

* S-Block :-

Physical Properties

of Alkali Metals :-

(a) Atomic Size because $n \uparrow$ (b) I.E. \downarrow becoz $n \uparrow$ $Li > Na > K > Rb > Cs < Fr^*$ due to $Be > Mg > Ca > Sr > Ba < Ra$ poorshielding effect
of 4f Sub-shell.

| | | |
|-----------------|------------------------|------------------------|
| size \uparrow | 3Li } 8 | Be |
| | 11Na } 8 | Mg |
| | 19K } 8 | Ca |
| | 37Rb } 18 | Sr |
| | 55Cs } 18 | Ba |
| | 87Fr* } 32 | Ra* |
| Radioactive | ns ¹ config | ns ² config |

(c) $D = \frac{M}{V}$
 $V \uparrow$ D \uparrow down the group $Li < Na > K < Rb < Cs$ $D_{Na} > D_K$ $Na = 1s^2 2s^2 2p^6 3s^1$ $K = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^0 4s^1$ vol. of K $>>$ vol. of Na

(h) Photoelectric effect :- increases down the group because ionisation energy decrease.

Generally, K, Rb, Cs are used in photocell.

(e) electropositive character :- increases down the group because I.E. \downarrow .

(f) Crystalline structure :- Bcc structure have C.N. = 8

(g) M.B.S. \propto no. of upe
 $\propto \frac{1}{\text{size}}$

* Lithium is harder than other elements of group IA because of high M.B.S. classmate
Also known as analogous behaviour of Lithium.

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Down the group, M.B.S ↓
 $Li > Na > K > Rb > Cs > Fr$

liq at $27^{\circ}C$

M.B.S \approx BP/MP

$Li > Na > K > Rb > Cs > Fr$

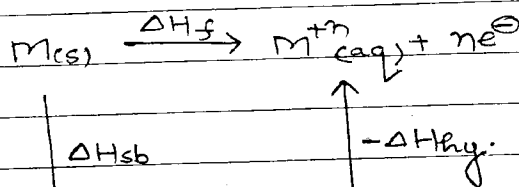
liq at $27^{\circ}C$ (not Room temperature)

(h) Reducing power:-

$Li > Cs > Rb > K > Na$

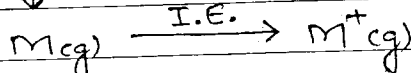
S.R.A

due to high
H.E.



ΔH_{sb}

$-\Delta H_{hy}$



$$\Delta H_f = \Delta H_{sb} + I.E. - \Delta H_{hy}$$

(i) These metals are soft and easily cut by knife. They have metallic lustre due to oscillation of e^{-} .

* Chemical Properties:-

→ These metals are more reactive and form ionic compound except LiX ($X = Cl, Br, I$) is predominantly covalent. $LiF =$ Ionic.

→ These metals are kept in kerosene oil except Li. Li is lighter, so it is kept in paraffin paper.

* Stability of Hydride decreases down the group.

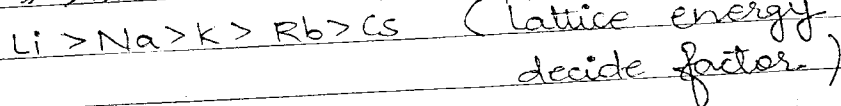
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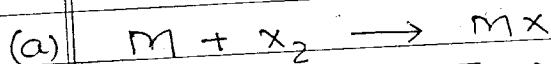
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(c) Reactivity order for formation of hydride:-

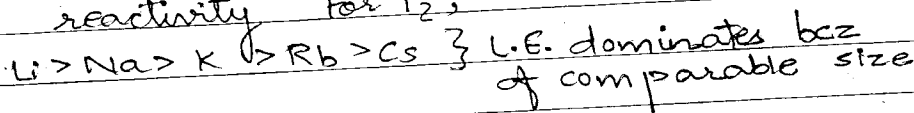


* Rx^n with Halogens :-

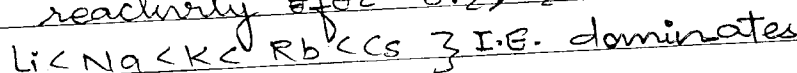


Ionic but $LiX = \text{covalent}$
($X = Cl, Br, I$)

(b) Order of reactivity for F_2 ,



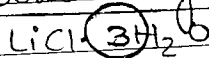
(c) Order of reactivity for Br_2, I_2



(d) Alkali metal halide are water soluble except LiF which is sparingly / insoluble because of high I.E.

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(e) Generally, lithium salts are hydrated due to high polarising power.



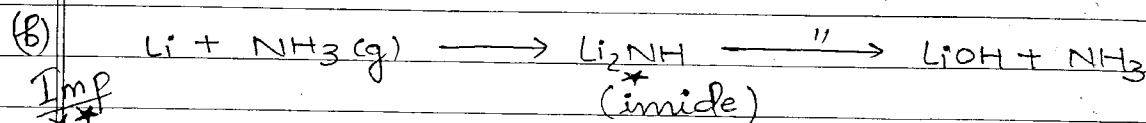
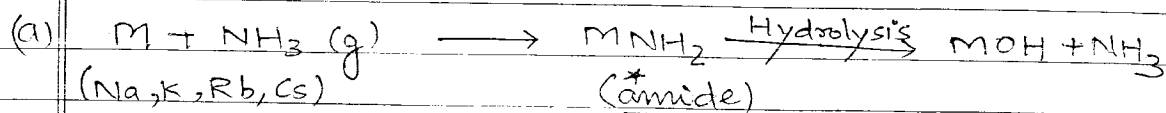
Integer type.

Note:- Gun powder = S + Charcoal + Nitrate.

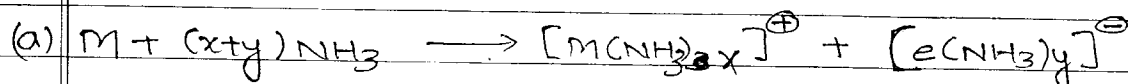
Nitrates which can be used here are:-

- (a) $LiNO_3$ X } due to strong polarisation,
- (b) $NaNO_3$ X } they get hydrated.
- (c) KNO_3 ✓

* Reaxn with NH_3 :-



* Rxn with $\text{NH}_3 (\text{l})$:-



(b) If conc. soln of M in NH_3 is used, then, blue colour changes to bronze and paramagnetic behaviour decreases because of collision.
 increase in

* Blue colour

* Conductor

* ammoniated^e

* S.R.A.

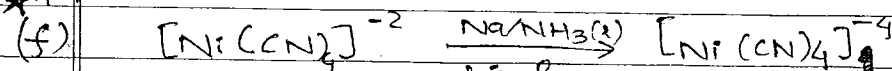
* paramagnetic

due to amide form.

(c) On standing, this soln liberates hydrogen. If catalytic impurities (Pt, Zn, Fe) are absent, then soln becomes stable.

(d) Metal can be recovered from soln of alkali metals while ammoniates can be recovered from alkaline earth metal.

(e) Be, Mg donot form soln in liq. NH_3 bcz \uparrow I.E.



* dsp^2

* sp^3

~~tetrahedral~~

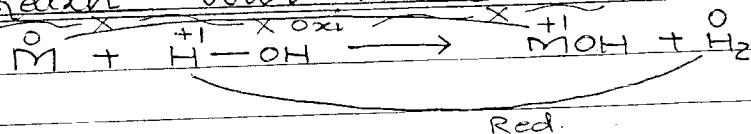
* tetrahedral

* square planar

* Diamagnetic.

* Diamagnetic.

* Reaxn with water:-



Order, $\text{Li} < \text{Na} < \text{K} < \text{Rb} < \text{Cs}$

- (a) Li reacts gently with water.
 (b) Na " vigorously " "
 (c) K, Rb, Cs " violently " "

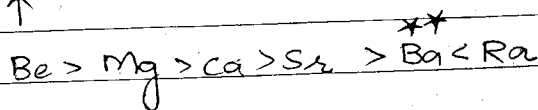
This explanation lie in kinetics, not in thermodynamics. When potassium react with water, then heat of rxn is sufficient to melt it or vapourise it. Molten metal spread on surface increasing surface area and rxn becomes faster.

* Group - II A :-

* Physical properties:-

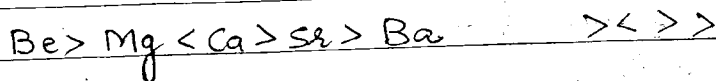
(a) Atomic size \uparrow , $n \uparrow$

(b) I.E \downarrow , $n \uparrow$



(c) $D = M \uparrow$ $\Delta \uparrow$ down the group with some irregularity
 $\vee \uparrow$
 $\text{Be} > \text{Mg} < \text{Ca} < \text{Sr} < \text{Ba} > > < <$

(d) M.P. \downarrow down the group with some irregularity



* Here concept of MBS in MP/BP fails
bcz all of them have different
crystalline structure.

classmate

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(e) B.P \downarrow , $Be > Mg < Ca > Sr < Ba$ $> < > <$

(f) Reducing property

$Be < Mg < Ca < Sr < Ba$



weak reducing
Agent

* Chemical properties :-

Generally, II A elements form ionic compound
except

(a) BeX_2 = Predom. covalent
($X = F, Cl, Br, I$)

(b) $MgX_2 / AlX_3 / LiX$ - Predom. covalent
($X = Cl, Br, I$)

(c) $LiF / MgF_2 / AlF_3$ - Predom. Ionic.

* Reaxn with O_2 :-

(a) $M + O_2 \longrightarrow MO \xrightarrow{\text{excess}} X$
(Be, Mg, Ca)

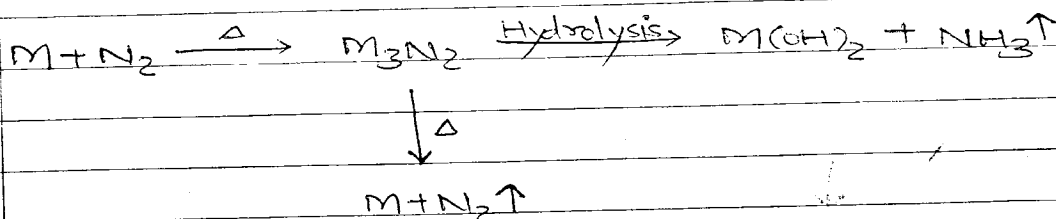
(b) $M + O_2 \longrightarrow MO \xrightarrow{\text{oxide}} MO_2 \xrightarrow{\text{excess}} X$
(Sr, Ba)

Note:- (a) BeO = covalent but other oxides are ionic
having rock salt structure.

(b) BeO = amphoteric & other Basic.

(c) All are stable towards heat.

* Reaxn with N₂ :-



* Reaxn with air :-

(a) Be and Mg are kinetically inert to oxygen and water to ~~oxygen~~ because of formation of oxide film on their surface, however, powdered Be brilliantly on ignition in air to beryllium oxide and Be₃N₂. Mg is more electropositive and burns with dazzling brilliance in air to give MgO & Mg₃N₂.

(b) Ca, Sr, Ba are readily attacked by air to form oxide and nitride.

* Rxn with water :-

(a) Alkaline earth metal have lesser tendency to react with water as compared to alkali metal.

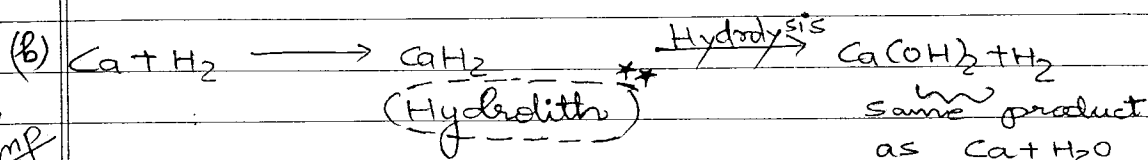
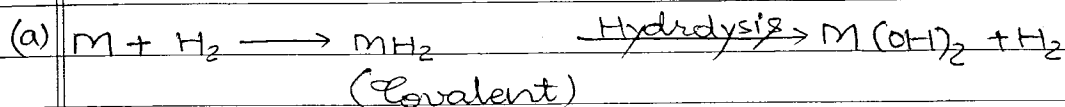
(b) * Be = inert

* Mg = react with warm water or when amalgamated with Hg.

* Ca, Sr, Ba = react with cold water.

- (c) Mg forms protective layer of MgO , that's why it doesn't react readily unless layer is removed amalgamating with Hg.

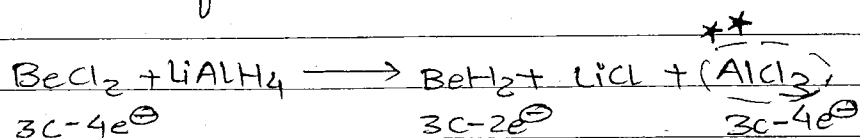
* Reaxn with H_2 :-



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- (c) All the elements except Beryllium combine with ~~hydro-~~ ^{hydro-} ~~oxygen~~ upon heating to form their hydride.

BeH_2 , however, can be prepared by rxn of $BeCl_2$ and $LiAlH_4$



* Reaxn with X_2 :-

- (a) All the alkaline earth metals combine with halogen and form their halides.

- (b) Thermal decomposition of $(NH_4)_2BeF_4$ is the best route for preparation of BeF_2 and $BeCl_2$ is conveniently made from the oxide.

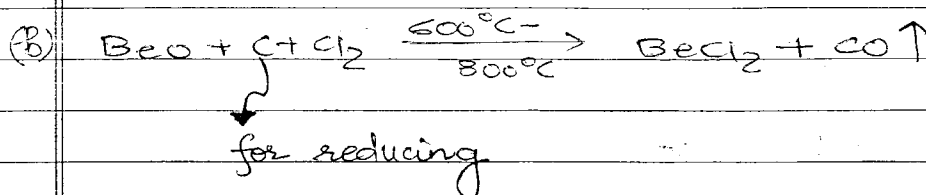
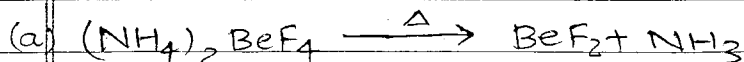
- (c) The tendency to form halide hydrate gradually decreases down the group.
 $MgCl_2 \cdot 6H_2O$, $CaCl_2 \cdot 6H_2O$, $SrCl_2 \cdot 6H_2O$, $BaCl_2 \cdot 2H_2O$

- (d) ~~***~~ Except Be halide, all other halides of alkaline earth metals are ionic in nature and Be halides are essentially covalent and soluble in organic solvent.

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* Reaxn with acids:-

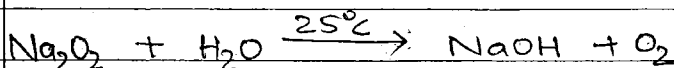
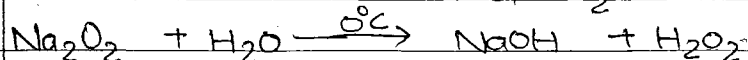
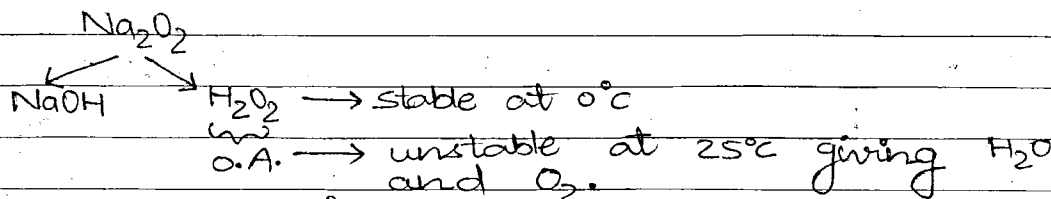
Order, $\text{Be} < \text{Mg} < \text{Ca} < \text{Sr} < \text{Ba}$
 weak

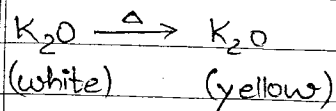
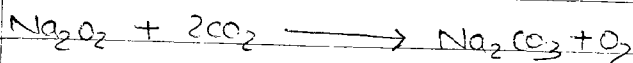
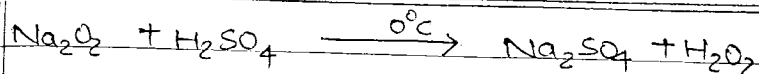
Reducing agent.

Rxn with X_2 (Remaining)

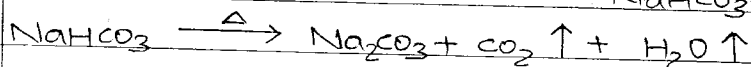
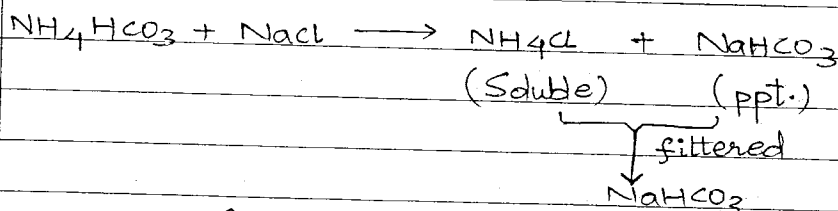
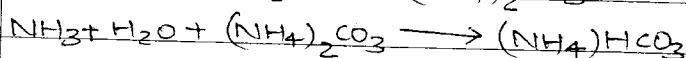
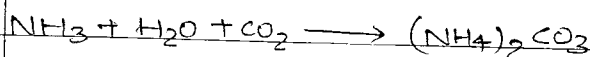
- (e) The dehydration of hydrated chlorides, Bromides and iodide of Ca, Sr, Ba can be achieved on heating, however, the corresponding hydrated halides of Be and Mg on heating suffer hydrolysis. (g) The fluorides are relatively less soluble than the chlorides due to their high lattice energy.

Keypoint of Rxns of Na_2O_2





* Solvay Process :- (NaHCO_3)

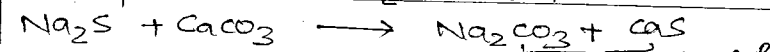
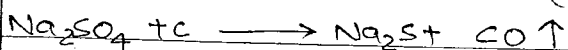
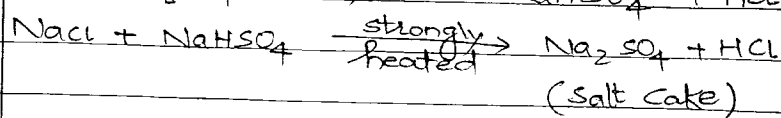


K_2CO_3 can't be prepared bcz KHCO_3 is soluble



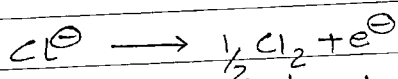
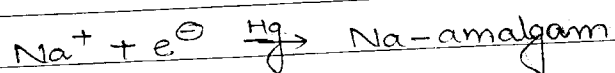
In this process, NH_3 is recovered when soln containing NH_4Cl is treated with $\text{Ca}(\text{OH})_2$, CO_2 is obtained by by-product.

Leblanc process :- (Na_2CO_3 , K_2CO_3 preparation)

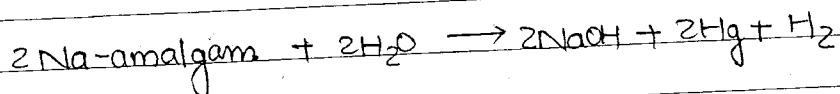


Castner - Kellner Cell :- (NaOH preparation)

NaOH is generally prepared commercially by electrolysis of NaCl in Castner-Kellner cell. A brine soln is electrolysed using a mercury cathode and a carbon anode. Na metal discharged at cathode combines with mercury to form sodium amalgam. Cl_2 is evolved at the anode.

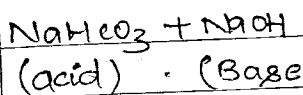
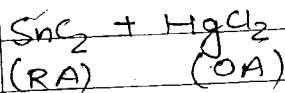


The amalgam is treated with H_2O to give NaOH.



Note: Other methods for preparation of NaOH are

- (i) Electrolysis of NaCl (aq.)
- (ii) Gossage's process.



} Do not exist together.