5. Alkali and Alkaline Earth metals

1. $4Li + O_2 \rightarrow 2Li_2O$
2. $2Na + O_2 \rightarrow Na_2O_2$
3. $Rb + O_2 \rightarrow RbO_2$
4. $2Na + 2C_2H_5OH \rightarrow 2C_2H_5ONa + H_2\uparrow$
5. $H–C{\equiv}C–H \xrightarrow{Na} H–C{=}C–Na \xrightarrow{Na} Na–C{=}C-Na$
6. $Li_2CO_3 \xrightarrow{\Delta} Li_2O + CO_2\uparrow$
7. **Solvay process:**
   (i) $2NH_3 + H_2O + CO_2 \rightarrow (NH_4)_2CO_3$
   (ii) $(NH_4)_2CO_3 + H_2O + CO_2 \rightarrow 2NH_4HCO_3$
   (iii) $NH_4HCO_3 + NaCl \rightarrow NH_4Cl + NaHCO_3$
   (iv) $2NaHCO_3 \rightarrow Na_2CO_3 + CO_2\uparrow + H_2O$
8. $Na_2CO_3.10H_2O \xrightarrow{-9H_2O} Na_2CO_3.H_2O \xrightarrow[-H_2O]{\Delta} Na_2CO_3$
9. $BeO + C + Cl_2 \xrightarrow{600–800K} BeCl_2 + CO$
10. $BeCl_2 + LiAlH_4 \rightarrow 2BeH_2 + LiCl + AlCl_3$
11. $2BaO + O_2 \rightarrow 2BaO_2$
12. $Be(OH)_2 + 2NaOH \rightarrow Na_2BeO_2 + 2H_2O$
13. $Be(OH)_2 + 2HCl \rightarrow BeCl_2 + 2H_2O$
14. $CaCO_3 \xrightarrow{\Delta} CaO + CO_2\uparrow$
15. $CaO + H_2O \rightarrow Ca(OH)_2$
16. $2Ca(OH)_2 + 2Cl_2 \rightarrow CaCl_2 + Ca(OCl)_2 + 2H_2O$
17. $CaSO_4.2H_2O \xrightarrow[-1/2H_2O]{393K} CaSO_4.{}^1/_2H_2O$
18. $CaCO_3 + CO_2 + H_2O \rightarrow Ca(HCO_3)_2$

Important formula:

1. Lithium oxide : Li_2O (Simple oxide)
2. Sodium peroxide : Na_2O_2 (Peroxide)
3. Potassium superoxide : KO_2 (Superoxide)
4. Lithium hydride : LiH
5. Sodium acetylide : Na – C = C – Na
6. Lithium hydroxide : LiOH
7. Lithium carbide : Li_2C_2
8. Lithium fluoride : LiF
9. Lithium carbonate : Li_2CO_3
10. Sodium carbonate deca hydrate (or) washing soda: $Na_2CO_3.10H_2O$
11. Sodium bicarbonate (or) baking soda : $NaHCO_3$
12. Sodium chloride : NaCl (Cooking or table salt)
13. Beryllium chloride : $BeCl_2$
14. Beryllium hydride : BeH_2
15. Beryllium oxide : BeO
16. Barium oxide : BaO
17. Barium Peroxide : BaO_2
18. Beryllium hydroxide : $Be(OH)_2$
19. Quick lime : CaO
20. Lime stone : $CaCO_3$
21. Slaked lime (or) lime water : $Ca(OH)_2$
22. Bleaching powder : $CaOCl_2$
23. Gypsum : $CaSO_4.2H_2O$
24. Plaster of Paris : $CaSO4.{}^1/_2H_2O$

Important Points to Remember

- **s – block elements –** Group 1 and 2 elements are those in which the last electron enters the outermost s – orbital.
- **Group 1 elements –** Alkali metals Li, Na, K, Rb, Cs, and Fr with electronic configuration as noble gas [ns^1].
- **Half-life of francium –** 21 minutes.

- **Oxidation state of alkali metals** + 1
- **Atomic radii and ionic radii of alkali metals –** On moving down the group increases and across the period decreases.
- **Periodic trends in alkali group –** Reactivity, atomic radius, formation of electropositive ion and density increases down the group. Melting point and boiling point decreases down the group.

- **Occurrence of Alkali metals**

	Element	Occurrence
1.	Lithium	Spodume and lepidolite (Silicate minerals
2.	Sodium	Rock salt (NaCl)
3.	Potassium	Nitre and carnallite
4.	Rubidium and cesium	Minerals with other alkali metals
5.	Francium	Radioactive. It does not occur in nature

- **Distinctive behavior of lithium –** Extremely small size, greater polarizing power of ion, least electropositive character and non-availability of d-orbitals.
- **Chemical properties –** Alkali metals are highly reactive and reacts with oxygen, hydrogen, halogen and liquid ammonia.
- **Uses of alkali metals –** Oxidizing agents (oxide of alkali metals), strong bases (hydroxides of alkali metals), sodium and potassium ions perform important biological functions such as ion balance and nerve impulse conduction.
- **Fruits rich in potassium –** Avocadoes, potatoes and bananas.
- **Group 2 elements –** Alkaline earth elements with general electronic configuration as [noble gases] ns^2. They are Be, Mg, Ca, Sr, Ba and Ra.
- **Alkaline earth metals –** Except Be, all other oxides and hydroxides are alkaline in nature.
- **Occurrence of alkaline earth metals –**

	Element	Occurrence
1.	Beryllium	Rare
2.	Radium	The rarest
3.	Magnesium and calcium	Rocks and minerals
4.	Magnesium	8^{th} most abundant element and occur as carnallite, magnesite and dolomite
5.	Calcium	5^{th} most abundant element and occur as chalk, limestone and gypsum
6.	Strontium	Celestite and strontianite
7.	Barium	Less common and occur as barite

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- **Pyrotechnics –** Alkaline earth metals are used to produce colours in firework shows.
- **Oxidation state of alkaline earth metals -** +2.
- **Trends in periodic properties -**

  (i) Atomic and ionic radii increases down the group.

  (ii) Ionization enthalpy and hydration enthalpy decreases down the group.
- **Anomalous behavior of beryllium –** (i) Small size (ii) high polarizing power (iii) high electro negativity (iv) absence of vacant d-orbital (v) high ionization enthalpy.
- **Chemical properties –** Alkali metals react with H_2 and halogens.
- **Uses of beryllium –**

  (i) Used as radiation windows for X-ray tube and X-ray detectors.

  (ii) As sample holder in X-ray emission studies.

  (iii) Used to build the beam pipe in accelerators.

  (iv) Used in detectors.
- **Uses of magnesium –**

  (i) For the removal of sulfur from iron and steel.

  (ii) For the refining of titanium.

  (iii) Used as photoengrave plates in printing industry.

  (iv) Magnesium alloys are used in airplanes and missile construction.

  (v) Mg ribbon is used in Grignard reagent synthesis. (vi) As desiccant.

  (vii) As sacrificial anode in controlling galvanic corrosion.

  (viii) As a reducing agent.

  (ix) Mg + Al alloy used in fabrication and welding.
- **Uses of calcium –**

  (i) Used as a reducing agent in the metallurgy of uranium, zirconium and thorium.

  (ii) As a deoxidizer, desulfurizer or decarbonizer for ferrous and non-ferrous alloys.

  (iii) As a getter in vacuum tubes.

  (iv) In making of cements and mortars.

  (v) In dehydrating oils.

  (vi) In fertilizers, concrete and making Plaster of Paris.
- **Uses of strontium –**

  (i) ^{90}Sr is used in cancer therapy.

  (ii) $^{87}Sr/^{86}Sr$ ratio is used in marine investigations as well as in teeth, tracking animal migrations or in criminal forensics.

(iii) Used in dating of rocks.

(iv) Used as a radioactive tracer.

❖ **Uses of barium –**

(i) Used in metallurgy, pyrotechnics, petroleum mining and radiology.

(ii) Deoxidizer in copper refining.

(iii) Ba + Ni alloy is used in electron tubes and in spark plug electrodes.

(iv) As a scavenger to remove oxygen and other gases in television and electronic tybes.

(v) ^{133}Ba is used as a source in the calibration of gamma ray detector.

❖ **Uses of radium –** Used in self – luminous paints for watches, nuclear panels, aircraft switches, clocks and instrument dials.

❖ **Chemical properties of alkaline earth metals –**

(i) They form monoxides and peroxide with oxygen.

(ii) The oxides of alkaline earth metals react with water to give hydroxides.

(iii) They form halides when react with halogens.

(iv) Alkaline earth metals form salts of oxo-acids such as carbonates, sulphates and nitrates.

❖ **Important compounds of calcium –**

❖ **Quick lime –** CaO

❖ **Slaking of lime –** The process of addition of limited amount of water breaks the lump of lime is called slaking of lime.

❖ **Uses of quick lime –**

(i) To manufacture cement, mortar and glass.

(ii) To manufacture sodium carbonate and slaked lime.

(iii) In the purification of sugar.

(iv) As drying agent.

❖ **Slaked lime –** $Ca(OH)_2$

❖ **Bleaching powder –** $Ca(OCl)_2$

❖ **Uses of slaked lime –**

(i) In the preparation of mortar, a building material.

(ii) In white wash.

(iii) In glass making and in tanning industry.

(iv) For the preparation of bleaching powder and in purification of sugar.

❖ **Gypsum –** $CaSO_4.2H_2O$

❖ **Desert Rose –** Gypsum crystals are found to occur in a form that resembles the petals of a flower and this occur in desert terrains.

- **Alabaster –** A variety of gypsum and valued as an ornamental stone.
- **Plaster of Paris –** $CaSO_4.{}^1/_2H_2O$
- **Uses of gypsum -**

(i) It has been used by the sculptors.

(ii) To prepare Plaster of Paris.

(iii) Used in making dry walls or plaster boards.

(iv) It is used in making surgical and orthopedic casts, casting molds and surgical splints.

(v) It is used in agriculture as a soil additive, conditioner and fertilizer.

(vi) It is used in toothpaste, shampoo and hair products.

- **Calcium sulphate –** Acts as a coagulator in making tofu. It is used in baking, as a dough conditioner. It is used to treat upset stomach and eczema.
- **Gypsum –** It is used as a hardening retarder to control the speed at which concrete sets.
- **Satin spar –** It is a variety of gypsum, used as an ornamental stone, while alabaster is used for sculpting.
- **Gypsum –** It is used to give colour to cosmetics and drugs. It can be found in canned vegetables, flour, ice cream, blue cheese and white bread. It is mainly used in wine making.
- **Uses of Plaster of Paris -**

(i) It is used in building industry as well as plasters.

(ii) It is used for immobilizing the affected part of organ, where there is a bone fracture or sprain.

(iii) It is also used in dentistry, making casts of statues and busts.

- **Biological importance of magnesium and calcium –**

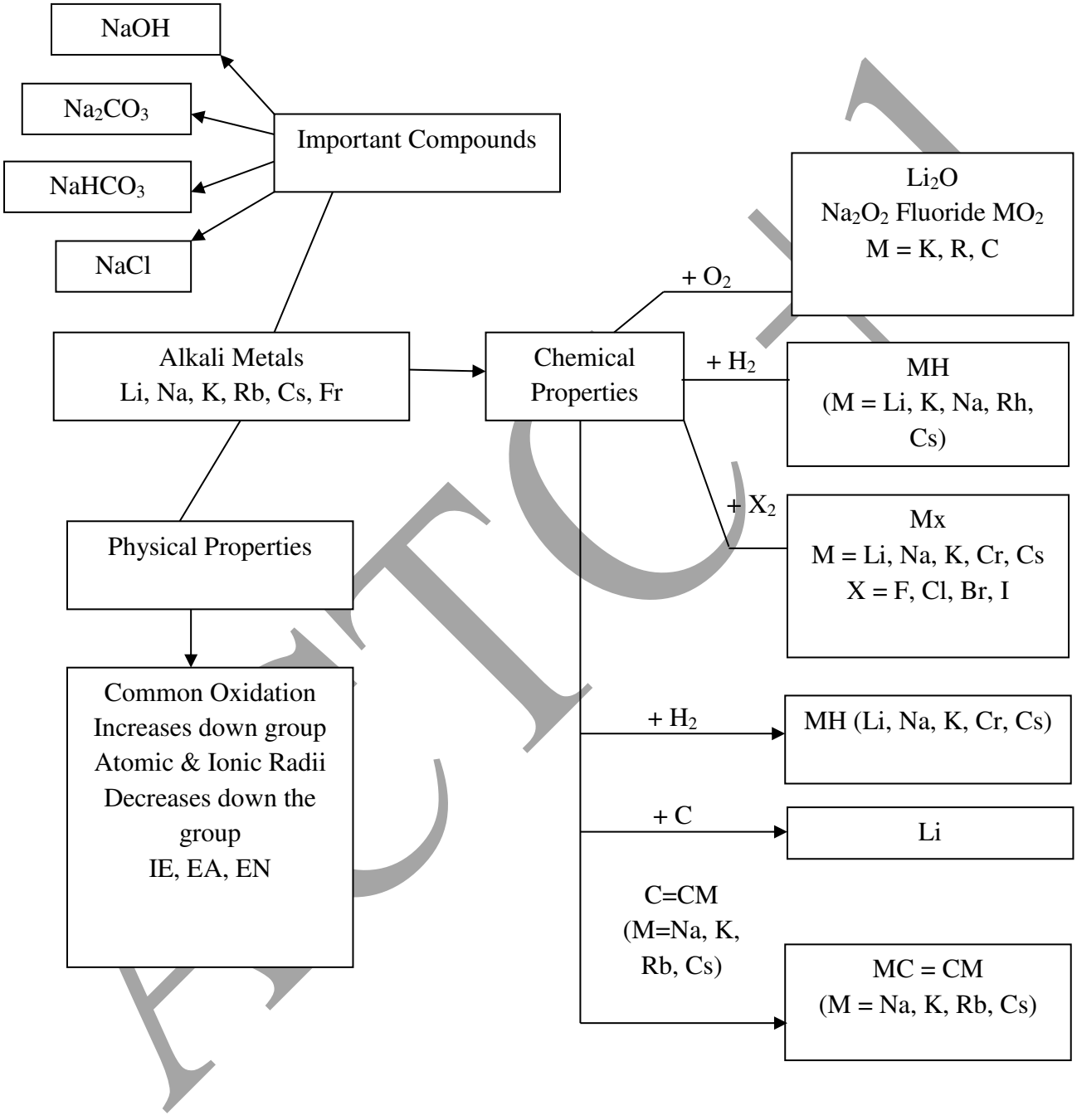
(i) An adult body contains about 25g of Mg and 1200g of Ca. The daily requirement in the human body has been estimated to be 200 – 300mg.

(ii) All enzymes transfer requires magnesium as the co-factor. The main pigment of chlorophyll is magnesium.

(iii) 99% of body calcium is present in bones and teeth. It also play important roles in neuromuscular function, inter neuronal transmission, cell membrane integrity and blood coagulation.

(iv) The calcium concentration is maintained by two hormones – calcitonin and parathyroid hormones.

CHAPTER MAP



Choose the correct answer

1. For alkali metals, which one of the following trends is incorrect ?

a) Hydration energy : Li > Na > K > Rb b) Ionisation energy : Li > Na > K > Rb

c) Density : Li < Na < K < Rb d) Atomic size : Li < Na < K < Rb

2. Which of the following statements is incorrect ?

a) Li^+ has minimum degree of hydration among alkali metal cations.

b) The oxidation state of K in KO_2 is +1

c) Sodium is used to make Na / Pb alloy d) $MgSO_4$ is readily soluble in water

3. Which of the following compounds will not evolve H_2 gas on reaction with alkali metals?

a) ethanoic acid b) ethanol c) phenol **d) none of these**

4. Which of the following has the highest tendency to give the reaction

$M^+_{(g)} \xrightarrow{\text{Aqueous Medium}} M^+_{(aq)}$

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

5. sodium is stored in

a) alcohol b) water **c) kerosene** d) none of these

6. RbO_2 is

a) superoxide and paramagnetic b) peroxide and diamagnetic

c) superoxide and diamagnetic d) peroxide and paramagnetic

7. Find the wrong statement

a) sodium metal is used in organic qualitative analysis

b) sodium carbonate is soluble in water and it is used in inorganic qualitative analysis

c) potassium carbonate can be prepared by solvay process

d) potassium bicarbonate is acidic salt

8. Lithium shows diagonal relationship with

a) sodium **b) magnesium** c) calcium d) aluminium

9. In case of alkali metal halides, the ionic character increases in the order

a) MF < MCl < MBr < MI **b) MI < MBr < MCl < MF**

c) MI < MBr < MF < MCl d) none of these

10. In which process, fused sodium hydroxide is electrolysed for extraction of sodium ?

a) Castner's process b) Cyanide process c) Down process d) All of these

11. The product obtained as a result of a reaction of nitrogen with CaC_2 is (NEET)

a) $Ca(CN)_3$ b) CaN_2 **c) $Ca(CN)_2$** d) Ca_3N_2

12. Which of the following has highest hydration energy

a) $MgCl_2$ b) $CaCl_2$ c) $BaCl_2$ d) $SrCl_2$

13. Match the flame colours of the alkali and alkaline earth metal salts in the Bunsen burner

(p) Sodium	(1) Brick red
(q) Calcium	(2) Yellow
(r) Barium	(3) Violet
(s) Strontium	(4) Apple green
(t) Cesium	(5) Crimson red
(u) Potassium	(6) Blue

a) p - 2, q - 1, r - 4, s - 5, t - 6, u - 3
b) p - 1, q - 2, r - 4, s - 5, t - 6, u - 3
c) p - 4, q - 1, r - 2, s - 3, t - 5, u - 6
d) p - 6, q - 5, r - 4, s - 3, t - 1, u - 2

14. Assertion : Generally alkali and alkaline earth metals form superoxides
Reason : There is a single bond between O and O in superoxides.
a) both assertion and reason are true and reason is the correct explanation of assertion
b) both assertion and reason are true but reason is not the correct explanation of assertion
c) assertion is true but reason is false **d) both assertion and reason are false**

15. Assertion : $BeSO_4$ is soluble in water while $BaSO_4$ is not
Reason : Hydration energy decreases down the group from Be to Ba and lattice energy remains almost constant.
a) both assertion and reason are true and reason is the correct explanation of assertion
b) both assertion and reason are true but reason is not the correct explanation of assertion
c) assertion is true but reason is false d) both assertion and reason are false

16. Which is the correct sequence of solubility of carbonates of alkaline earth metals?
a) $BaCO_3 > SrCO_3 > CaCO_3 > MgCO_3$ **b) $MgCO_3 > CaCO_3 > SrCO_3 > BaCO_3$**
c) $CaCO_3 > BaCO_3 > SrCO_3 > MgCO_3$ d) $BaCO_3 > CaCO_3 > SrCO_3 > MgCO_3$

17. In context with beryllium, which one of the following statements is incorrect ? (NEET Phase - 2)
a) It is rendered passive by nitric acid b) It forms Be_2C
c) Its salts are rarely hydrolysed d) Its hydride is electron deficient and polymeric

18. The suspension of slaked lime in water is known as (NEET Phase - II)
a) lime water b) quick lime **c) milk of lime** d) aqueous solution of slaked lime

19. A colourless solid substance (A) on heating evolved CO_2 and also gave a white residue, soluble in water. Residue also gave CO_2 when treated with dilute HCl.
a) Na_2CO_3 **b) $NaHCO_3$** c) $CaCO_3$ d) $Ca(HCO_3)_2$

20. The compound (X) on heating gives a colourless gas and a residue that is dissolved in water to obtain (B). Excess of CO_2 is bubbled through aqueous solution of B, C is formed. Solid (C) on heating gives back X. (B) is
a) $CaCO_3$ **b) $Ca(OH)_2$** c) Na_2CO_3 d) $NaHCO_3$

21. Which of the following statement is false ? (NEET - Phase - I)

a) Ca^{2+} ions are not important in maintaining the regular beating of the heart

b) Mg^{2+} ions are important in the green parts of the plants

c) Mg^{2+} ions form a complex with ATP d) Ca^{2+} ions are important in blood clotting

22. The name 'Blue John' is given to which of the following compounds?

a) CaH_2 **b) CaF_2** c) $Ca_3(PO_4)_2$ d) CaO

23. Formula of Gypsum is

a) $CaSO_4 . 2H_2O$ b) $CaSO_4 . ½ H_2O$ c) $3CaSO_4 . H_2O$ d) $2CaSO_4 . 2H_2O$

24. When CaC_2 is heated in atmospheric nitrogen in an electric furnace the compound formed is

a) $Ca(CN)_2$ **b) CaNCN** c) CaC_2N_2 d) $CaNC_2$

25. Among the following the least thermally stable is

(a) K_2CO_3 b) Na_2CO_3 (c) $BaCO_3$ **d) Li_2CO_3**

Part II

26.Why sodium hydroxide is much more water soluble than chloride?

NaOH , NaCl

- In both case Na^+ is common. In NaOH, OH^- is the conjugate base of weak acid H_2O, **OH^- is strong base**.
- In NaCl, Cl^- is the conjugate base of strong acid HCl. Hence **Cl^- is weak base.**
- So, sodium hydroxide is much more water soluble than chloride.

(NaOH is much more soluble than NaCl. Enthalpy of a solution can be expressed as the sum of lattice enthalpy and enthalpy of hydration of a compound. Dissolution of NaCl is accompanied by very small heat change so solubility of NaCl is less than NaOH.)

27. Write the chemical equations for the reactions involved in solvay process of preparation of sodium carbonate.

The equations involved in solvay process are,

$2NH_3 + H_2O + CO_2 \rightarrow (NH_4)_2CO_3$ Ammonium carbonate

$(NH_4)_2CO_3 + H_2O + CO_2 \rightarrow 2NH_4HCO_3$ ammonium bicarbonate

$2NH_4HCO_3 + NaCl \rightarrow NH_4Cl + NaHCO_3$ sodium bicarbonate

$2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$

Sodium carbonate

The ammonia used in this process can be recovered by treating the resultant ammonium chloride solution with calcium hydroxide. Calcium chloride is formed as a by-product.

28. An alkali metal (x) forms a hydrated sulphate, $X_2SO_4. 10H_2O$. Is the metal more likely to be sodium (or) potassium.

The metal more likely to form a hydrated sulphate is **sodium** of formula $Na_2SO_4.10H_2O$. it is otherwise called as Glauber's salt.

Reason:

Smaller the size of the ion greater is the degree of hydration. Hydration energy is in the order of $Li^+ > Na^+ > K^+ > Rb^+ > Cs^+$ so sodium is hydrated more easily than potassium.

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29. Write balanced chemical equation for each of the following chemical reactions.

(i) Lithium metal with nitrogen gas **(ii) heating solid sodium bicarbonate**

(iii) Rubidum with oxgen gas **(iv) solid potassium hydroxide with CO_2**

(v) heating calcium carbonate **(vi) heating calcium with oxygen**

(i) $6Li_{(s)} + N_{2(g)} \rightarrow 2Li_3N_{(s)}$

(ii) $2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$

(iii) $Rb + O_2 \rightarrow RbO_2$

(iv) $KOH + CO_2 \rightarrow KHCO_3$

(v) $CaCO_3 \leftrightarrow CaO + CO_2$

(vi) $2Ca + O_2 \rightarrow 2CaO$

30. Discuss briefly the similarities between beryllium and aluminium.

Beryllium shows a diagonal relationship with aluminium. In this case the size of these ions is not as close. However, their charge per unit area and electro-negativity values are almost similar. Similarities between Beryllium and Aluminium.

	Properties
1	Beryllium chloride forms a **dimeric structure** like aluminium chloride with chloride bridges. Both are soluble in organic solvents and are strong Lewis acids.
2	Beryllium hydroxide dissolves in excess of alkali and gives beryllate ion $[Be(OH)_4]^{2-}$ as aluminium hydroxide which gives aluminate ion, $[Al(OH)_4]^-$.
3	Beryllium and Aluminium ions have strong tendency to form complexes, BeF_4^{2-}, AlF_6^{3-}
4	Both beryllium and aluminium hydroxides are **amphoteric** in nature.
5	Carbides of beryllium (Be_2C) like aluminium carbide (Al_4C_3) give methane on hydrolysis
6	Both beryllium and aluminium are rendered passive by nitric Acid.

31. Give the systematic names for the following (i) milk of magnesia (ii) lye (iii) lime (iv) Caustic potash (v) washing soda (vi) soda ash (v) trona

(i) Magnesium hydroxide $Mg(OH)_2$

(ii) Sodium hydroxide NaOH

(iii) Calcium oxide CaO

(iv) Potassium hydroxide KOH

(v) Sodium carbonate decahydrate $Na_2CO_3.10H_2O$

(vi) Sodium carbonate Na_2CO_3

(vii) Sodium sesquicarbonate $Na_2CO_3.NaHCO_3.2H_2O$ (mineral)

32. Substantiate Lithium fluoride has the lowest solubility among group one metal fluorides.

(i) The solubility of alkali metal fluorides is in the order LiF < NaF < KF < RbF < CsF.

(ii) The solubility of LiF is due to its Very **high lattice energy** because of small sizes of both Li^+ and F^-

33. Mention the uses of plaster of Paris.

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(i) In the building industry as well as plasters.

(ii) It is used for immobilizing the affected part of organ where there is abone fracture.

(iii) In dentistry, in ornamental work.

(v) For making casts of statues and busts.

34. Beryllium halides are Covalent whereas magnesium halides are ionic why?

Due to small size of Be^{2+}, the charge density is very high. According to Fajan's Rule, cation with small size has high polarizing power and prefers to form covalent bonds. So beryllium halides are Covalent in nature.

Whereas magnesium ion(Mg^{2+}) is bigger and it is involved in transfer of electrons to form ionic bond.

35. Alkaline earth metal (A), belongs to 3rd period reacts with oxygen and nitrogen to form compound (B) and (C) respectively. It undergo metal displacement reaction with $AgNO_3$ solution to form compound (D).

(i) Alkaline earth metal (A) belonging to 3rd period is magnesium

(ii) Magnesium reacts with oxygen and nitrogen to form magnesium oxide (B) and magnesium nitride (C).

$2Mg + O_2 \rightarrow 2MgO$

$3Mg + N_2 \rightarrow Mg_3N_2$

(iii) Magnesium undergoes metal displacement reaction with $AgNO_3$ to form magnesium nitrate (D). $Mg + 2AgNO_3 \rightarrow Mg(NO_3)_2 + 2Ag$

Compound / Element	Formula	Name
A	Mg	Magnesium
B	MgO	Magnesium oxide
C	Mg_3N_2	Magnesium nitride
D	$Mg(NO_3)_2$	Magnesium nitrate

36. Write balanced chemical equation for the following processes

(a) heating calcium in oxygen (b) heating calcium carbonate

(c) evaporating a solution of calcium hydrogen carbonate

(d) heating calcium oxide with carbon

(a) $2Ca_{(s)} + O_{2(g)} \rightarrow 2CaO_{(s)}$

(b) $CaCO_3 \leftrightarrow CaO + CO_2$

(c) $Ca(HCO_3)_2 \rightarrow CaCO_3 + CO_2 + H_2O$

(d) $2CaO_{(s)} + 5C_{(s)} \rightarrow 2CaC_{2(s)} + CO_{2(g)}$

37. Explain the important common features of Group 2 elements.

Group 2 elements are known as alkaline earth metals. It includes beryllium , magnesium, calcium, strontium, barium, and radium. They exist in +2 oxidation states.

The general outer electronic configuration of alkaline earth metal is ns^2

Physical Characteristics:

- They are silvery, white, and hard metals. They are softer but harder than alkali metals.
- Their melting and boiling points are higher compared to alkali metals
- They are strongly electropositive in nature Alkaline earth metals give different color with flame test.

Chemical Properties:

- All alkaline earth metals forms monoxide.
- All alkaline earth metals forms peroxide except beryllium.
- They have high electrical and thermal conductivities as they have metallic bonding .
- The oxides of alkaline earth metals are basic but less basic than alkali metals.
- Hydroxides of alkaline earth metals are basic in nature except beryllium hydroxide.
- Group 2 metals forms solid carbonates
- Alkaline earth metals also form sulphates such as $BeSO_4$,and $MgSO_4$.
- Group 2 elements form hydrated, crystallized nitrates.
- Alkaline earth metals forms halides after reacting with halogens.

38. Why alkaline earth metals are harder than alkali metals.

- due to the presence of 2 electrons in its outermost shell as compared to alkali metals, which have only 1 electron in valence shell.

(Or)

(i) Atomic radius of alkaline earth metals are small and their densities are larger than those of alkali metals

(ii) Alkaline earth metals have close packed crystal structure

(iii) Generally alkaline earth metals are soft yet less than that of alkali metals.

(iv) This is because the metallic bonding in alkaline earth metals are stronger than alkali metals.

39. How is plaster of Paris prepared?

Plaster of pairs is obtained when gypsum, $CaSO_4.2H_2O$, is heated to 393K

($CaSO_4.2H_2O \rightarrow CaSO_4.1/2H_2O + 1\ 1/2H_2O$)

Calcium sulphate hemihydrate

$2(CaSO_4.2H_2O) \rightarrow 2CaSO_4.H_2O + 3H_2O$

40. Give the uses of gypsum.

(i) Gypsum is used in making drywalls or plaster boards.

(ii) It is used in the production of plaster of Paris, which is used as a sculpting material.

(iii) It is used in making surgical and orthopedic cats.

(iv) It plays an important role in agriculture as a soil additive, conditioner, and fertilizer.

(vi) It is used in toothpastes, shampoos, and hair products.

(vii) It is used in baking as a dough conditioner.

(viii) It is used to give colour to cosmetics and drugs.

(ix) It plays a very important role in wine making.

41. Describe briefly the biological importance of Calcium and magnesium.

(i) Magnesium plays an important role in many biochemical reactions catalyzed by enzymes.

(ii) Magnesium is the co-factor of all enzymes that utilize ATP in phosphate transfer and energy release.

(iii) Magnesium also essential for DNA synthesis and is responsible for the stability and proper functioning of DNA.

(iv) Magnesium is also used for balancing electrolytes in our body.

(v) Deficiency of magnesium results into convulsion and neuromuscular irritation.

(vi) Calcium is a major component of bones and teeth.

(vii) Calcium is also present in blood and its concentration is maintained by hormones (calcitonin and parathyroid hormone).

(viii) Deficiency of calcium in blood causes it to take longer time to clot.

(ix) Calcium is also important for muscle contraction.

(x) Chlorophyll, contains magnesium which plays an important role in photosynthesis.

42. Which would you expect to have a higher melting point, magnesium oxide or magnesium fluoride? Explain your reasoning

- Magnesium oxide has very strong ionic bonds as compared to magnesium fluoride.
- Mg^{2+} and O^{2-} have charges of +2 and -2 respectively.
- Oxygen ion is smaller than fluoride ion.
- The smaller the ionic radii, the smaller the bond length in MgO and the bond is stronger than MgF_2.
- Due to more strong bond nature in MgO, it has high melting point than MgF_2.