

s - block elements

Electronic configuration: ns^{1-2}

ns^1 = Alkali metals

ns^2 = Alkaline earth metals.

Li, Na, K, Rb, Cs, Fr

Be, Mg, Ca, Sr, Ba, Ra

Physical properties:

1. Silvery white, soft and light metals

Period

Li Be B C N O S F Ne

↓

Largest size :

Along the period, alkali metals have a larger atomic radius than halogens due to the effective charge of the protons that are able to attract the electrons. As we move from left to right along the period, we are adding electrons

to the same shell so that effective nuclear charge increases, leading to a decrease in size.

Down the group, as more electronic shells are added to an atom, the size increases.

Melting points and boiling points of alkali metals are low, indicating weak metallic bonding.

Flame test; Characteristic colouration
in oxidizing flame.

Metal	Li	Na	K	Rb	Cs
	Crimson red	Yellow	Pale violet	Reddish violet	Blue

Chemical Properties:

Alkali metals are highly reactive because of their large size and low ionisation enthalpy.

Reactivity towards air: Burn vigorously
in O_2 forming oxides.

Li \longrightarrow Monoxide Li_2O

Na \longrightarrow Peroxide

Other metals \longrightarrow Superoxide

Reducing property:

are very
ic the
weakest.

good reducing
best reducing

Alkali metals

agent. Li
agent. Na is the

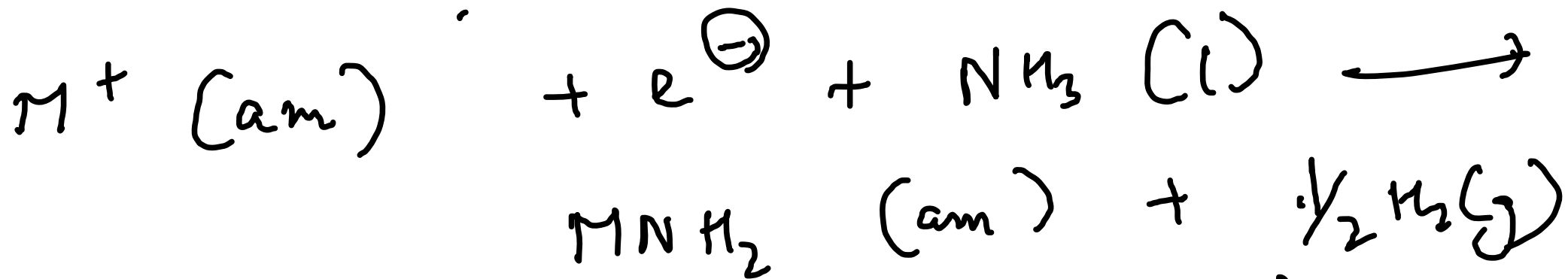
Li: Anomalous property → high polarising
charge radius

Although Li has the highest ionisation energy, it is the strongest reducing agent.

Solution in liquid ammonia:

They dissolve in liquid ammonia to produce a deep blue solution, which is conducting in nature.

Blue color?



The blue color of the solution is due to the unpaired electron, and the solution is paramagnetic.

If the concentration is increased, the blue color changes to bronze and becomes diamagnetic.

Paramagnetism \equiv Odd no. of electrons.

Diamagnetism \equiv Even electrons.

Group II:

Alkaline Earth Metals:

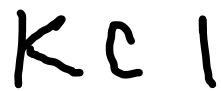
Order: $\text{Be}^{2+} > \text{Mg}^{2+} > \text{Ca}^{2+} > \text{Sr}^{2+} > \text{Ba}^{2+}$

The energy released as a result of formation of new bonds between ions and water molecules is called hydration enthalpy.

Hydration enthalpies of alkaline earth metal ions decrease with the increasing ionic size down the group.

Hydration enthalpies of alkaline earth metal ions are larger than those of alkali metals.

$MgCl_2$ & $CaCl_2$ exist as hydrates
in the form of $MgCl_2 \cdot 6H_2O$



→ no hydrate

Properties:

1. Silvery white, lustrous, relatively soft but harder than alkali metals.
2. M.P. & B.P. of Be & Mg are high due to their small size.

Sodium is highly reactive and reacts vigorously with oxygen, CO_2 & moisture present in air such that it may cause fire - In order to prevent explosive reaction, sodium is kept immersed in kerosene because sodium does not react with kerosene.

$\text{Na} \rightarrow$ reducing agent. Compounds present in kerosene are already reduced

Therefore, Na does not show any reaction with kerosine oil -

Metal

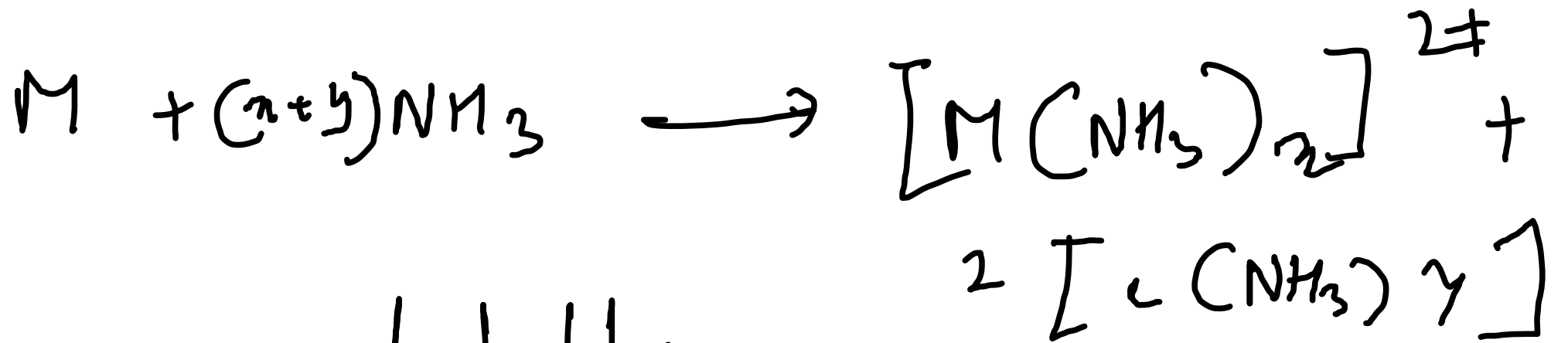
	Be	Mg	Ca	Sr	Ba
	↓	↓	↓	↓	↓
	No color	No color	Brick red	Crimson red	Apple green

Chemical properties

Reactivity towards air - & water
& Be & Mg are inert to oxygen
& \nearrow H_2O

Mg is more electropositive
& burns with dazzling brilliance
in air to give
oxide \leftarrow MgO & Mg_3N_2 \rightarrow nitride

Ca, Sr, Ba \rightarrow readily oxidised
to form oxides, nitrides
Alkaline earth metals are also strong
reducing agents due to large -ve
value of their reduction potential



deep blue

black soln. ions

forming ammoniated

Anomalous behavior of Be & Al

• Be^{2+} : ionic radius $\sim 31 \text{ pm}$

charge : radius ratio nearly same as that of Al^{3+} .

Be & Al resembles in many aspects w.r.t their properties due to diagonal relationship.

Bleaching powder preparation

Problems:

1. Ionic mobility of which of the following alkali metal ions is lowest when aqueous solution of their salts are put under electric field?

a) Na b) K c) Rb d) Li

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Correct option: d

More the extent of hydration, lesser is the ionic mobility.

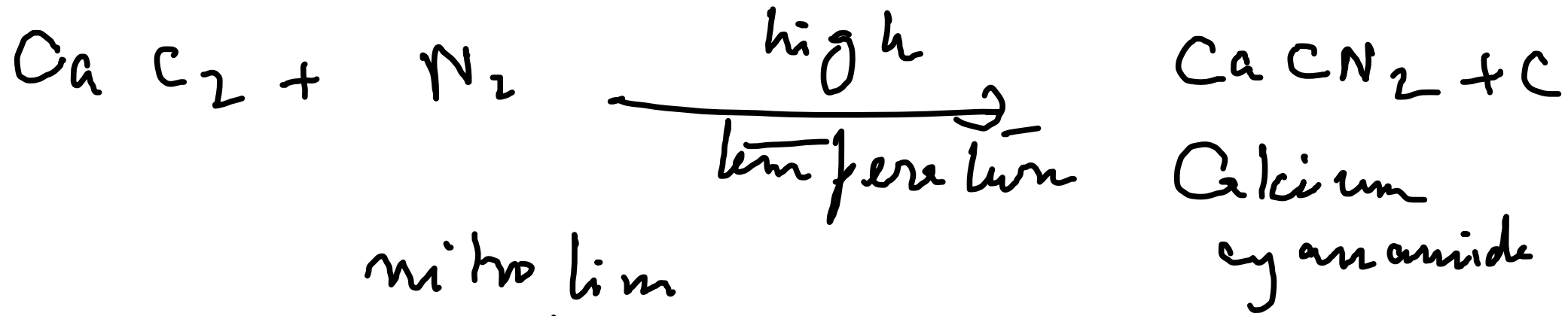
In all the alkali metals Li^+ has the smallest size. Therefore, extent of hydration is maximum for Li^+ ion. i.e. dissociation of

Li in water occurs and get hydrated. Smaller the size of a cation, greater is the hydration, lesser is the ionic mobility.

2) The product obtained as a result of reaction of nitrogen with CaC_2 is



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micro lime
↓
fertilizer -

3. Which of the following statement is false?

- i) Ca^{2+} ions are important in blood clotting
- ii) Ca^{2+} regular "beating" of the heart, not "in maintaining"

iii) Mg^{2+} ions are imp. in the green parts of plants

iv) Mg^{2+} ions form a complex with ATP.

Correct option : b

i) Ca^{2+} ions are very imp. factors for blood clotting

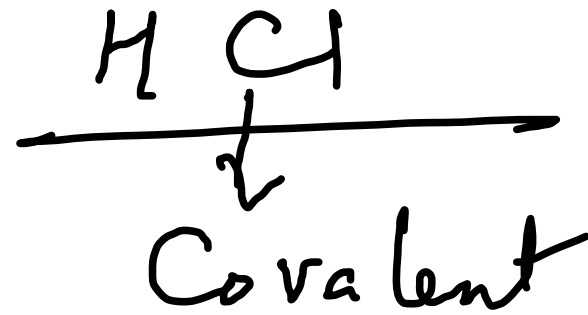
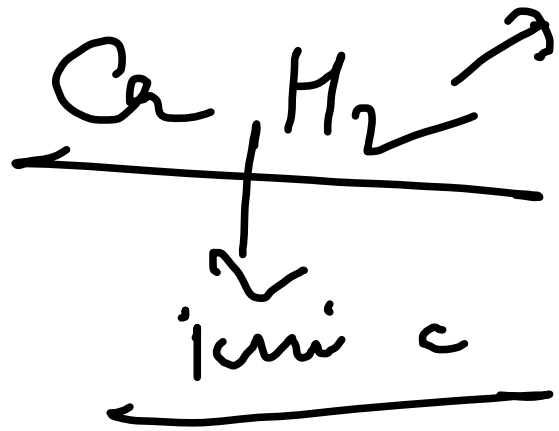
ii) Ca^{2+} ions are imp. for maintaining regular heart beating

Key: Calcium that enters the heart cell through the Ca^{2+} ion channel activates the ryanodine receptor to release enough calcium from the sarcoplasmic reticulum to initiate heart muscle contraction. This is done by binding to another structure named troponin, inside the heart muscle cell. There for Ca can regulate muscle contraction, including

beating of the heart muscle.

Q Which of the following statements on H is incorrect?

- i) Hydrogen never acts as cation in ionic salts
- ii) H_3O^+ ions exist freely in solution
- iii) Dihydrogen does not act as a reducing agent.
- iv) H has 3 isotopes of which tritium is the most common



- i) In ionic salts, hydrogen never behaves as cation, but behaves as H^{\ominus} .
- ii) H_3O^+ exists freely in soln.
- iii) Dihydrogen acts as reducing agent.
- iv) H $\begin{array}{l} \nearrow \\ \longrightarrow \\ \searrow \end{array}$ Protium \longrightarrow abundant, 99.98%
Deuterium
Tritium