10 The s-Block Elements

1. In the case of alkali metals, the covalent character decreases in the order :
(a) MF > MCl > MBr > MI
(b) MF > MCl > MI > MBr
(c) MI > MBr > MCl > MF
(d) MCl > MI > MBr > MF

2. The mobility of metal ions in aqueous medium (Li , Na , K , Rb) in the electric field, follows the order
(a) Li > Na > K > Rb
(b) Rb > Na K > Li
(c) Li < Na < K < Rb
(d) Na K > Rb > Li

3. The main oxides formed on combustion of Li, Na and K in excess of air are, respectively:

Tricky

(a) Li_2O_2, Na_2O_2 and KO_2
(b) Li_2O, Na_2O_2 and KO_2
(c) Li_2O, Na_2O and KO_2
(d) LiO_2, Na_2O_2 and K_2O

4. Which of the following oxides of potassium is not known ?
(a) K_2O (b) K_2O_4 (c) KO_3 (d) K_2O_3

5. Nitrogen dioxide cannot be prepared by heating
(a) KNO_3 (b) $Pb(NO_3)_2$
(c) $Cu(NO_3)_2$ (d) $AgNO_3$

6. Incorrect statement is:
(a) $NaHCO_3$ and $KHCO_3$ have same crystal structure
(b) On heating $LiNO_3$ decomposes into Li_2O and NO_2
(c) Among alkali metals, Li metal impart red colour to flame
(d) Li_2SO_4 does not form alum

7. Which is not correctly matched

Toughnut

(i) Basic strength $Cs_2O < Rb_2O < K_2O < Na_2O < Li_2O$ of oxides.
(ii) Stability of $Na_2O_2 < K_2O_2 < Rb_2O_2 < Cs_2O_2$ peroxides.
(iii) Stability of $LiHCO_3 < NaHCO_3 < KHCO_3 < RbHCO_3 < CsHCO_3$.
(iv) Melting point NaF < NaCl < NaBr < NaI
(a) (i) and (iv) (b) (i) and (iii)
(c) (i) and (ii) (d) (ii) and (iii)

8. The solubility order for alkali metal fluoride in water is :
(a) LiF < RbF < KF < NaF
(b) RbF < KF < NaF < LiF
(c) LiF > NaF > KF > RbF
(d) LiF < NaF < KF < RbF

9. Based on lattice energy and other considerations, which one of the following alkali metal chloride is expected to have the highest melting point?
(a) NaCl (b) KCl (c) LiCl (d) RbCl

10. In crystals which one of the following ionic compounds would you expect maximum distance between centres of cations and anions?
(a) LiF (b) CsF (c) CsI (d) LiI

11. Which of the following statements about Na_2O_2 is not correct?

Critical Thinking

(a) It is diamagnetic in nature
(b) It is derivative of H_2O_2
(c) Na_2O_2 oxidises Cr^{3+} to CrO_4^{2-} in acid medium.
(d) It is the super oxide of sodium

12. The correct order of thermal stability of hydroxides is:
(a) $Ba(OH)_2 < Ca(OH)_2 < Sr(OH)_2 < Mg(OH)_2$
(b) $Mg(OH)_2 < Sr(OH)_2 < Ca(OH)_2 < Ba(OH)_2$
(c) $Mg(OH)_2 < Ca(OH)_2 < Sr(OH)_2 < Ba(OH)_2$
(d) $Ba(OH)_2 < Sr(OH)_2 < Ca(OH)_2 < Mg(OH)_2$

13. The reducing power of a metal depends on various factors. Suggest the factor which makes Li metal the strongest reducing agent in aqueous solution:
(a) Sublimation enthalpy
(b) Ionisation enthalpy
(c) Hydration enthalpy
(d) Electron-gain enthalpy

14. Select the correct statements :

I. Cs^+ is more highly hydrated than the other alkali metal ions

II. Among the alkali metals Li, Na, K and Rb, lithium has the highest melting point

III. Among the alkali metals, only lithium forms a stable nitride by direct combination with nitrogen

(a) I, II and III (b) I and II

(c) I and III (d) II and III

15. In the following sequence of reaction, identify the compounds (A), (B) (C) and (D) :

$$\underset{\text{Solution}}{Na_2CO_3} \xrightarrow{SO_2} (A) \xrightarrow{Na_2CO_3} (B) \xrightarrow[\text{Heat}]{S} (C) \xrightarrow{AgNO_3} (D)$$

(a) Na_2SO_3, $NaHSO_3$, Na_2S, Ag_2S

(b) $NaHSO_3$, Na_2SO_3, $Na_2S_2O_3$, Ag_2S

(c) $NaHSO_3$, Na_2SO_4, Na_2S, Ag_2O

(d) Na_2SO_3, Na_2SO_4, $Na_2S_2O_3$, Ag

16. Which of the following does not illustrate the anomalous properties of lithium?

(a) The melting point and boiling point of Li are comparatively high

(b) Li is much softer than the other group I metals

(c) Li forms a nitride Li_3N unlike group I metals

(d) The ion of Li and its compounds are more heavily hydrated than those of the rest of the group

17. The order solubility in water of alkaline earth metal sulphates down the group is Be > Mg > Ca > Sr > Ba. This is due to increases in

(a) ionization energy

(b) melting point

(c) coordination number

(d) All of these

18. A chloride dissolves appreciably in cold water. When placed on a Pt wire in bunsen flame, no distinctive colour is noted. Which cation could be present?

(a) Be^{2+} (b) Ba^{2+} (c) Pb^{2+} (d) Ca^{2+}

19. An unknown inorganic compound (X) loses its water of crystallization on heating and its aqueous solution gives the following reactions :

Critical Thinking

(a) It gives a white turbidity with dilute HCl solution

(b) It decolourises a solution of iodine in potassium iodide

(c) It gives a white precipitate with silver nitrate solution which turns black on standing.

Identify the compound (X)

(a) $Na_2CO_3.10H_2O$ (b) $Na_2S_2O_3.5H_2O$

(c) $Na_2SO_4.10H_2O$ (d) None of these

20. A metal M readily forms its sulphate MSO_4 which is water-soluble. It forms its oxide MO which becomes inert on heating. It forms an insoluble hyroxide $M(OH)_2$ which is soluble in NaOH solution. Then M is

(a) Mg (b) Ba (c) Ca (d) Be

21. Melting point of calcium halides decreases in the order

(a) $CaF_2 > CaCl_2 > CaBr_2 > CaI_2$

(b) $CaI_2 > CaBr_2 > CaCl_2 > CaF_2$

(c) $CaBr_2 > CaI_2 > CaF_2 > CaCl_2$

(d) $CaCl_2 > CaBr_2 > CaI_2 > CaF_2$

22. Which of the following is not correct ?

Tricky

(a) $2Li_2O \xrightarrow[673K]{heat} Li_2O_2 \quad 2Li$

(b) $2K_2O \xrightarrow[673K]{heat} K_2O_2 \quad 2K$

(c) $2Na_2O \xrightarrow[673K]{heat} Na_2O_2 \quad 2Na$

(d) $2Rb_2O \xrightarrow[673K]{heat} Rb_2O_2 \quad 2Rb$

23. The alkali metals form salt-like hydrides by the direct synthesis at elevated temperature. The thermal stability of these hydrides decreases in which of the following orders ?

(a) CsH > RbH > KH > NaH > LiH

(b) KH > NaH > LiH > CsH > RbH

(c) NaH > LiH > KH > RbH > CsH

(d) LiH > NaH > KH > RbH > CsH

24. Which of the following is not correct about the solution when moderate amount of sodium metal is dissolved in liquid ammonia at low temperature?

(a) Na^+ ions are produced in solution

(b) We get a blue coloured solution

(c) the solution acts as a good conductor of electricity

(d) Liquid ammonia remains diamagnetic

25. The order of solubility of lithium halides in non polar solvents follows the order

(a) LiI LiBr LiCl LiF

(b) LiF LiI LiBr LiCl

(c) LiCl LiF LiI LiBr

(d) LiBr LiCl LiF LiI

26. Which of the following is most stable?

(a) Na_3N (b) Li_3N

(c) K_3N (d) Rb_3N

27. $ZnCl_2 + NaHCO_3 \xrightarrow{Heat} (A) \xrightarrow{Heat}$

(B) (C) H_2O (B) NaOH $\rightarrow$ (D)

Identify the compound (D) present in the solution.

Toughnut

(a) $ZnCO_3$ (b) $Zn(OH)_2$

(c) ZnO (d) Na_2ZnO_2

28. Which of the following has correct increasing basic strength?

(a) MgO<BeO<CaO<BaO

(b) BeO<MgO<CaO<BaO

(c) BaO<CaO<MgO<BeO

(d) CaO<BaO<BeO<MgO

29. Which of the following statement is false ?

(a) Strontium decomposes water readily than beryllium.

(b) Barium carbonate melts at a higher temperature than calcium carbonate.

(c) Barium hydroxide is more soluble in water than magnesium hydroxide.

(d) Beryllium hydroxide is more basic than barium hydroxide.

30. Which of the following is the best method for preparation of BeF_2?

(a) Reaction of Be with F_2

(b) Thermal decomposition of $(NH_4)_2BeF_4$

(c) Reaction of Be with HF

(d) All of the above are equally effective

31. Aqueous solution of a group 2 element is precipitated by adding Na_2CO_3, then this precipitate is tested on flame, no light in visible region is observed , this element can be

Tricky

(a) Ba (b) Mg (c) Ca (d) Sr

32. Which of the following are found in biological fluids Na^+, Mg^{2+}, Ca^{2+}, K^+, Sr^{2+}, Li^+ and Ba^{2+}?

(a) Mg^{2+}, Ca^{2+}, and Sr^{2+}

(b) Na^{2+} and K^+

(c) Na^+, K^+, Mg^{2+} and Ca^{2+}

(d) Sr^+, Li and Ba^{2+}

33. Metallic magnesium is prepared by

(a) reduction of MgO by coke.

(b) electrolysis of aqueous solution of $Mg(NO_3)_2$.

(c) displacement of Mg by iron from $MgSO_4$ solution.

(d) electrolysis of molten $MgCl_2$.

34. A compound (A) is used in preparation of washing soda to recover ammonia in Solvay's process. When CO_2 is bubbled through an aqueous solution of (A), the solution turns milky. It is used in white washing due to disinfectant nature. What is the chemical formula of A?

Critical Thinking

(a) $Ca(HCO_3)_2$ (b) CaO

(c) $Ca(OH)_2$ (d) $CaCO_3$

35. BeF_2 is soluble in water whereas fluorides of other alkaline earth metals are insoluble because of

(a) ionic nature of BeF_2.

(b) covalent nature of BeF_2.

(c) greater hydration energy of Be^{2+} ion as compared to its lattice energy.

(d) none of these.

36. Which category of salts of alkaline earth metals is not found in solid sate, but found in solution state?

(a) Carbonates (b) Bicarbonates

(c) Hydroxides (d) Sulphates

37. Sodium carbonate solution in water is alkaline due to

(a) hydrolysis of Na^+

(b) hydrolysis of CO_3^{2-}

(c) hydrolysis of both Na^+ and CO_3^{2-} ions

(d) None of these

38. When a crystal of caustic soda is exposed to air, a liquid layer is deposited because :

(a) Crystal loses water

(b) Crystal absorbs moisture and CO_2

(c) Crystal melts

(d) Crystal sublimes

39. Which of the following statements is correct for $CsBr_3$?
(a) It is a covalent compound.
(b) It contains Cs^{3+} and Br^- ions.
(c) It contains Cs^+ and Br_3^- ions
(d) It contains Cs^+, and Br^- and lattice Br_2 molecule.

40. The pair of compounds which cannot exits together in solution is

(a) $NaHCO_3$ and NaOH
(b) Na_2CO_3 and $NaHCO_3$
(c) Na_2CO_3 and NaOH
(d) $NaHCO_3$ and NaCl

41. Na_2SO_3 and $NaHCO_3$ may be distinguished by treating their aqueous solution with :
(a) MgO (b) $MgSO_4$
(c) litmus solution. (d) dil. acid

42. Substance which absorbs CO_2 and violently reacts with H_2O with sound is :
(a) H_2SO_4 (b) $CaCO_3$
(c) ZnO (d) CaO

43. When sulphur is heated with NaOH (aq). The compounds formed are
(a) Na_2S H_2O
(b) Na_2SO_3 H_2O
(c) Na_2S $Na_2S_2O_3$ H_2O
(d) $Na_2S_2O_3$ H_2O

44. The metal X is prepared by the electrolysis of fused chloride. It reacts with hydrogen to form a colourless solid from which hydrogen is released on treatment with water. The metal is :
(a) Ca (b) Al (c) Zn (d) Cu

45. Acidified solution of sodium thiosulphate is unstable because in thiosulphate

(a) the sulphur atoms are at unstable oxidation state of +2
(b) the two sulphur atoms are at different oxidation states of + 6 and – 2
(c) the S-S bond are unstable bonds.
(d) sulphur is in zero oxidation state.

46. Two metals (A) and (B) belong to the same group of the periodic table. Metal (A) forms an insoluble oxide but a soluble sulphate, metal (B) forms a soluble oxide but an insoluble sulphate. Both metals (A) and (B) form hydroxides which are soluble in alkalis. (A) and (B) are
(a) Ba and Mg (b) Na and K
(c) Mg and Ba (d) K and Rb

47. Among the given statements, the incorrect one is
(a) Be differs much from other alkali metals than Li does from other alkali metals.
(b) Be generally forms covalent compounds.
(c) Be forms a very strong complex, $[Be(H_2O)_4]^{2+}$.
(d) Be usually has more than four water of crystallisation associated with it.

48. Calcium imide on hydrolysis gives gas (B) which on oxidation by bleaching powder gives gas (C). Gas (C) on reaction with magnesium give compound (D) which on hydrolysis gives again gas (B). Identify (B), (C) and (D).

(a) NH_3, N_2, Mg_3N_2
(b) N_2,NH_3, MgNH
(c) N_2, N_2O_5, $Mg(NO_3)_2$
(d) NH_3, NO_2, $Mg(NO_2)_2$

49. Which one is the correct statement with reference to solubility of $MgSO_4$ in water?
(a) SO_4^{2-} ion mainly contributes towards hydration energy.
(b) Sizes of Mg^{2+} and SO_4^{2-} are similar.
(c) Hydration energy of $MgSO_4$ is higher in comparison to its lattice energy.
(d) Ionic potential (charge/radius ratio) of Mg^{2+} is very low.

50. A solid compound 'X' on heating gives CO_2 gas and a residue. The residue mixed with water forms 'Y'. On passing an excess of CO_2 through 'Y' in water, a clear solution 'Z', is obtained. On boiling 'Z', compound 'X' is reformed. The compound 'X' is

(a) $Ca(HCO_3)_2$ (b) $CaCO_3$
(c) Na_2CO_3 (d) K_2CO_3

51. Amongst the following hydroxides, the one which has the lowest value of K_{sp} is :
(a) $Ca(OH)_2$ (b) $Mg(OH)_2$
(c) $Be(OH)_2$ (d) $Ba(OH)_2$

52. For which one of the following minerals, the composition given is incorrect?
(a) Soda ash — (Na_2CO_3)
(b) Carnallite — ($KCl \cdot MgCl_2 \cdot 6H_2O$)
(c) Borax — ($Na_2B_4O_7 \cdot 7H_2O$)
(d) Glauber's salt — ($Na_2SO_4 \cdot 10H_2O$)

53. The difference of number of water molecules in gypsum and plaster of Paris is  **Critical Thinking**

(a) $\frac{5}{1}$ (b) 2 (c) 1/2 (d) $1\frac{1}{2}$

54. Which is not obtained when metal carbides react with H_2O?

(a) $Al_4C_3 + H_2O \longrightarrow CH \equiv CH$

(b) $CaC_2 + H_2O \longrightarrow CH \equiv CH$

(c) $Mg_4C_3 + H_2O \longrightarrow CH_3C \equiv CH$

(d) $Be_2C + H_2O \longrightarrow CH_4$

55. $CaCl_2$ is preferred over NaCl for clearing ice on roads particularly in very cold countries. This is because:

(a) $CaCl_2$ is less soluble in H_2O than NaCl

(b) $CaCl_2$ is hygroscopic but NaCl is not

(c) Eutectic mixture of $CaCl_2/H_2O$ freezes at –55°C while that of $NaCl/H_2O$ freezes at –18°C

(d) NaCl makes the road slipperty but $CaCl_2$ does not

56. Which of the following statement about the sulphate of alkali metal is correct?

(a) Except Li_2SO_4 all sulphate of other alkali metals are soluble in water

(b) All sulphate salts of alkali metals except lithium sulphate forms alum.

(c) All sulphate salts of alkali metals except lithium sulphate do not decompose at high temperature

(d) All of the above

57. Mg_2C_3 reacts with water forming propyne gas. C_3^{4-} ions has:

(a) two sigma and two pi bonds

(b) three sigma and one pi bond

(c) two sigma and one pi bond

(d) two sigma and three pi bonds

58. If NaOH is added to an aqueous solution of Zn^2 ions, a white precipitate appears and on adding excess NaOH, the precipitate dissolves. In this solution zinc exists in the :

(a) both in cationic and anionic parts

(b) there is no zinc left in the solution

(c) cationic part

(d) anionic part.

59. Which is incorrect statement?  **Critical Thinking**

(a) The heats of hydration of the dipositive alkaline earth metal decrease with an increase in their ionic size

(b) $NaNO_3$ forms Na_2O_2 on heating

(c) Hydration of alkali metal ion is less than that of IIA group

(d) Alkaline earth metal ions, because of their much larger charge to size ratio, exert a much stronger electrostatic attraction on the oxygen of water molecule surrounding them

60. Which of the following does not form an oxide on heating?

(a) $ZnCO_3$ (b) $CaCO_3$

(c) Li_2CO_3 (d) Na_2CO_3

Answer KEY

1	(c)	**7**	(a)	**13**	(c)	**19**	(b)	**25**	(a)	**31**	(b)	**37**	(b)	**43**	(c)	**49**	(c)	**55**	(c)
2	(c)	**8**	(d)	**14**	(d)	**20**	(d)	**26**	(b)	**32**	(c)	**38**	(b)	**44**	(a)	**50**	(b)	**56**	(d)
3	(b)	**9**	(a)	**15**	(b)	**21**	(a)	**27**	(d)	**33**	(d)	**39**	(c)	**45**	(b)	**51**	(c)	**57**	(a)
4	(b)	**10**	(c)	**16**	(b)	**22**	(a)	**28**	(b)	**34**	(c)	**40**	(a)	**46**	(c)	**52**	(c)	**58**	(d)
5	(a)	**11**	(d)	**17**	(c)	**23**	(d)	**29**	(d)	**35**	(c)	**41**	(b)	**47**	(d)	**53**	(d)	**59**	(b)
6	(a)	**12**	(d)	**18**	(a)	**24**	(d)	**30**	(b)	**36**	(b)	**42**	(d)	**48**	(a)	**54**	(a)	**60**	(d)

Hints & Solutions

1. **(c)** As the size of halide ion decreases, $I^- > Br^- > Cl^- > F^-$, tendency to get polarised by cation M decreases and hence covalent character decreases.

2. **(c)** Down the group with decrease in positive charge tendency to get hydrated decreases and hence the size of hydrated ion decreases. Thus mobility increases.

3. **(b)** On heating with excess of air Li, Na and K forms following oxides

$$4Li + O_2 \longrightarrow \underset{\text{Lithium monoxide}}{2Li_2O}$$

$$4Na + O_2 \xrightarrow{575K} \underset{\text{Sodium peroxide}}{Na_2O_2}$$

$$K + O_2 \longrightarrow \underset{\text{Potassium superoxide}}{KO_2}$$

4. **(b)** O_4^{2-} ion is not possible and K_2O_4 is unknown.

5. **(a)** Only nitrates of heavy metals and lithium decompose on heating to produce NO_2.

6. **(a)** The crystal structures of $NaHCO_3$ and $KHCO_3$ both show hydrogen bonding but are different. In $NaHCO_3$, the HCO_3^- ions are linked into an infinite chain, while in $KHCO_3$, a dimeric anion is formed.

7. **(a)** Basic strength of the oxides increases in the order

$Li_2O < Na_2O < K_2O < Rb_2O < Cs_2O$. The increase in basic strength is due to the decrease in I.E. and increase in electropositive character.

The melting points of the halides decrease in the order NaF > NaCl > NaBr > NaI, as the size of the halide ion increases. The decrease in melting point is due to increase in the covalent character with increase in the size of anion according to Fajan's rule.

8. **(d)** Higher the lattice enthalpy lower will be solubility i.e.,

$$\text{lattice enthalpy} \quad \frac{1}{\text{Solubility}}$$

Since the lattice enthalpy of alkali metals follow the order

Li > Na > K > Rb

Hence the correct order of solubility is

LiF < NaF < KF < RbF

9. **(a)** NaCl due it to its largest lattice energy has the highest melting point.

10. **(c)** As Cs^+ ion has larger size than Li^+ and I^- has larger size than F^-, therefore maximum distance between centres of cations and anions is in CsI.

11. **(d)** Na_2O_2 is peroxide of sodium not super oxide. The formula of sodium superoxide is NaO_2.

12. **(d)** Stability of ionic compounds decreases with decrease in lattice enthalpy. Thus stability of alkaline earth metal hydroxides decreases with decrease in lattice enthalpy as the size of alkali earth metal cations increases down the group.

13. **(c)** Due to high hydration energy of Li^+ cation, the standard reduction potential of Li^+ is more negative among all alkali metal cations hence Li act as strong reducing agent in water.

14. **(d)** Amongst alkali metal ions, Li ions are highly hydrated.

15. **(b)**

$$Na_2CO_3 \quad 2SO_2 \quad H_2O \rightarrow \underset{(A)}{2NaHSO_3} \quad CO_2$$

$$\underset{(A)}{2NaHSO_3} + Na_2CO_3 \rightarrow \underset{(B)}{2Na_2SO_3} \quad H_2O \quad CO_2$$

$$\underset{(B)}{2Na_2SO_3} + S \xrightarrow{\text{Heat}} \underset{(C)}{2Na_2S_2O_3}$$

$$Na_2S_2O_3 + AgNO_3 \rightarrow \underset{(D)}{Ag_2S} \quad H_2SO_4$$

16. **(b)** Actually Li is harder than other alkali metals.

17. **(c)** In crystalline sulphates, the coordination number of the ions increases from Be to Ba and so also the lattice energy hence solubility in H_2O decreases.

18. **(a)** Due to very high I.E. of Be, its valence electrons require high energy to remove (excite) which is not available in bunsen flame hence Be^{2+} ions do not impart colour to the flame.

19. **(b)** $X = Na_2S_2O_3.5H_2O$

$$Na_2S_2O_3 + 2HCl \longrightarrow 2NaCl \quad H_2O \quad S \quad SO_2$$

$$KI_3 + 2Na_2S_2O_3 \longrightarrow KI \quad 2NaI \quad Na_2S_4O_6$$

$$2AgNO_3 + Na_2S_2O_3 \longrightarrow Ag_2S_2O_3 \quad 2NaNO_3$$

$$Ag_2S_2O_3 \quad H_2O \longrightarrow Ag_2S \quad H_2SO_4$$

20. **(d)** Beryllium shows anomalous properties due to its small size.

21. **(a)** As the size of the anion increases, the covalent character increases and hence the m.p. decrease.

22. **(a)** Lithium does not form peroxide.

23. **(d)** The stability of alkali metal hydrides decreases from Li to Cs. It is due to the fact that M–H bonds become weaker with increase in size of alkali metals as we move down the group from Li to Cs. Thus the order of stability of hydrides is

$LiH > NaH > KH > RbH > CsH$

24. **(d)** Liquid ammonia remains paramagnetic

25. **(a)** As the size of the anion increases from F^- to I^-, the covalent character increase and hence the solubility in non -polar solvent increases

LiI LiBr LiCl LiF

26. **(b)** Only Li_3N is stable, others are not formed at all.

27. **(d)** $ZnCl_2 + 2NaHCO_3 \xrightarrow{\Delta}$

$$Zn(HCO_3)_2 \quad 2NaCl$$
(A)

$$Zn(HCO_3)_2 \xrightarrow{\Delta}$$
(A)

$$ZnCO_3 \quad H_2O \quad CO_2 \uparrow$$
(B) (C)

$$ZnCO_3 + 2NaOH \rightarrow Na_2ZnO_2 \quad 2H_2O$$
(B) (D)

28. **(b)** The basic character of oxides increases down the group.

29. **(d)** $Be(OH)_2$ is amphoteric, but the hydroxides of other alkaline earth metals are basic. The basic strength increases gradually.

30. **(b)** Thermal decomposition of $(NH_4)_2BeF_4$ is the best method for preparation of BeF_2.

31. **(b)** Electrons in Mg due to its small size are tightly bound so they cannot be excited by the flame.

32. **(c)** Monovalent sodium and potassium ions and divalent magnesium and calcium ions are found in large proportions in biological fluids.

33. **(d)** $\underset{\text{(Molten)}}{MgCl_2} \xrightarrow{\text{Electrolysis}} \underset{\text{Cation}}{Mg^{+2}} \quad \underset{\text{Anion}}{2Cl^-}$

$Anode \rightarrow 2Cl^- \rightarrow 2Cl + 2e^-, Cl + Cl \rightarrow Cl_2$

$Cathode \rightarrow Mg^{+2} + 2e^- \rightarrow Mg$

34. **(c)** $NH_3 \uparrow \xrightarrow[\text{Solvay's process}]{NH_4Cl} \underset{\text{(A)}}{Ca(OH)_2}$

$$\xrightarrow{CO_2} CaCO_3$$

35. **(c)** Be^{2+} being small in size is heavily hydrated and heat of hydration exceeds the lattice energy. Hence BeF_2 is soluble in water.

36. **(b)** The bicarbonates of alkaline earth metals exist in solution only.

37. **(b)** Due to anionic hydrolysis

$$CO_3^{2-} \quad H_2O \rightleftharpoons HCO_3^- \quad OH$$

38. **(b)** It is hygroscopic and deliquescent. It absorbs moisture and CO_2 to form Na_2CO_3

$$2NaOH + CO_2 \longrightarrow Na_2CO_3 \quad H_2O$$

39. **(c)** $CsBr_3$ may be represented as $Cs^+Br_3^-$

40. **(a)** $NaHCO_3 + NaOH \rightarrow Na_2CO_3 \quad H_2O$

($NaHCO_3$ is an acidic salt)

41. **(b)** $2MgSO_4 + 2Na_2CO_3 + H_2O \longrightarrow$

$$MgCO_3.Mg(OH)_2 + 2Na_2SO_4 \quad CO_2$$

Basic magnesium carbonate

42. **(d)** $CaO + CO_2 \longrightarrow CaCO_3$

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

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43. **(c)** $4S + 6NaOH \longrightarrow$

$$Na_2S_2O_3 \quad 2Na_2S \quad 3H_2O$$

44. **(a)** $Ca + H_2 \longrightarrow CaH_2 \quad 2H_2O \longrightarrow Ca(OH)_2 \quad H_2$

45. **(b)** $\underset{\text{(Disproportionation)}}{Na_2S_2O_3} + 2HCl \longrightarrow 2NaCl \quad SO_2 \quad S \quad H_2O$

46. **(c)** MgO is insoluble, whereas $MgSO_4$ is soluble, whereas BaO is soluble, but $BaSO_4$ is insoluble.

47. **(d)** Hydrated Be^{2+} ion exists as $[Be(H_2O)_4]^{2+}$.

48. **(a)** $Ca(NH) + 2H_2O \longrightarrow Ca(OH)_2 \quad \underset{(B)}{NH_3(g)}$

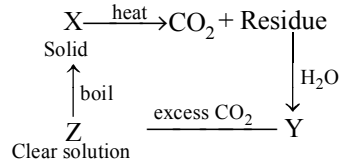
$\underset{(B)}{2NH_3} + 3CaOCl_2 \longrightarrow \underset{(C)}{N_2(g)} \quad 3CaCl_2 \quad 3H_2O$

$\underset{(C)}{N_2(g)} + 3Mg \longrightarrow \underset{(D)}{Mg_3N_2}$

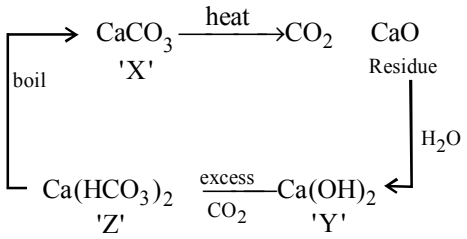
$\underset{(D)}{Mg_3N_2} + 6H_2O \longrightarrow 3Mg(OH)_2 \quad \underset{(B)}{NH_3}$

49. **(c)** $MgSO_4$ is the only alkaline earth metal sulphate which is soluble in water and for solubility hydration energy should be greater than lattice energy.

50. **(b)**



The given properties coincide with $CaCO_3$



51. **(c)** $Be(OH)_2$ is insoluble in water and thus has lower value of K_{sp}.

52. **(c)** Barax is $Na_2B_4O_7.1OH_2O$.

53. **(d)** Gypsum is $CaSO_4.2H_2O$, where as plaster of paris is $CaSO_4\ \frac{1}{2}H_2O$.

No. of water $= \left(2 - \frac{1}{2}\right) \longrightarrow \frac{3}{2}$ or $1\frac{1}{2}$ molecules

54. **(a)** $Al_4C_3 + 12H_2O \longrightarrow 4Al(OH)_3 + 3CH_4$

55. **(c)** Due to much lower freezing point of eutectic mixture of $CaCl_2/H_2O$.

56. **(d)** All are facts

57. **(a)** The structure of C_3^{4-} ion is $\overset{-2}{C} \quad C \quad \overset{-2}{C}$ i.e, $2\sigma\ 2\pi$ bonds.

58. **(d)** $Zn^2 \quad 2NaOH \longrightarrow Zn(OH)_2 \quad 2Na$

$Zn(OH)_2 \quad 2NaOH \longrightarrow Na_2ZnO_2 \quad 2H_2O$

$Na_2ZnO_2 \longrightarrow 2Na \quad (ZnO_2)^{2-}$

59. **(b)** $NaNO_3 \xrightarrow{\Delta} NaNO_2 \quad O_2$

60. **(d)** Na_2CO_3 does not decompose to form Na_2O.