S BLOCK

ALKALI METALS

1. Valence electronic configuration ***ns^1***
2. Hydration enthalpy: decreases with increase in ionic size. Li^+ has maximum hydration enthalpy.
3. ***Flame colouration: Alkali metals and their salts give characteristic colour to non-luminous flame. This is because the heat from the flame excites the outer most orbital electron to a higher energy level. When this electron comes back to the ground level, they emit the radiation in the visible region. For example, Li gives crimson red, sodium gives yellow, potassium gives violet, Rubidium gives red violet and Ceasium gives blue colour to the flame. So alkali metals can be detected by flame test***

Solution in liquid ammonia: The alkali metals dissolve in liquid ammonia to give deep blue solutions which are good conductors.

$M + (x+y)NH_3 \rightarrow [M(NH_3)_x]^+ + e[(NH_3)_y]^-$

The blue colour of the solution is due to the ammoniated electron, which absorbs energy in the visible region and gives blue colour to the solution.

Anomalous Properties of Lithium

Due to its **small size** and **high polarizing power**, Lithium shows some properties different from that of other alkali metals. Some of these are:

1. Li is much harder and has high melting point and boiling point.
2. Li is the least reactive but the strongest reducing agent among all the alkali metals.
3. It forms only monoxide with oxygen.
4. LiCl is deliquescent and crystallizes as a hydrate . 5. Lithium bicarbonate is stable only in solution

ALKALINE EARTH METALS

1. General electronic configuration ns^2 2.
2. Hydration enthalpy: Hydration enthalpy of alkaline earth metal ions decreases with increase in ionic size.
3. ***Flame colouration : Alkaline earth metals give characteristic colour to the flame. In flame the electrons are excited to higher energy levels and when they return to the ground state, energy is emitted in the form of visible light. So calcium gives brick red, Strontium gives crimson red and Barium gives apple green colour to the flame.***

Solution in liquid ammonia: They dissolve in liquid ammonia to form deep blue black solution due to the formation of ammoniated electrons.

$M + (x + y)NH^3 \rightarrow [M(NH_3)x]^{2+} + 2[e(NH_3)y]^-$

Anomalous Properties of Beryllium

Beryllium shows some anomalous behaviour as compared to magnesium and other members of the group. Some of the properties are:

1. Be has high ionization enthalpy and small size. It forms compounds which are highly covalent and get easily hydrolised.
2. It does not show co-ordination number more than 4 as its valence shell contains only 4 orbitals. The remaining members of the group can have a co-ordination number of 6 by making use of vacant dorbitals.

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Diagonal relationship

The similarity in properties shown by diagonally placed elements of second and third periods in modern periodic table is called diagonal relationship. Diagonal relationship between ***Li*** and ***Mg*** Li shows the following similarities in properties with Be of the second group.

1. Both Li and Be are harder but lighter than other elements of the respective group.
2. Both react slowly with water.
3. They do not form superoxides.
4. Their chlorides are soluble in ethanol and are deliquescent.
5. Their bicarbonates are stable only in solution.

Biological Importance of sodium and potassium Na^+ ions are found mainly on the outside of cells and in the interstitial fluid which surrounds the cell. These ions participate

- in the transmission of nerve signals,
- in regulating the flow of water across the cell membranes and in the transport of sugars and aminoacids.

K^+ ions are mainly found within cell fluids.

- They activate many enzymes,
- participate in the oxidation of glucose to ATP
- helps in the transmission of nerve signals along with sodium ions.

3. The oxide and hydroxide of Be are amphoteric in nature.
4. $BeCl_2$ exists as dimer even in vapour phase and is soluble in organic solvents

Diagonal relationship between Beryllium and Aluminium

1. Like Al, Beryllium is not readily attacked by acids because of the presence of an oxide film on the surface of the metal. 2. $Be(OH)_2$ dissolves in excess of alkali to give beryllate ion, just as $Al(OH)_3$ gives aluminate ion.
3. The chlorides of both the elements have bridged structure in vapour phase. Both the chlorides are soluble in organic solvents and are strong Lewis acids. They are used as Friedel – Crafts catalyst

Biological Importance of Magnesium and Calcium

- Mg is present in Chlorophyll, the green colouring pigment in plants.
- All enzymes that use ATP in phosphate transfer require Mg as cofactor.
- Ca is present in bones and teeth in the form of calcium phosphate.
- It also plays important roles in neuromuscular function, interneuronal transmission, cell membrane integrity and blood coagulation.

SOME IMPORTANT COMPOUNDS OF SODIUM

Sodium Carbonate	***Sodium Hydroxide (Caustic Soda) [NaOH]***	***Sodium bicarbonate, $NaHCO_3$ (Baking Soda)***
$[Na_2CO_3.10H_2O]$ (Washing Soda) Preparation: **Solvay Process** (Ammonia-Soda Process) In this process, CO_2 is passed	Preparation: It is prepared	It is prepared by

through a concentrated solution of NaCl saturated with ammonia. Ammonium carbonate first formed then converted to ammonium bicarbonate and finally reacts with NaCl to form $NaHCO_3$. Sodium bicarbonate crystals are separated and heated to get sodium carbonate • In this process, NH_3 is recovered when the solution containing NH_4Cl is treated with $Ca(OH)_2$. • ***Solvay process cannot be used for the preparation of K_2CO_3 because potassium bicarbonate ($KHCO_3$) is so much soluble in water*** ***Action of Heat***: on heating loses its water of crystallisation to form a monohydrate. Above 373K the monohydrate becomes completely anhydrous and changes to a white powder called ***"soda ash"*** **Uses** • in water softening, laundering and cleaning. • it is used in the manufacture of soap, glass, borax and caustic soda. • It is used in paper, paints and textile industries.	commercially by the electrolysis of NaCl in Castner-Kellner cell. The Brine solution (NaCl solution) is electrolysed by using a mercury cathode and a carbon anode $2Na/Hg + 2H_2O \rightarrow 2NaOH + 2Hg + H_2$ **Uses**: • in the manufacture of soap, artificial silk, paper and a number of chemicals. • in petroleum refining. • in the purification of bauxite	saturating a solution of Sodium carbonate with CO2. $Na_2CO_3 + H_2O + CO_2 \rightarrow 2NaHCO_3$ **Uses** • It is a mild antiseptic for skin infection • It is used as a fire extinguisher

SOME COMPOUNDS OF CALCIUM

Calcium Oxide, CaO [Quick lime]	***Calcium Hydroxide, $Ca(OH)_2$ [Slaked lime***	***Calcium Carbonate, $CaCO_3$ [Lime stone]***	***Calcium Sulphate (Plaster of Paris), $CaSO_4 \cdot ½ H_2O$***
It is prepared commercially by heating lime stone ($CaCO_3$) in a rotary kiln (furnace) at 1070 – 1270K.	It is prepared by adding water to quick lime. An aqueous	It can be prepared by passing carbon dioxide through slaked lime or	It is a hemihydrate of calcium sulphate. It is obtained

On exposure to air, it absorbs moisture and CO_2 ***The addition of limited amount of water breaks the big pieces of lime. This process is called slaking of lime.*** Quick lime slaked with soda (NaOH) gives solid soda lime (NaOH + CaO). combines with acidic oxides at high temperature to form salts. So it is used as a flux in metallurgy. **Uses:** 1. It is an important primary material for the manufacture of cement and is the cheapest form of alkali. 2. It is used in the purification of sugar and in the manufacture of dye stuffs	solution of slaked lime is known ***lime water*** and a suspension of slaked lime in water is known as ***milk of lime.*** ***When CO_2 is passed through lime water, it turns milky due to the formation of $CaCO_3$. On passing CO_2 continuously, the solution becomes clear due to the formation of soluble calcium bicarbonate $[Ca(HCO_3)_2]$*** When dry chlorine gas is passed through dry slaked lime, we get bleaching powder **Uses:** 1. It is used in the preparation of mortar, a building material. 2. It is used in white washing due to its disinfectant nature. 3. It is used in glass making, in tanning, for the preparation of bleaching powder	by the addition of sodium carbonate to calcium chloride. **Uses** 1. Calcium carbonate along with magnesium carbonate is used as a flux in the extraction of metals such as iron. 2.manufacture of high quality paper. 3. It is also used as an antacid, mild abrasive in tooth paste, a constituent of chewing gum, and filler in cosmetics.	when gypsum is heated to 393 K. ***Above 393 K, anhydrous calcium sulphate ($CaSO_4$) 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. During this process its volume increases.*** **Uses**: 1. The largest use of Plaster of Paris is in the building industry as well as plasters. 2. It is used for immoblising the affected part of organ where there is a bone fracture

The p- Block Elements

1. In group 13 elements, atomic radius increases down the group. But atomic radius of gallium is

less than that of aluminium. Why?

2. How can you explain the higher stability of BCl_3 as compared to $TlCl_3$?

3. What is inert pair effect? What is its consequence?

4. What are electron deficient compounds? Explain with examples.

5. Give the structure of aluminium chloride ($AlCl_3$)?

6. What is Borax? What is the action of heat on it?

7. A aqueous solution of borax is basic in nature. Justify.

8. Give the preparation and structure of ortho boric acid?

9. Ortho boric acid is monobasic even though it contains three hydrogen atoms. Why?

10. Give the preparation and structure of diborane

11. What is inorganic benzene? Give its preparation?

12. CCl_4 cannot be hydrolysed. Why?

13. Give the anomalous behaviour of carbon

14. What is allotropy? Explain the allotropes of carbon?

15. What are water gas and producer gas. Give any one of their use?

16. Suggest a reason for the toxicity of CO?

17. What is dry ice? Give its use?

18. CO_2 is a gas, while SiO_2 is a solid. Account for this?

19. What are silicones? Give their preparation?

20. What are Silicates?

21. What are zeolites? Mention its uses?

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PREVIOUS HSE QUESTIONS FROM THE CHAPTER "S-BLOCK ELEMENTS"

1. Lithium and Magnesium show diagonal relationship.

a) Give any two similarities between Li and Mg. (2)

b) What happens when Na is treated with i) water and ii) NH_3 ?

[July 2017]

2. The s-block elements of periodic table constitute alkali metals and alkaline earth metals.

a) The hydroxides and carbonates of sodium and potassium are more soluble than that of corresponding salts of magnesium and calcium. Explain. (2)

b) Write the chemical name of the following:

i)Caustic soda ii) Baking soda iii) Slaked lime iv) Milk of lime (2)

[March 2017]

3. a) Alkali metals dissolve in liquid ammonia to give blue coloured solutions. Why? (2)

b) Plaster of Paris is an important compound of calcium.

i) Give the chemical formula of plaster of Paris.(1)

ii) Identify the property of plaster of Paris which helps in plastering of broken bones. (1)

[March 2016]

4. Alkali metals are highly reactive due to their low ionization enthalpies.

a) The alkali metal which acts as the strongest reducing agent in aqueous solution is ..... (1)

b) How is sodium carbonate prepared using Solvay process? Is this method suitable for the preparation ofpotassium carbonate? Justify.(3)

[October 2015]

5. a) The metal present in the chlorophyll of plants is ..... (1)

b) Give any two uses of caustic soda. (1)

c) When sodium metal dissolves in liquid ammonia, it gives a deep blue coloured solution. Explain thereason. (2)

[March 2015]

6.Give reasons.

i)KO_2 is paramagnetic. (1)

ii)Solutions of alkali metals in liquid ammonia are blue in colour. (1)

[September 2013]

7. Alkali metals and alkaline earth metals belong to the s-block of the periodic table.

a) Name the process used for the industrial preparation of sodium carbonate. (1)

b) The above method is not suitable for the preparation of potassium carbonate. Give the reason(1)

c) Draw the chain structure of beryllium chloride in solid state. (1)

d) Write the chemical equation showing the preparation of Plaster of Paris from gypsum. (1)

[March 2013]

8. a) Lithium and Magnesium belong to 1 st and 2 nd groups in the periodic table. They resemble each other in many respects.

i)Name such relationship.(1)

ii) Give one similarity between Li and Mg. (1)

b) A compound of calcium is used in hospitals for setting fracture of bones.

i) Write the name and formula of the above compound.(1)

ii) What is dead burnt plaster? (1)

[September 2012]

9.Fill in the blanks:

a) Molecular formula of Plaster of Paris is .....

b) Beryllium shows diagonal relationship with .....

c) The metal present in chlorophyll is .....

d) Solvay process is associated with the preparation of .....(2)

`[September 2010]

10.When CO_2 is passed through lime water it turns milky.

a) What is the reaction in the above case?(1)

b) What happens when more CO_2 is passed to the milky solution? Why?