

Multiple Choice Questions

Single Correct Answer Type

Q1. The alkali metals are low melting. Which of the following alkali metals is expected to melt if the room temperature rises to 30°C?

(a) Na (b) K (c) Rb (d) Cs

Sol: (d) Among alkali metals, melting point decreases as the strength of metallic bonding decreases with increasing size of the atom. Thus, Cs has the lowest melting point (28.5°C) and will melt at 30°C.

Q2. Alkali metals react with water vigorously to form hydroxides and dihydrogen. Which of the following alkali metals reacts with water least vigorously?

(a) Li . (b) Na (c) K (d) Cs

Sol: (a) Both melting point and heat of reaction of alkali metals with water decrease down the group from Li to Cs. Although the heat of reaction of Li is the highest, but due to its high melting point, even this heat is not sufficient to melt the metal, which exposes greater surface to water for reaction. As a result, Li has the least reactivity but the reactivity increases as the melting point of alkali metals decreases down the group from Li to Cs.

Q3. The reducing power of a metal depends on various factors. Suggest the factor which makes Li, the strongest reducing agent in aqueous solution.

**(a) Sublimation enthalpy (b) Ionisation enthalpy
(c) Hydration enthalpy (d) Electron-gain enthalpy**

Sol: (c) Lithium has highest hydration enthalpy which accounts for its high negative E° value and its high reducing power.

Q4. Metal carbonates decompose on heating to give metal oxide and carbon dioxide. Which of the metal carbonates is most stable thermally?

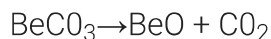
**(a) $MgCO_3$
(b) $CaCO_3$
(c) $SrCO_3$
(d) $BaCO_3$**

Sol: (d) Thermal stability of metal carbonates increases as the electropositive character of the metal or the basicity of the metal hydroxide increases from $Be(OH)_2$ to $Ba(OH)_2$. Thus, $BaCO_3$ is the most stable.

Q5. Which of the carbonates given below is unstable in air and is kept in CO_2 atmosphere to avoid decomposition.

- (a) BeCO_3
- (b) MgCO_3
- (c) CaCO_3
- (d) BaCO_3

Sol: (a) Due to least electropositive character or least basicity of Be, BeCO_3 is less stable and hence decomposes to give BeO and CO_2 .



Since the decomposition reaction is reversible, therefore, to increase the stability of BeCO_3 or to reverse the above equilibrium, BeCO_3 is kept in an atmosphere of CO_2 .

Q6. Metals form basic hydroxides. Which of the following metal hydroxides is the least basic?

- (a) Mg(OH)_2 (b) Ca(OH)_2 (c) Sr(OH)_2 (d) Ba(OH)_2

Sol: (a) As the ionization enthalpy increases from Mg \rightarrow Ba, the M – O bond becomes weaker and weaker down the group and hence basicity increases down the group. Thus, Mg(OH)_2 is least basic.

Q7. Some of the Group 2 metal halides are covalent and soluble in organic solvents. Among the following metal halides, the one which is soluble in ethanol is

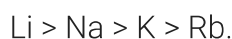
- (a) BeCl_2
- (b) MgCl_2
- (c) CaCl_2
- (d) SrCl_2

Sol: Due to small size, high electronegativity and high ionization enthalpy of Be, BeCl_2 is covalent and hence most soluble in organic solvents such as ethanol.

Q8. The order of decreasing ionization enthalpy in alkali metals is

- (a) $\text{Na} > \text{Li} > \text{K} > \text{Rb}$ (b) $\text{Rb} < \text{Na} < \text{K} < \text{Li}$
- (c) $\text{Li} > \text{Na} > \text{K} > \text{Rb}$ (d) $\text{K} < \text{Li} < \text{Na} < \text{Rb}$

Sol: (c) Ionization enthalpy decreases with increase in Size of the atom in a group. Hence, the order is:



Q9. The solubility of metal halides depends on their nature, lattice enthalpy and hydration enthalpy of the individual ions. Amongst fluorides of alkali metals, the lowest solubility of LiF in water is due to

- (a) ionic nature of lithium fluoride. . .
- (b) high lattice enthalpy. ‘
- (c) high hydration enthalpy for lithium ion.
- (d) low ionization enthalpy of lithium atom.

Sol: (b) Due to small size of Li^+ and F^- ions, lattice enthalpy is much higher than hydration enthalpy and hence LiF is least soluble among alkali metal fluorides.

Q10. Amphoteric hydroxides react with both alkalis and acids. Which of the following group 2 metal hydroxides is soluble in sodium hydroxide?

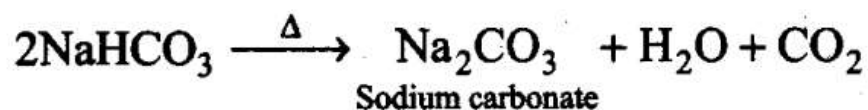
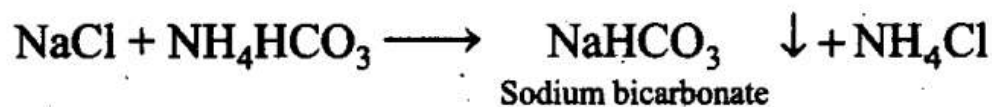
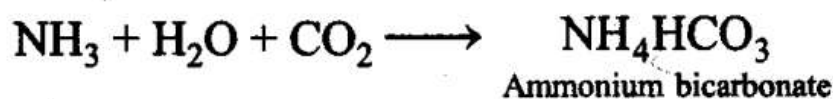
- (a) $\text{Be}(\text{OH})_2$
- (b) $\text{Mg}(\text{OH})_2$
- (c) $\text{Ca}(\text{OH})_2$
- (d) $\text{Ba}(\text{OH})_2$

Sol: (a) $\text{Be}(\text{OH})_2$ reacts with NaOH to give beryllate ion, becoming soluble in it. $\text{Be}(\text{OH})_2 + 2\text{OH}^- \rightarrow [\text{Be}(\text{OH})_4]^{2-}$

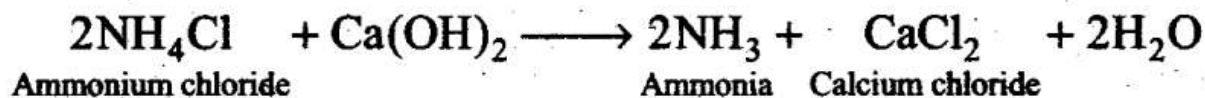
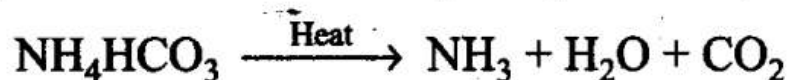
Q11. In the synthesis of sodium carbonate, the recovery of ammonia is done by treating NH_4Cl with $\text{Ca}(\text{OH})_2$. The by-product obtained in this process is

- (a) CaCl_2
- (b) NaCl
- (c) NaOH
- (d) NaHCO_3

Sol: (a) Sodium carbonate is synthesised by Solvay or ammonia soda process. The reactions involved are



NH_3 is recovered from NH_4HCO_3 and NH_4Cl formed during the reaction.



Q12. When sodium is dissolved in liquid ammonia, a solution of deep blue colour is obtained. The colour of the solution is due to

- (a) ammoniated electron
- (b) sodium ion
- (c) sodium amide
- (d) ammoniated sodium ion

Sol: (a) $\text{M} + (\text{x} + \text{y})\text{NH}_3 \rightarrow \text{M}^+(\text{NH}_3)_\text{x} + \text{e}^-(\text{NH}_3)_\text{y}$

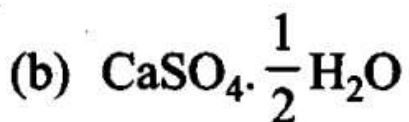
The colour of solution (deep blue) is due to the ammoniated electron which absorbs energy in the visible region.

Q13. By adding gypsum to cement

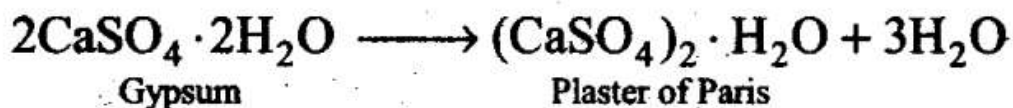
- (a) setting time of cement becomes less.
- (b) setting time of cement increases.
- (c) colour of cement becomes light.
- (d) shining surface is obtained.

Sol: (b) Raw materials for cement are limestone, clay and gypsum. Cement is a dirty greyish heavy powder containing calcium aluminates and silicates. Gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) is added to the components to increase the setting time of cement so that it gets sufficiently hardened. Setting of cement is an exothermic process and involves hydration of calcium aluminates and , silicates.

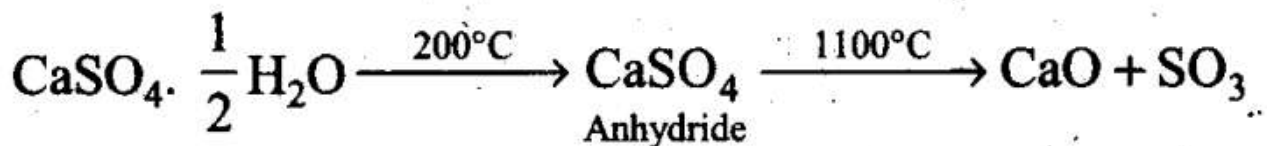
Q14. Dead burnt plaster is



Sol. (a) Plaster of Paris is prepared by heating gypsum at 120°C .



On heating plaster of Paris at 200°C , it forms anhydrous calcium sulphate, i.e., dead plaster which has no setting property as it absorbs water very slowly.



Q15. Suspension of slaked lime in water is known as

- (a) lime water
- (b) quick lime
- (c) milk of lime
- (d) aqueous solution of slaked lime

Sol: (c) Suspension of slaked lime in water is known as milk of lime.

Q16. Which of the following elements does not form hydride by direct heating with dihydrogen?

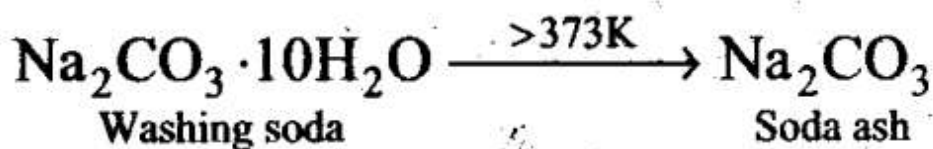
- (a) Be
- (b) Mg
- (c) Sr
- (d) Ba

Sol: (a) Due to high ionization enthalpy and small size, Be does not react with hydrogen by direct heating.

Q17. The formula of soda ash is

- (a) $\text{NaHCO}_3 \cdot 10\text{H}_2\text{O}$
- (b) $\text{Na}_2\text{CO}_3 \cdot 2\text{H}_2\text{O}$
- (c) $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$
- (d) Na_2CO_3

Sol: (d) On heating washing soda, it loses its water of crystallization. Above 373 K, it becomes completely anhydrous white powder called soda ash.



Q18. A substance which gives brick red flame and breaks down on heating to give oxygen and brown gas is

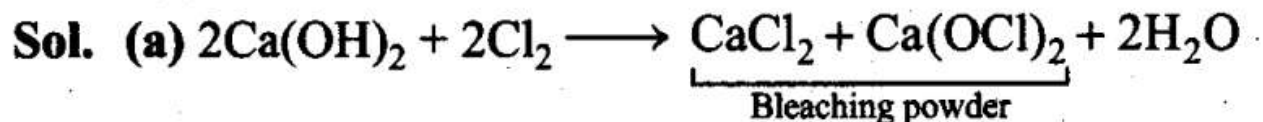
- (a) Magnesium nitrate
- (b) Calcium nitrate
- (c) Barium nitrate
- (d) Strontium nitrate

Sol: (b) $2\text{Ca}(\text{NO}_3)_2 \rightarrow 2\text{CaO} + 4\text{NO}_2 + \text{O}_2$

NO_2 is a brown gas. Ca^{2+} imparts brick red colour to the flame.

Q19. Which of the following statements is true about $\text{Ca}(\text{OH})_2$?

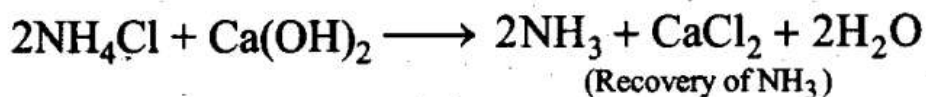
- (a) It is used in the preparation of bleaching powder.
- (b) It is a light blue solid.
- (c) It does not possess disinfectant property.
- (d) It is used in the manufacture of cement.



Q20. A chemical A is used for the preparation of washing soda to recover ammonia. When CO_2 is bubbled through an aqueous solution of A, the solution turns milky. It is used in white washing due to its disinfectant nature. What is the chemical formula of A?

- (a) $\text{Ca}(\text{CO}_3)_2$
- (b) CaO
- (c) $\text{Ca}(\text{OH})_2$
- (d) CaCO_3

Sol. (c) $\text{Ca}(\text{OH})_2$



It is used in white washing due to its disinfectant nature.

Q21. Dehydration of hydrates of halides of calcium, barium and strontium, i.e., $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$, $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$, $\text{SrCl}_2 \cdot 2\text{H}_2\text{O}$, can be achieved by heating. These become wet on keeping in air. Which of the following statements is correct about these halides?

- (a) Act as dehydrating agents.
- (b) Can absorb moisture from air.
- (c) Tendency to form hydrate decreases from calcium to barium.
- (d) All of the above.

Sol: (d) Chlorides of alkaline earth metals are hydrated salts. Due to their hygroscopic nature, they can be used as dehydrating agents to absorb moisture from air.

Extent of hydration decreases from Mg to Ba, i.e., $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$, $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$, $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$, $\text{SrCl}_2 \cdot 2\text{H}_2\text{O}$.

Q22. Metallic elements are described by their standard electrode potential, fusion enthalpy, atomic size, etc. The alkali metals are characterized by which of the following properties?

- (a) High boiling point.
- (b) High negative standard electrode potential.
- (c) High density.
- (d) Large atomic size.

Sol: (b, d) Alkali metals have high negative standard electrode potential and large atomic size.

Q23. Several sodium compounds find use in industries. Which of the following compounds are used for textile industry?

- (a) Na_2CO_3

(b) NaHCO_3

(c) NaOH

(d) NaCl

Sol: (a, c) Na_2CO_3 and NaOH are used in textile industry.

Q24. Which of the following compounds are readily soluble in water?

(a) BeSO_4

(b) MgSO_4

(c) BaSO_4

(d) SrSO_4

Sol: (a, b) Solubility decreases down the group because hydration enthalpy decreases more rapidly than lattice enthalpy. Thus, BeSO_4 and MgSO_4 are soluble.

Q25. When zeolite, which is hydrated sodium aluminium silicate, is treated with hard water, the sodium ions are exchanged with which of the following ion(s)?

(a) H^+ ions

(b) Mg^{2+} ions

(c) Ca^{2+} ions

(d) SO_4^{2-} ions

Sol: (b, c) Sodium zeolite removes Ca^{2+} and Mg^{2+} ions from hard water. $\text{Na}_2\text{Z} + \text{M}^{2+} \rightarrow \text{MZ} + 2\text{Na}^+$ ($\text{M} = \text{Ca}, \text{Mg}$) where, $\text{Z} = \text{Al}_2\text{Si}_2\text{O}_8\text{H}_2\text{O}$

Q26. Identify the correct formula of halides of alkaline earth metals from the following.

(a) $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$

(b) $\text{BaCl}_2 \cdot 4\text{H}_2\text{O}$

(c) $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$

(d) $\text{SrCl}_2 \cdot 4\text{H}_2\text{O}$

Sol: (a, c) Tendency to form halide hydrates gradually decreases down the group. The hydrates are $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$, $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$, $\text{SrCl}_2 \cdot 6\text{H}_2\text{O}$ and $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$.

Q27. Choose the correct statements from the following.

(a) Beryllium is not readily attacked by acids because of the presence of an oxide film on the surface of the metal.

(b) Beryllium sulphate is readily soluble in water as the greater hydration enthalpy of Be^{2+} overcomes the lattice enthalpy factor.

(c) Beryllium exhibits coordination number more than four.

(d) Beryllium oxide is purely acidic in nature.

Sol: (a, b) Be does not exhibit coordination number more than four and BeO is amphoteric in nature.

Q28. Which of the following are the correct reasons for anomalous behaviour of lithium?

- (a) Exceptionally small size of its atom.
- (b) Its high polarizing power.
- (c) It has high degree of hydration.
- (d) Exceptionally low ionization enthalpy.

Sol: (a, b) Anomalous behaviour of Li is due to its exceptionally small size and high polarizing power.

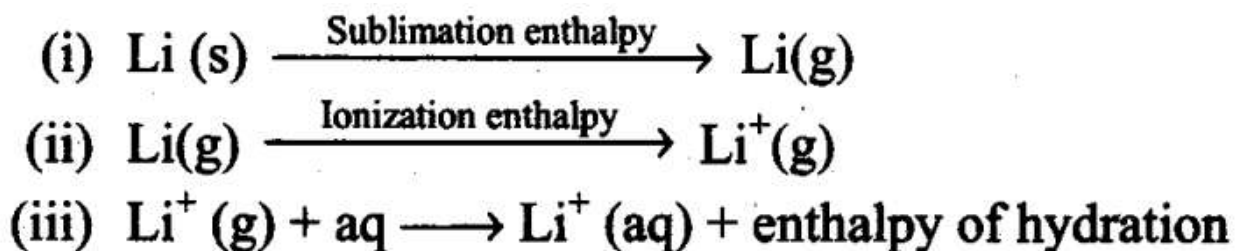
Short Answer Type Questions

Q29. How do you account for the strong reducing power of lithium in aqueous solution? .

Sol: Electrode potential is a measure of the tendency of an element to lose electrons in the aqueous solution. It mainly depends upon the following three factors

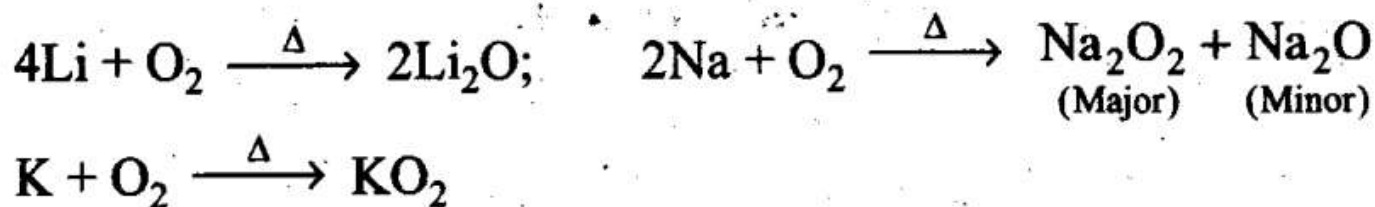
- (i) Sublimation enthalpy
- (ii) Ionization enthalpy
- (iii) Enthalpy of hydration

The sublimation enthalpies of alkali metals are almost similar. Since Li has the smallest size, its enthalpy of hydration is the highest among alkali metals. Although ionization enthalpy of Li is the highest among alkali metals, it is more than compensated by the high enthalpy of hydration. Thus, Li has the most negative standard electrode potential (-3.04 V) and hence Li is the strongest reducing agent in aqueous solution mainly because of its high enthalpy of hydration.



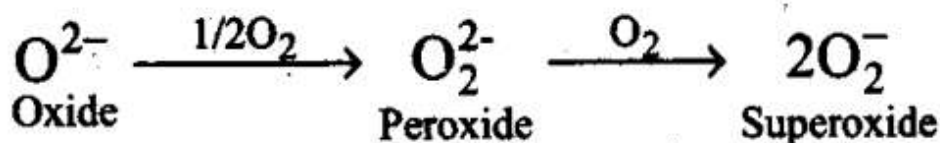
Q30. When heated in air, the alkali metals form various oxides. Mention the oxides formed by Li, Na and K.

Sol: The reactivity of alkali metals towards oxygen increases down the group as the atomic size increases. Thus, Li forms only lithium oxide (Li_2O), sodium forms mainly sodium peroxide (Na_2O_2) along with a small amount of sodium oxide while potassium forms only potassium superoxide (KO_2).



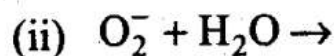
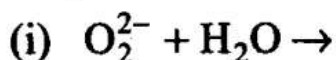
This is because of the following two reasons:

(i) As the size of the metal cation increases, the positive field around it becomes weaker and weaker thereby permitting the initially formed oxide (O^{2-}) ion to combine with another oxygen atom to form first peroxide ion (O_2^{2-}) and then superoxide (O_2^-) ion.

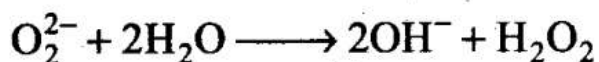


(ii) Since larger cations stabilize larger anions due to higher lattice energies, therefore, the stability increases from oxide \rightarrow peroxide \rightarrow superoxide as the size of the metal cation increases down the group and the size of the anion increases from oxide \rightarrow peroxide \rightarrow superoxide.

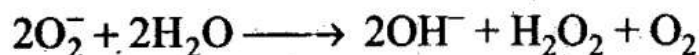
31. Complete the following reactions



Sol. (i) Peroxide ions react with water and form H_2O_2 .



(ii) Superoxides react with water and form H_2O_2 and O_2 .



Q32. Lithium resembles magnesium in some of its properties. Mention two such properties and give reasons for this resemblance.

Sol:(i) Both Li and Mg are harder and lighter than other elements in their groups.

(ii) Both form ionic nitrides Li_3N and Mg_3N_2 by heating in an atmosphere of nitrogen.

Li resembles Mg due to similar atomic radii and ionic radii.

Q33. Name an element' from Group 2 which forms an amphoteric oxide and a water soluble sulphate.

Sol: Due to small size and somewhat high ionization enthalpy of Be, $Be(OH)_2$ is amphoteric in nature, i.e., it reacts with both acids and bases. Further, due to small size, the hydration enthalpy of Be^{2+} ions is much higher than the lattice enthalpy of $BeSO_4$. As a result, $BeSO_4$ is highly soluble in water.

Q34. Discuss the trend of the following:

(i) Thermal stability of carbonates of Group 2 elements.

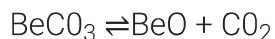
(ii) The solubility and the nature of oxides, of Group 2 elements.

Sol: (i) All the alkaline earth metals form carbonates (MCO_3). All these carbonates decompose on heating to

give CO_2 and metal oxide. The thermal stability; of these carbonates increases down the group, i.e., from Be to Ba,



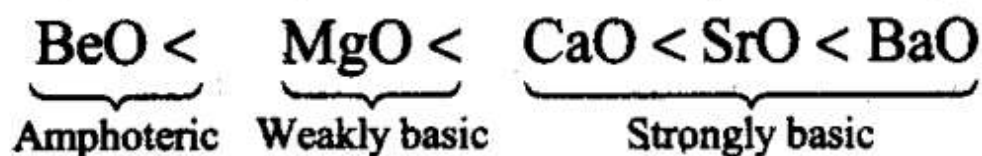
BeCO_3 is unstable to the extent that it is stable only in atmosphere of CO_2 . It however shows reversible decomposition in closed container



Hence, more is the stability of oxide formed, less will be stability of carbonates. Stability of oxides decreases down the group. Since beryllium oxide is high stable, it makes BeCO_3 unstable.

(ii) All the alkaline earth metals form oxides of formula MO . The oxides are very stable due to high lattice energy and are used as refractory material. Except BeO (predominantly covalent), all other oxides are ionic and their lattice energy decreases as the size of cation increases.

The oxides are basic and basic nature increases from BeO to BaO (due to increasing ionic nature).



BeO dissolves both in acid and alkalies to give salts and is amphoteric.

The oxides of the alkaline earth metals (except BeO and MgO) dissolve in water to form basic hydroxides and evolve a large amount of heat. BeO and MgO possess high lattice energy and thus are insoluble in water.

Q35. Why are BeSO_4 and MgSO_4 readily soluble in water while CaSO_4 , SrSO_4 and BaSO_4 are insoluble?

Sol: The hydration enthalpies of BeSO_4 and MgSO_4 are quite high because of small size of Be^{2+} and Mg^{2+} ions. These hydration enthalpy values are higher than their corresponding lattice enthalpies and therefore, BeSO_4 and MgSO_4 are highly soluble in water. However, hydration enthalpies of CaSO_4 , SrSO_4 and BaSO_4 are not very high as compared to their respective lattice enthalpies and hence these are insoluble in water.

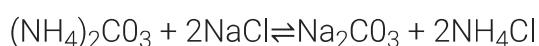
Q36. All compounds of alkali metals are easily soluble in water but lithium compounds are more soluble in organic solvents. Explain.

Sol: Because of the small size, high electronegativity and high ionization enthalpy, lithium compounds have considerable covalent character while compounds of other alkali metals are ionic in nature. As a result, compounds of lithium are more soluble in organic solvents while those of other alkali metals are more soluble in water.

Q37. In the Solvay process, can we obtain sodium carbonate directly by treating the solution containing $(\text{NH}_4)_2\text{CO}_3$ with sodium chloride? Explain.

Sol: No. In Solvay process, ammonium hydrogencarbonate is prepared from ammonium carbonate, which then reacts with sodium chloride to form sodium hydrogencarbonate. Due to low solubility of NaHCO_3 , it gets precipitated and decomposes on heating to give Na_2CO_3 .

We cannot obtain sodium carbonate directly by treating the solution containing $(\text{NH}_4)_2\text{CO}_3$ with sodium chloride as both the products formed on reaction, i.e., Na_2CO_3 and NH_4Cl are soluble and the equilibrium will not shift in forward direction.



38. Write the Lewis structure of O_2^- ion and find out the oxidation state of each oxygen atom. What is the average oxidation state of oxygen in this ion?

Sol. Lewis structure of O_2^- is $:\ddot{\text{O}}-\ddot{\text{O}}:^-$ Oxygen atom with no charge has 6 electrons. Thus, its oxidation state is 0. Oxygen atom that carries negative charge has 7 electrons. Thus, its oxidation state is -1.

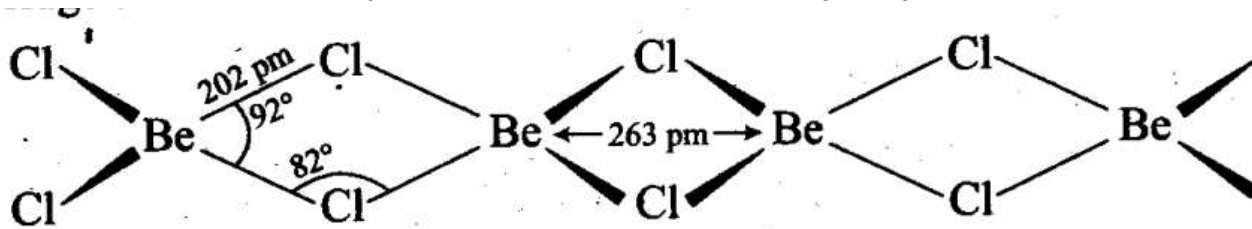
$$\text{Average O.S.} = \frac{0 + (-1)}{2} = \frac{-1}{2}$$

Q39. Why do beryllium and magnesium not impart colour to the flame in the flame test?

Sol: All alkaline earth metals (except Be and Mg) impart a characteristic colour to the Bunsen flame. The different colours arise due to different energies required for electronic excitation and de-excitation.

Be and Mg atoms, due to their small size, bind their electrons more strongly (because of higher effective nuclear charge). Hence, they require high excitation energy and are not excited by the energy of the flame with the result that no flame colour is shown by them.

Q40. What is the structure of BeCl_2 molecule in gaseous and solid state? Beryllium chloride has different structures in solid and vapour state. In solid state, it exists in the form of polymeric chain structure in which each Be-atom is surrounded by four chlorine atoms, having two of the chlorine atoms covalently bonded while the other two by coordinate bonds. The resulting bridge structure contains infinite chains.



Structure of BeCl_2 in solid state

In vapour state, above 1200 K, it exists as a monomer having linear structure and zero dipole moment. But below 1200 K, it exists as dimer even in the vapour state.

Matching Column Type Questions

In the following questions, more than one option of column I and II may be correlated.

Q41. Match the elements given in Column I with the properties mentioned in Column II.

Column I	Column II
(i) Li	(a) Insoluble sulphate
(ii) Na	(b) Strongest monoacidic base
(iii) Ca	(c) Most negative E° value among alkali metals
(iv) Ba	(d) Insoluble oxalate
	(e) $6s^2$ outer electronic configuration

Sol: (i \rightarrow c); (ii \rightarrow b); (iii \rightarrow d); (iv \rightarrow a, e)

(i) Li – Most negative E° among alkali metals

[Due to very high hydration energy the resulting E° is most negative].

(ii) Na – Strongest monoacidic base

[Alkalies are more acidic than alkaline earth metals. LiOH has covalent character], –

(iii) Ca – insoluble oxalate

[Calcium oxalate is insoluble in water.]

(iv) Ba – Insoluble sulphate

[Hydration energy decreases as size of cation increases].

$6s^2$ outer electronic configuration

${}_{56}\text{Ba} = 1s^2, 2s^2, 2p, 3s^2, 3p^6, 3d^{10}, 4s^2, 4p^6, 4d^{10}, 5s^2, 5p^6, 6s^2$

Q42. Match the compounds given in Column I with their uses mentioned in Column II.

Column I	Column II
(i) CaCO_3	(a) Dentistry, ornamental work
(ii) Ca(OH)_2	(b) Manufacture of sodium carbonate from caustic soda
(iii) CaO	(c) Manufacture-of high quality paper
(iv) CaSO_4	(d) Used in white washing

Sol: (i \rightarrow c); (ii \rightarrow d); (iii \rightarrow b); (iv \rightarrow a)

(i) CaCO_3 – Manufacture of high quality paper

(ii) Ca(OH)_2 – Used in white washing

(iii) CaO – Manufacture of sodium carbonate from caustic soda

(iv) CaSO_4 – Dentistry, ornamental work

Q43. Match the elements given in Column I with the colour they impart to the flame given in Column II.

Column I	Column II
(i) Cs	(a) Apple green
(ii) Na	(b) Violet
(iii) K	(c) Brick red

(iv) Ca

(d) Yellow

(v) Sr

(e) Crimson red

(vi) Ba

(f) Blue

Sol: (i \rightarrow f); (ii \rightarrow d); (iii \rightarrow b); (iv \rightarrow c); (v \rightarrow e); (vi \rightarrow a)

Elements with the characteristic flame colour are as follows ‘

- (i) Cs – Blue
- (ii) Na-Yellow
- (iii) K- Violet
- (iv) Ca-Brick red
- (v) Sr – Crimson red
- (vi) Ba – Apple green

Flame colours are produced from the movement of the electrons in the metal ions present in the compounds. These movements of electrons (electronic excitation and de-excitation) requires energy. Each atom has particular energy gap between ground and excited energy ‘ level. Therefore, each of these movements involves a specific amount of energy emitted as light energy, and each corresponds to a particular colour. As we know energy gap between ground and excited state energy level increases, wavelength of light absorbed decreases and complementary colour is observed.

Assertion and Reason Type Questions

In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below each question.

Q44. Assertion (A): The carbonate of lithium decomposes easily on heating to , form lithium oxide and CO_2 .

Reason (R): Lithium being very small in size polarizes large carbonate ion leading to the formation of more stable Li_2O and CO_2 .

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) Both A and R are not correct.
- (d) A is not correct but R is correct.

Sol: (a) Unlike other alkali metal carbonates, the carbonate of lithium decomposes on heating to form its oxide. Its oxide is stabilised by polarization.

Q44. Assertion (A): Beryllium carbonate is kept in the atmosphere of carbon dioxide.

Reason (R): Beryllium carbonate is unstable and decomposes to give beryllium oxide and carbon dioxide:

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) Both A and R are not correct.
- (d) A is not correct but R is correct.

Sol: (a) BeCO_3 is kept in the atmosphere of CO_2 , otherwise it will decompose to give its oxide and carbon dioxide.

Long Answer Type Questions

Q46. The s-block elements are characterized by their larger atomic sizes, lower ionization enthalpies, invariable +1 oxidation state and solubilities of their oxosalts. In the light of these features, describe the nature of their oxides, halides and oxosalts.

Sol: (i) Nature of oxides – Alkali metals form M_2O , M_2O_2 and MO_2 types of oxides. The stability of the peroxide or superoxide increases as the size of metal cation increases. This is due to the stabilization of large anions by larger cations.

(ii) Nature of halides – Alkali metal halides have general formula MX . All halides are soluble in water. LiF is very less soluble in water due to its high lattice energy. Their melting points and boiling points follow the trend – fluoride > chloride > bromide > iodide. This is because with increase in size of the halide ion, lattice energy increases.

(iii) Oxosalts – Oxosalts of alkali metals are generally soluble in water and thermally stable. As electropositive character increases down the group, stability of carbonates and bicarbonates increases.

Q47. Present a comparative account of the alkali and alkaline earth metals with respect to the following characteristics:

(a) Tendency to form ionic/covalent compounds

(b) Nature of oxides and their solubility in water

(c) Formation of oxosalts

(d) Thermal stability of oxosalts

Alkali metals	Alkaline earth metals
(i) All alkali metals except Li form ionic compounds.	(i) All alkaline earth metals except Be form ionic compounds.
(ii) The solubility of oxides of alkali metals increases down the group. The basic character of the oxides increases down the group	(ii) The solubility of oxides of Mg, – Ca, Sr and Ba increases from Mg to Ba. BeO , however, is covalent and insoluble in water. The basic character of oxides increases from MgO to BaO . BeO is, however, amphoteric.

(iii) All alkali metals form oxo salts such as carbonates, sulphates and nitrates.	(iii) All alkaline earth metals form oxo salts such as carbonates, sulphates and nitrates.
(iv) Solubility of carbonates and sulphates increases down the group.	(iv) Solubility of carbonates and sulphates decreases down the group.
(v) Carbonates and sulphates of Li decompose on heating while the stability, of carbonates and sulphates of other metals increases down the group.	(v) The carbonates and sulphates of alkaline earth metals all decompose on heating but the temperature of their decomposition increases down the group, i.e., their thermal stability increases.