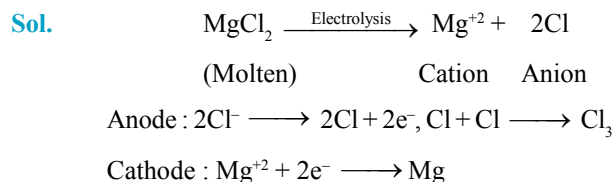




- Ex. 6** Metallic magnesium is prepared by  
 (A) Reduction of MgO by coke  
 (B) Electrolysis of aqueous solution of Mg(NO<sub>3</sub>)<sub>2</sub>  
 (C) Displacement of Mg by ion from MgSO<sub>4</sub> solution  
 (D) Electrolysis of molten MgCl<sub>2</sub>

**Ans.** (D)



- Ex. 7** The first ionization potential of Mg is  
 (A) Less than Al                      (B) More than Al                      (C) Equal to Al                      (D) Zero

**Ans.** (B)

**Sol.** The first ionization potential of Mg is more than Al since the electron has to be removed from completely filled s valence shell of Mg.

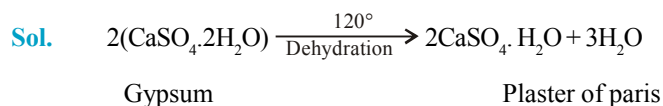
- Ex. 8** Portland cement is manufactured by using—  
 (A) Lime stone, clay and sand                      (B) Lime stone, gypsum and sand  
 (C) Lime stone, gypsum and alumina                      (D) Lime stone, clay and gypsum

**Ans.** (D)

**Sol.** Lime stone – CaCO<sub>3</sub>  
 Clay – silica and alumina  
 Gypsum – CaSO<sub>4</sub>·2H<sub>2</sub>O

- Ex. 9** Gypsum CaSO<sub>4</sub>·2H<sub>2</sub>O on heating to about 120°C forms a compound which has the chemical composition represented by  
 (A) CaSO<sub>4</sub>                      (B) 2CaSO<sub>4</sub>·H<sub>2</sub>O                      (C) CaSO<sub>4</sub>·H<sub>2</sub>O                      (D) 2CaSO<sub>4</sub>·3H<sub>2</sub>O

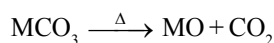
**Ans.** (B)



- Ex. 10** Which of the following compound decomposes at highest temperature –  
 (A) SrCO<sub>3</sub>                      (B) BaCO<sub>3</sub>                      (C) CaCO<sub>3</sub>                      (D) MgCO<sub>3</sub>

**Ans.** (B)

**Sol.** BaCO<sub>3</sub> decomposes at highest temp.  
 All the carbonates decompose on heating to give CO<sub>2</sub> and metal oxide.



The stability of carbonate towards heat depends upon the stability of the resulting metal oxide. More is the stability of the resulting metal oxide lesser is the stability of the carbonate towards heat and vice versa.

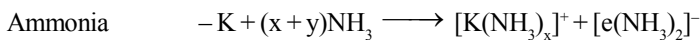
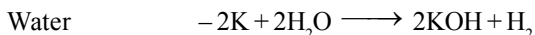
## CHEMISTRY FOR JEE MAIN & ADVANCED

**Ex. 11** Potassium is kept in

- (A) Alcohol                      (B) Water                      (C) Kerosene                      (D) Liquid ammonia

**Ans.** (C)

**Sol.** Alkali metals are highly reactive metal. They react with



Ammoniated cation                      Ammoniated electron

But they do not react with Kerosene.

**Ex. 12** Which of the following is used as barium metal for getting the X-ray spectrum of the human digestive system?

- (A) BaSO<sub>4</sub>                      (B) BaCl<sub>2</sub>                      (C) BaF<sub>2</sub>                      (D) BaCO<sub>3</sub>

**Ans.** (A)

**Sol.** BaSO<sub>4</sub> is both insoluble in water and opaque to X-rays and hence is used to get the X-ray spectrum of the digestive system?

**Ex. 13** If Na<sup>+</sup> ion is larger than Mg<sup>2+</sup> ion and S<sup>2-</sup> ion is larger than Cl<sup>-</sup> ion, which of the following will be least soluble in water?

- (A) Sodium chloride                      (B) Sodium sulphate                      (C) Magnesium chloride                      (D) Magnesium sulphide

**Ans.** (D)

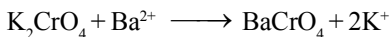
**Sol.** Magnesium sulphide. Higher the lattice energy lower the solubility. Out of the four combinations possible, the lattice energy of MgS (Bi-bivalent ionic solid) is higher than those of Na<sub>2</sub>S, MgCl<sub>2</sub> (uni-bivalent or biunivalent ionic solids) and NaCl (uniunivalent ionic solids) and hence MgS is the least soluble.

**Ex. 14** The cation which gives a yellow precipitate with potassium chromate is

- (A) SrCO<sub>3</sub>                      (B) BaCO<sub>3</sub>                      (C) CaCO<sub>3</sub>                      (D) MgCO<sub>3</sub>

**Ans.** (B)

**Sol.** Barium gives a yellow ppt. of barium chromate with pot. chromate.

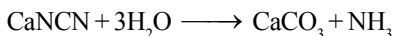


**Ex. 15** Which liberates ammonia when treated with

- (A) Li<sub>3</sub>N                      (B) Mg<sub>3</sub>N<sub>2</sub>                      (C) CaCN<sub>2</sub>                      (D) All

**Ans.** (D)

**Sol.** All nitrides react with H<sub>2</sub>O to yield NH<sub>3</sub>. Calcium cyanamide (CaCN<sub>2</sub>) on hydrolysis also given NH<sub>3</sub>.



## Exercise # 1

[Single Correct Choice Type Questions]

- CsBr<sub>3</sub> contains

(A) Cs-Br covalent bonds (B) Cs<sup>3+</sup> and Br<sup>-</sup> ions  
(C) Cs<sup>+</sup> and Br<sub>3</sub><sup>-</sup> ions (D) Cs<sup>3+</sup> and Br<sub>3</sub><sup>3-</sup> ions
- The golden yellow colour associated with NaCl to Bunsen flame can be explained on the basis of

(A) low ionisation potential of sodium (B) emission spectrum  
(C) photosensitivity of sodium (D) sublimation of metallic sodium of yellow vapours
- Incorrect statement regarding the dissolution of alkali & alkaline earth metals in liq. NH<sub>3</sub> is

(A) Due to high L.E. and I.E. Be and Mg do not dissolve in liquid NH<sub>3</sub>.  
(B) Deep blue colour is due to absorption spectrum of solvated electron.  
(C) Solution conducts electricity at all concentration.  
(D) Solution remains paramagnetic at all concentration.
- Which of the following carbide produces propyne on reaction with water.

(A) CaC<sub>2</sub> (B) Be<sub>2</sub>C (C) Al<sub>4</sub>C<sub>3</sub> (D) Mg<sub>2</sub>C<sub>3</sub>
- (Yellowppt) T  $\xleftarrow{k_2CrO_4/H^+}$  X  $\xrightarrow{dil.HCl}$  Y (Yellowppt) + Z ↑ (pungent smelling gas) If X gives green flame test. Then, X is

(A) MgSO<sub>4</sub> (B) BaS<sub>2</sub>O<sub>3</sub> (C) CuSO<sub>4</sub> (D) PbS<sub>2</sub>O<sub>3</sub>
- Which of the following carbide does not release any hydrocarbon on reaction with water.

(A) SiC (B) Be<sub>2</sub>C (C) CaC<sub>2</sub> (D) Mg<sub>2</sub>C<sub>3</sub>
- The salt which finds uses in qualitative inorganic analysis is

(A) CuSO<sub>4</sub>·5H<sub>2</sub>O or ZnSO<sub>4</sub>·5H<sub>2</sub>O (B) K<sub>2</sub>SO<sub>4</sub>·Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>·24H<sub>2</sub>O  
(C) Na(NH<sub>4</sub>)HPO<sub>4</sub>·4H<sub>2</sub>O (D) FeSO<sub>4</sub>·(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>·6H<sub>2</sub>O
- (i) A + Na<sub>2</sub>CO<sub>3</sub> → B + C (ii) A  $\xrightarrow{CO_2}$  (Milky)C The chemical formula of A and B are respectively

(A) NaOH & Ca(OH)<sub>2</sub> (B) Ca(OH)<sub>2</sub> and NaOH  
(C) NaOH and CaO (D) CaO & Ca(OH)<sub>2</sub>
- Which of the following statement is false

(A) The milk of magnesia used as antacid is chemically MgO + MgCl<sub>2</sub>  
(B) Stability of alkali metal peroxides increases with increase in atomic number.  
(C) Hydration energy of AgF is higher than its lattice energy.  
(D) Anhydrous MgCl<sub>2</sub> cannot be prepared by direct heating of MgCl<sub>2</sub>·6H<sub>2</sub>O.
- Na + Al<sub>2</sub>O<sub>3</sub>  $\xrightarrow{Hightemperature}$  X  $\xrightarrow[water]{CO_2in}$  Y; Compound Y is

(A) NaAlO<sub>2</sub> (B) NaHCO<sub>3</sub> (C) Na<sub>2</sub>CO<sub>3</sub> (D) Na<sub>2</sub>O<sub>2</sub>
- Mg<sub>2</sub>C<sub>3</sub> reacts with water forming propyne. C<sub>3</sub><sup>4-</sup> 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

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12. (White ppt)  $D \xleftarrow{\text{Na}_2\text{CO}_3} A \xrightarrow[\text{(in acetic acid)}]{\text{K}_2\text{CrO}_4} B \text{ (Yellow ppt)}$   
 $\text{dil. H}_2\text{SO}_4 \downarrow C \text{ (White ppt)}$   
 if is the metallic salt, then the white ppt. of D must be of  
 (A) stronsium carbonate (B) red lead (C) barium carbonate (D) calcium carbonate
13. Calcium imide on hydrolysis will give gas (B) which on oxidation by bleaching powder gives gas (C) gas (c) on reaction with magnesium give compound (D). (D) on hydrolysis gives again gas (B). (B), (C) and (D) are  
 (A)  $\text{NH}_3, \text{N}_2, \text{Mg}_3\text{N}_2$  (B)  $\text{N}_2, \text{NH}_3, \text{MgNH}$   
 (C)  $\text{N}_2, \text{N}_2\text{O}_5, \text{Mg}(\text{NO}_3)_2$  (D)  $\text{NH}_3, \text{NO}_2, \text{Mg}(\text{NO}_2)_2$
14. Crown ethers and cryptands form  
 (A) complexes with alkali metals  
 (B) salts of alkali metals  
 (C) hydroxides of alkali metals used for inorganic quantitative analysis  
 (D) organic salts of alkali metals
15. The pair of compounds which cannot exist together in aqueous solution is :  
 (I)  $\text{NaH}_2\text{PO}_4$  and  $\text{NaHCO}_3$  (II)  $\text{Na}_2\text{CO}_3$  and  $\text{NaHCO}_3$   
 (III)  $\text{NaOH}$  and  $\text{NaH}_2\text{PO}_2$  (IV)  $\text{NaHCO}_3$  and  $\text{NaOH}$   
 (A) I, II, III (B) II, III (C) I, IV (D) only IV
16. Li does not resemble other alkali metals in following properties :  
 (A)  $\text{Li}_2\text{CO}_3$  decomposes into oxides while other alkali metal carbonates are thermally stable  
 (B)  $\text{LiCl}$  is predominantly covalent  
 (C)  $\text{Li}_3\text{N}$  is stable  
 (D) all are correct
17. The commercial method of preparation of potassium by reduction of molten  $\text{KCl}$  with metallic sodium at  $850^\circ\text{C}$  is based on the fact that  
 (A) potassium is solid and sodium distils off at  $850^\circ\text{C}$   
 (B) potassium being more volatile and distils off thus shifting the reaction forward  
 (C) sodium is more reactive than potassium at  $850^\circ\text{C}$   
 (D) sodium has less affinity to chloride ions in the presence of potassium ion
18. Choose the correct alternate (s).  
 (I)  $\text{BeCO}_3$  is kept in the atmosphere of  $\text{CO}_2$  since is least thermally stable.  
 (II) Be dissolves in an alkali forming  $[\text{Be}(\text{OH}_4)]^{2-}$   
 (III)  $\text{BeF}_2$  forms complex ion with  $\text{NaF}$  in which Be goes with cation.  
 (IV)  $\text{BeF}_2$  forms complex ion with  $\text{NaF}$  in which Be goes with anion.  
 (A) I, II, III (B) II & III (C) I, II, III & IV (D) I, II & IV
19. Nitrogen dioxide can not be obtained from  
 (A)  $\text{Cu}(\text{NO}_3)_2$  (B)  $\text{Hg}(\text{NO}_3)_2$  (C)  $\text{NaNO}_3$  (D)  $\text{AgNO}_3$
20. Which fo the following option is incorrect regarding the property of 'hypo'  
 (A) The heating effect of hypo is a type of disproportionation reaction  
 (B)  $\text{Na}_2\text{S}_5$  is a heating product of hypo  
 (C)  $\text{Na}_2\text{S}_5$  and hypo both have S-S linkage  
 (D)  $\text{SO}_2$  reacts with  $\text{NaOH}$  and produced hypo

21. Which of the following gases are evolved by the electrolysis of aqueous solution of NaCl ?  
(A)  $H_2$  (B)  $Cl_2$  (C)  $O_2$  (D) Both A and B
22. Which of the following is not a water softener ?  
(A)  $Na_2CO_3$  (B)  $Na_2SO_4$  (C) Calgon (D) Permutit
23. When conc.  $H_2SO_4$  was treated with  $K_4[Fe(CN)_6]$ , CO gas was evolved. By mistake, somebody used dilute  $H_2SO_4$  instead conc.  $H_2SO_4$ , then the gas evolved was  
(A) CO (B) HCN (C)  $N_2$  (D)  $CO_2$
24. A solution of metal hydroxide (MOH) with copper sulphate and mixed tartarate of metal M with another metal  $M_1$  of the same group is used in the detection of -CHO group. Metal M and  $M_1$  are respectively  
(A) K,Na (B) K,Rb (C) Na,Li (D) Rb,Na
25. Which of the following statement is false  
(A) The milk of magnesia used as antacid is chemically  $MgO+MgCl_2$   
(B) stability of alkali metal peroxides increases with increase in atomic number.  
(C) Hydration energy of AgF is higher than its lattice energy.  
(D) Anhydrous  $MgCl_2$  cannot be prepared by direct heating of  $MgCl_2 \cdot 6H_2O$ .
26. The first ionization enthalpy of magnesium is lower than the first ionization enthalpy of :  
(A) Lithium (B) Sodium (C) Calcium (D) Beryllium
27. Chemical A is used for water softening to remove temporary hardness. A reacts with  $Na_2CO_3$  to generate caustic soda. When  $CO_2$  is bubbled through A, it turns cloudy. What is the chemical formula of A :  
(A)  $CaCO_3$  (B) CaO (C)  $Ca(OH)_2$  (D)  $Ca(HCO_3)_2$
28. The substance not likely to contain  $CaCO_3$  is :  
(A) Calcined gypsum (B) Sea shells (C) Dolomite (D) A marble statue
29. A metal M readily forms water soluble sulphate  $MSO_4$ , water insoluble hydroxide  $M(OH)_2$  and oxide MO which becomes inert on heating. The hydroxide is soluble in NaOH. The M is :  
(A) Be (B) Mg (C) Ca (D) Sr
30. 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)  $Ca^{2+}$
31. The hydroxide which is best soluble in water is :  
(A)  $Ba(OH)_2$  (B)  $Mg(OH)_2$  (C)  $Sr(OH)_2$  (D)  $Ca(OH)_2$
32. What is X in the following reaction ?  
 $MgCl_2 + 2H_2O \rightarrow X + 2HCl + H_2O$   
(A) MgO (B) Mg (C)  $Mg(OH)_2$  (D)  $Mg(OH)Cl$
33. Alkaline earth metals (group 2 or IIA elements) differ from group 12 (or IIB) elements in the electronic configuration of their :  
(A) Antipenultimate shell (B) Innermost shell  
(C) Outermost shell (D) Penultimate shell
34. In electrolysis of NaCl when Pt electrode is taken then  $H_2$  is liberated at cathode while with Hg cathode it forms sodium amalgam :  
(A) Hg is more inert than Pt  
(B) More voltage is required to reduce  $H^+$  at Hg than at Pt  
(C) Na is dissolved in Hg while it does not dissolve in Pt  
(D) Conc. of  $H^+$  ions is larger when Pt electrode is taken

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35. An alkaline earth metal (M) gives a salt with chlorine, which is insoluble in water at room temperature but soluble in boiling water. It also forms an insoluble sulphate whose mixture with a sulphide of a transition metal is called 'lithopone' a white pigment. Metal M is :  
 (A) Ca (B) Mg (C) Ba (D) Sr
36. The reaction of an element A with water produces combustible gas B and an aqueous solution of C. When another substance D reacts with this solution C also produces the same gas B. D also produces the same gas even on reaction with dilute  $H_2SO_4$  at room temperature. Element A imparts golden yellow colour to Bunsen flame. Then A, B, C and D may be identified as :  
 (A) Na,  $H_2$ , NaOH and Zn (B) K,  $H_2$ , KOH and Zn  
 (C) K,  $H_2$ , NaOH and Zn (D) Ca,  $H_2$ ,  $CaCO_3$  and Zn
37. The correct statement is/are:  
 (A)  $BeCl_2$  is a covalent compound (B)  $BeCl_2$  is an electron deficient molecule  
 (C)  $BeCl_2$  can form dimer (D) The hybrid state of Be in  $BeCl_2$  is  $sp^2$
38. The correct sequence of increasing covalent character is represented by -  
 (A)  $BeCl_2 < NaCl < LiCl$  (B)  $NaCl < LiCl < BeCl_2$   
 (C)  $BeCl_2 < LiCl < NaCl$  (D)  $LiCl < NaCl < BeCl_2$
39. The paramagnetic species is :  
 (A)  $KO_2$  (B)  $SiO_2$  (C)  $TiO_2$  (D)  $BaO_2$
40. The pair of amphoteric hydroxides is :-  
 (A)  $Al(OH)_3, LiOH$  (B)  $Be(OH)_2, Mg(OH)_2$   
 (C)  $B(OH)_3, Be(OH)_2$  (D)  $Be(OH)_2, Zn(OH)_2$
41. The metallic lustre exhibited by sodium is explained by  
 (A) diffusion of sodium ions (B) oscillation of loose electrons  
 (C) excitation of free protons (D) existence of body centred cubic lattice
42. The stable superoxide is formed by the element  
 (A) Li (B) Na (C) K (D) Ca
43. Stable oxide is obtained by heating the carbonate of the element  
 (A) Li (B) K (C) Na (D) Rb
44. Maximum thermal stability is shown by  
 (A)  $MgCO_3$  (B)  $CaCO_3$  (C)  $SrCO_3$  (D)  $BaCO_3$
45. A solution of sodium sulphate in water is electrolysed using inert electrodes. The products at the cathode and anode are respectively  
 (A)  $H_2, O_2$  (B)  $O_2, H_2$  (C)  $O_2, Na$  (D)  $O_2, SO_2$
46. The hydration energy of  $Mg^{2+}$  is greater than that of  
 (A)  $Al^{3+}$  (B)  $Na^+$  (C)  $Be^{2+}$  (D)  $Mg^{3+}$
47. Calcium is obtained by the  
 (A) electrolysis of molten calcium chloride (B) electrolysis of a solution of  $CaCl_2$  in water  
 (C) reduction of  $CaCl_2$  with carbon (D) roasting of limestone
48. Molten sodium is used in nuclear reactors to  
 (A) absorb neutrons in order to control the chain reaction  
 (B) slow down the fast neutrons  
 (C) absorb the heat generated by nuclear fission  
 (D) extract radio-isotopes produced in the reactor

49. Which one of the following is most basic ?  
(A)  $\text{Al}_2\text{O}_3$  (B)  $\text{MgO}$  (C)  $\text{SiO}_2$  (D)  $\text{P}_2\text{O}_5$
50. Which of the following imparts violet colouration to the Bunsen burner non-luminous flame  
(A)  $\text{NaCl}$  (B)  $\text{BaCl}_2$  (C)  $\text{CaCl}_2$  (D)  $\text{KCl}$
51. Four alkali metals A, B, C and D are having respectively standard reduction potentials as -3.05, -1.66, -0.40 and 0.80 V. Which one will be the most reducing agent ?  
(A) A (B) B (C) C (D) D
52. The material used in photoelectric cells contains -  
(A) Cs (B) Si (C) Sn (D) Ti
53. Bone ash contains  
(A)  $\text{CaO}$  (B)  $\text{CaSO}_4$  (C)  $\text{Ca}_3(\text{PO}_4)_2$  (D)  $\text{Ca}(\text{H}_2\text{PO}_4)_2$
54. Which of the following does not illustrate the anomalous properties of Li ?  
(A) The m.p. and b.p. of Li are comparatively high  
(B) Li is much softer than the other I group metals  
(C) Li forms a nitride  $\text{Li}_3\text{N}$  unlike group I metals  
(D) The ion of Li and its compounds are more heavily hydrated than those of the rest of the group
55. Of the following the commonly used as a laboratory desiccator is  
(A)  $\text{Na}_2\text{CO}_3$  (B)  $\text{CaCl}_2$  (C)  $\text{NaCl}$  (D) None of the above
56. Which of the following hydride is covalent and polymeric :-  
(A)  $\text{CaH}_2$  (B)  $\text{BeH}_2$  (C)  $\text{NaH}$  (D)  $\text{BaH}_2$
57. Sodium loses its lustre on exposure to air due to formation of -  
(A)  $\text{Na}_2\text{O}$ ,  $\text{NaOH}$  and  $\text{Na}_2\text{CO}_3$  (B)  $\text{Na}_2\text{O}$  and  $\text{NaOH}$   
(C)  $\text{Na}_2\text{O}$  and  $\text{Na}_2\text{CO}_3$  (D)  $\text{NaOH}$  and  $\text{Na}_2\text{CO}_3$
58. Which one of the following compounds gives methane on treatment with water ?  
(A)  $\text{Al}_4\text{C}_3$  (B)  $\text{CaC}_2$  (C)  $\text{VC}$  (D)  $\text{SiC}$
59. The increasing order of solubility is  
(A)  $\text{CaCO}_3, \text{KHCO}_3, \text{NaHCO}_3$  (B)  $\text{NaHCO}_3, \text{KHCO}_3, \text{CaCO}_3$   
(C)  $\text{KHCO}_3, \text{NaHCO}_3, \text{CaCO}_3$  (D)  $\text{CaCO}_3, \text{NaHCO}_3, \text{KHCO}_3$



## Exercise # 2

Part # I

[Multiple Correct Choice Type Questions]

- The addition of which metal into liquid  $\text{NH}_3$  leads to the formation of blue solution.  
(A) Li (B) Sr (C) Cs (D) Ba
- Which statement(s) is / are correct regarding alkali metals  
(A) Thermal stability of metal nitrate increases on moving upward the group.  
(B) Water solubility of metal carbonate increases on moving down the group.  
(C) All metal bicarbonate salts exist in solution form except  $\text{NaHCO}_3$ .  
(D) B.P. and M.P. decreases down the group.
- Which of the following metals on treatment with alkali will liberate  $\text{H}_2$  gas ?  
(A) Be (B) Sn (C) Ga (D) In
- Which of the following properties show a similar trend on moving from Li to Cs within the group  
(A) Ionic mobility in aqueous solution (B) Reactivity towards water  
(C) Solubility of Bromide salt (D) Thermal stability of Carbonate salt
- Oxygen ions structure in its peroxide superoxide, ozonide :  
(A)  $\text{O}_2^-$ ,  $\text{O}_2^{2-}$ ,  $\text{O}_3^{2-}$  (B)  $\text{O}_2^{2-}$ ,  $\text{O}_2^-$ ,  $\text{O}_3^-$  (C)  $\text{O}_2^{2-}$ ,  $\text{O}^{2-}$ ,  $\text{O}_3^-$  (D)  $\text{O}_2^-$ ,  $\text{O}_2^{3-}$ ,  $\text{O}_3^{2-}$
- Anhydrous  $\text{MgCl}_2$  can be prepared by heating  $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$   
(A) in a current of dry HCl gas (B) with carbon  
(C) until it fuses (D) with lime
- $\text{K}_2\text{CS}_3$  can be called potassium  
(A) sulphocyanide (B) thiocarbide  
(C) thiocarbonate (D) thiocyanate
- Amongst  $\text{LiCl}$ ,  $\text{RbCl}$ ,  $\text{BeCl}_2$  and  $\text{MgCl}_2$ , the compounds with the greatest and least ionic character respectively are :-  
(A)  $\text{LiCl}$ ,  $\text{RbCl}$  (B)  $\text{RbCl}$ ,  $\text{BeCl}_2$   
(C)  $\text{RbCl}$ ,  $\text{MgCl}_2$  (D)  $\text{MgCl}_2$ ,  $\text{BeCl}_2$
- Which of the following statement is/are false for alkali metals ?  
(A) Lithium is the strongest reducing agent  
(B) Na is amphoteric in nature  
(C)  $\text{Li}^+$  is exceptionally small  
(D) All alkali metals give blue solution in liquid ammonia
- The alkali metal that reacts with nitrogen directly to form nitride is  
(A) Li (B) Na (C) K (D) Rb
- Magnesium on reaction with very dilute  $\text{HNO}_3$  gives  
(A) NO (B)  $\text{N}_2\text{O}$  (C)  $\text{H}_2$  (D)  $\text{NO}_2$
- The metal which cannot be produced on reduction of its oxide by aluminium is  
(A) K (B) Mn (C) Cr (D) Fe
- The minimum equivalent conductance in fused state is shown by -  
(A)  $\text{MgCl}_2$  (B)  $\text{BeCl}_2$  (C)  $\text{CaCl}_2$  (D)  $\text{SrCl}_2$

14. On dissolving moderate amount of sodium metal in liquid  $\text{NH}_3$  at low temperature, which one of the following does not occur  
 (A) Blue coloured solution is obtained.  
 (B)  $\text{Na}_+$  ions are formed in the solution.  
 (C) Liquid  $\text{NH}_3$  becomes good conductor of electricity.  
 (D) Liquid ammonia remains diamagnetic.
15. Which of the following is incorrect ?  
 (A) Mg burns in air releasing dazzling light rich in UV rays.  
 (B)  $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$  when mixed with ice gives freezing mixture.  
 (C) Mg cannot form complexes  
 (D) Be can form complexes due to its very small size.
16. In the reaction  $\text{M} + \text{O}_2 \rightarrow \text{MO}_2$  (super oxide) the metal is  
 (A) Li (B) Na (C) K (D) Ba
17. Identify the correct statement -  
 (A) Gypsum contains a lower percentage of Ca than plaster of paris  
 (B) Gypsum is obtained by heating plaster of paris  
 (C) Plaster of paris can be obtained by hydration of gypsum  
 (D) Plaster of paris is obtained by partial oxidation of gypsum
18. Alum is the name used for all double salts having the composition  $\text{M}_2^{\text{I}}\text{SO}_4 \cdot \text{M}_2^{\text{III}}(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$ . Where  $\text{M}^{\text{III}}$  stands for  $\text{Al}^{+3}$ ,  $\text{Cr}^{+3}$ ,  $\text{Fe}^{+3}$ , while  $\text{M}^{\text{I}}$  stands for :-  
 (A)  $\text{Li}^+$ ,  $\text{Cu}^+$ ,  $\text{Ag}^+$  (B)  $\text{Li}^+$ ,  $\text{NH}_4^+$ ,  $\text{Na}^+$  (C)  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Rb}^+$  (D)  $\text{Ca}^{+2}$ ,  $\text{Mg}^{+2}$ ,  $\text{Sr}^{+2}$
19. Only those elements of s-block can produce superoxides which have :-  
 (A) High ionisation energy (B) High electronegativity  
 (C) High charge density (D) Low ionisation potential
20. Which can not be used to generate  $\text{H}_2$  :-  
 (A)  $\text{Al} + \text{NaOH}$  (B)  $\text{Zn} + \text{NaOH}$  (C)  $\text{Mg} + \text{NaOH}$  (D)  $\text{LiH} + \text{H}_2\text{O}$
21. The hydride ion  $\text{H}^-$  is stronger base than its hydroxide ion  $\text{OH}^-$ . Which of the following reaction will occur if sodium hydride is dissolved in water :-  
 (A)  $\text{H}_{(\text{aq})}^- + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+$  (B)  $\text{H}_{(\text{aq})}^- + \text{H}_2\text{O} \rightarrow \text{OH}^- + \text{H}_2$   
 (C)  $\text{H}^- + \text{H}_2\text{O} \rightarrow \text{H}_2 + \text{O}_2$  (D)  $\text{H}^- + \text{H}_2\text{O} \rightarrow$  No reaction
22. When Na and Li placed in dry air we get :-  
 (A)  $\text{NaOH}$ ,  $\text{Na}_2\text{O}$ ,  $\text{Li}_2\text{O}$  (B)  $\text{Na}_2\text{CO}_3$ ,  $\text{Na}_2\text{O}_2$ ,  $\text{Li}_2\text{O}$   
 (C)  $\text{Na}_2\text{O}$ ,  $\text{Li}_3\text{N}$ ,  $\text{NH}_3$  (D)  $\text{Na}_2\text{O}$ ,  $\text{Li}_2\text{O}$ ,  $\text{Li}_3\text{N}$
23. On allowing ammonia solution of s-block metals to stand for a long time, blue colour becomes fade. The reason is :-  
 (A) Formation of  $\text{NH}_3$  gas (B) Formation of metal amide  
 (C) Cluster formation of metal ions (D) Formation of metal nitrate

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24. On heating sodium metal in the current of dry ammonia leads to the formation of which gas -  
 (A)  $\text{NaNH}_2$  (B)  $\text{NaN}_3$  (C)  $\text{NH}_3$  (D)  $\text{H}_2$
25. Which of the following does not give an oxide on heating-  
 (A)  $\text{MgCO}_3$  (B)  $\text{Li}_2\text{CO}_3$  (C)  $\text{ZnCO}_3$  (D)  $\text{K}_2\text{CO}_3$
26. The ionic conductance of following cation in a given concentration are in the order  
 (A)  $\text{Li}^+ < \text{Na}^+ < \text{K}^+ < \text{Rb}^+$  (B)  $\text{Li}^+ > \text{Na}^+ > \text{K}^+ > \text{Rb}^+$   
 (C)  $\text{Li}^+ < \text{Na}^+ > \text{K}^+ > \text{Rb}^+$  (D)  $\text{Li}^+ = \text{Na}^+ < \text{K}^+ < \text{Rb}^+$
27. In presence of iron, alkali metal react with liquid ammonia and form  
 (A) Metal mixture +  $\text{H}_2$  (B) Iron metal mixture +  $\text{H}_2$   
 (C) Metal mixture (D) Metal amide +  $\text{H}_2$
28.  $\text{Na}^+$  and  $\text{Ag}^+$  differ in  
 (A)  $\text{Na}_2\text{CO}_3$  is thermally stable while  $\text{Ag}_2\text{CO}_3$  decomposes into  $\text{Ag}$ ,  $\text{CO}_2$  and  $\text{O}_2$   
 (B)  $\text{Ag}^+$  forms complexes,  $\text{Na}^+$  does not  
 (C)  $\text{NaCl}$  is water soluble,  $\text{AgCl}$  is insoluble  
 (D)  $\text{NaBr}$ -yellow and  $\text{AgBr}$  pale yellow
29. The stability order of oxide, peroxide and superoxide of alkali metal is  
 (A) Normal oxide > super oxide > per oxide (B) Normal oxide > per oxide > super oxide  
 (C) super oxide > per oxide > normal oxide (D) per oxide > normal oxide > super oxide
30. Match list I with list II and choose the correct answer from the codes given below
- | List I  | List II              |
|---|----------------------|
| (A) $\text{NaNO}_3$                                     | (a) Baking soda      |
| (B) $\text{Na}(\text{NH}_4)\text{HPO}_4$                | (b) Chile salt peter |
| (C) $\text{NaHCO}_3$                                    | (c) Microcosmic salt |
| (D) $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ | (d) Washing soda     |
- 
- | Codes is : | A | B | C | D |
|------------|---|---|---|---|
| (A)        | a | b | c | d |
| (B)        | b | c | a | d |
| (C)        | c | a | b | d |
| (D)        | d | a | b | c |
31. Which of the following statement is not correct  
 (A)  $\text{LiOH}$  is amphoteric in nature  
 (B)  $\text{LiCl}$  is soluble in pyridine  
 (C)  $\text{Li}_3\text{N}$  is stable while  $\text{Na}_3\text{N}$  doesn't exist even at room temperature  
 (D)  $\text{BeO}$  is amphoteric in nature
32. Which of the following statement is correct for s-block elements :-  
 (A)  $\text{Be}$  has smallest atomic size in II A group  
 (B)  $\text{Li}$  is most metallic  
 (C)  $\text{Mg}$  impart red colour to the flame  
 (D)  $\text{Cs}$  is most reducing in water

33. Which of the following are ionic carbides?  
 (A)  $\text{CaC}_2$  (B)  $\text{Al}_4\text{C}_3$  (C)  $\text{SiC}$  (D)  $\text{Be}_2\text{C}$
34. Which of the following groups of elements have chemical properties that are most similar :  
 (A) Na, K, Ca (B) Mg, Sr, Ba (C) Be, Al, Ca (D) Be, Ra, Cs
35. When  $\text{K}_2\text{O}$  is added to water, the solution becomes basic in nature because it contains a significant concentration of :  
 (A)  $\text{K}^+$  (B)  $\text{O}^{2-}$  (C)  $\text{OH}^-$  (D)  $\text{O}_2^{2-}$
36.  $\text{X} \xrightarrow{\text{N}_2, \Delta} \text{Y} \xrightarrow{\text{H}_2\text{O}} \text{Z}$  (colourless gas)  $\xrightarrow{\text{CuSO}_4} \text{T}$  (blue colour) :  
 Then, substances Y and T are -  
 (A)  $\text{Y} = \text{Mg}_3\text{N}_2$  and  $\text{T} = \text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  (B)  $\text{Y} = \text{Mg}_3\text{N}_2$  and  $\text{T} = \text{CuSO}_4 \cdot 4\text{NH}_3$   
 (C)  $\text{Y} = \text{Mg}(\text{NO}_3)_2$  and  $\text{T} = \text{CuO}$  (D)  $\text{Y} = \text{MgO}$  and  $\text{T} = \text{CuSO}_4 \cdot 4\text{NH}_3$
37. If X and Y are the second ionisation potentials of alkali and alkaline earth metals of same period, then :  
 (A)  $\text{X} > \text{Y}$  (B)  $\text{X} < \text{Y}$  (C)  $\text{X} = \text{Y}$  (D)  $\text{X} \ll \text{Y}$
38. Which of the following substance(s) is/are used in laboratory for drying purposes?  
 (A) Anhydrous  $\text{P}_2\text{O}_5$  (B) Graphite  
 (C) Anhydrous  $\text{CaCl}_2$  (D)  $\text{Na}_3\text{PO}_4$
39.  $\text{X} \xrightarrow{\text{CaCl}_2} \text{CaCl}_2 + \text{Y} \uparrow$ ; the effective ingredient of X is :  
 (A)  $\text{OCl}^-$  (B)  $\text{Cl}^-$  (C)  $\text{OCl}^+$  (D)  $\text{OCl}_2^-$
40.  $\text{BeCl}_2 + \text{LiAlH}_4 \rightarrow \text{X} + \text{LiCl} + \text{AlCl}_3$   
 (A) X is lithium hydride (B) X is  $\text{BeH}_2$   
 (C) X is  $\text{BeCl}_2 \cdot 2\text{H}_2\text{O}$  (D) X is  $\text{LiH}$
41.  $\text{Na}_2\text{SO}_4$  is water soluble but  $\text{BaSO}_4$  is insoluble because :  
 (A) The hydration energy of  $\text{Na}_2\text{SO}_4$  is higher than that of its lattice energy  
 (B) The hydration energy of  $\text{Na}_2\text{SO}_4$  is less than that of its lattice energy  
 (C) The hydration energy of  $\text{BaSO}_4$  is less than that of its lattice energy  
 (D) The hydration energy of  $\text{BaSO}_4$  is higher than that of its lattice energy
42. The incorrect statement(s) is/are :  
 (A) Mg cannot form complexes  
 (B) Be can form complexes due to a very small atomic size  
 (C) The first ionisation potential of Be is higher than that of Mg.  
 (D) Mg forms an alkaline hydroxide while Be forms amphoteric oxides.
43. Which of the following statements are false ?  
 (A)  $\text{BeCl}_2$  is a linear molecule in the vapour state but it is polymeric in the solid state  
 (B) Calcium hydride is called hydrolith  
 (C) Carbides of both Be and Ca react with water to form acetylene  
 (D) Oxides of both Be and Ca are amphoteric.

44. (White ppt)  $D \xrightarrow{\text{Na}_2\text{CO}_3} A \xrightarrow[\text{(in acetic acid)}]{\text{K}_2\text{CrO}_4} B$  (Yellow ppt)  
 $\text{dil.H}_2\text{SO}_4 \downarrow$   
 C(White ppt)  
 if A is the metallic salt, then the white ppt. of D must be of  
 (A) Magnesium oxide (B) Red lead  
 (C) Barium carbonate (D) Calcium carbonate
45. Which of the following compounds are paramagnetic in nature ?  
 (A)  $\text{KO}_2$  (B)  $\text{K}_2\text{O}_2$  (C)  $\text{Na}_2\text{O}_2$  (D)  $\text{RbO}_2$
46.  $\text{NaOH}(\text{Solid}) + \text{CO} \xrightarrow{200^\circ\text{C}} \text{X}$ ; product X is :  
 (A)  $\text{NaHCO}_3$  (B)  $\text{NaHCO}_2$  (C)  $\text{HCOONa}$  (D)  $\text{H}_2\text{CO}_3$
47. EDTA is used in the estimation of :  
 (A)  $\text{Mg}^{2+}$  ions (B)  $\text{Ca}^{2+}$  ions (C)  $\text{HCOONa}$  (D)  $\text{H}_2\text{CO}_3$
48. Fire extinguishers contain :  
 (A) conc.  $\text{H}_2\text{SO}_4$  solution (B)  $\text{H}_2\text{SO}_4$  and  $\text{NaHCO}_3$  solutions  
 (C)  $\text{NaHCO}_3$  solution (D)  $\text{CaCO}_3$  solution
49.  $\text{CsBr}_3$  contains :  
 (A) Cs-Br covalent bonds (B)  $\text{Cs}^{3+}$  and  $\text{Br}^-$  ions  
 (C)  $\text{Cs}^+$  and  $\text{Br}_3^-$  ions (D)  $\text{Cs}^{3+}$  and  $\text{Br}_3^{3-}$  ions
50.  $\text{KO}_2$  finds use in oxygen cylinders used for space and submarines. The fact(s) related to such use of  $\text{KO}_2$  is/are :  
 (A) it produces  $\text{O}_2$  (B) It produces  $\text{O}_3$   
 (C) It absorbs  $\text{CO}_2$  (D) It absorbs both  $\text{CO}$  and  $\text{CO}_2$
51. The compound(s) which have -O-O- bond(s) is/are :  
 (A)  $\text{BaO}_2$  (B)  $\text{Na}_2\text{O}_2$  (C)  $\text{CrO}_5$  (D)  $\text{Fe}_2\text{O}_3$
52.  $\text{Na} + \text{Al}_2\text{O}_3 \xrightarrow{\text{hightemperature}} \text{X} \xrightarrow[\text{water}]{\text{CO}_2\text{in}} \text{Y}$ ; bond(s) is/are :  
 (A)  $\text{NaAlO}_2$  (B)  $\text{NaHCO}_3$  (C)  $\text{Na}_2\text{CO}_3$  (D)  $\text{Na}_2\text{O}_2$

Part # II

[Assertion & Reason Type Questions]

These questions contains, Statement I (assertion) and Statement II (reason).

- (A) Statement-I is true, Statement-II is true ; Statement-II is correct explanation for Statement-I.  
 (B) Statement-I is true, Statement-II is true ; Statement-II is not a correct explanation for statement-I  
 (C) Statement-I is true, Statement-II is false  
 (D) Statement-I is false, Statement-II is true

1. **Statement-I** : Lithium is the weakest reducing agent among alkali metals.  
**Statement-II** : In alkali metals I.P. decreases down the group.
2. **Statement-I** :  $\text{BaCO}_3$  is more soluble in  $\text{HNO}_3$  than in plain water.  
**Statement-II** : Carbonate is a weak base and reacts with the  $\text{H}^+$  from the strong acid causing the barium salt to dissociate.

3. **Statement-I** :  $\text{Li}_2\text{SO}_4$  do not form double salt like alum.  
**Statement-II** : Atomic size of Li is too small.
4. **Statement-I** : NaCl when exposed in air it becomes wet.  
**Statement-II** : NaCl contains hygroscopic impurities like  $\text{CaCl}_2$ ,  $\text{MgCl}_2$  etc.
5. **Statement-I** :  $\text{BeCl}_2$  fumes in moist air.  
**Statement-II** :  $\text{BeCl}_2$  reacts with moisture of form HCl gas.
6. **Statement-I** : Superoxides of alkalimetals are paramagnetic.  
**Statement-II** : Superoxides contain the ion  $\text{O}_2^-$  which has one unpaired electron in its anti-bonding molecular orbital.
7. **Statement-I** : Aqueous solution of  $\text{Na}_2\text{SO}_4$  on electrolysis gives  $\text{H}_2$  and  $\text{O}_2$  gases in cathode and anode respectively.  
**Statement-II** : Discharge potential on  $\text{H}^{\oplus}$  is less than  $\text{Na}^+$  but discharge potential of  $\text{OH}^-$  is more than  $\text{SO}_4^{2-}$
8. **Statement-I** :  $\text{Mg}^{2+} + \text{ZnSO}_4 \rightarrow \text{MgSO}_4 + \text{Zn}^{2+}$   
**Statement-II** : More active metal can displace less active metal from its salt solution.
9. **Statement-I** : Mg gets oxidised, when heated in  $\text{CO}_2$  atmosphere  
**Statement-II** : Mg has a strong affinity for oxygen
10. **Statement-I** :  $\text{K}^+$  and  $\text{NH}_4^+$  ions have lot of similarities in their test  
**Statement-II** : Radius of  $\text{K}^+$  is almost equal to radius of  $\text{NH}_4^+$
11. **Statement-I** : Alkali metal carbonates ( $\text{M}_2\text{CO}_3$ ) are soluble in water.  
**Statement-II** : Usually ionic compounds are fairly soluble in water.
12. **Statement-I** :  $\text{Li}_2\text{SO}_4$  do not form double salt like alum.  
**Statement-II** : Li reacts with  $\text{NH}_3$  gas to form  $\text{LiNH}_2$
13. **Statement-I** :  $\text{BeCl}_2$  can not be easily hydrolysed.  
**Statement-II** :  $\text{BeCl}_2$  is electron deficient compound.

**Exercise # 3**

Part # I

[Matrix Match Type Questions]

1. Match the column-

**Column - I**

- (A) Ba
- (B) Ca
- (C) Na
- (D) Rb

**Column - II**

- (p) Golden yellow
- (q) Apple green
- (r) Brick red
- (s) violet

2. Match the column-

**Column I**

For the production of  $H_2O_2$

- (A) Down process
- (B) Solvay process
- (C) Leblance process
- (D) Castner- Kellner cell

**Column II**

- (p)  $K_2CO_3$
- (q) Manufacture of Na
- (r) Manufacture of NaOH
- (s)  $Na_2CO_3$

3. Match the column-

**Column I**

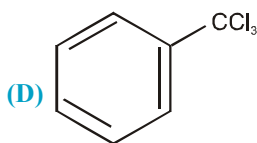
**Reactions**

- (A)  $ZnCl_2 + NaOH$
- (B)  $PCl_3 + NaOH$
- (C)  $PCl_5 + NaOH$

**Column II**

**Moles of reactant of NaOH reacted per mole**

- (p) 8
- (q) 6
- (r) 4



(S) 5

4. Match the column-

**Column - I**

- (A)  $NaOH + SO_2 \rightarrow$
- (B)  $NaOH + CO_2 \rightarrow$
- (C)  $NaOH + NO_2 \rightarrow$
- (D)  $NaOH + HNO_3 \rightarrow$

**Column - II**

- (p)  $NaNO_3$
- (q)  $Na_2SO_3$
- (r)  $Na_2CO_3$
- (s)  $NaNO_2$

5. Match List-I with List-II and select the correct answer using the codes given below the lists.

**List - I (compound)**

- (A)  $B_4C$
- (B)  $Al_4C_3$
- (C)  $Mg_2C_3$
- (D) WC

**List - II**

- (1) Propyne preparation
- (2) Abrasive
- (3) Methane preparation
- (4) Interstitial carbides

6. Match List-I with List-II and select the correct answer using the codes given below the lists.

**List - I (compound)**

- (a)  $BaSO_4 + ZnS$
- (b)  $Ni_3$
- (c)  $N_2O_4$
- (d)  $KO_2$

**List - II (used in)**

- (1) Explosive
- (2) Oxidiser in rocket propellants
- (3) Space capsule
- (4) Pigment

7. **Column-I**  
 (A) Solvay process  
 (B) Evolve  $\text{CO}_2$   $\uparrow$  on heating  
 (C) aq. soln. is neutral towards litmus  
 (D) Oxone
- Column-II**  
 (p) NaCl  
 (q)  $\text{Na}_2\text{O}_2$   
 (r)  $\text{NaHCO}_3$   
 (s)  $\text{Na}_2\text{CO}_3$
8. **Column-I**  
 (A) Hydrolith  
 (B) Nitrolith  
 (C) Dolomite  
 (D) Pearl's ash
- Column-II**  
 (p) Contain Ca  
 (q) Used as a fertilizer  
 (r) Used to prepare  $\text{H}_2$   
 (s) Contain potassium
9. **Column-I**  
 (A) Metal sulphate  $\xrightarrow{\Delta}$  metal oxide +  $\text{SO}_2$  +  $\text{O}_2$   
 (B) Metal cation +  $\text{K}_2\text{CrO}_4 \rightarrow$  yellow ppt  
 (C) Metal +  $\text{NH}_3 \xrightarrow{\text{(liquid)}}$  blue solution  
 (D)  $\text{MCl}_2$  + conc.  $\text{H}_2\text{SO}_4 \rightarrow$  white ppt.
- Column-II**  
 (p) Ba  
 (q) Sr  
 (r) Na  
 (s) Mg

## Part # II

## [Comprehension Type Questions]

## Comprehension # 1

Dilute solutions of alkali metals in liquid  $\text{NH}_3$  are blue. It is ammoniated electron which is responsible for the blue colour of the solution, and the electrical conductivity is due to the ammoniated cation,  $[\text{M}(\text{NH}_3)_x]^+$  as well as the ammoniated electron,  $[\text{e}(\text{NH}_3)_y]^-$ , values of x and y depend on the extent of solvation (by  $\text{NH}_3$ ). Dilute solutions are paramagnetic due to free electrons.

1. What happens if alkali metals is allowed to react with concentrated liquid ammonia?  
 (A) Paramagnetic character of solvated electrons is retained.  
 (B) Solvated electrons associate to form electron-pairs and paramagnetic character decreases.  
 (C) Reducing character is increased.  
 (D) Reducing character is not affected.
2. Ammoniated solutions of alkali metals are reducing agents due to presence of free ammoniated or solvated electrons that can reduce :
- |                                       |   |
|---------------------------------------|---|
| [I] $\text{O}_2$ to $\text{O}_2^{2-}$ | [II] $\text{K}_2[\text{Ni}(\text{CN})_4]$ to $\text{K}_4[\text{Ni}(\text{CN})_4]$ |
| [III] aromatic ring                   | [IV] non-terminal alkyne  |
- Choose the correct code  
 (A) III & IV      (B) II & III      (C) I, II, III & IV      (D) I, III & IV

## Comprehension # 2

Alkali metals readily react with oxyacids forming corresponding salts like  $\text{M}_2\text{CO}_3$ ,  $\text{MHCO}_3$ ,  $\text{MNO}_3$ ,  $\text{M}_2\text{SO}_4$  etc. with evolution of hydrogen. They also dissolve in liquid  $\text{NH}_3$  but without the evolution of hydrogen. The colour of its dilute solution is blue but when it is heated and concentrated then its colour becomes bronze.

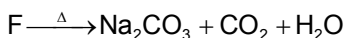
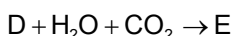
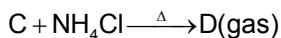
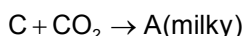
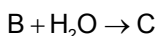
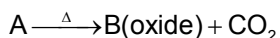
1. Among the nitrate of alkali metals which one can be decomposed to its oxide?  
 (A)  $\text{NaNO}_3$       (B)  $\text{KNO}_3$       (C)  $\text{LiNO}_3$       (D) All of these



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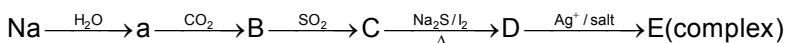
2. Among the carbonates of alkali metals which one has highest stability ?  
 (A)  $\text{Cs}_2\text{CO}_3$                       (B)  $\text{Rb}_2\text{CO}_3$                       (C)  $\text{K}_2\text{CO}_3$                       (D)  $\text{Na}_2\text{CO}_3$
3. Which of the following statement about the sulphate of alkali metal is correct ?  
 (A) Except  $\text{Li}_2\text{SO}_4$  all sulphate of other alkali metals are soluble in water  
 (B) All sulphates of alkali metals except lithium sulphate forms alum.  
 (C) The sulphates of alkali metals cannot be hydrolysed.  
 (D) All of these
4. Which of the following statement about solution of alkali metals in liquid ammonia is correct ?  
 (A) The solution have strong oxidizing properties.  
 (B) Both the dilute solution as well as concentrated solution are paramagnetic in nature  
 (C) Charge transfer is the responsible for the colour of the solution  
 (D) None of these
5. Which metal bicarbonates does not exist in solid state ?  
 (i)  $\text{LiHCO}_3$                       (ii)  $\text{Ca}(\text{HCO}_3)_2$                       (iii)  $\text{Zn}(\text{HCO}_3)_2$                       (iv)  $\text{NaHCO}_3$                       (v)  $\text{AgHCO}_3$   
 (A) (ii), (iii), (v)                      (B) (i), (ii), (iii)                      (C) (i), (ii), (v)                      (D) (ii), (iii), (iv)

### Comprehension # 3



1. A is :  
 (A)  $\text{Ca}(\text{HCO}_3)_2$                       (B)  $\text{CaCO}_3$                       (C)  $\text{CaO}$                       (D)  $\text{Na}_2\text{CO}_3$
2. B and C are :  
 (A)  $\text{CaO}$ ,  $\text{Ca}(\text{OH})_2$                       (B)  $\text{Ca}(\text{OH})_2$ ,  $\text{CaCO}_3$                       (C)  $\text{CaCO}_3$ ,  $\text{Ca}(\text{OH})_2$                       (D)  $\text{Ca}(\text{OH})_2$ ,  $\text{CaO}$
3. D, E and F are :  
 (A)  $\text{NH}_3$ ,  $\text{NH}_4\text{Cl}$ ,  $\text{NH}_4\text{HCO}_3$                       (B)  $\text{NH}_3$ ,  $\text{NH}_4\text{HCO}_3$ ,  $\text{NaHCO}_3$   
 (C)  $\text{NH}_4\text{HCO}_3$ ,  $\text{Na}_2\text{CO}_3$ ,  $\text{NaHCO}_3$                       (D) None

### Comprehension # 4



1. The compound B and C are :  
 (A)  $\text{Na}_2\text{CO}_3$ ,  $\text{Na}_2\text{SO}_4$                       (B)  $\text{NaHCO}_3$ ,  $\text{Na}_2\text{SO}_4$                       (C)  $\text{Na}_2\text{CO}_3$ ,  $\text{Na}_2\text{SO}_3$                       (D) None of these
2. The compound D is :  
 (A)  $\text{Na}_2\text{SO}_4$                       (B)  $\text{Na}_2\text{S}_4\text{O}_6$                       (C)  $\text{Na}_2\text{S}_2\text{O}_5$                       (D)  $\text{Na}_2\text{S}_2\text{O}_3$

3. Oxidation number of each 'S' atom compound D :  
 (A) +2, +2                      (B) +4, 0                      (C) +6, -2                      (D) +5, -1

### Comprehension # 5

Following given passage the five observation regarding alkali metals are mentioned.

- (i) On exposure to air, sodium hydroxide becomes liquid and after some time it changes to white powder.  
 (ii) In water LiF is least soluble fluorides among fluorides of alkali metal, but its solubility increases as HF is added in aqueous solution.  
 (iii) LiH more stable than NaH when heated separately  
 (iv) When excess of  $\text{Na}_2\text{S}_2\text{O}_3$  solution is added to the  $\text{FeCl}_3$  solution an intense violet colouration is produced, but violet colour disappeared shortly  
 (v) Between  $\text{Na}^+$  and  $\text{Ag}^+$ ,  $\text{Ag}^+$  is stronger Lewis acid.
- The explanation of observation (v) is :  
 (A) Because  $\text{Na}^+$  has inert gas configuration which has greater polarisation power  
 (B) Because  $\text{Ag}^+$  has inert gas configuration which has greater polarisation power  
 (C) Because  $\text{Ag}^+$  has pseudo inert gas configuration which has lesser polarisation power  
 (D) Because  $\text{Ag}^+$  has pseudo inert gas configuration which has greater polarisation power
  - The explanation for the observation (iv) is :  
 (A) Initially with  $\text{FeCl}_3$ ,  $\text{Na}_2\text{S}_2\text{O}_3$  produce an intense violet colour substance  $\text{Fe}_2(\text{S}_2\text{O}_3)_3$ . But  $\text{Fe}_2(\text{S}_2\text{O}_3)_3$  changes to  $\text{Fe}^{2+}$  &  $\text{S}_4\text{O}_6^{2-}$  on standing  
 (B) Initially with  $\text{FeCl}_3$ , is reduced to  $\text{FeCl}_2$  by  $\text{Na}_2\text{S}_2\text{O}_3$ ,  $\text{FeCl}_2$  so produced undergo unstable complex formation  $\text{Fe}(\text{S}_2\text{O}_3)_3^{4-}$  which is violet in colour.  
 (C) Initially with  $\text{FeCl}_3$ ,  $\text{Na}_2\text{S}_2\text{O}_3$  produce colloidal Fe which is violet in colour. After sometime, the colloidal suspension changes to the ppt of Fe.  
 (D) There is no reaction
  - As per observation (iii) LiH is more stable than NaH, because :  
 (A) Due to small size of  $\text{Li}^+$ , the lattice energy of LiH is greater  
 (B) Due to greater size of H, the lattice energy of LiH is greater  
 (C) LiH is more covalent than NaH  
 (D) Due to greater size of  $\text{Na}^+$ , the lattice energy of NaH is greater.
  - As per observation (ii) the solubility of LiF increases in the presence of HF, because :  
 (A) The HF further ionises to  $\text{H}^+$  &  $\text{F}^-$   
 (B) In the presence of HF, there will be a common ion effect  
 (C) In the presence HF,  $\text{F}^-$  is converted to  $\text{HF}_2^-$   
 (D) All of the above
  - The reaction for observation (i) can be explained as -  
 (A)  $\text{NaOH}(\text{S}) \xrightarrow{\text{H}_2\text{O}} \text{NaOH}(\text{aq}) \xrightarrow{\text{H}_2\text{O}} \text{N}$   
 (B)  $\text{NaOH}(\text{S}) \xrightarrow{\text{H}_2\text{O}} \text{NaOH}(\text{aq}) \xrightarrow{-\text{H}_2\text{O}} \text{Na}_2\text{O}(\text{S})$   
 (C)  $\text{NaOH}(\text{S}) \xrightarrow{\text{H}_2\text{O}} \text{NaOH}(\text{aq}) \xrightarrow{\text{O}_2/\text{air}} \text{Na}_2\text{O}(\text{S})$   
 (D)  $\text{NaOH}(\text{S}) \xrightarrow{\text{H}_2\text{O}} \text{NaOH}(\text{aq}) \xrightarrow{\text{CO}_2} \text{Na}_2\text{CO}(\text{S})$

## Exercise # 4

## [Subjective Type Questions]

- Write balanced equation for reaction between
  - $\text{Na}_2\text{O}_2$  and water
  - $\text{KO}_2$  and water
  - $\text{Na}_2\text{O}_2$  and  $\text{CO}_2$
- Element A burns in nitrogen to give an ionic compound B. Compound B reacts with water to give C and D. A solution of C becomes milky on bubbling carbon dioxide. Identify A, B, C and D.
- In water LiF is least soluble fluoride among fluorides of alkali metals, but its solubility increases as HF is added in aqueous solution, why?
- What happens when  $\text{CuSO}_4(\text{aq.})$  is treated with excess of  $\text{Na}_2\text{S}_2\text{O}_3$  solution?
- Arrange the following in order of increasing .....
 

(i) Thermal stability	$\text{BeSO}_4, \text{MgSO}_4, \text{CaSO}_4$
(ii) Polarising power	$\text{Be}^{2+}, \text{Mg}^{2+}, \text{Ca}^{2+}$
(iii) Solubility in $\text{H}_2\text{O}$	$\text{Be}(\text{OH})_2, \text{Mg}(\text{OH})_2, \text{Ca}(\text{OH})_2$
(iv) Covalent nature	$\text{BeCl}_2, \text{MgCl}_2, \text{CaCl}_2$
(v) Hydrolysis nature	$\text{BeCl}_2, \text{MgCl}_2, \text{CaCl}_2$
(vi) Lattice energy	$\text{CaF}_2, \text{MgF}_2, \text{BaF}_2$
(vii) Hydration energy	$\text{Be}^{2+}, \text{Mg}^{2+}, \text{Ba}^{2+}$
(viii) Solubility in water	$\text{MgF}_2, \text{BaF}_2, \text{BeF}_2$
(ix) Basic nature	$\text{Be}, \text{Mg}, \text{Ca}, \text{Sr}$
- Hydrogen reacts with a metal (A) to give an ionic hydride (B). The metal (A) gives brick red colour with bunsen flame. The hydride formed is commonly known by its trade name. The compound (B) on treating with water gives back  $\text{H}_2$  and (C). Identify (A), (B) and (C).
- Explain the following :
  - The reaction between marble and dilute  $\text{H}_2\text{SO}_4$  is not used to prepare carbon dioxide.
  - Lime water becomes turbid on passing  $\text{CO}_2$  though it, but becomes clear when more  $\text{CO}_2$  is passed.
  - Alkaline earth metals have higher melting points than alkali metals.
  - Beryllium does not exhibit a covalency beyond 4.
- $\text{PbO}_2$  is soluble in  $\text{NaOH}$  and also in  $\text{HCl}$ . What does it reflect about the nature of  $\text{PbO}_2$  ?
- What happens when :
  - Hot and concentrated caustic soda solution reacts with iodine.
  - White phosphorus is heated with caustic soda.
  - Excess of caustic soda reacts with zinc sulphate solution.
  - Excess of  $\text{NaOH}$  is added to  $\text{AlCl}_3$  solution.
- (A) is binary compound of a univalent metal. 1.422 g of (A) reacts completely with 0.321 g of sulphur in an evacuated and sealed tube to give 1.743 g of a white crystalline solid (B) that formed a hydrated double salt (C) with  $\text{Al}_2(\text{SO}_4)_3$ . Identify (A), (B) and (C).

11. A white solid is either  $\text{Na}_2\text{O}$  or  $\text{Na}_2\text{O}_2$ . A piece of red litmus paper turns white when it is dipped into a freshly made aqueous solution of the white solid.
- Identify the substance and explain with balanced equation
  - Explain what would happen to the red litmus if the white solid were the other compound
12. A compound (X) imparts a golden yellow flame and shows the following reactions:
- Zinc powder when boiled with a concentrated aqueous solution of (X) dissolves and hydrogen is evolved.
  - When an aqueous solution of (X) is added to an aqueous solution of stannous chloride, a white precipitate is obtained first which dissolves in excess of solution of (X). Identify (X) and write equations at step (i) and (ii).
13. When a gas (A) is passed through dry KOH at low temperature, a deep red coloured compound (B) and a gas (C) are obtained. The gas (A) on reaction with but-2-ene followed by treatment with  $\text{Zn}/\text{H}_2\text{O}$  yields acetaldehyde. Identify (A), (B) and (C)
14. Element (M) is a shiny and highly reactive metal (melting point  $63^\circ\text{C}$ ) and element (X) is a highly reactive non-metal (melting point  $-7.2^\circ\text{C}$ ). They react to form a compound with the empirical formula MX, a colourless, brittle solid that melts at  $734^\circ\text{C}$ . When dissolved in water or when in the molten state, the substance conduct electricity. When chlorine gas is bubbled through an aqueous solution containing (MX), a reddish-brown liquid appears and  $\text{Cl}^-$  are formed. From these observations, identify M and X.
15. Name an element which is invariably bivalent and whose oxide is soluble in excess of NaOH and its dipositive ion has a noble gas core.
16. Out of the elements marked A, B, C, D, E, F, G and H:
- Which form superoxide?
  - Which form thermally stable carbonate?
  - Which forms strongest base?
  - Which show diagonal relationship?
  - Which forms amphoteric oxide?

A	B																		
C	D																		
E	F																		
G	H																		


17. Arrange the following sulphates of alkaline earth metals in order of their decreasing thermal stability.  
 $\text{BeSO}_4$ ,  $\text{MgSO}_4$ ,  $\text{CaSO}_4$ ,  $\text{SrSO}_4$ .
18. Element (A) burns in nitrogen to give an ionic compound B. Compound B reacts with water to give (C) and (D). A solution of (C) becomes milky on bubbling  $\text{CO}_2$ . Identify (A) to (D).

## CHEMISTRY FOR JEE MAIN & ADVANCED

19. (i) An inorganic compound (A) is formed on passing a gas (B) through a concentrated liquor containing sodium sulphide and sodium sulphite.  
(ii) On adding (A) into a dilute solution of silver nitrate, a white precipitate appears which quickly changes into a black coloured compound (D).  
(iii) On adding two or three drops of ferric chlorid into the excess of solution of (A), a violet coloured compound (D) is formed. This colour disappears quickly.  
(iv) On adding a solution of (A) into the solution of cupric chloride, a white precipitate is first formed which dissolves on adding excess of (A) forming a compound (E).  
Identify (A) to (E) and give chemical equations for the reactions step (i) to (iv).
20. When gas (A) is passed through dry KOH at low temperature, a deep red coloured compound (B) and a gas (C) are obtained. The gas (A) on reaction with but-2-ene followed by treatment with Zn/ H<sub>2</sub>O yields acetaldehyde. Identify (A), (B) and (C).
21. (A) is binary compound of a univalent metal. 1.422 g of (A) reacts completely with 0.321 g of sulphur in an evacuated and sealed tube to give 1.743 g of white crystalline solid (B) that formed a hydrated double salt (C) with Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>. Identify (A), (B) and (C).
22. Arrange MgO, SrO, K<sub>2</sub>O, Nio, Cs<sub>2</sub>O in their increasing order of basic nature.
23. A compound [X] imparts a golden yellow flame and shows the following reactions :  
(i) Zinc powder when boiled with a concentrated aqueous solution of [X] dissolved and hydrogen is evolved  
(ii) when an aqueous solution of (X) is added to an aqueous solution of stannous chloride, a white precipitate is obtained first which dissolves in excess of solution of (X). Identify (X) and write equations at step (i) and (ii).
24. Arrange the following increasing order of solubility  
LiI, RbI, NaI, CsI, KI
25. How many X-O-X linkages are present in the structure of calgon (NaPO<sub>3</sub>)<sub>6</sub>
26. Identify the following :  
$$\text{Na}_2\text{CO}_3 \xrightarrow{\text{SO}_2} \text{A} \xrightarrow{\text{Na}_2\text{CO}_2} \text{B} \xrightarrow{\text{elements S}} \text{C} \xrightarrow{\text{I}_2} \text{D}$$
  
Also mention the oxidation state of S in all the compounds
27. The solubility of calcium acetate decreases while that of lead nitrate increases which increase in temperature.
28. Beryllium chloride shows acidic nature in water or why BeCl<sub>2</sub> is easily hydrolysed ?
29. A white solid is either Na<sub>2</sub>O or Na<sub>2</sub>O<sub>2</sub>. A piece of red litmus paper turns white when it is dipped into a freshly made aqueous solution of the white solid.  
(i) Identify the substance and explain with balanced equation.  
(ii) Explain what would happen to the red litmus if the white solid were the other compound.
30. Between Na<sup>+</sup> and Ag<sup>+</sup>, which is a stronger Lewis acid and why ?
31. The crystalline salts of alkaline earth metals contain more water of crystallisation than the corresponding alkali metal salts, why ?

## Exercise # 5

## Part # I

## [Previous Year Questions] [AIEEE/JEE-MAIN]

- One mole of magnesium nitride on reaction with excess of water gives :- [AIEEE - 2004]  
 (1) Two mole of  $\text{HNO}_3$  (2) Two mole of  $\text{NH}_3$   
 (3) 1 mole of  $\text{NH}_3$  (4) 1 mole of  $\text{HNO}_3$
- The ionic mobility of alkali metal ions in aqueous solution is maximum for :- [AIEEE - 2006]  
 (1)  $\text{Rb}^+$  (2)  $\text{Li}^+$  (C)  $\text{Na}^+$  (D)  $\text{K}^+$
- Which of the following on thermal-decomposition yields a basic as well as an acidic oxide? [AIEEE - 2012]  
 (1)  $\text{NH}_4\text{NO}_3$  (2)  $\text{NaNO}_3$  (3)  $\text{KClO}_3$  (4)  $\text{CaCO}_3$
- Fire extinguishers contain  $\text{H}_2\text{SO}_4$  and which one of the following :- [AIEEE - 2012]  
 (1)  $\text{CaCO}_3$  (2)  $\text{NaHCO}_3$  and  $\text{Na}_2\text{CO}_3$   
 (3)  $\text{Na}_2\text{CO}_3$  (4)  $\text{NaHCO}_3$
- Which one of the following will react most vigorously with water? [AIEEE - 2012]  
 (1) Li (2) K (3) Rb (4) Na
- A metal M on heating in nitroge gas gives Y. Y on treatment with  $\text{H}_2\text{O}$  gives a colourless gas which when passed through  $\text{CuSO}_4$  solution gives a blue colour, Y is :- [AIEEE - 2012]  
 (1)  $\text{NH}_3$  (2)  $\text{MgO}$  (3)  $\text{Mg}_3\text{N}_2$  (4)  $\text{Mg}(\text{NO}_3)_2$
- Which one fo the following alkaline earth metal sulphates has its hydration enthalpy greater than its lattice enthalpy? [JEE main - 2015]  
 (1)  $\text{BaSO}_4$  (2)  $\text{SrSO}_4$  (3)  $\text{CaSO}_4$  (4)  $\text{BeSO}_4$
- The main oxides formed on combustion of Li, Na and K in excess of air are, respectively : [JEE main - 2016]  
 (1)  $\text{LiO}_2$ ,  $\text{Na}_2\text{O}_2$  and  $\text{K}_2\text{O}$  (2)  $\text{Li}_2\text{O}_2$ ,  $\text{Na}_2\text{O}_2$  and  $\text{KO}_2$   
 (3)  $\text{Li}_2\text{O}$ ,  $\text{Na}_2\text{O}_2$  and  $\text{KO}_2$  (4)  $\text{Li}_2\text{O}$ ,  $\text{Na}_2\text{O}$  and  $\text{KO}_2$
- Both lithium and magnesium display several similar properties due to the digonal relationship, however, the one which is incorrect is : [JEE main - 2017]  
 (1) both form basic carbonates  
 (2) both form soluble bicarbonates  
 (3) both form nitrides  
 (4) nitrates of both Li and Mg yield  $\text{NO}_2$  and  $\text{O}_2$  on heating
- The recommended concentration of fluoride ion in drinking water is up to 1 ppm as fluoride ion is required to make teeth enamel harder by converting  $[\text{3Ca}_3(\text{PO}_4)_2 \cdot \text{Ca}(\text{OH})_2]$  to : [JEE main - 2018]  
 (1)  $[\text{3}(\text{CaF}_2) \cdot \text{Ca}(\text{OH})_2]$  (2)  $[\text{3} \text{Ca}_3(\text{PO}_4)_2 \cdot \text{CaF}_2]$  (3)  $[\text{3} \{\text{Ca}(\text{OH})_2\} \cdot \text{CaF}_2]$  (4)  $[\text{CaF}_2]$

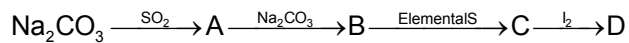
1.  $\text{MgSO}_4 + \text{NH}_4\text{Cl} + \text{Na}_2\text{HPO}_4 \rightarrow$  white crystalline precipitate. [JEE - 2006]  
 (A)  $\text{MgCl}_2 \cdot \text{MgSO}_4$  (B)  $\text{MgSO}_4$  (C)  $\text{Mg}(\text{NH}_4)\text{PO}_4$  (D)  $\text{Mg}(\text{PO}_4)_2$
2. Statement-I Alkali metals dissolve in liquid ammonia to give blue solutions. [JEE - 2007]  
 State ment-I Alkali metals in liquid ammonia give solvated species of the type  $[\text{M}(\text{NH}_3)_n]$  (M = alkali metals)  
 (A) If both Statement \_ I & Statement \_II are True & the Statement-II is a corect explanation of the Statement  
 (B) If both Statement - I & Statement-II are True but Statement -II is not a correct explanation of the Statement -I.  
 (C) If Stement -I is True but the Statement -II is False.  
 (D) If Statement -I is False but the Statement -II is True.
3. A solution of colourless salt H on boiling with excess NaOH produces a non-fiammable gas. The gas evolution ceases after sometime. Upon addition of Zn dust to the same solution, the gas evolution restarts. The colourless salts(s) H is (are) [JEE - 2008]  
 (A)  $\text{NH}_4\text{NO}_3$  (B)  $\text{NH}_4\text{NO}_2$  (C)  $\text{NH}_4\text{Cl}$  (D)  $(\text{NH}_4)_2\text{SO}_4$
4. White phosphorus on reaction with NaOH gives  $\text{PH}_3$  as one of the products. This is a [JEE - 2008]  
 (A) dimerization reaction (B) disproportionation reaction  
 (C) condensation reaction (D) precipitation reaction
5. Aqueous solution of  $\text{Na}_2\text{S}_2\text{O}_3$  on reaction with  $\text{Cl}_2$  gives [JEE - 2008]  
 (A)  $\text{Na}_2\text{S}_4\text{O}_6$  (B)  $\text{NaHSO}_4$  (C)  $\text{NaCl}$  (D)  $\text{NaOH}$
6. The compound(s) formed upon combustion of sodium metal in excess air is (are) [JEE - 2009]  
 (A)  $\text{Na}_2\text{O}_2$  (B)  $\text{Na}_2\text{O}$  (C)  $\text{NaO}_2$  (D)  $\text{NaOH}$
7. Amongst the folowing, the total number of compounds whose aqueous solution turns red litmus paper blue is [JEE - 2010]  
 KCN  $\text{K}_2\text{SO}_4$   $(\text{NH}_4)_2\text{C}_2\text{O}_4$  NaCl  $\text{Zn}(\text{NO}_3)_2$   
 $\text{FeCl}_3$   $\text{K}_2\text{CO}_3$   $\text{NH}_4\text{NO}_3$  LiCN

#### ASSERTION & REASON QUESTIONS

- (A) Statement-I is true, statement-II is true ; statement-II is a correct explanation for statement-I  
 (B) Statement-I is true, statement-II is true ; statement-II is NOT a correct explanation for statement-I  
 (C) Statement-I is true, statement-II is false  
 (D) Statement-I is false, statement-II is true
8. **Statement-I** : Alkali metals dissolve in liquid ammonia to give blue solutions. [JEE - 2007]  
**Statement-II** : Alkali metals in liquid ammonia give solvated species of the type  $[\text{M}(\text{NH}_3)_n]^+$  (M = alkali metals)

## SUBJECTIVE QUESTIONS

1. Identify the following :



Also mention the oxidation state of S in all the compounds.

2. Beryllium chloride shows acidic nature in water or why  $\text{BeCl}_2$  is easily hydrolysed ?
3. The crystalline salt of alkaline earth metals contain more water of crystallisation than the corresponding alkali metal salts, why ?
4. Arrange the following sulphates of alkaline earth metals in order of their decreasing thermal stability  $\text{BeSO}_4$ ,  $\text{MgSO}_4$ ,  $\text{CaSO}_4$ ,  $\text{SrSO}_4$ .
5. Why the solubility of calcium acetate decreases while that of lead nitrate increases with increase in temperature.
6. Why magnesium is not precipitated from a solution of its salt by  $\text{NH}_4\text{OH}$  In the presence of  $\text{NH}_4\text{Cl}$ .



MOCK TEST

SECTION - I : STRAIGHT OBJECTIVE TYPE

- Property of all alkaline earth metals that increase with their atomic number is :  
 (A) solubility of their carbonates (B) thermal stability of their sulphates  
 (C) ionisation energy (D) electronegativity
- Which is not correctly matched ?  
 (A) Basic strengths of oxides  $\text{Cs}_2\text{O} < \text{Rb}_2\text{O} < \text{K}_2\text{O} < \text{Na}_2\text{O} < \text{Li}_2\text{O}$   
 (B) Stability of peroxides  $\text{Na}_2\text{O}_2 < \text{K}_2\text{O}_2 < \text{Rb}_2\text{O}_2 < \text{Cs}_2\text{O}_2$   
 (C) Stability of bicarbonates  $\text{LiHCO}_3 < \text{NaHCO}_3 < \text{KHCO}_3 < \text{RbHCO}_3 < \text{CsHCO}_3$   
 (D) Melting point  $\text{NaF} < \text{NaCl} < \text{NaBr} < \text{NaI}$   
 (A) A and D (B) A and C (C) A and B (D) B and C
- The melting point of lithium ( $101^\circ\text{C}$ ) is just double the melting point of sodium ( $90^\circ\text{C}$ ) because :  
 (A) down the group, the hydration energy decreases  
 (B) down the group, the ionization energy decreases  
 (C) down the group, the cohesive energy decreases  
 (D) None of the above
- The basic character of hydroxides of alkaline earth metals is in the order :  
 (A)  $\text{Mg}(\text{OH})_2 < \text{Be}(\text{OH})_2 < \text{Ca}(\text{OH})_2 < \text{Ba}(\text{OH})_2$   
 (B)  $\text{Be}(\text{OH})_2 < \text{Mg}(\text{OH})_2 < \text{Ca}(\text{OH})_2 < \text{Ba}(\text{OH})_2$   
 (C)  $\text{Ba}(\text{OH})_2 < \text{Ca}(\text{OH})_2 < \text{Mg}(\text{OH})_2 < \text{Be}(\text{OH})_2$   
 (D)  $\text{Ba}(\text{OH})_2 < \text{Ca}(\text{OH})_2 < \text{Be}(\text{OH})_2 < \text{Mg}(\text{OH})_2$
- The following compounds have been arranged in order of their increasing thermal stabilities. Identify the correct order.  
 (I)  $\text{K}_2\text{CO}_3$  (II)  $\text{MgCO}_3$  (III)  $\text{CaCO}_3$  (IV)  $\text{BeCO}_3$   
 (A)  $\text{I} < \text{II} < \text{III} < \text{IV}$  (B)  $\text{IV} < \text{II} < \text{III} < \text{I}$   
 (C)  $\text{IV} < \text{II} < \text{I} < \text{III}$  (D)  $\text{II} < \text{IV} < \text{III} < \text{I}$
- $\text{KO}_2 + \text{CO}_2 + \text{H}_2\text{O} \xrightarrow{+\text{more CO}_2} [\text{X}] + [\text{Y}]$   
 Products [X] and [Y] are respectively :  
 (A)  $\text{K}_2\text{CO}_3, \text{O}_2$  (B)  $\text{KHCO}_3, \text{O}_2$  (C)  $\text{KOH}, \text{K}_2\text{CO}_3$  (D)  $\text{KHCO}_3, \text{H}_2\text{O}$
- $\text{NaNO}_3 \xrightarrow{800^\circ\text{C}} \text{products}$  ;  
 Select the correct statements for the product formed in the above reaction.  
 (A) Two gases are liberated, which are neutral towards litmus and are also diamagnetic.  
 (B) Two gases are liberated, one gas is neutral and other gas is acidic towards litmus but both are diamagnetic  
 (C) Only one gas is liberated which is colourless and paramagnetic  
 (D) Two gases are liberated, one is colourless and paramagnetic and other one is colourless and diamagnetic.
- A metal [X] on heating in nitrogen gas gives [Y]. [Y] on treatment with  $\text{H}_2\text{O}$  gives a colourless gas which when passed through  $\text{CuSO}_4$  solution gives a blue colour. [Y] is  
 (A)  $\text{Mg}(\text{NO}_3)_2$  (B)  $\text{Mg}_3\text{N}_2$  (C)  $\text{NaN}_2$  (D)  $\text{MgO}$

9. Which of the following statement(s) is/are false?
- (A)  $\text{NaO}_2$  has three different crystal structures.  
(B) Sodium sulphide is readily oxidised by moist air to form sodium thiosulphate.  
(C) Group 1 sulphides hydrolyse appreciably  
(D) The solubility of hydroxides of alkali metals and alkaline earth metals decreases down the group.

### SECTION - II : MULTIPLE CORRECT ANSWER TYPE

10. Alkali metals are characterized by :
- (A) good conductor of heat and electricity  
(B) high oxidation potentials  
(C) high melting points  
(D) solubility in liquid ammonia
11. Property(ies) of all alkali metals that increase with their atomic number is/are :
- (A) solubility of their hydroxides  
(B) thermal stability of their carbonates  
(C) softness  
(D) Hydration energy
12. Highly pure dilute solution of sodium in liquid ammonia :
- (A) shows blue colour  
(B) exhibits electrical conductivity  
(C) produces sodium amide instantly  
(D) produces hydrogen gas instantly
13. Sodium sulphate is soluble in water but barium sulphate is sparingly soluble because :
- (A) the hydration energy of  $\text{Na}_2\text{SO}_4$  is more than its lattice energy.  
(B) the lattice energy of  $\text{BaSO}_4$  is more than its hydration energy.  
(C) the lattice energy has no role to play in solubility.  
(D) the lattice energy of  $\text{Na}_2\text{SO}_4$  is more than its hydration energy.

### SECTION - III : ASSERTION AND REASON TYPE

14. **Statement - 1** : A solution of sodium in liquid ammonia at  $-33^\circ$  conducts electricity. On cooling, the conductivity of this solution decreases because,  
**Statement - 2** : On cooling the mobility of free electrons decreases.
- (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.  
(B) Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1.  
(C) Statement-1 is True, Statement-2 is False.  
(D) Statement-1 is False, Statement-2 is True.
15. **Statement - 1** : Potassium and caesium are useful as electrodes in photoelectric cells.  
**Statement - 2** : Potassium and caesium, when irradiated with light, the light energy absorbed is sufficient to eject out an electron from an atom.
- (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.  
(B) Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1.  
(C) Statement-1 is True, Statement-2 is False.  
(D) Statement-1 is False, Statement-2 is True.

16. **Statement - 1** : The alkali metal can form ionic hydrides which contain the hydride ion H<sup>-</sup>.  
**Statement - 2** : The alkali metals have low electronegativity value than hydrogen; their molten/fused hydrides conducts electricity and liberates hydrogen at the anode.
- (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.  
 (B) Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1.  
 (C) Statement-1 is True, Statement-2 is False.  
 (D) Statement-1 is False, Statement-2 is True.

### SECTION - IV : COMPREHENSION TYPE

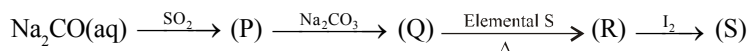
Read the following comprehensions carefully and answer the questions.

#### Comprehension # 1

The elements of group 1 describe, more clearly than any other group of elements, the effects of increasing the size of atoms or ions on the physical and chemical properties. The chemical and physical properties of the elements are closely related to their electronic structures and sizes. These metals are highly electropositive and thus form very strong bases, and have quite stable oxo-salts. In the manufacturing of sodium hydroxides, chlorine and sodium carbonate, the sodium chloride is used as starting material.

17. The following compounds have been arranged in the order of their increasing thermal stabilities. Identify the correct order,  
 $K_2CO_3$ (I),  $Na_2CO_3$ (II),  $Rb_2CO_3$ (III),  $Li_2CO_3$ (IV)
- (A) I < II < III < IV      (B) IV < II < III < I      (C) IV < II < I < III      (D) II < IV < III < I
18. Highly pure solution of sodium in liquid ammonia at  $-33^\circ C$  – (select correct statement) :  
 (A) is bad conductor of electricity.  
 (B) produces solvated ions responsible for electrical conductivity.  
 (C) instantly produces sodium amide with liberation of hydrogen gas.
19. Which of the product is not correctly matched with its manufacture process?  
 (A) Sodium hydroxide – Castner Kellner method.      (B) Chlorine – Leblanc process.  
 (C) Potassium carbonate – Solvay process      (D) Ammonia – Haber's process

#### Comprehension # 2



20. Select the correct statement for compound (R).  
 (A) Compound (R) is used as antichlor.  
 (B) Compound (Q) and sodium sulphide give compound (R) with iodine.  
 (C) Compound (R) is used in photography  
 (D) All of these
21. Which of the following statement is false for compound (Q) ?  
 (A) With dil.  $H_2SO_4$  it produces a colourless irritating gas which turns acidified  $K_2Cr_2O_7$  green.  
 (B) It produces a white precipitate with barium nitrate solution which is insoluble in dilute HCl.  
 (C) It does not decolourise the acidified  $KMnO_4$  solution  
 (D) (B) and (C) both

22. Oxidation state of S in all the compounds P to S (if sulphur atoms more than one then consider the average oxidation state) are respectively.

(A)  $+4, +4, +6, +\frac{5}{2}$

(B)  $+4, +4, +2, +\frac{5}{2}$

(C)  $+4, +4, -2, +\frac{5}{2}$

(D) None of these

### Comprehension # 3

Alkali metals oxide are obtained by combustion of the metals. Although Na normally gives  $\text{Na}_2\text{O}_2$ , it will take up further oxygen at elevated pressure and temperatures to form  $\text{NaO}_2$ . The per and superoxides of the heavier alkalis can also be prepared by passing stoichiometric amounts of oxygen into their solution in liquid ammonia.

The different alkali metal oxides can be distinguished by reaction with water. The superoxides reacts with  $\text{CO}_2$  and give oxygen gas. The stability of per and superoxides is based upon that larger cation can stabilise larger anion, due to larger lattice energy.

Alkali metals dissolve in liquid ammonia. Dilute solutions are dark blue in colour but as the concentration increases above 3M, the colour change to copper bronze and the solution acquires the metallic lusture due to the formation of metal ions clusters. The solution of alkali metals in liquid ammonia are good conductors of electricity due to the presence of ammoniated cations and ammoniated electrons. However, the conductivity decreases as the concentrations increases, since ammoniated electrons and ammoniated electrons and ammoniated cation associate.

23. Solution of sodium metals in liquid ammonia is strongly reducing due to the presence of :  
 (A) sodium hydride      (B) sodium atoms      (C) sodium amide      (D) solvated electrons
24.  $\text{KO}_2$  is used in oxygen cylinders in space and submarines because it :  
 (A) eliminates moisture      (B) absorbs  $\text{CO}_2$  only  
 (C) absorbs  $\text{CO}_2$  and increases  $\text{O}_2$  contents      (D) produces ozone
25. Select the correct choice for alkali metal oxides.  
 (A) Metal oxides react with water forming only metal hydroxides.  
 (B) Metal peroxides react with water forming metal hydroxides and oxygen gas.  
 (C) Metal superoxides react with water forming metal hydroxides, hydrogen peroxide and  $\text{O}_2$  gas.  
 (D) All of these
26. On dissolving smaller (less than 3M) amount of sodium metal in liquid ammonia at low temperature, which one of the following does not occur?  
 (A) Blue coloured solution is obtained  
 (B) Ammoniated  $\text{Na}^+$  ions are formed in the solution  
 (C) Liquid  $\text{NH}_3$  becomes good conductor of electricity  
 (D) Liquid ammonia remains diamagnetic

### SECTION - V : MATRIX - MATCH TYPE

27. Match the order given in column(I) with the property(ies) in column(II).

#### Column I

- (A)  $\text{Rb}_2\text{CO}_3 > \text{K}_2\text{CO}_3 > \text{Na}_2\text{CO}_3$   
 (B)  $\text{SrSO}_4 > \text{CaSO}_4 > \text{MgSO}_4$   
 (C)  $\text{Rb} > \text{K} > \text{Na}$   
 (D)  $\text{Be} > \text{Mg} > \text{Ca}$

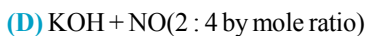
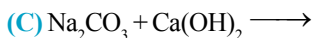
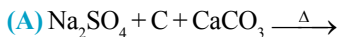
#### Column II

- (p) solubility of salts in water  
 (q) Thermal stability of salts  
 (r) Softness of metals  
 (s) Hydration energy of metals

28. Match the products of the given reactions given in column(I) with property(ies) in column(II).

**Column I**

**Column II**



(p) One of the products has  $\text{sp}^2$  hybridisation of central atom

(q) One of the products has  $\text{sp}^3$  hybridisation of central atom

(r) One of the product is obtained as insoluble precipitate

(s) One of the product is a neutral oxide.

**SECTION - VI : SUBJECTIVE TYPE**

29. Why are alkali metals (except Li) kept in kerosene?
30.  $\text{IE}_1$  value of Mg is more than that of Na while  $\text{IE}_2$  value is less. explain?
31. Sodium is prepared by electrolytic method and not by chemical methods. Why?
32. LiF is least soluble among the flourides of alkali metals. Explain
33. Name the proces used in the manufacture bof  $\text{Na}_2\text{CO}_3$ .
34. What is quick lime, slaked lime and lime water ? Explain in detail.
35. Contrast the action of heat on the following and elaborate your answer.  
 (i)  $\text{Na}_2\text{CO}_3$  and  $\text{CaCO}_3$   
 (ii)  $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$  and  $\text{CaCl}_2 \cdot 56\text{H}_2\text{O}$   
 (iii)  $\text{Ca}(\text{NO}_3)_2$  and  $\text{NaNO}_3$

## ANSWER KEY

## EXERCISE - 1

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

## EXERCISE - 2 : PART # I

1.	A, B, C, D	2.	B, C, D	3.	A, B, C	4.	A, B, D	5.	B
6.	A	7.	C	8.	B	9.	B	10.	A
11.	C	12.	A	13.	B	14.	D	15.	C
16.	C	17.	A	18.	C	19.	D	20.	C
21.	B	22.	D	23.	B	24.	D	25.	D
26.	A	27.	D	28.	D	29.	B	30.	B
31.	A	32.	A	33.	A, B, D	34.	B, C	35.	B
36.	B	37.	A	38.	A, C	39.	A	40.	B
41.	A, C	42.	A	43.	C, D	44.	C	45.	A, D
46.	C	47.	C	48.	B	49.	C	50.	A, C
51.	A, B, C	52.	C						

## PART # II

1. D 2. C 3. A 4. A 5. A 6. C 7. C 8. D 9. A 10. A 11. D 12. C 13. D

## EXERCISE - 3 : PART # I

- |    |   |    |  |
|----|---|----|--|
| 1. | $A \rightarrow (q), B \rightarrow (r), C \rightarrow (p), D \rightarrow (s)$                      | 2. | $A \rightarrow (q), B \rightarrow (s), C \rightarrow (r), D \rightarrow (p)$       |
| 3. | $A \rightarrow (r), B \rightarrow (s), C \rightarrow (p), D \rightarrow (r)$                      | 4. | $A \rightarrow (q), B \rightarrow (r), C \rightarrow (p, s), D \rightarrow (p)$    |
| 5. | $A \rightarrow (2), B \rightarrow (3), C \rightarrow (1), D \rightarrow (4)$                      | 6. | $A \rightarrow (4), B \rightarrow (1), C \rightarrow (2), D \rightarrow (3)$       |
| 7. | $A \rightarrow (r, s), B \rightarrow (r, s), C \rightarrow (p), D \rightarrow (q)$                | 8. | $A \rightarrow (p, r), B \rightarrow (p, q), C \rightarrow (p), D \rightarrow (s)$ |
| 9. | $A \rightarrow (p, q, s), B \rightarrow (p, q), C \rightarrow (p, q, r, s), D \rightarrow (p, q)$ |    |  |

## PART # I I

- Comprehension # 1 : 1. B 2. C
- Comprehension # 2 : 1. C 2. A 3. D 4. D 5. A
- Comprehension # 3 : 1. B 2. A 3. B
- Comprehension # 4 : 1. C 2. D 3. C
- Comprehension # 5 : 1. D 2. A 3. A 4. C 5. D

EXERCISE - 5 : PART # I

1. 2   2. 1   3. 4   4. 3   5. 3   6. 3   7. 4   8. 3   9. 1   10. 2

PART # II

1. C   2. B   3. A,B   4. B   5. B   5. A,B   7. 3   8. B

MOCK TEST

1.	B	2.	A	3.	C	4.	B	5.	B
6.	B	7.	D	8.	B	9.	A,B,D		
10.	A,B,C	11.	A,B	12.	A,B	13.	D	14.	A
15.	A	16.	A	17.	A → (p,q), B → (q), C → (r), D → (s)				
18.	A → (p,q,r), B → (p,q,r), C → (p,r), D → (p,q,s)								
19.	C	20.	B	21.	C	22.	D	23.	D
24.	B	25.	D	26.	C	27.	D	28.	D