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Metallurgy (JEE Advanced)

Sintering ⇒ Partial fusion of metallic ore

ZnO PbO

S-BLOCK

alkali metals

⑨ Reaction with Halogen

$$M + X_2 \longrightarrow MX$$

Halides are Ionic

$LiX \longrightarrow$ Predom. covalent
(X = Cl | Br | I)

Note ⇒ alkali metal Halides are soluble except LiF Insoluble due to high LE

Note ⇒ Li salts are generally hydrated

because of high polarising power (ϕ)

of Li cation

$LiCl \cdot 3H_2O$

★ **Gun Powder ⇒ S + charcoal + nitrates**

one Which following nitrate can be used in Gun powder

① $LiNO_3$ ② $NaNO_3$ ③ KNO_3 ④ all

. Order of reactivity for F_2

$Li > Na > K > Rb > Cs$

Order of reactivity for $Cl_2 | Br_2 | I_2$

$Li < Na < K < Rb < Cs$

Reaction with $NH_3(g)$

$$Li + NH_3(g) \longrightarrow \underset{\text{(Imide)}}{Li_2NH} \xrightarrow{\text{Hydrolysis}} LiOH + NH_3$$

$$M + NH_3 \longrightarrow \underset{\text{amide}}{M^+NH_2^-} \xrightarrow{\text{Hydrolysis}} MOH + NH_3$$

(M = Na | K | Rb (s))

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Imp

Reaction with liq. NH_3

$$M + (x+y)NH_3 \xrightarrow{(liq.)} \left[M(NH_3)_x\right]^+ + \left[e(NH_3)_y\right]^-$$

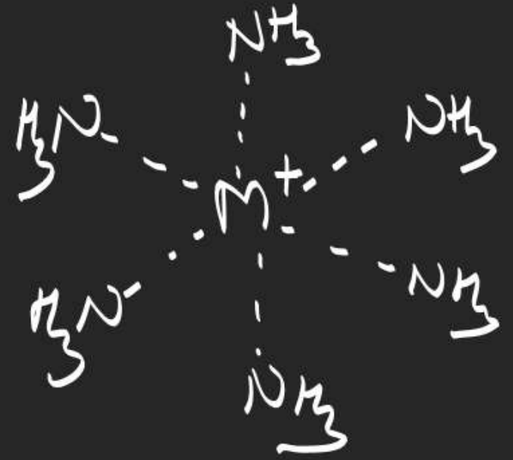
ammoniated e^-

Conductor

Strong reducing agent (S.R.A)

Blue colour

Paramagnetic



$$[\overset{+2}{Ni}(CN)_4]^{-2} \xrightarrow[\text{Birch Reduction}]{Na/NH_3(l)} [\overset{0}{Ni}(CN)_4]^{-4}$$

dsp^2 sq. planar — sp^3 tet.

Note → Solution of alkali metals in liq. NH_3 on standing ↑ liberates H_2 and solution becomes amide solution. if Catalytic impurities (Zn Fe Pt) are absent then this solution becomes stable.

Note ⇒ Conc. solution of alkali metals in liq. NH_3 present then it's Blue Colour Changes to bronze and it's Paramagnetic nature decreases and solution becomes Diamag.

alkaline earth metals form same type of solution with liq-NH_3 except → Be and Mg

Note → due to high I.E Be and Mg do not form such type of compound.

Note ⇒ f-block element Eu and Yb also form such solution with liq. NH_3

Note ⇒ In case of alkali metals, metal can be recovered from this solution on boiling

While in case of alkaline earth metal ammoniates can be recover

$$\left[M(NH_3)_x\right]^{+2}$$

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alkaline earth metal

Be → except Be
Mg
Ca
Sr
Ba
* Ra

① Atomic size ↑ because shell ↑

② I.E ↓ down the down group

because n ↑

Be > Mg > Ca > Sr > Ba < Ra ← due to poor S.E of 4f Subshell.
*

$D = \frac{m\uparrow}{V\uparrow}$

$D\uparrow$ down the group with some irregularities.

Be > Mg > Ca < Sr < Ba

Keypoint >><<

M.P/B.P ↓ down the group with some irregularities

M.P Be > Mg < Ca > Sr > Ba

B.P Be > Mg < Ca > Sr < Ba

Reducing power

Be < Mg < Ca < Sr < Ba

Be → lowest R.A in s-Block due to I.E

Chemical Reaction

① these metals form Ionic Compound.

except

BeX_2 ⟶ Predom. Covalent

(X = F | Cl | Br | I)

MgX_2 | AlX_3 | LiX — Predom Covalent

(X = Cl Br I)

MgF_2 | AlF_3 | LiF → Predom. Ionic

① Reaction with O_2

$$M + O_2 \longrightarrow \underset{\text{(oxide)}}{MO} \xrightarrow[O_2]{\text{excess}} X$$

(Be | Mg | Ca)

$$\underset{(Sr \mid Ba)}{M} + O_2 \longrightarrow \underset{\text{(oxide)}}{MO} \xrightarrow[O_2]{\text{excess}} \underset{\text{(Peroxide)}}{MO_2} \xrightarrow[O_2]{\text{excess}} X$$

Reaction with N_2

$$M + N_2 \longrightarrow M_3N_2 \xrightarrow{\text{Hydrolysis}} M(OH)_2 + NH_3$$

$$M_3N_2 \xrightarrow{\Delta} M + N_2$$

$$Mg + N_2 \xrightarrow{\Delta} Mg_3N_2 \xrightarrow{H^+ - OH^-} Mg(OH)_2 + NH_3$$

$$Mg_3N_2 \xrightarrow{\Delta} Mg + N_2$$

Reaction with H_2

$$M + H_2 \longrightarrow MH_2 \xrightarrow{H^+-OH} M(OH)_2 + H_2$$

Hydrides are ionic
except BeH_2 and MgH_2 — predom. covalent

$$Ca + H_2 \longrightarrow \underset{\text{Hydrolith}}{CaH_2} \xrightarrow{H^+-\bar{O}H} Ca(OH)_2 + H_2$$

Note → BeH_2 can not form from above reaction.

$$BeCl_2 + LiAlH_4 \xrightarrow{\Delta} BeH_2 + AlCl_3 + LiCl$$

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Reaction with Halogen

$$M + X_2 \longrightarrow \underset{\text{Halides (Ionic)}}{MX_2} \xrightarrow{H^+ - OH} M(OH)_2 + HX$$

except

- BeX_2 ($X = F, Cl, Br, I$)
- MgX_2 ($X = Cl, Br, I$)

} Predom. covalent

Reaction with water

Be = Inert towards water

Mg = react with warm water

Ca | Sr | Ba ⟶ Cold water

$Ca + H_2O \longrightarrow Ca(OH)_2 + H_2$

Note ⇒ Mg form protective layer of it's oxide which can be remove from boiling or amalgamation.

one Which of the following set produce same product with water

① Mg, Ca ② MgH_2 CaH_2 ③ Ca, CaH_2 ④ none

$$Ca + H^+-\bar{O}H \longrightarrow Ca(OH)_2 + H_2$$

$$CaH_2 + H^+-\bar{O}H \longrightarrow Ca(OH)_2 + H_2$$

Note ⇒

Be
Mg
Ca
Sr
Ba

↓ Charge density

↓ Polarising power

$BeCl_2 \cdot 6H_2O$ $MgCl_2 \cdot 6H_2O$ $CaCl_2 \cdot 6H_2O$ $SrCl_2 \cdot 6H_2O$ $BaCl_2 \cdot 2H_2O$

On Heating Be | Mg | Ca Halides undergoes in Hydrolysis

While Sr and Ba get anhydrous

Note ⇒ BeF_2 and $BeCl_2$ can not formdirectly from above reaction.

$$BeO + C + Cl_2 \xrightarrow{600^\circ - 800^\circ C} BeCl_2 + CO$$

Note ⇒ Best method for formation of BeF_2 is thermal decomposition of

$$(NH_4)_2BeF_4 \xrightarrow{\Delta} NH_3 + BeF_2 + HF$$