EXERCISE-01

SELECT THE CORRECT ALTERNATIVE (ONLY ONE CORRECT ANSWER)

1. Alkaline earth metals (group 2 or II A elements) differ from group 12 (or II B) elements in the electronic configuration of their:
   (A) Antipenultimate shell      (B) Innermost shell
   (C) Outermost shell            (D) Penultimate shell

2. The first ionization enthalpy of magnesium is lower than the first ionization enthalpy of:
   (A) Lithium                   (B) Sodium
   (C) Calcium                   (D) Beryllium

3. Chemical A is used for water softening to remove temporary hardness. A reacts with Na₂CO₃ to generate caustic soda. When CO₂ is bubbled through A, it turns cloudy. What is the chemical formula of A:
   (A) CaCO₃                  (B) CaO
   (C) Ca(OH)₂             (D) Ca(HCO₃)₂

4. The substance not likely to contain CaCO₃ is:
   (A) Calcined gypsum       (B) Sea shells
   (C) Dolomite             (D) A marble statue

5. A metal M readily forms water soluble sulphate MSO₄, 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

6. 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) Be²⁺                  (B) Ba²⁺
   (C) Pb²⁺                  (D) Ca²⁺

7. 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

8. What is X in the following reaction?
   MgCl₂ + 2 H₂O → X + 2 HCl + H₂O
   (A) MgO               (B) Mg₃(OH)₂
   (C) Mg(OH)₂         (D) Mg(OH) Cl

9. (Yellow ppt) T ← X → Y (Yellow ppt) + Z↑ (pungent smelling gas) If X gives green flame test. Then, X is:
   (A) MgSO₄             (B) BaS₂O₃
   (C) CuSO₄           (D) PbS₂O₃

10. The correct statement is/are:
    (A) BeCl₂ is a covalent compound      (B) BeCl₂ is an electron deficient molecule
        (C) BeCl₂ can form dimer             (D) The hybrid state of Be in BeCl₂ is sp²

11. 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 H₂SO₄ at room temperature. Element A imparts golden yellow colour to Bunsen flame. Then A, B, C and D may be identified as:
    (A) Na, H₂, NaOH and Zn
    (B) K, H₂, KOH and Zn
    (C) K, H₂, NaOH and Zn
    (D) Ca, H₂, CaCOH₂ and Zn

12. 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

13. In electrolysis of NaCl when Pt electrode is taken then H₂ 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
14. 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$_2$

15. The paramagnetic species is:
   (A) KO$_2$   (B) SiO$_2$   (C) TiO$_2$   (D) BaO$_2$

16. 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)$_2$

17. Maximum thermal stability is shown by
   (A) MgCO$_3$   (B) CaCO$_3$   (C) SrCO$_3$   (D) BaCO$_3$

18. Stable oxide is obtained by heating the carbonate of the element
   (A) Li   (B) K   (C) Na   (D) Rb

19. The stable superoxide is formed by the element
   (A) Li   (B) Na   (C) K   (D) Ca

20. 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

21. 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$_2$

22. The hydration energy of Mg$^{2+}$ is greater than that of
   (A) Al$^{3+}$   (B) Na$^+$   (C) Be$^{2+}$   (D) Mg$^{3+}$

23. 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

24. The material used in photoelectric cells contains –
   (A) Cs   (B) Si   (C) Sn   (D) Ti

25. 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

26. Which of the following imparts violet colouration to the Bunsen burner non-luminous flame
   (A) NaCl   (B) BaCl$_2$   (C) CaCl$_2$   (D) KCl

27. Which one of the following is most basic?
   (A) Al$_2$O$_3$   (B) MgO   (C) SiO$_2$   (D) P$_2$O$_5$

28. 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
29. Bone ash contains
   (A) CaO
   (B) CaSO₄
   (C) Ca₃(PO₄)₂
   (D) Ca(H₂PO₄)₂

30. 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 Li₃N unlike group I metals
   (D) The ion of Li and its compounds are more heavily hydrated than those of the rest of the group

31. Of the following the commonly used as a laboratory desicator is
   (A) Na₂CO₃
   (B) CaCl₂
   (C) NaCl
   (D) None of the above

32. The increasing order of solubility is
   (A) CaCO₃, KHCO₃, NaHCO₃
   (B) NaHCO₃, KHCO₃, CaCO₃
   (C) KHCO₃, NaHCO₃, CaCO₃
   (D) CaCO₃, NaHCO₃, KHCO₃

33. Which one of the following compounds gives methane on treatment with water?
   (A) Al₄C₃
   (B) CaC₂
   (C) VC
   (D) SiC

34. Sodium loses its lustre on exposure to air due to formation of –
   (A) Na₂O, NaOH and Na₂CO₃
   (B) Na₂O and NaOH
   (C) Na₂O and Na₂CO₃
   (D) NaOH and Na₂CO₃

35. Which of the following hydride is covalent and polymeric? :
   (A) CaH₂
   (B) BeH₂
   (C) NaH
   (D) BaH₂
SELECT THE CORRECT ALTERNATIVES (ONE OR MORE THEN ONE CORRECT ANSWERS)

1. Which of the following is incorrect?
   (A) Mg burns in air releasing dazzling light rich in UV rays.
   (B) CaCl₂  6 H₂O when mixed with ice gives freezing mixture.
   (C) Mg cannot form complexes
   (D) Be can form complexes due to its very small size.

2. On dissolving moderate amount of sodium metal in liquid NH₃ at low temperature, which one of the following does not occur
   (A) Blue coloured solution is obtained.
   (B) Na⁺ ions are formed in the solution.
   (C) Liquid NH₃ becomes good conductor of electricity.
   (D) Liquid ammonia remains diamagnetic.

3. The minimum equivalent conductance in fused state is shown by –
   (A) MgCl₂    (B) BeCl₂    (C) CaCl₂    (D) SrCl₂

4. The metal which cannot be produced on reduction of its oxide by aluminium is
   (A) K    (B) Mn    (C) Cr    (D) Fe

5. Magnesium on reaction with very dilute HNO₃ gives
   (A) NO    (B) N₂O    (C) H₂    (D) NO₂

6. The alkali metal that reacts with nitrogen directly to form nitride is
   (A) Li    (B) Na    (C) K    (D) Rb

7. 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) Li⁺ is exceptionally small
   (D) All alkali metals give blue solution in liquid ammonia

8. Amongst LiCl, RbCl, BeCl₂ and MgCl₂, the compounds with the greatest and least ionic character respectively are :
   (A) LiCl, RbCl    (B) RbCl, BeCl₂    (C) RbCl, MgCl₂    (D) MgCl₂, BeCl₂

9. K₂CS₃ can be called potassium
   (A) sulphocyanide    (B) thiocarbide    (C) thiocarbonate    (D) thiocyanate

10. Anhydrous MgCl₂ can be prepared by heating MgCl₂.6H₂O
    (A) in a current of dry HCl gas    (B) with carbon
    (C) until it fuses    (D) with lime

11. Oxygen ions structure in its peroxide, superoxide, ozonide :
    (A) O₂⁻, O₂, O₃⁻²    (B) O₂⁻², O₂⁻, O₃⁻    (C) O₂⁻², O⁻², O₃⁻    (D) O₂⁻, O₂⁻³, O₃⁻²
12. In presence of iron, alkali metal react with liquid ammonia and form
   (A) Metal mixture + H₂   (B) Iron metal mixture + H₂
   (C) Metal mixture         (D) Metal amide + H₂

13. The ionic conductance of following cation in a given concentration are in the order
   (A) Li⁺ < Na⁺ < K⁺ < Rb⁺   (B) Li⁺ > Na⁺ > K⁺ > Rb⁺
   (C) Li⁺ < Na⁺ > K⁺ > Rb⁺   (D) Li⁺ = Na⁺ < K⁺ < Rb⁺

14. Which of the following does not give an oxide on heating –
   (A) MgCO₃         (B) Li₂CO₃
   (C) ZnCO₃         (D) K₂CO₃

15. On heating sodium metal in the current of dry ammonia leads to the formation of which gas–
   (A) NaNH₂          (B) NaN₃
   (C) NH₃            (D) H₂

16. On allowing ammonia solution of s-block metals to stand for a long time, blue colour becomes fade. The reason is:-
   (A) Formation of NH₃ gas   (B) Formation of metal amide
   (C) Cluster formation of metal ions (D) Formation of metal nitrate

17. When Na and Li placed in dry air we get :-
   (A) NaOH, Na₂O, Li₂O   (B) Na₂CO₃, Na₂O₂, Li₂O
   (C) Na₂O, Li₃N, NH₃   (D) Na₂O, Li₂O, Li₃N

18. The hydride ion H⁻ is stronger base than its hydroxide ion OH⁻. Which of the following reaction will occur if sodium hydride is dissolved in water:-
   (A) H⁻(aq) + H₂O → H₃O⁺    (B) H⁻(aq) + H₂O → OH⁻ + H₂
   (C) H⁻ + H₂O → H₂ + O₂    (D) H⁻ + H₂O → No reaction

19. Which can not be used to generate H₂ :-
   (A) Al + NaOH        (B) Zn + NaOH
   (C) Mg + NaOH        (D) LiH + H₂O

20. 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

21. Alum is the name used for all double salts having the composition M⁺⁺SO₄.M⁺⁺(SO₄)₃.24H₂O. Where M⁺⁺ stands for Al⁺³, Cr⁺³, Fe⁺³, while M⁺ stands for:-
   (A) Li⁺, Cu⁺, Ag⁺     (B) Li⁺, NH₄⁺, Na⁺
   (C) Na⁺, K⁺, Rb⁺     (D) Ca⁺², Mg⁺², Sr⁺²

22. 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

23. In the reaction M + O₂ → MO₂ (super oxide) the metal is
   (A) Li        (B) Na
   (C) K        (D) Ba
24. Na⁺ and Ag⁺ differ in
(A) Na₂CO₃ is thermally stable while Ag₂CO₃ decomposes into Ag, CO₂ and O₂
(B) Ag⁺ forms complexes, Na⁺ does not
(C) NaCl is water soluble, AgCl is insoluble
(D) NaBr-yellow and AgBr pale yellow

25. 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

26. Match list I with list II and choose the correct answer from the codes given below

<table>
<thead>
<tr>
<th>List I</th>
<th>List II</th>
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<tbody>
<tr>
<td>(A) NaNO₃</td>
<td>(a) Baking soda</td>
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<tr>
<td>(B) Na(NH₄)HPO₄</td>
<td>(b) Chile salt peter</td>
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<td>(C) NaHCO₃</td>
<td>(c) Microcosmic salt</td>
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<tr>
<td>(D) Na₂CO₃.10H₂O</td>
<td>(d) Washing soda</td>
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</table>

Codes is:

(A) a b c d
(B) b c a d
(C) c a b d
(D) d a b c

27. Which of the following statement is not correct
(A) LiOH is amphoteric in nature
(B) LiCl is soluble in pyridine
(C) Li₃N is stable while Na₃N doesn’t exist even at room temperature
(D) BeO is amphoteric in nature

28. Which of the following statement is correct for s–block elements :-
(A) Be has smallest atomic size in II A group
(B) Li is most metallic
(C) Mg impart red colour to the flame
(D) Cs is most reducing in water

29. Which of the following are ionic carbides?
(A) CaC₂    (B) Al₄C₃    (C) SiC    (D) Be₂C

30. 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
31. Which of the following statements are false?
   (A) 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.

32. 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.

33. Na$_2$SO$_4$ is water soluble but BaSO$_4$ is insoluble because:
   (A) The hydration energy of Na$_2$SO$_4$ is higher than that of its lattice energy
   (B) The hydration energy of Na$_2$SO$_4$ is less than that of its lattice energy
   (C) The hydration energy of BaSO$_4$ is less than that of its lattice energy
   (D) The hydration energy of BaSO$_4$ is higher than that of its lattice energy

34. BeCl$_2$ + LiAlH$_4$ → X + LiCl + AlCl$_3$
   (A) X is lithium hydride
   (B) X is BeH$_2$
   (C) X is BeCl$_2$ 2H$_2$O
   (D) X is LiH

35. X → CaCl$_2$ + Y \uparrow; the effective ingredient of X is:
   (A) OCl$^-$
   (B) Cl$^-$
   (C) OCl$^+$
   (D) OCl$_2^-$

36. Which of the following substance(s) is/are used in laboratory for drying purposes?
   (A) Anhydrous P$_2$O$_5$
   (B) Graphite
   (C) Anhydrous CaCl$_2$
   (D) Na$_3$PO$_4$

37. If X and Y are the second ionisation potentials of alkali and alkaline earth metals of same period, then:
   (A) X > Y
   (B) X < Y
   (C) X = Y
   (D) X << Y

38. X $\xrightarrow{N_2, \Delta}$ Y $\xrightarrow{H_2O}$ Z (colourless gas) $\xrightarrow{CuSO_4}$ T (blue colour)

Then, substances Y and T are:
   (A) Y = Mg$_3$N$_2$ and T = CuSO$_4$ 5H$_2$O
   (B) Y = Mg$_3$N$_2$ and T = CuSO$_4$ 4NH$_3$
   (C) Y = Mg(NO$_3$)$_2$ and T = CuO
   (D) Y = MgO and T = CuSO$_4$ 4NH$_3$

39. When K$_2$O is added to water, the solution becomes basic in nature because it contains a significant concentration of:
   (A) K$^+$
   (B) O$^{2-}$
   (C) OH$^-$
   (D) O$_2^-$
40. (White ppt) $D \xrightarrow{\text{Na}_2\text{CO}_3} A \xrightarrow{\text{K}_2\text{CrO}_4 \text{in acetic acid}} B$ (Yellow ppt) 
\[
dil. \text{H}_2\text{SO}_4 \downarrow \\
\text{C(White ppt)}
\]

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

41. Which of the following compounds are paramagnetic in nature?
(A) KO$_2$  
(B) K$_2$O$_2$  
(C) Na$_2$O$_2$  
(D) RbO$_2$

42. $\text{NaOH(Solid)} + \text{CO} \xrightarrow{200^\circ C} \text{X}$; product X is :
(A) NaHCO$_3$  
(B) NaHCO$_2$  
(C) HCOONa  
(D) H$_2$CO$_3$

43. EDTA is used in the estimation of :
(A) Mg$^{2+}$ ions  
(B) Ca$^{2+}$ ions  
(C) Both Ca$^{2+}$ and Mg$^{2+}$ ions  
(D) Mg$^{2+}$ ions but not Ca$^{2+}$ ions

44. $\text{Na} + \text{Al}_2\text{O}_3 \xrightarrow{\text{high temperature}} \text{X} \xrightarrow{\text{CO}_2 \text{ in water}} \text{Y}$; compound Y is :
(A) NaAlO$_2$  
(B) NaHCO$_3$  
(C) Na$_2$CO$_3$  
(D) Na$_2$O$_2$

45. The compound(s) which have –O–O– bond(s) is/are :
(A) BaO$_2$  
(B) Na$_2$O$_2$  
(C) CrO$_5$  
(D) Fe$_2$O$_3$

46. KO$_2$ finds use in oxygen cylinders used for space and submarines. The fact(s) related to such use of KO$_2$ is/are :
(A) it produces O$_2$  
(B) It produces O$_3$  
(C) It absorbs CO$_2$  
(D) It absorbs both CO and CO$_2$

47. CsBr$_3$ contains :
(A) Cs–Br covalent bonds  
(B) Cs$^{3+}$ and Br$^{-}$ ions  
(C) Cs$^+$ and Br$_3^-$ ions  
(D) Cs$^{3+}$ and Br$_3^{3-}$ ions

48. Fire extinguishers contain :
(A) conc. H$_2$SO$_4$ solution  
(B) H$_2$SO$_4$ and NaHCO$_3$ solutions  
(C) NaHCO$_3$ solution  
(D) CaCO$_3$ solution

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**BRAIN TEASERS**

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TRUE / FALSE

1. Magnesium is an essential constituent of chlorophyll, the green colouring matter of plants.
2. Setting of cement is an endothermic process.
3. Calcium bicarbonate is known in solid state.
4. BeH₂ is an ionic hydride.
5. BeCO₃ is thermally stable compounds.
6. In the electrolysis of fused calcium hydride, hydrogen is liberated at cathode.
7. MgCl₂·6H₂O on heating forms MgCl₂.
8. Sodium when heated in excess of oxygen gives sodium oxide.
9. In group IA of alkali metals, the ionisation potential decreases down the group. Therefore, lithium is a poorer reducing agent in gaseous medium.
10. The softness of group IA metals increases down the group with increasing atomic number.

FILL IN THE BLANKS

1. Anhydrous magnesium chloride is obtained by heating the hydrated salt with..................
2. Ca(OH)₂ is..................... basic than Mg(OH)₂.
3. CaH₂ is commerciely known as.....................
4. Magnesium burn is air forming ..................... and .....................
5. Ba react with cold water ..................... Mg reacts with..................... while Be has..................... with boiling water.
6. A standard solution of sodium hydroxide cannot be prepared by direct weighing because...................
7. Potassium bicarbonate cannot be prepared by solvay process because.......................
8. Solution of alkali metals in liquid ammonia conducts electricity due to.......................

MATCH THE COLUMN

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<th>Column-II</th>
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<tbody>
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<td>(A) Hydrolith</td>
<td>(p) Contain Ca</td>
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<td>(B) Nitrolium</td>
<td>(q) Used as a fertilizer</td>
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<td>(C) Dolomite</td>
<td>(r) Used to prepare H₂</td>
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<td>(D) Pearl's ash</td>
<td>(s) Contain potassium</td>
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<td>(A) Solvay process</td>
<td>(p) NaCl</td>
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<td>(B) Evolve CO₂↑ on heating</td>
<td>(q) Na₂O₂</td>
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<td>(C) aq. soln. is neutral towards litmus</td>
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<td>(A) Metal sulphate $\xrightarrow{\Delta} \text{metal oxide} + \text{SO}_2 + \text{O}_2$</td>
<td>(p) Ba</td>
</tr>
<tr>
<td>(B) Metal cation $+ \text{K}_2\text{CrO}_4 \rightarrow$ yellow ppt</td>
<td>(q) Sr</td>
</tr>
<tr>
<td>(C) Metal $+ \text{NH}_3 \xrightarrow{\text{blue solution}}$</td>
<td>(r) Na</td>
</tr>
<tr>
<td>(D) $\text{MCI}_2 + \text{conc. H}_2\text{SO}_4 \rightarrow$ white ppt.</td>
<td>(s) Mg</td>
</tr>
</tbody>
</table>

**ASSERTION & REASON QUESTIONS**

These questions contain 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**: Li$_2$SO$_4$ do not form double salt like alum.
   **Because**
   **Statement-II**: Atomic size of Li is too small.

2. **Statement-I**: NaCl when exposed in air it becomes wet.
   **Because**
   **Statement-II**: NaCl contains hygroscopic impurities like CaCl$_2$, MgCl$_2$ etc.

3. **Statement-I**: Lithium is the weakest reducing agent among alkali metals.
   **Because**
   **Statement-II**: In alkali metals I.P. decreases down the group.

4. **Statement-I**: BaCO$_3$ is more soluble in HNO$_3$ than in plain water.
   **Because**
   **Statement-II**: Carbonate is a weak base and reacts with the H$^+$ from the strong acid causing the barium salt to dissociate.

5. **Statement-I**: BeCl$_2$ fumes in moist air.
   **Because**
   **Statement-II**: BeCl$_2$ reacts with moisture of form HCl gas.

**COMPREHENSION BASED QUESTIONS**

Comprehension # 1

A $\xrightarrow{\Delta} \text{B (oxide)} + \text{CO}_2$
B $+ \text{H}_2\text{O} \rightarrow \text{C}$
C $+ \text{CO}_2 \rightarrow \text{A (milky)}$
C $+ \text{NH}_4\text{Cl} \xrightarrow{\Delta} \text{D (gas)}$
D $+ \text{H}_2\text{O} + \text{CO}_2 \rightarrow \text{E}$
E $+ \text{NaCl} \rightarrow \text{F}$
F $\xrightarrow{\Delta} \text{Na}_2\text{CO}_3 + \text{CO}_2 + \text{H}_2\text{O}$

1. **A is**:
   (A) Ca(HCO$_3$)$_2$
   (B) CaCO$_3$
   (C) CaO
   (D) Na$_2$CO$_3$
2. B and C are:
(A) CaO, Ca(OH)$_2$  
(B) Ca(OH)$_2$, CaCO$_3$
(C) CaCO$_3$, Ca(OH)$_2$  
(D) Ca(OH)$_2$, CaO

3. D, E and F are:
(A) NH$_3$, NH$_4$Cl, NH$_4$HCO$_3$
(B) NH$_3$, NH$_4$HCO$_3$, NaHCO$_3$
(C) NH$_4$HCO$_3$, Na$_2$CO$_3$, NaHCO$_3$
(D) None

**Comprehension # 2**

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 solublity increases as HF is added in aqueous solution.

(iii) LiH more stable than NaH when heated separately.

(iv) When excess of Na$_2$S$_2$O$_3$ solution is added to the FeCl$_3$ solution an intense violet colouration is produced, but violet colour disappeared shortly.

(v) Between Na$^-$ and Ag$^+$, Ag$^+$ is stronger Lewis acid.

1. The explanation of observation (v) is:
(A) Because Na$^+$ has inert gas configuration which has greater polarisation power.
(B) Because Ag$^+$ has inert gas configuration which has greater polarisation power.
(C) Because Ag$^+$ has pseudo inert gas configuration which has lesser polarisation power.
(D) Because Ag$^+$ has pseudo inert gas configuration which has greater polarisation power.

2. The explanation for the observation (iv) is:
(A) Initially with FeCl$_3$, Na$_2$S$_2$O$_3$ produce an intense violet colour substance Fe$_2$(S$_2$O$_3$)$_3$. But Fe$_2$(S$_2$O$_3$)$_3$ changes to Fe$^{2+}$ & S$_4$O$_6^{2-}$ on standing.
(B) Initially with FeCl$_3$, is reduced to FeCl$_2$ by Na$_2$S$_2$O$_3$, FeCl$_2$ so produced undergo unstable complex formation Fe(S$_2$O$_3$)$_3^{4-}$ which is violet in colour.
(C) Initially with FeCl$_3$, Na$_2$S$_2$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.

3. As per observation (iii) LiH is more stable than NaH, because:
(A) Due to small size of 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 Na$^+$, the lattice energy of NaH is greater.

4. As per observation (ii) the solubility of LiF increases in the presence of HF, because:
(A) The HF further ionises to H$^+$ & F$^-$
(B) In the presence of HF, there will be a comon ion effect.
(C) In the presence HF, F$^-$ is converted to HF$_2^-$
(D) All of the above.
5. The reaction for observation (i) can be explained as –

(A) NaOH (S) $\xrightarrow{\text{H}_2\text{O}}$ NaOH(aq) $\xrightarrow{\text{H}_2\text{O}}$ N

(B) NaOH (S) $\xrightarrow{\text{H}_2\text{O}}$ NaOH(aq) $\xrightarrow{-\text{H}_2\text{O}}$ Na$_2$O (S)

(C) NaOH (S) $\xrightarrow{\text{H}_2\text{O}}$ NaOH(aq) $\xrightarrow{\text{O}_2/\text{air}}$ Na$_2$O (S)

(D) NaOH (S) $\xrightarrow{\text{H}_2\text{O}}$ NaOH(aq) $\xrightarrow{\text{CO}_2}$ Na$_2$CO (S)

Comprehension # 3

Na $\xrightarrow{\text{H}_2\text{O}}$ a $\xrightarrow{\text{CO}_2}$ B $\xrightarrow{\text{SO}_2}$ C $\xrightarrow{\text{Na}_2\text{S}_2\text{O}_3}$ D $\xrightarrow{\text{Ag}^+/\text{salt}}$ E (complex)

1. The compound B and C are :

(A) Na$_2$CO$_3$, Na$_2$SO$_4$

(B) NaHCO$_3$, Na$_2$SO$_4$

(C) Na$_2$CO$_3$, Na$_2$SO$_3$

(D) None of these

2. The compound D is :

(A) Na$_2$SO$_4$

(B) Na$_2$S$_4$O$_6$

(C) Na$_2$S$_2$O$_5$

(D) Na$_2$S$_2$O$_3$

3. Oxidation number of each 'S' atom in compound D :

(A) + 2, + 2

(B) + 4, 0

(C) + 6, − 2

(D) + 5, − 1

Comprehension # 4

Alkali metals readily react with oxyacids forming corresponding salts like M$_2$CO$_3$, MHCO$_3$, MNO$_3$, M$_2$SO$_4$ etc. with evolution of hydrogen. They also dissolve in liquid 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) NaNO$_3$

(B) KNO$_3$

(C) LiNO$_3$

(D) All of these

2. Among the carbonates of alkali metals which one has highest stability?

(A) Cs$_2$CO$_3$

(B) Rb$_2$CO$_3$

(C) K$_2$CO$_3$

(D) Na$_2$CO$_3$

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

(A) Except Li$_2$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) LiHCO$_3$  (ii) Ca(HCO$_3$)$_2$  (iii) Zn (HCO$_3$)$_2$  (iv) NaHCO$_3$  (v) AgHCO$_3$
   (A) (ii), (iii), (v)  (B) (i), (ii), (iii)  (C) (i), (ii), (v)  (D) (ii), (iii), (iv)
1. Explain the following:
   (i) The reaction between marble and dilute H$_2$SO$_4$ is not used to prepare carbon dioxide.
   (ii) Lime water becomes turbid on passing CO$_2$ though it, but becomes clear when more CO$_2$ is passed.
   (iii) Alkaline earth metals have higher melting points than alkali metals.
   (iv) Beryllium does not exhibit a covalency beyond 4.

2. PbO$_2$ is soluble in NaOH and also in HCl. What does it reflect about the nature of PbO$_2$?

3. What happens when:
   (i) Hot and concentrated caustic soda solution reacts with iodine.
   (ii) White phosphorus is heated with caustic soda.
   (iii) Excess of caustic soda reacts with zinc sulphate solution.
   (iv) Excess of NaOH is added to AlCl$_3$ solution.

4. Write balanced equation for reaction between
   (i) Na$_2$O$_2$ and water  (ii) KO$_2$ and water  (iii) Na$_2$O$_2$ and CO$_2$

5. 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.

6. In water LiF is least soluble fluoride among fluorides of alkali metals, but its solubility increases as HF is added in aqueous solution, why?

7. What happens when CuSO$_4$(aq.) is treated with excess of Na$_2$S$_2$O$_3$ solution?

8. Arrange the following in order of increasing ............
   (i) Thermal stability        BeSO$_4$, MgSO$_4$, CaSO$_4$
   (ii) Polarising power       Be$^{2+}$, Mg$^{2+}$, Ca$^{2+}$
   (iii) Solubility in H$_2$O    Be(OH)$_2$, Mg(OH)$_2$, Ca(OH)$_2$
   (iv) Covalent nature        BeCl$_2$, MgCl$_2$, CaCl$_2$
   (v) Hydrolysis nature       BeCl$_2$, MgCl$_2$, CaCl$_2$
   (vi) Lattice energy         CaF$_2$, MgF$_2$, BaF$_2$
   (vii) Hydration energy      Be$^{2+}$, Mg$^{2+}$, Ba$^{2+}$
   (viii) Solubility in water  MgF$_2$, BaF$_2$, BeF$_2$
   (ix) Basic nature           Be, Mg, Ca, Sr

9. 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 H$_2$ and (C). Identify (A), (B) and (C).
1. (i) Insoluble CaSO₄ is formed which deposits on the surface of marble and prevents further action of dilute H₂SO₄, so the evolution of CO₂ ceases after sometime.
   (ii) Insoluble CaCO₃ is first precipitated which dissolves in excess of CO₂ due to the form of Ca(HCO₃)₂.
   \[
   \text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O} \; \text{(Insoluble)}
   \]
   \[
   \text{CaCO}_3 + \text{H}_2\text{O} + \text{CO}_2 \rightarrow \text{Ca(HCO}_3)_2 \; \text{(Soluble)}
   \]
   (iii) Metallic bonding is much stronger in alkaline earth metals as two electrons are present in valence shell.
   (iv) The outermost energy shell in beryllium is the second. It cannot accommodate more than 8 electrons and hence a covalency limit 4 cannot be exceeded.

2. PbO₂ are amphoteric nature
   \[
   \text{PbO}_2 + 4\text{HCl} \rightarrow \text{PbCl}_4 + 2\text{H}_2\text{O}
   \]
   \[
   \text{PbO}_2 + 2\text{NaOH} \rightarrow \text{Na}_2\text{PbO}_3 + \text{H}_2\text{O}
   \]

3. (i) 3\text{I}_2 + 6\text{NaOH} \rightarrow 5\text{NaI} + \text{NaI}_3 + 3\text{H}_2\text{O}
   (ii) \text{P}_4 + 3\text{NaOH} + 3\text{H}_2\text{O} \rightarrow \text{PH}_3 + 3\text{NaH}_2\text{PO}_2
   (iii) \text{ZnSO}_4 + 2\text{NaOH} \rightarrow \text{Zn(OH)}_2\text{Na}_2\text{SO}_4
   (iv) \text{AlCl}_3 + 3\text{NaOH} \rightarrow \text{Al(OH)}_3 + 3\text{NaCl}

4. (i) \text{NaO}_2 + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2\text{O}_2
   (ii) \text{KO}_2 + \text{H}_2\text{O} \rightarrow \text{KO} + \text{H}_2\text{O}_2 + \text{O}_2
   (iii) 2\text{Na}_2\text{O}_2 + 2\text{CO}_2 \rightarrow 2\text{Na}_2\text{CO}_3 + \text{O}_2

5. A = \text{Ca}, \quad B = \text{Ca}_3\text{N}_2, \quad C = \text{Ca(OH)}_2, \quad D = \text{NH}_3

6. In presence of HF, F⁻ is converted into bifluoride ion HF₂⁻, allowing further dissolution of solid LiF.

7. \text{CuSO}_4 + \text{Na}_2\text{S}_2\text{O}_3 \rightarrow \text{CuS}_2\text{O}_3 + \text{Na}_2\text{SO}_4
   \[
   2\text{CuS}_2\text{O}_3 + \text{Na}_2\text{S}_2\text{O}_3 \rightarrow \text{CuS}_2\text{O}_3 + \text{Na}_2\text{S}_4\text{O}_6
   \]
   Cupric thiosulphate
   \[
   3\text{CuS}_2\text{O}_3 + 2\text{Na}_2\text{S}_2\text{O}_3 \rightarrow \text{Na}_4\{\text{Cu}_6\text{S}_2\text{O}_{15}\}_3
   \]
   Sodium cuprothiosulphate.

8. (i) \text{BeSO}_4 < \text{MgSO}_4 < \text{CaSO}_4
   (ii) \text{Ca}^{2+} < \text{Mg}^{2+} < \text{Be}^{2+}
   (iii) \text{Be(OH)}_2 < \text{Mg(OH)}_2 < \text{Ca(OH)}_2
   (iv) \text{CaCl}_2 < \text{MgCl}_2 < \text{BeCl}_2
   (v) \text{CaCl}_2 < \text{MgCl}_2 < \text{BeCl}_2
   (vi) \text{BaF}_2 < \text{CaF}_2 < \text{MgF}_2
   (vii) \text{Ba}^{2+} < \text{Mg}^{2+} < \text{Be}^{2+}
   (viii) \text{BaF}_2 < \text{MgF}_2 < \text{BeF}_2
   (ix) \text{Be} < \text{Mg} < \text{Ca} < \text{Sr}

9. (i) Ca gives brick red colour to flame
   (ii) \text{Ca} + \text{H}_2 \rightarrow \text{CaH}_2 \; \text{(hydrolith, trade name)}
   \[ \text{(A)} \quad \text{(B)} \]
   (iii) \text{CaH}_2 + 2\text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + 2\text{H}_2
1. 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 Zn/H₂O yields acetaldehyde. Identify (A), (B) and (C)

2. A compound (X) imports a golden yellow flame and shows the following reactions:
   (i) Zinc powder when boiled with a concentrated aqueous solution of (X) dissolves 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).

3. A white solid is either Na₂O or Na₂O₂. 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

4. (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 Al₂(SO₄). Identify (A), (B) and (C).

5. Element (M) is a shiny and highly reactive metal (melting point 63°C) and element (X) is a highly reactive non-metal (melting point – 7.2°C). They react to form a compound with the empirical formula MX, a colourless, brittle solid that melts at 734°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 and Cl⁻ are formed. From these observations, identify M and X.

6. Name an element which is invariable bivalent and whose oxide is soluble in excess of NaOH and its dipositive ion has a noble gas core.

7. Out of the elements marked A, B, C, D, E, F, G and H:
   (a) Which form superoxide?
   (b) Which form thermally stable carbonate?
   (c) Which forms strongest base?
   (d) Which show diagonal relationship?
   (e) Which forms amphoteric oxide?
1. The gas (A) on treatment with but-2-ene followed by treatment with Zn/H₂O yields acetaldehyde and thus (A) is ozone.

   (i) \[ O_3 + CH_3 - CH=CH-CH_3 \rightarrow CH_3-\text{CH}-\text{CH}_3 \]
   Mono ozonide

   \[ 2\text{CH}_3\text{CHO} \xrightarrow{\text{H}_2\text{O}} \text{Zn} \]
   Acetaldehyde

   (ii) \[ 5O_3 + 2\text{KOH} \rightarrow 2\text{K}_2\text{O}_3 + \text{H}_2\text{O(g)} + 5O_2 \]
   (A) Potassium ozonide
   (Q) Deep red (B)

2. (i) \[ \text{Zn} + 2\text{NaOH} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2 \]
   (X)

   (ii) (X) is also justified by step 2 reactions:

   \[ 2\text{NaOH} + \text{SnCl}_2 \rightarrow \text{Sn(OH)}_2 + 2\text{NaCl} \]
   (X) White ppt.

   \[ \text{Sn(OH)}_2 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SnO}_2 + 2\text{H}_2\text{O} \]
   (Excess) Soluble
   (X)

3. (i) \[ \text{Na}_2\text{O}_2 + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2\text{O} + [O] \]

   [O] + Litmus \rightarrow White (bleaching)
   Red

   (ii) The other compound Na₂O will give NaOH on dissolution in water. The red litmus will turn to blue.

4. \[ 2\text{KO}_2 + \text{S} \rightarrow \text{K}_2\text{SO}_4 \xrightarrow{\text{Al(SO}_4)_{3}} \text{K}_2\text{SO}_4 \quad \text{Al}_2(\text{SO}_4)_3 \quad 2\text{H}_2\text{O} \]
   (A) (B) (C)

5. The given facts suggest M to be potassium (K) and (X) to be bromine (Br₂).

   \[ 2\text{K} + \text{Br}_2 \rightarrow 2\text{KBr} \]
   (Ionic solid with m. pt. 734°C)

6. Be

7. (a) E and G   (b) C, E and G   (c) G   (d) A and D   (e) B
1. A metal M readily forms its sulphate \( \text{MSO}_4 \) which is water soluble. It forms oxide \( \text{MO} \) which becomes inert on heating. It forms insoluble hydroxide which is soluble in \( \text{NaOH} \). The metal M is:

   (1) \( \text{Mg} \)  \( \text{(2) Ba} \)  \( \text{(3) Ca} \)  \( \text{(4) Be} \)  

   [AIEEE-2002]

2. \( \text{KO}_2 \) is used in space and submarines because it

   (1) Absorbs \( \text{CO}_2 \) and increase \( \text{O}_2 \) concentration
   (2) Absorbs moisture
   (3) Absorbs \( \text{CO}_2 \)
   (4) Produces ozone

   [AIEEE-2002]

3. In curing cement plasters, water is sprinkled from time to time. This helps in:

   (1) Hydrating sand and gravel mixed with cement
   (2) Converting sand into silicate
   (3) Developing interlocking needle like crystals of hydrated silicates
   (4) Keeping it cool

   [AIEEE-2003]

4. The solubilities of carbonates decreases down the magnesium group due to decrease in:

   (1) Inter-ionic attraction
   (2) Entropy of solution formation
   (3) Lattice energy of solids
   (4) Hydration energy of cations

   [AIEEE-2003]

5. The substance not likely to contain \( \text{CaCO}_3 \) is:

   (1) Sea shells  \( \text{(2) Dolomite} \)
   (3) A marble statue  \( \text{(4) Calcined gypsum} \)

   [AIEEE-2003]

6. One mole of magnesium nitride on reaction with excess of water gives:

   (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 \( \text{HNO}_3 \)

   [AIEEE-2004]

7. The ionic mobility of alkali metal ions in aqueous solution is maximum for:

   (1) \( \text{Rb}^- \)  \( \text{(2) Li}^- \)  \( \text{(3) Na}^- \)  \( \text{(4) K}^- \)

   [AIEEE-2006]

8. Which of the following on thermal-decomposition yields a basic as well as an acidic oxide ?

   (1) \( \text{NH}_4\text{NO}_3 \)  \( \text{(2) NaNO}_3 \)  \( \text{(3) KClO}_3 \)  \( \text{(4) CaCO}_3 \)

   [AIEEE-2012]

9. Fire extinguishers contain \( \text{H}_2\text{SO}_4 \) and which one of the following:

   (1) \( \text{CaCO}_3 \)  \( \text{(2) NaHCO}_3 \) and \( \text{Na}_2\text{CO}_3 \)
   (3) \( \text{Na}_2\text{CO}_3 \)  \( \text{(4) NaHCO}_3 \)

   [AIEEE-2012 (Online)]

10. Which one of the following will react most vigorously with water?

    (1) \( \text{Li} \)  \( \text{(2) K} \)  \( \text{(3) Rb} \)  \( \text{(4) Na} \)

    [AIEEE-2012 (Online)]

11. A metal M 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:

    (1) \( \text{NH}_3 \)  \( \text{(2) MgO} \)  \( \text{(3) Mg}_3\text{N}_2 \)  \( \text{(4) Mg(NO}_3\text{)}_2 \)

    [AIEEE-2012 (Online)]
1. Which process is used in the extractive metallurgy of Mg:
(A) Fused salt electrolysis
(B) Self reduction
(C) Aquaous solution electrolysis
(D) Thermite reduction

2. A sodium salt on treatment with MgCl$_2$ gives white precipitate only on heating. The anion of sodium salt is:
(A) HCO$_3^-$
(B) CO$_3^{2-}$
(C) NO$_3^-$
(D) SO$_4^{2-}$

3. The following compounds have been arranged in order of their increasing thermal stabilities. Identify the correct order:
(IIT 96)
(I) K$_2$CO$_3$  (II) MgCO$_3$  (III) CaCO$_3$  (IV) BeCO$_3$
(A) I < II < III < IV
(B) IV < II < III < I
(C) IV < II < I < III
(D) II < IV < III < I

4. Property of the alkaline earth metals that increases with their atomic number is –
(IIT 97)
(A) Ionisation energy
(B) Solubility of their hydroxides
(C) Solubility of their sulphates
(D) Electronegativity

5. The characteristics of solid sodium chloride are
(REE 96)
(1) Brittle
(2) Ionic
(3) Covalent
(4) Non-conductor
(A) 1 & 2
(B) 3 & 4
(C) 1, 2, & 4
(D) 1, 3, & 4

6. Which of the following are not amphoteric –
(REE 97)
(1) Be(OH)$_2$
(2) Sr(OH)$_2$
(3) Ca(OH)$_2$
(4) Al(OH)$_3$
(A) 1 & 3
(B) 2 & 3
(C) 1 & 4
(D) 2 & 4

7. Highly dilute solution of sodium in liquid ammonia:
(i) Shows blue colour
(ii) Exhibits electrical conductive
(iii) Produces sodium amide
(iv) Produces hydrogen gas
(A) (i), (ii), (iii)
(B) (i), (ii)
(C) (iii), (iv)
(D) Only (ii)

8. Which of the following hydrides is not ionic
(A) CaH$_2$
(B) BaH$_2$
(C) SrH$_2$
(D) BeH$_2$

9. The compound(s) formed upon combustion of sodium metal in excess air is (are) [JEE 2009]
(A) Na$_2$O$_2$
(B) Na$_2$O
(C) NaO$_2$
(D) NaOH

ASSERTION & REASON QUESTIONS

   (IIT 2007)
   Because:
   Statement–II: Alkali metals in liquid ammonia give solvated species of the type [M(NH$_3$)$_n$]$^+$ (M = alkali metals)
**SUBJECTIVE QUESTIONS**

1. Identify the following:

\[ \text{Na}_2\text{CO}_3 \xrightarrow{\text{SO}_2} A \quad \text{Na}_2\text{CO}_3 \xrightarrow{\text{Elemental S}} B \quad \text{I}_2 \xrightarrow{\text{C}} D \]

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 salts 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 \( \text{NH}_3\text{OH} \) in the presence of \( \text{NH}_4\text{Cl} \).

**PREVIOUS YEARS QUESTIONS**

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- **Assertion - Reason Questions**

1. B

- **Subjective Questions**

1. A = NaHSO\(_3\), Oxidation state of S = + 4
   
   B = Na\(_2\)SO\(_3\), Oxidation state of S = + 4
   
   C = Na\(_2\)S\(_2\)O\(_3\), Oxidation state of S = + 6 & - 2
   
   D = Na\(_2\)S\(_4\)O\(_6\), Oxidation state of S = + 5 & 0

2. \( \text{BeCl}_2 \) is a salt of weak base \( \text{Be(OH)}_2 \) and strong acid HCl and thus undergoes hydrolysis to result in an acidic solution in water.

\[ \text{BeCl}_2 + 4\text{H}_2\text{O} \xrightarrow{\text{Hydration}} [\text{Be(H}_2\text{O)}_4]^{2+} + 2\text{Cl}^- \]

3. Alkaline earth metals have smaller size and more nuclear charge.

4. \( \text{SrSO}_4 > \text{CaSO}_4 > \text{MgSO}_4 > \text{BeSO}_4 \)

5. \( (\text{CH}_3\text{COO})_2\text{Ca} \) shows exothermic dissolution whereas \( \text{Pb(NO}_3)_2 \) show endothermic dissolution.

6. The dissociation of \( \text{NH}_3\text{OH} \) (a weak electrolyte) is suppressed in presence of \( \text{NH}_4\text{Cl} \) due to common ion effect. Thus, [OH\(^-\)] in solution becomes low. The ionic product of concentrations of Mg\(^{2+}\) and OH\(^-\) ions does not exceed the solubility product of Mg(OH\(_2\)) and thus Mg(OH\(_2\)) is not precipitated.