na<sub>2</sub>CO<sub>3</sub>.
- (2) It is white crystalline, deliquescent, highly corrosive solid.
- (3) It is stable towards heat.
- (4) It's aqueous solution alkaline in nature and soapy in touch.

$$NH_4CI + NaOH \longrightarrow NaCI + NH_3 \uparrow + H_2O$$

FeCl<sub>3</sub> + 3NaOH 
$$\longrightarrow$$
 Fe(OH)<sub>3</sub>  $\downarrow$  + 3NaCl

$$ZnCl_2 + 2NaOH \longrightarrow Zn(OH)_2 \downarrow + 2NaCl$$

$$Zn(OH)_2 \downarrow + 2NaOH \longrightarrow Na_2ZnO_2 + 2H_2O$$
 [Same with AlCl<sub>3</sub>, SnCl<sub>2</sub>, PbCl<sub>2</sub>]

soluble

(6) Acidic and amphoteric oxides gets dissolved easily e.g.

$$CO_2 + 2NaOH \longrightarrow Na_2CO_3 + H_2O$$

$$AI_2O_3 + 2NaOH \longrightarrow 2NaAIO_2 + H_2O$$

(7) Aluminium and Zn metal gives  $H_2$  from NaOH.

$$2AI + 2NaOH + 2H_2O \longrightarrow 3H_2 + 2NaAIO_2$$

- (8) Several non metals such as P, S, Cl etc. yield a hydride instead of hydrogen.e.g.
  - $4P + 3NaOH + 3H_2O \longrightarrow PH_3 + 3NaH_2PO_2$  (Disproportionation reaction)
- (9) NaOH is stable towards heat but reduced to metal when heated with carbon.  $2NaOH + C \longrightarrow 2Na + 2CO + H_2$

(10). NaOH + Metal Oxide (M) 
$$\xrightarrow{+2}$$
 Na<sub>2</sub>MO<sub>2</sub>  $\xrightarrow{+3}$  Na<sub>3</sub>MO<sub>3</sub>  $\xrightarrow{+4}$  Na<sub>2</sub>MO<sub>3</sub>

Above are general reactions of NaOH with metal oxides having metal's Oxidation number +2, +3 & +4 respectively.

- Uses : It is used in
- (i) The manufacture of soap, paper, artificial silk and a number of chemicals.
- (ii) In petroleum refining.
- (iii) In the purification of bauxite.
- (iv) In the textile industries for mercerising cotton fabrics.
- (v) For the preparation of pure fats and oils .
- (vi) As a laboratory reagent.

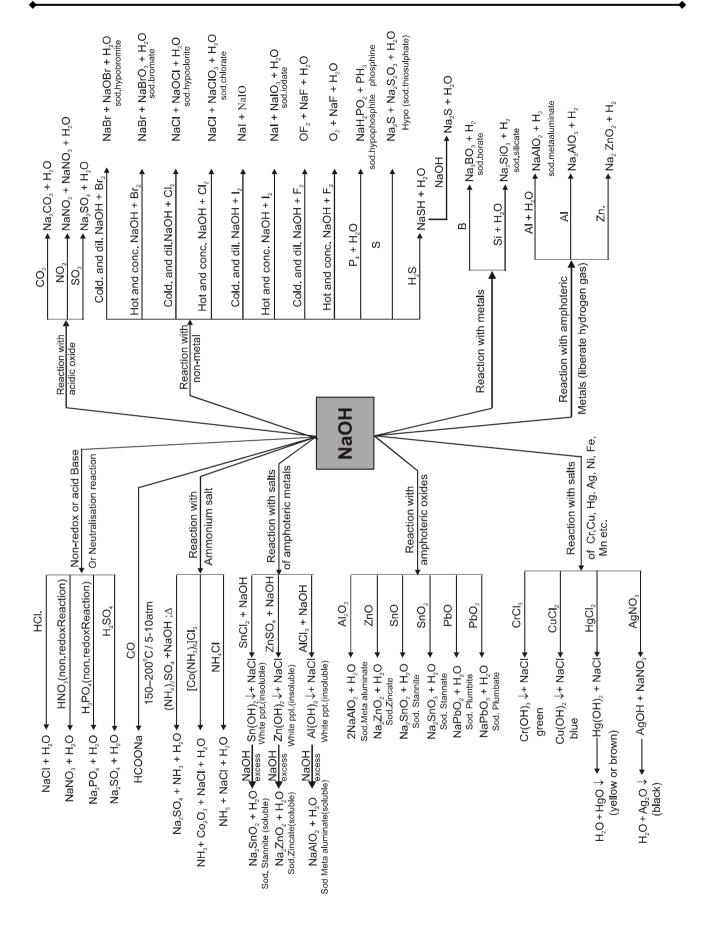
### 2. Potassium Hydroxide (KOH):

#### **Preparation:**

- (1) It is prepared by electrolysis of KCl solution.
- (2) KOH resembles NaOH in all its reactions. However KOH is much more soluble in alcohol. This accounts for the use of alcoholic KOH in organic chemistry.
- (3) It is used for the absorption of gases like  $CO_2$ ,  $SO_2$ , etc. It is used for making soft soaps.

#### Properties:Same as NaOH

- (1) It is stronger base compared to NaOH.
- (2) Solubility in water is more compared to NaOH.
- (3) In alcohol, NaOH is sparingly soluble but KOH is highly soluble.
- (4) As a reagent KOH is less frequently used but in absorption of CO<sub>2</sub>, KOH is preferably used compared to NaOH. Because KHCO<sub>3</sub> formed is soluble whereas NaHCO<sub>3</sub> is insoluble and may therefore choke the tubes of apparatus used.



#### 3. Magnesium Hydroxide (Mg(OH)<sub>2</sub>):

It occurs in nature as the mineral brucite. **Preparation:** 

| Name of compound                                 | Name and Brief about the  | Related chemical reaction   |
|--|---|---|
|  | process   |   |
| Magnesium<br>Hydroxide<br>(Mg(OH) <sub>2</sub> ) | It can be prepared by adding<br>caustic soda solution to a<br>solution of Magnesium sulphate<br>or chloride solution. | $\begin{array}{cccc} MgSO_4 + 2NaOH & \longrightarrow & Mg(OH)_2 + Na_2SO_4 \\ MgCl_2 + 2NaOH & \longrightarrow & Mg(OH)_2 + 2NaCl \\ MgCl_2 + Ca(OH)_2 & \longrightarrow & Mg(OH)_2 + CaCl_2 \\ & MgO + H_2O & \longrightarrow & Mg(OH)_2 \end{array}$ |

#### **Chemical Properties:**

(1) It can be dried at temperature upto 100°C only otherwise it breaks into its oxide at higher temperature.

$$Mg(OH)_2 \longrightarrow MgO + H_2O$$

- (2) It is slightly soluble in water imparting alkalinity.
- (3) It dissolves in NH<sub>4</sub>Cl solution.

 $Mg(OH)_2 + 2NH_4CI \longrightarrow MgCl_2 + 2NH_3.H_2O$ 

Thus,  $Mg(OH)_2$  is not therefore precipitated from a solution of  $Mg^{2+}$  ions by  $NH_3.H_2O.$  in presence of excess of  $NH_4CI.$ 

<u>Uses</u>: A suspension of Mg(OH)<sub>2</sub> in water is used in medicine as an **antacid** under the name, **milk of magnesia**.

#### 4. Calcium Hydroxide (Ca(OH)<sub>2</sub>):

#### Preparation :

| Name of compound                         | Name and Brief about the process | Related chemical reaction             |
|--|----------------------------------|---------------------------------------|
| Calcium Hydroxide (Ca(OH) <sub>2</sub> ) | By spraying water on quicklime.  | $CaO + H_2O \longrightarrow Ca(OH)_2$ |

#### **Properties:**

- (1) It is a white amorphous powder.
- (2) It is sparingly soluble in water.
- (3) It's solubility in hot water is less than that of cold water. Hence solubility decreases with increase in temperature.
- (4) The aqueous solution is known as lime water and a suspension of slaked lime in water is known as milk of lime.
- (5) When carbon dioxide is passed through lime water it turns milky due to the formation of calcium carbonate.

$$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$$

On passing excess of carbon dioxide, the precipitate dissolves to form calcium hydrogen carbonate.

$$CaCO_3 + CO_2 + H_2O \longrightarrow Ca(HCO_3)_2$$

Milk of lime reacts with chlorine to form hypochlorite, a constituent of bleaching powder.

$$2Ca(OH)_2 + 2Cl_2 \longrightarrow CaCl_2 + Ca(OCl)_2 + H_2O$$

Bleaching powder

#### <u>Uses</u>:

- (i) It is used in the preparation of mortar, a building material.
- (ii) It is used in white wash due to its disinfectant nature.
- (iii) It is used in glass making, in tanning industry, for the preparation of bleaching powder and for purification of sugar.

# **CARBONATES**

## 1. Sodium Carbonate (Washing soda) Na<sub>2</sub>CO<sub>3</sub>.10H<sub>2</sub>O:

#### **Preparation:**

1.

| Name of<br>compound  | Name and Brief about the process  | Related chemical reaction  |
|--|---|--|
| Sodium<br>Carbonate<br>(Washing soda)<br>Na <sub>2</sub> CO <sub>3</sub> .10H <sub>2</sub> O | (1) Leblanc Process<br>(2) Solvay Process<br>Step-1 (In ammonia absorber)<br>(i)Saturation of brine with<br>ammonia and CO <sub>2</sub><br>(ii) Ammoniated brine is filtered<br>to remove calcium and<br>magnesium impurities as their<br>insoluble carbonates.   | $\begin{array}{l} NaCl + H_2SO4(conc.) & \xrightarrow{mildheating} NaHSO4 + HCl \\ NaCl + NaHSO4 & \xrightarrow{Strongly} Na_2SO4 + HCl \\ & & (SaltCake) \\ Na_2SO4 + 4C & \longrightarrow Na_2S + 4CO \uparrow \\ Na_2S + CaCO_3 & \longrightarrow Na_2CO_3 + CaS \\ 2NH_3 + CO_2 & + H_2O & \longrightarrow (NH4)_2CO_3 \\ CaCl_2 + (NH4)_2CO_3 & \longrightarrow CaCO_3 \downarrow + 2NH4Cl \\ MgCl_2 + (NH4)_2CO_3 & \longrightarrow MgCO_3 \downarrow + 2NH4Cl \\ \end{array}$ |
|  | Step-2 (In carbonation tower) :<br>(i) Formation of insoluble<br>NaHCO <sub>3</sub><br>(ii) Reaction is exothermic and<br>hence there is a cooling<br>arrangement.<br>(iii) NaHCO <sub>3</sub> is insoluble in<br>cold brine solution because<br>of the common ion effect. It is<br>separated by filtration and the<br>filtered is used for recovering<br>NH <sub>3</sub> & CO <sub>2</sub> . | NH <sub>3</sub> + CO <sub>2</sub> + H <sub>2</sub> O $\longrightarrow$ NH <sub>4</sub> HCO <sub>3</sub> ;<br>NH <sub>4</sub> HCO <sub>3</sub> + NaCl $\xrightarrow{30^{\circ}C}$ NaHCO <sub>3</sub> + NH <sub>4</sub> Cl   |
|  | Step-3 (Calcination to get sodium carbonate) :  | $2 \text{ NaHCO}_3 \xrightarrow{150^{\circ}\text{C}} \text{Na}_2\text{CO}_3 + \text{CO}_2 + \text{H}_2\text{O}$  |
|  | Step - 4 (In recovery tower) :<br>Recovery of ammonia and<br>carbondioxide.<br>CaCl <sub>2</sub> is obtained as by<br>product.  | $\begin{array}{ccc} NH_4 \ HCO_3 & & \xrightarrow{\Delta/Steam} & NH_2 + CO_2 + H_2O \\ \\ 2NH_4 \ Cl \ +Ca(OH)_2 & & \xrightarrow{\Delta/Steam} & 2NH_3 + 2H_2O +CaCl_2 \end{array}$  |

\* advantage is taken of low solubility of NaHCO<sub>3</sub>, it gets precipitated in the reaction of NaCl + NH<sub>4</sub>HCO<sub>3</sub>.

2. Naturally from trona

$$2(Na_2CO_3.NaHCO_3.2H_2O) \xrightarrow{heat} 3Na_2CO_3 + CO_2 + 5H_2O$$

### **Properties**

(1) (2)

Anhydrous Na<sub>2</sub>CO<sub>3</sub> is called as soda ash, which does not decompose on heating but melts at 852°C. Sodium carbonate is a white crystalline solid which exists as a decahydrate, Na<sub>2</sub>CO<sub>3</sub>·10H<sub>2</sub>O. This is also called washing soda. It is readily soluble in water. On heating, the decahydrate loses its water of crystallisation to form monohydrate. Above 373K, the monohydrate becomes completely anhydrous and changes to a white powder called soda ash.

 $Na_2CO_3 \cdot 10H_2O \xrightarrow{375K} Na_2CO_3 \cdot H_2O + 9H_2O$  $Na_2CO_3 \cdot H_2O \xrightarrow{>373K} Na_2CO_3 + H_2O$ (soda ash)

Carbonate part of sodium carbonate gets hydrolysed by water to form an alkaline solution.  $Na_2CO_3 + H_2O \longrightarrow H_2CO_3$  (weak acid) + NaOH (strong)

(3) Na<sub>2</sub>CO<sub>3</sub> absorbs CO<sub>2</sub> yielding sparingly soluble sodium bicarbonate which can be calcined at 250° to get pure sodium carbonate.

Na<sub>2</sub>CO<sub>3</sub> + H<sub>2</sub>O + CO<sub>2</sub>  $\rightarrow$  2NaHCO<sub>3</sub> (solid)

(4) It dissolved in acid with effervescence of  $CO_2$  and causticised by lime to give caustic soda.

 $Na_2CO_3 + HCI \longrightarrow 2NaCI + H_2O + CO_2$ 

 $Na_2CO_3 + Ca(OH)_2 \longrightarrow 2NaOH + CaCO_3$ 

#### Uses:

- (i) It is used in water softening, laundering and cleaning.
- (ii) It is used in the manufacture of glass, soap, borax and caustic soda.
- (iii) It is used in paper, paints and textile industries.
- (iv) It is an important laboratory reagent both in qualitative and quantitative analysis.

#### 2. Potassium Carbonate (K<sub>2</sub>CO<sub>3</sub>)

| Name of compound                  | Name and Brief about the process  | Related chemical reaction  |
|-----------------------------------|---|--|
| Potassium<br>Carbonate<br>(K2CO3) | By <b>leblance process</b> , it can be<br>prepared but by <b>solvay process</b> it<br><b>cannot be prepared</b> because<br>KHCO <sub>3</sub> is soluble in water. | $\begin{array}{c} \text{KCI} + \text{H}_2\text{SO}_4 \text{ (conc.)} & \xrightarrow{\text{mild heating}} \text{KHSO}_4 + \text{HCI} \\ \text{KCI} + \text{KHSO}_4 & \xrightarrow{\text{Strongly}} \text{K}_2\text{SO}_4 + \text{HCI} \\ & \xrightarrow{\text{heated}} \text{K}_2\text{SO}_4 + \text{4C} & \longrightarrow \text{K}_2\text{S} + \text{4CO} \uparrow \\ \text{K}_2\text{S} + \text{CaCO}_3 & \longrightarrow \text{K}_2\text{CO}_3 + \text{CaS} \end{array}$ |

#### **Properties:**

It resembles with Na<sub>2</sub>CO<sub>3</sub>, m.p. is 900°C but a mixture of Na<sub>2</sub>CO<sub>3</sub> and K<sub>2</sub>CO<sub>3</sub> melts at 712°C.

#### **Uses** It is used in glass manufacturing.

#### \* need not memories.

**Note :** Calcium carbonate and Magnesium carbonate found in nature.

Calcium bicarbonate and Magnesium bicarbonate are present in temporary hardness of water. Unstable and unimportant. Same for KHCO<sub>3</sub>.

# **CHLORIDES**

# Sodium Chloride (NaCl) and Potassium Chloride, Calcium Chloride

# Preparation:

NaCl : Found in nature as rock salt or in sea water. KCl : Found in nature as sylvine (KCl) or carnallite (KCl.MgCl<sub>2</sub>.6H<sub>2</sub>O) CaCl<sub>2</sub> : Obtained as byproduct in Solvay's process.

#### Properties of NaCI :

- (1) It is nonhygroscopic but the presence of MgCl<sub>2</sub> in common salt renders it hygroscopic.
- (2) It is used to prepare freezing mixture in laboratory [Ice-common salt mixture is called freezing mixture and temperature goes down to -23°C.]
- (3) For melting ice and snow on road.

#### Uses of NaCI:

- (i) It is used as a common salt or table salt for domestic purpose.
- (ii) It is used for the preparation of  $Na_2O_2$ , NaOH and  $Na_2CO_3$ .

### Magnesium Chloride (MgCl<sub>2</sub>)

It occurs in nature as mineral carnallite, KCI.MgCl<sub>2</sub>.6H<sub>2</sub>O.

**Preparation :** By Dow's Processes (Natural Brine process and Dolomite process).

#### **Properties:**

- (1) It crystallises as hexahydrate. MgCl<sub>2</sub>. 6H<sub>2</sub>O
- (2) It is deliquescent solid.
- (3) This hydrate undergoes hydrolysis as follows:

 $MgCl_2 \cdot 6H_2O \longrightarrow Mg(OH)CI + HCI + 5H_2O$ 

 $Mg(OH)CI \longrightarrow MgO + HCI$ 

Hence, Anh.  $MgCl_2$  cannot be prepared by heating this hydrate. Because of this formation of HCl. Sea water cannot be used in marine boilers which corrodes the iron body.

(4) Anhydrous  $MgCl_2$  can be prepared by heating a double salt like.  $MgCl_2.NH_4Cl.6H_2O$  as follows:

 $\mathsf{MgCl}_2 : \mathsf{NH}_4\mathsf{CI} : \mathsf{6H}_2\mathsf{O} \xrightarrow{-\mathsf{H}_2\mathsf{O}} \mathsf{MgCl}_2 : \mathsf{NH}_4\mathsf{CI} \xrightarrow{\mathsf{strong}} \mathsf{MgCl}_2 + \mathsf{NH}_3 + \mathsf{HCI}$ 

- (5) It is a colourless crystalline solid, highly deliquescent and highly soluble in water.
- (6) Sorel Cement is a mixture of MgO and MgCl<sub>2</sub> (paste like) which set to hard mass on standing. This is used in dental filling, flooring etc.
- (7) Anh.  $CaCl_2$  is used in drying gases and organic compounds but not NH<sub>3</sub> or alcohol due to the formation of CaCl<sub>2</sub> . 8NH<sub>3</sub> and CaCl<sub>2</sub> . 4C<sub>2</sub>H<sub>5</sub>OH.

# **SULPHATES**

### 1. Magnesium Sulphate (MgSO<sub>4</sub>):

It occurs in nature as minerals kiesserite (MgSO<sub>4</sub>.H<sub>2</sub>O), epsom salt (MgSO<sub>4</sub>.7H<sub>2</sub>O)and kainite (KCl.MgSO<sub>4</sub>.3H<sub>2</sub>O).

### Preparation:

- (1) It is obtained by dissolving kieserite. MgSO<sub>4</sub>.H<sub>2</sub>O in boiling water and then crystallising the solution as a hepta hydrate. i.e. MgSO<sub>4</sub>.7H<sub>2</sub>O. It is called as Epsom salt.
- (2) It is also obtained by dissolving magnesite in hot dil. H<sub>2</sub>SO<sub>4</sub>.

 $MgCO_3 + H_2SO_4 \longrightarrow MgSO_4 + H_2O + CO_2$ 

(3) By dissolving dolomite (CaCO<sub>3</sub>.MgCO<sub>3</sub>) in hot dil. H<sub>2</sub>SO<sub>4</sub> and removing the insoluble CaSO<sub>4</sub> by filtration.

CaCO<sub>3</sub>.MgCO<sub>3</sub> (dolomite) +  $2H_2SO_4 \longrightarrow MgSO_4 + CaSO_4 + 2CO_2 + 2H_2O_3$ 

(4) It is isomorphous with  $FeSO_4.7H_2O$ ,  $ZnSO_4.7H_2O$ .

### **Chemical Properties:**

### Heating effect:

(1) When heated to 150°C, it changes to monohydrate. On further heating, it becomes anhydrous at 200°C. On strong heating, it decomposes into MgO.

 $MgSO_{4}.7H_{2}O \xrightarrow{150^{\circ}C} MgSO_{4}.H_{2}O \xrightarrow{200^{\circ}C} MgSO_{4} \xrightarrow{strong} MgO + SO_{2} + O_{2}.$ 

(2) Magnesium sulphate when heated with lamp black at 800°C produces SO<sub>2</sub> and CO<sub>2</sub> gases.

$$2MgSO_4 + C \longrightarrow 2MgO + 2SO_2 + CO_2$$

(3) It forms double salts with alkali metal sulphates, e.g., K<sub>2</sub>SO<sub>4</sub>.MgSO<sub>4</sub>.6H<sub>2</sub>O.

### 2. Calcium Sulphate (Plaster of paris) $CaSO_{4.1/2} H_2O$

It occurs as anhydrite CaSO<sub>4</sub> , hemihydrate CaSO<sub>4</sub>. $\frac{1}{2}H_2O$  and as the dihydrate (CaSO<sub>4</sub>.2H<sub>2</sub>O) gypsum, alabaster or satin-spar.

### Preparation:

(1) It is a hemihydrate of calcium sulphate. It is obtained when gypsum, CaSO<sub>4</sub>·2H<sub>2</sub>O, is heated to 393 K.

 $2(CaSO_{4}.2H_{2}O) \longrightarrow 2(CaSO_{4}).H_{2}O + 3H_{2}O$ 

Above 393 K, no water of crystallisation is left and anhydrous calcium sulphate, CaSO<sub>4</sub> is formed. This is known as 'dead burnt plaster'.

It has a remarkable property of setting with water. On mixing with an adequate quantity of water it forms a plastic mass that gets into a hard solid in 5 to 15 minutes.

(2) It can be prepared by reacting any calcium salt with either sulphuric acid or a soluble sulphate.

 $CaCl_{2} + H_{2}SO_{4} \longrightarrow CaSO_{4} + 2HCl; \quad CaCl_{2} + Na_{2}SO_{4} \longrightarrow CaSO_{4} + 2NaCl$ 

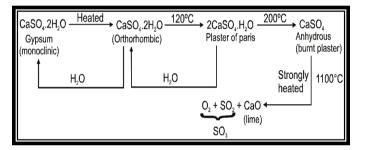
#### **Properties:**

It is a white crystalline solid. It is sparingly soluble in water and solubility decreases as temperature increases.

It dissolves in dilute acids. It also dissolves in ammonium sulphate due to the formation of double sulphate, (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>.CaSO<sub>4</sub>.H<sub>2</sub>O.

The setting process is **exothermic**. The process of setting takes place in stages. In the first stage, there is conversion of Plaster of Pairs into orthorhombic form of gypsum (setting step) and in the second stage orthorhombic form changes into monoclinic form (hardening step).

The setting of Plaster of Paris may be **catalysed by sodium chloride** while it is retarded by borax or alum. Addition of alum to Plaster of Paris makes the setting very hard. The mixture is known as **Keene's cement**.



**Dead plaster** has no setting property as it takes up water only very slowly.

A suspension of gypsum when saturated with ammonia and carbon dioxide forms ammonium sulphate, a nitrogenous fertilizer.

 $2NH_3 + CaSO_4 + CO_2 + H_2O \longrightarrow (NH_4)_2 SO_4 + CaCO_3$ 

When strongly heated with carbon, it forms calcium sulphide.

 $CaSO_4 + 4C \longrightarrow CaS + 4CO$ 

**Uses:** For preparing blackboard chalk. In anhydrous form as drying agent.

### Fertilizer

**1. Cynamide:** It is an organic compound with the formula CN<sub>2</sub>H<sub>2</sub>. This white solid is widely used in agriculture and the production of pharmaceuticals and other organic compounds.

Cyanamide is produced by hydrolysis of calcium cyanamide, which in turn is prepared from calcium carbide via the frank-Caro process.

 $CaC_2 + N_2 \longrightarrow CaCN_2 + C$ ; frank-Caro process

 $CaCN_2 + H_2O + CO_2 \longrightarrow CaCO_3 + H_2NCN$  (Cynamide)

The main reaction exhibited by cyanamide involves additions of compounds containing an acidic proton. Water, hydrogen sulfide, and hydrogen selenide react with cyanmide to give urea, thiourea, and selenourea, respectively :

 $H_2NCN + H_2E \rightarrow H_2NC$  (E)  $NH_2$ ; (E= O, S, Se)

2. Fluorapatite: It is a phosphate mineral with the formula Ca<sub>5</sub> (PO<sub>4</sub>)<sub>3</sub>.

### <u>Cement</u>

Cement is a product obtained by combining a material rich in lime, CaO with other material such as clay which contains silica, SiO<sub>2</sub> along with the oxides of aluminium, iron and magnesium.

The raw materials for the manufacture of cement are limestone and clay. When clay and lime are strongly heated together they fuse and react to form cement clinker. This clinker is mixed with 2-3% by weight of gypsum (CaSO<sub>4</sub>.2H<sub>2</sub>O) to form cement. Thus important ingredients present in Portland cement are dicalcium silicate (Ca<sub>2</sub>SiO<sub>4</sub>) 26%, tricalcium silicate (Ca<sub>3</sub>SiO=5) 51% and tricalcium aluminate (Ca<sub>3</sub>Al<sub>2</sub>O<sub>6</sub>) 11%.

**Setting of cement :** When mixed with water, the setting of cement takes place to give a hard mass. This is due to the hydration of the molecules of the constituents and their rearrangement. The purpose of adding gypsum is only to slow down the process of setting of the cement so that it gets sufficiently hardened.

**Uses :** Cement has become a commodity of national necessity for any country next to iron and steel. It is used in concrete and reinforced concrete, in plastering and in the construction of bridges, dams and buildings.

#### Common Names

The names marked with asterisk (\*) should be memorized with formulae. Others are given only for reference. You need not memorize them.

| Metal         | Ore name  | Formula  |
|---------------|---|--|
| Lithium (Li)  | Spodumene   | LiAI(SiO <sub>3</sub> ) <sub>2</sub>   |
|               | Lepidolite  | KLi <sub>2</sub> AI(AI,Si) <sub>3</sub> O <sub>10</sub> (F,OH) <sub>2</sub>  |
|               | Petalite  | LiAI(Si <sub>2</sub> O <sub>5</sub> ) <sub>2</sub>   |
| Sodium (Na)   | *Washing soda   | Na <sub>2</sub> CO <sub>3</sub> .10H <sub>2</sub> O  |
|               | *Baking soda  | NaHCO <sub>3</sub>   |
|               | *Sodium carbonate<br>(soda ash/ washing soda)                       | Na <sub>2</sub> CO <sub>3</sub>  |
|               | *Sodium chloride<br>(rock salt or <u>halite</u> )                   | NaCl   |
|               | *Sodium nitrate (Chile saltpeter)                                   | NaNO <sub>3</sub>  |
|               | Salt cake   | Na <sub>2</sub> SO <sub>4</sub>  |
|               | Fusion mixture  | Na <sub>2</sub> CO <sub>3</sub> + K <sub>2</sub> CO <sub>3</sub> (eq. molar mix.)  |
|               | Sodium sesquicarbonate (trona)                                      | Na <sub>2</sub> CO <sub>3</sub> .NaHCO <sub>3</sub> .2H <sub>2</sub> O (it is a double salt)   |
|               | *Microcosmic salt   | Na(NH <sub>4</sub> )HPO <sub>4</sub> .4H <sub>2</sub> O (it is obtained by mixing solutions of sodium phosphate and ammonium phosphate or chloride)  |
|               | Soda feldspar or sodium feldspar (albite)                           | Na <sub>2</sub> O. Al <sub>2</sub> O <sub>3</sub> . 6SiO <sub>2</sub>  |
|               | Potash feldspars or orthoclase or microcline or Potassium feldspars | K <sub>2</sub> O. Al <sub>2</sub> O <sub>3</sub> .6SiO <sub>2</sub>  |
|               | *Нуро   | Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> . 5H <sub>2</sub> O  |
|               | *Sodium aluminium fluoride (cryolite)                               | Na <sub>3</sub> AIF <sub>6</sub>   |
|               | *Borax (Tincal)   | Na <sub>2</sub> B <sub>4</sub> O <sub>7</sub> .10H <sub>2</sub> O  |
|               | *Sodium sulphate (glauber's salt)                                   | Na <sub>2</sub> SO <sub>4</sub> .10H <sub>2</sub> O<br>( <b>Sodium sulfate</b> is the <u>sodium</u> salt of <u>sulfuric</u><br><u>acid</u> . When <u>anhydrous</u> , it is a white crystalline<br>solid of formula Na <sub>2</sub> SO <sub>4</sub> known as the mineral<br><u>thenardite</u> ; the <u>decahydrate</u> Na <sub>2</sub> SO <sub>4</sub> .10H <sub>2</sub> O is<br>known as <b>Glauber's salt</b> ) |
|               | Sodium aluminium silicate<br>(Soda Feldspar)                        | NaAlSi <sub>3</sub> O <sub>8</sub>   |
| Potassium (K) | Sylvite   | KCI  |

|                   | Schonite                        | K <sub>2</sub> SO <sub>4</sub> .MgSO <sub>4</sub> .6H <sub>2</sub> O  |
|-------------------|---------------------------------|---|
|                   | Kainite                         | MgSO <sub>4</sub> .KCl.3H <sub>2</sub> O  |
|                   | *Carnallite                     | MgCl <sub>2</sub> .KCl.6H <sub>2</sub> O  |
|                   | *Indian saltpetre (Nitre)       | KNO <sub>3</sub> (used especially as a fertilizer and explosive)  |
|                   | Pearl ash                       | K <sub>2</sub> CO <sub>3</sub>  |
|                   | Schonite                        | K <sub>2</sub> SO <sub>4</sub> .MgSO <sub>4</sub> .6H <sub>2</sub> O( it is a double salt)                              |
|                   | Langbeinite                     | K <sub>2</sub> SO <sub>4</sub> .2MgSO <sub>4</sub>  |
|                   | Polyhalite                      | K <sub>2</sub> SO <sub>4</sub> .MgSO <sub>4</sub> .2CaSO <sub>4</sub> .2H <sub>2</sub> O                                |
|                   | *Potassium Alum                 | K <sub>2</sub> SO <sub>4</sub> . Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> . 24H <sub>2</sub> O                   |
|                   | Alunite or Alumstone            | K2SO4. Al2 (SO4)3. 4AI(OH)3   |
|                   | Mica                            | K <sub>2</sub> O. 3Al <sub>2</sub> O <sub>3</sub> . 6SiO <sub>2</sub> .2H <sub>2</sub> O                                |
|                   | Feldspar                        | KAISi <sub>3</sub> O <sub>8</sub> (K <sub>2</sub> O.Al <sub>2</sub> O <sub>3</sub> .6SiO <sub>2</sub> )                 |
| Beryllium (Be)    | Beryl                           | 3BeO. Al <sub>2</sub> O <sub>3</sub> 6SiO <sub>2</sub>  |
|                   | Chrysoberyl                     | BeO.Al <sub>2</sub> O <sub>3</sub>  |
|                   | Phenacite                       | BeSiO <sub>4</sub>  |
|                   | Bromalite                       | BeO   |
|                   | *Baryta                         | Ba(OH) <sub>2</sub>   |
| Magnesium<br>(Mg) | *Magnesite                      | MgCO <sub>3</sub>   |
|                   | *Dolomite                       | MgCO <sub>3</sub> .CaCO <sub>3</sub>  |
|                   | *Epsom salt                     | MgSO <sub>4</sub> .7H <sub>2</sub> O  |
|                   | Kieserite                       | MgSO <sub>4</sub> .H <sub>2</sub> O   |
|                   | Asbestos                        | CaMg <sub>3</sub> (SiO <sub>3</sub> ) <sub>4</sub>  |
|                   | Talc                            | Mg(Si <sub>2</sub> O <sub>5</sub> ) <sub>2</sub> Mg (OH) <sub>2</sub>   |
|                   | Brucite                         | Mg(OH) <sub>2</sub>   |
|                   | *Magnesia                       | MgO   |
|                   | Artinite                        | MgCO <sub>3</sub> .Mg(OH) <sub>2</sub> .3H <sub>2</sub> O   |
|                   | *Sorel cement (magnesia cement) | Mg4Cl2(OH)6(H2O)8   |
| Calcium (Ca)      | *Quick lime                     | CaO   |
|                   | *Slaked lime                    | Ca(OH) <sub>2</sub>   |
|                   | *Hydrolith                      | CaH <sub>2</sub>  |
|                   | *Calcium cynamide               | CaCN₂ OR CaNCN  |
|                   | *Limestone (Marble / Whiting)   | CaCO <sub>3</sub>   |
|                   | Anhydrite                       | CaSO <sub>4</sub>   |
|                   | *Gypsum                         | CaSO <sub>4</sub> .2H <sub>2</sub> O  |
|                   | *Fluorspar or Fluorite          | CaF <sub>2</sub>  |
|                   | Phosphorite                     | Ca <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>   |
|                   | *Fluorapatite                   | 3Ca <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub> .CaF <sub>2</sub> OR Ca <sub>5</sub> (PO <sub>4</sub> ) <sub>3</sub> F |
|                   | *Plaster of paris               | CaSO <sub>2</sub> .½H <sub>2</sub> O  |
|                   | *Bleaching powder               | CaOCl <sub>2</sub>  |
|                   | *Rock phosphate                 | Ca <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>   |
|                   | Wollastonite                    | CaSiO <sub>2</sub>  |
|                   | Colmanite                       | 2CaO.3Ba <sub>2</sub> O <sub>3</sub> .5H <sub>2</sub> O   |
| Strontium(Sr)     | Strontianite                    | SrCO <sub>3</sub>   |
|                   | Celestite                       | SrSO <sub>4</sub>   |
|                   | Barytes or Heavy spar           | BaSO <sub>4</sub>   |

# Periodic Properties of s-Block

| Properties   | Order  |
|--|--|
| Thermal stability  | LiH > NaH > KH > RbH > CsH   |
| Basic strength   | BeO < MgO < CaO < SrO  |
| Basic Strength or Solubility in water or thermal stability | LiOH < NaOH < KOH < RbOH < CsOH  |
| Basic Strength and Solubility in water                     | Be(OH) <sub>2</sub> <mg(oh)<sub>2<ca(oh)<sub>2<ba(oh)<sub>2</ba(oh)<sub></ca(oh)<sub></mg(oh)<sub>   |
| Thermal stability  | Be(OH) <sub>2</sub> <mg(oh)<sub>2<ca(oh)<sub>2<sr(oh)<sub>2&lt; Ba(OH)<sub>2</sub></sr(oh)<sub></ca(oh)<sub></mg(oh)<sub>  |
| Solubility in water or thermal stability                   | Li <sub>2</sub> CO <sub>3</sub> < Na <sub>2</sub> CO <sub>3</sub> < K <sub>2</sub> CO <sub>3</sub> < Rb <sub>2</sub> CO <sub>3</sub> < Cs <sub>2</sub> CO <sub>3</sub> |
| Solubility in water  | BaCO <sub>3</sub> < CaCO <sub>3</sub> < MgCO <sub>3</sub> < BeCO <sub>3</sub>  |
| Thermal stability  | BeCO <sub>3</sub> < MgCO <sub>3</sub> < CaCO <sub>3</sub> < BaCO <sub>3</sub>  |
| Solubility in water  | BaSO <sub>4</sub> < SrSO <sub>4</sub> < CaSO <sub>4</sub> < MgSO <sub>4</sub> < BeSO <sub>4</sub>  |