

## s-Block Elements

### JEE (Main) Exercises

#### Single Correct Answer Type

- Electrolysis of fused NaCl will give:
  - Na
  - NaOH
  - NaClO
  - NaClO<sub>3</sub>
- Chile saltpetre is the ore of:
  - Iodine
  - Bromine
  - Sodium
  - Magnesium
- In view of their low ionization energies, the alkali metals are:
  - Weak oxidizing agents
  - Strong reducing agents
  - Strong oxidizing agents
  - Weak reducing agents
- Which of the following has lowest melting point?
  - Li
  - Na
  - K
  - Cs
- Smallest among these species is:
  - Hydrogen
  - Helium
  - Lithium
  - Lithium ion
- Which one of the following electrolytes used in Down's process of extracting sodium metal?
  - NaCl + KCl + KF
  - NaCl
  - NaOH + KCl + KF
  - NaCl + NaOH
- Shine at freshly cut sodium is because of:
  - Due to oscillations of free electrons
  - Due to weak metallic bonding
  - Due to absorption of light in crystal lattice
  - Due to the presence of free valency at the surface
- The solubility of alkali metal hydroxides follows the order:
  - LiOH < NaOH < KOH < RbOH < CsOH
  - LiOH > NaOH > KOH > RbOH < CsOH
  - LiOH > CsOH > RbOH > NaOH > KOH
  - None of these
- Which of the following carbonate(s) decompose readily?
  - Li<sub>2</sub>CO<sub>3</sub>
  - Na<sub>2</sub>CO<sub>3</sub>
  - K<sub>2</sub>CO<sub>3</sub>
  - Rb<sub>2</sub>CO<sub>3</sub>
- The sequence of ionic mobility in aqueous solution is:
  - Rb<sup>+</sup> > K<sup>+</sup> > Cs<sup>+</sup> > Na<sup>+</sup>
  - Na<sup>+</sup> > K<sup>+</sup> > Rb<sup>+</sup> > Cs<sup>+</sup>
  - K<sup>+</sup> > Na<sup>+</sup> > Rb<sup>+</sup> > Cs<sup>+</sup>
  - Cs<sup>+</sup> > Rb<sup>+</sup> > K<sup>+</sup> > Na<sup>+</sup>
- Sodium peroxide which is a yellow solid, when exposed to air becomes white due to formation of:
  - H<sub>2</sub>O<sub>2</sub>
  - Na<sub>2</sub>O
  - Na<sub>2</sub>O and O<sub>3</sub>
  - NaOH and Na<sub>2</sub>CO<sub>3</sub>
- Among the alkali metals Cs is the most reactive because:
  - Its incomplete shell is nearest to the nucleus
  - It has a single electron in the valence shell
  - It is the heaviest alkali metal
  - Its outermost electron is more loosely bound than the outermost electron of the other alkali metals



13. Sodium hydride (NaH) when dissolved in water produces:  
 (a) Acidic solution (b) Basic solution  
 (c) Neutral solution (d) Cannot be predicted
14. The correct order of stability for the following super-oxides is:  
 (a)  $\text{KO}_2 > \text{RbO}_2 > \text{CsO}_2$  (b)  $\text{RbO}_2 > \text{CsO}_2 > \text{KO}_2$   
 (c)  $\text{CsO}_2 > \text{RbO}_2 > \text{KO}_2$  (d)  $\text{KO}_2 > \text{CsO}_2 > \text{RbO}_2$
15. In the case of alkali metals, the covalent character decreases in the order:  
 (a)  $\text{MF} > \text{MCl} > \text{MBr} > \text{MI}$   
 (b)  $\text{MF} > \text{MCl} > \text{MI} > \text{MBr}$   
 (c)  $\text{MI} > \text{MBr} > \text{MCl} > \text{MF}$   
 (d)  $\text{MCl} > \text{MI} > \text{MBr} > \text{MF}$
16. The oxide of an element whose electronic configuration is  $1s^2 2s^2 2p^6 3s^1$  is:  
 (a) Amphoteric (b) Basic  
 (c) Acidic (d) Neutral
17. The characteristic not related to alkali metals is:  
 (a) Their ions are isoelectronic with noble gases  
 (b) Metallic character  
 (c) Low electronegativity (d) High ionization energy
18. The electronic configuration of the outermost orbit in the case of alkaline earth metals is:  
 (a)  $ns^2$  (b)  $ns^2 np^1$   
 (c)  $ns^1$  (d)  $ns^2 np^4$
19. Plaster of Paris is:  
 (a)  $\text{CaSO}_4$  (b)  $\text{CaSO}_4 \cdot \text{H}_2\text{O}$   
 (c)  $2\text{CaSO}_4 \cdot \text{H}_2\text{O}$  (d)  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
20. The following compounds have been arranged in order of their increasing thermal stabilities. Identify the correct order:  
 $\text{K}_2\text{CO}_3$  (I),  $\text{MgCO}_3$  (II),  $\text{CaCO}_3$  (III),  $\text{BeCO}_3$  (IV)  
 (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)  $\text{II} < \text{IV} < \text{III} < \text{I}$
21. Silica reacts with magnesium to form a magnesium compound X. X reacts with dilute HCl and forms Y. Y is:  
 (a) MgO (b)  $\text{MgSiO}_3$   
 (c)  $\text{SiCl}_4$  (d)  $\text{MgCl}_2$
22. Among the following hydroxides, the one which has the lowest value of  $K_{sp}$  at ordinary temperature is:  
 (a)  $\text{Mg(OH)}_2$  (b)  $\text{Ca(OH)}_2$   
 (c)  $\text{Ba(OH)}_2$  (d)  $\text{Be(OH)}_2$
23. The first ionization potentials (eV) of Be and B respectively are:  
 (a) 8.29, 9.32 (b) 9.32, 9.32  
 (c) 8.29, 8.29 (d) 9.32, 8.29
24. Among the alkaline earth metals, the element forming predominantly covalent compound is:  
 (a) Ba (b) Sr  
 (c) Ca (d) Be
25. Chemical A is used for water softening to remove temporary hardness. A reacts with  $\text{Na}_2\text{CO}_3$  to generate caustic soda. When  $\text{CO}_2$  is bubbled through A, it turns cloudy. What is the chemical formula of A?  
 (a)  $\text{CaCO}_3$  (b) CaO  
 (c)  $\text{Ca(OH)}_2$  (d)  $\text{Ca(HCO}_3)_2$
26. The set representing the correct order of the first ionization potential is:  
 (a)  $\text{K} > \text{Na} > \text{Li}$  (b)  $\text{Be} > \text{Mg} > \text{Ca}$   
 (c)  $\text{B} > \text{C} > \text{N}$  (d)  $\text{Ge} > \text{Si} > \text{C}$
27. Aluminium is not present in which of the following minerals?  
 (a) Cryolite (b) Mica  
 (c) Feldspar (d) Fluorspar
28. A solution of sodium metal in liquid ammonia is strongly reducing due to the presence of:  
 (a) Sodium hydride (b) Sodium amide  
 (c) Sodium (d) Solvated electrons
29. The compound insoluble in acetic acid is:  
 (a) Calcium oxide (b) Calcium carbonate  
 (c) Calcium oxalate (d) Calcium hydroxide
30. KOH is preferably used to absorb  $\text{CO}_2$  gas because:  
 (a)  $\text{KHCO}_3$  is soluble in water and  $\text{NaHCO}_3$  is sparingly soluble in water  
 (b) KOH is cheaper than NaOH  
 (c) KOH is more soluble than NaOH in water  
 (d) KOH is stronger base than NaOH
31. Which of the following is correct statement?  
 (I)  $\text{Ca}^{2+}$  ions are important in blood clotting  
 (II)  $\text{Ca}_3(\text{PO}_4)_2$  is a part of bones  
 (III)  $3\text{Ca}_3(\text{PO}_4)_2 \cdot \text{CaF}_2$  is a part of enamel of teeth  
 (a) (I) and (II) (b) (II) and (III)  
 (c) (I) and (III) (d) (I), (II), and (III)
32. Consider the following statements:  
 (I)  $\text{Cs}^+$  ion is more highly hydrated than other alkali metal ions.  
 (II) Among the alkali metals Li, Na, K, and Rb, Li has the higher melting point.  
 (III) Among the alkali metals, only Li forms a stable nitride by direct combination.  
 (a) (I) and (III) are correct



- (b) (II) and (III) are correct  
 (c) (I), (II), and (III) are correct  
 (d) (I) and (II) are correct
33. Which of the following changes occurs when excess of  $\text{CO}_2$  gas is passed into a clear solution of lime water?  
 (a) A white precipitate containing both  $\text{CaCO}_3$  and  $\text{Ca}(\text{HCO}_3)_2$  is formed  
 (b) Initially a white precipitate of  $\text{CaCO}_3$  is formed which changes into soluble  $\text{Ca}(\text{HCO}_3)_2$  on passing excess  $\text{CO}_2$  gas  
 (c) A white precipitate of  $\text{Ca}(\text{HCO}_3)_2$  is formed  
 (d) A white precipitate of  $\text{CaCO}_3$  is formed
34. In the following sequence of reactions. Identify (E):  
 $\text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2 \longrightarrow (A) \xrightarrow{\Delta, \text{ZnCl}_2} (B)$   
 $\xrightarrow{\Delta} (C) + (D) \uparrow \xrightarrow{\text{NaOH}} (E)$   
 (a)  $\text{NaHCO}_3$  (b)  $\text{Na}_2\text{O}_2$   
 (c)  $\text{Na}_2\text{ZnO}_2$  (d)  $\text{ZnCO}_3$
35. The decomposition temperatures of alkaline earth metal carbonates are given below:  
 $\text{BeCO}_3$   $\text{MgCO}_3$   $\text{CaCO}_3$   $\text{SrCO}_3$   $\text{BaCO}_3$   
 $< 100^\circ\text{C}$   $< \dots\dots$   $< 900^\circ\text{C}$   $< \dots\dots$   $< 1300^\circ\text{C}$   
 The decomposition temperatures of  $\text{MgCO}_3$  and  $\text{SrCO}_3$  are respectively:  
 (a)  $1290^\circ\text{C}$ ,  $1200^\circ\text{C}$  (b)  $1290^\circ\text{C}$ ,  $540^\circ\text{C}$   
 (c)  $540^\circ\text{C}$ ,  $1290^\circ\text{C}$  (d)  $540^\circ\text{C}$ ,  $800^\circ\text{C}$
36. Aluminium is more reactive than iron because its standard reduction potential is higher. Still aluminium is less easily corroded than iron because:  
 (a) Al reacts with atmospheric carbon dioxide to form a self-protective layer of  $\text{Al}_2\text{O}_3$   
 (b) It has higher reducing power and forms a self-protective layer of  $\text{Al}_2\text{O}_3$   
 (c) It has higher reducing power and does not react with oxygen so easily  
 (d) Both (a) and (b)
37. Which one of the following statements is true for all the alkali metals?  
 (a) Their nitrates decompose on heating to give  $\text{NO}_2$  and  $\text{O}_2$   
 (b) Their carbonates decompose on heating to give  $\text{CO}_2$  and normal oxide  
 (c) They react with halogens to give the halides of the type,  $\text{MX}$   
 (d) They react with oxygen to give mainly the oxide,  $\text{M}_2\text{O}$
38. Select correct statement:  
 (a) Oxides ( $\text{M}_2\text{O}$ ) and peroxides ( $\text{M}_2\text{O}_2$ ) of alkali metals are diamagnetic and colorless  
 (b) Superoxides ( $\text{MO}_2$ ) of alkali metals are paramagnetic  
 (c) Li and Na do not form superoxides  
 (d) All are correct
39. Which of the following salts does not form any precipitate with excess of  $\text{NaOH}$ ?  
 (a)  $\text{ZnCl}_2$  (b)  $\text{FeCl}_3$   
 (c)  $\text{CrCl}_3$  (d)  $\text{CuSO}_4$
40. Which of the following is best  $\text{CO}_2$  absorber as well as source of  $\text{O}_2$  in space capsule?  
 (a)  $\text{KO}_2$  (b)  $\text{K}_2\text{O}_2$   
 (c)  $\text{KOH}$  (d)  $\text{LiOH}$
41. The aqueous solutions of lithium salts are poor conductor of electricity rather than other alkali metals because of:  
 (a) High ionization energy  
 (b) High electronegativity  
 (c) Lower ability of  $\text{Li}^+$  ions to polarize water molecules  
 (d) Higher degree of hydration of  $\text{Li}^+$  ions
42. A soft metal (A) gives violet flame test. When burnt in excess  $\text{O}_2$ , (A) gives chrome yellow powder (B) which on reaction with water gives alkaline solution C and  $\text{O}_2$ . Identify A and B:  
 (a) Na,  $\text{Na}_2\text{O}_2$  (b) K,  $\text{K}_2\text{O}_2$   
 (c) K,  $\text{KO}_2$  (d) Li,  $\text{Li}_2\text{O}_2$
43. (X), (Y), (Z) are elements in the third period. Oxide of (X) is ionic, that of (Y) is amphoteric, and of (Z) a giant molecule. (X), (Y) and (Z) will have atomic numbers in the order:  
 (a)  $(X) < (Y) < (Z)$  (b)  $(Z) < (Y) < (X)$   
 (c)  $(X) < (Z) < (Y)$  (d)  $(Y) < (X) < (Z)$
44. The inside surface of glass bottle containing caustic soda becomes dull because:  
 (a) Silica is present in glass. It does not dissolve in  $\text{NaOH}$  and hence forms soluble sodium silicate and thus inside surface becomes dull  
 (b) Silica is present in glass. It dissolves in  $\text{NaOH}$  slowly and forms soluble sodium silicate and thus inside surface becomes dull  
 (c) Both (a) and (b)  
 (d) None of the above
45. Potash alum is represented by the formula:  
 (a)  $\text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$



- (b)  $K \cdot Al(SO_4)_2 \cdot 12 H_2O$   
 (c) Both (a) and (b)  
 (d) None of these
46. Among of alkali metals, the metal with highest ionization potential is:  
 (a) Li (b) Na  
 (c) K (d) Rb
47. What is the oxidation state of K in  $KO_2$ ?  
 (a) -1 (b) -2  
 (c) +1 (d) Zero
48. A metal from period IV is added to water and a vigorous reaction takes place with the evolution of a gas. Which statements are correct?  
 1. Oxygen is evolved.  
 2. Hydrogen is evolved.  
 3. The resulting solution is acidic.  
 4. The resulting solution is basic.  
 (a) 1 and 3 only (b) 2 and 3 only  
 (c) 2 and 4 only (d) 1 and 4 only
49. A solution of sodium metal in liquid ammonia is strongly reducing due to the presence of:  
 (a) Sodium atoms (b) Sodium hydride  
 (c) Sodium amide (d) Solvated electrons
50. Sodium reacts with water more vigorously than lithium because it:  
 (a) Has higher atomic weight  
 (b) Is a metal  
 (c) Is more electropositive  
 (d) More electronegative
51. The hydration energy of  $Mg^{2+}$  is greater than that of:  
 (a)  $Al^{3+}$  (b)  $Na^+$   
 (c)  $Be^{2+}$  (d)  $Mg^{3+}$
52. Among  $KO_2$ ,  $AlO_2^-$ ,  $BaO_2$ , and  $NO_2^+$  unpaired electron is present in:  
 (a)  $NO_2^+$  and  $BaO_2$  (b)  $KO_2$  and  $AlO_2^-$   
 (c)  $KO_2$  only (d)  $BaO_2$  only
53. 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 metal  $M$  is:  
 (a) Be (b) Mg  
 (c) Ca (d) Sr
54. The paramagnetic species is:  
 (a)  $KO_2$  (b)  $SiO_2$   
 (c)  $TiO_2$  (d)  $BaO_2$
55. On dissolving moderate amount of sodium metal in liquid  $NH_3$  at low temperature, which one of the following does not occur?  
 (a) Blue colored solution is obtained  
 (b)  $Na^+$  ions reformed in the solution  
 (c) Liquid ammonia becomes good conductor of electricity  
 (d) Liquid ammonia remains diamagnetic
56.  $Na_2S_2O_3 \cdot 5H_2O$  is used in photography to:  
 (a) Reduce  $AgBr$  to metallic  $Ag$   
 (b) Remove reduced  $Ag$   
 (c) Remove undecomposed  $AgBr$  as a soluble complex  
 (d) Convert metallic  $Ag$  to silver salt
57. Among  $LiCl$ ,  $RbCl$ ,  $BeCl_2$ , and  $MgCl_2$  the compounds with greatest and least ionic character, respectively are:  
 (a)  $LiCl$ ,  $RbCl$  (b)  $RbCl$ ,  $BeCl_2$   
 (c)  $RbCl$ ,  $MgCl_2$  (d)  $MgCl_2$ ,  $BeCl_2$
58. Thermal stability of hydrides of first group elements follows the order:  
 (a)  $LiH > NaH > KH > RbH$   
 (b)  $LiH > KH > NaH > RbH$   
 (c)  $LiH > RbH > KH > NaH$   
 (d)  $LiH > KH > RbH > NaH$
59. When sodium is treated with sufficient oxygen/air, the product obtained is:  
 (a)  $Na_2O$  (b)  $Na_2O_2$   
 (c)  $NaO_2$  (d)  $NaO$
60.  $KO_2$  (potassium superoxide) is used in oxygen cylinders in space and submarines because it:  
 (a) Decomposes to give oxygen  
 (b) Eliminates moisture  
 (c) Absorbs  $CO_2$   
 (d) Produces ozone
61. The magnetic moment of  $KO_2$  at room temperature is ..... B.M.  
 (a) 1.41 (b) 1.73  
 (c) 2.23 (d) 2.64
62. The reaction that takes place when  $Cl_2$  gas is passed through conc.  $NaOH$  solution is:  
 (a) Oxidation (b) Reduction  
 (c) Displacement (d) Disproportionation
63. Calcium is extracted by the electrolysis of:  
 (a) Fused mixture of  $CaCl_2$  and  $CaF_2$   
 (b)  $CaCl_2$  solution  
 (c) Fused mixture of  $CaCl_2$  and  $NaF$   
 (d)  $Ca_3(PO_4)_2$  solution



## JEE (Advanced) Exercises

## Single Correct Answer Type

- When  $\text{CaC}_2$  is heated in atmospheric nitrogen in an electric furnace, the compound formed is:
  - $\text{Ca}(\text{CN})_2$
  - $\text{CaNCN}$
  - $\text{Ca}_3\text{N}_2$
  - $\text{CaNC}_2$
- Which of the following represents calcium chlorite?
  - $\text{CaClO}_2$
  - $\text{Ca}(\text{ClO}_4)_2$
  - $\text{Ca}(\text{ClO}_3)_2$
  - $\text{Ca}(\text{ClO}_2)_2$
- The most electropositive element among the alkaline earth metals is:
  - Be
  - Mg
  - Ca
  - Ba
- The right order of the solubility of sulphates of alkaline earth metals is:
  - $\text{Be} > \text{Ca} > \text{Mg} > \text{Ba} > \text{Sr}$
  - $\text{Mg} > \text{Be} > \text{Ba} > \text{Ca} > \text{Sr}$
  - $\text{Be} > \text{Mg} > \text{Ca} > \text{Sr} > \text{Ba}$
  - $\text{Mg} > \text{Ca} > \text{Ba} > \text{Be} > \text{Sr}$
- The compound which is insoluble in dil. HCl is:
  - MnS
  - ZnS
  - $\text{BaCO}_3$
  - $\text{BaSO}_4$
- The first ionization energies of alkaline earth metals are higher than those of the alkali metals. This is because:
  - There is increase in the nuclear charge of the alkaline earth metal
  - There is decrease in the nuclear charge of the alkaline earth metal
  - There is no change in the nuclear charge
  - None of the above
- Which of the following has maximum ionization energy?
  - $\text{Ba} \longrightarrow \text{Ba}^+ + e^-$
  - $\text{Be} \longrightarrow \text{Be}^+ + e^-$
  - $\text{Ca} \longrightarrow \text{Ca}^{2+} + 2e^-$
  - $\text{Mg} \longrightarrow \text{Mg}^{2+} + 2e^-$
- As the alkaline earth metals (except Be) tend to lose their valence electrons readily. They act as:
  - Weak oxidizing agents
  - Weak reducing agents
  - Strong oxidizing agents
  - Strong reducing agents
- The reaction of  $\text{Cl}_2$  with  $X$  gives bleaching powder.  $X$  is:
  - CaO
  - $\text{Ca}(\text{OH})_2$
  - $\text{Ca}(\text{OCl}_2)$
  - $\text{Ca}(\text{ClO}_3)_2$
- Which of the following carbides produces propyne on reaction with water?
  - $\text{CaC}_2$
  - $\text{Be}_2\text{C}$
  - $\text{Al}_4\text{C}_3$
  - $\text{Mg}_2\text{C}_3$
- $\text{KO}_2$  (potassium superoxide) is used in oxygen cylinders in space and submarines because it:
  - Produces ozone
  - Absorbs  $\text{CO}_2$
  - Absorbs  $\text{CO}_2$  and increase  $\text{O}_2$  contents
  - Eliminates moisture
- Which of the following compounds transforms baking soda into baking powder?
  - $\text{KHCO}_3$
  - $\text{NaHCO}_3$
  - $\text{KHC}_4\text{H}_4\text{O}_6$
  - KCl
- Baking powder used to make cake is a mixture of starch,  $\text{NaHCO}_3$ , and  $\text{Ca}(\text{H}_2\text{PO}_4)_2$ . The function of  $\text{Ca}(\text{H}_2\text{PO}_4)_2$  is:
  - Being acidic in nature and gives  $\text{CO}_2$  when moistened with  $\text{NaHCO}_3$
  - To slow down the release of  $\text{CO}_2$  gas
  - To act as a filler
  - None of these
- The alkali metals form salt-like hydrides by the direct synthesis at elevated temperature. The thermal stability of these hydrides decreases in which of the following orders?
  - $\text{NaH} > \text{LiH} > \text{KH} > \text{RbH} > \text{CsH}$
  - $\text{LiH} > \text{NaH} > \text{KH} > \text{RbH} > \text{CsH}$
  - $\text{CsH} > \text{RbH} > \text{KH} > \text{NaH} > \text{LiH}$
  - $\text{KH} > \text{NaH} > \text{LiH} > \text{CsH} > \text{RbH}$
- Which one of the following reactions is not associated with the Solvay process of manufacture of sodium carbonate?
  - $\text{NaCl} + \text{NH}_4\text{HCO}_3 \longrightarrow \text{NaHCO}_3 + \text{NH}_4\text{Cl}$
  - $2\text{NaOH} + \text{CO}_2 \longrightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O}$
  - $2\text{NaHCO}_3 \longrightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$
  - $\text{NH}_3 + \text{H}_2\text{CO}_3 \longrightarrow \text{NH}_4\text{HCO}_3$
- In the following reactions, (X) and (Y) are respectively:
 
$$\text{BaC}_2 + \text{N}_2 \xrightarrow{\Delta} (\text{X}) \quad \text{CaC}_2 + \text{N}_2 \xrightarrow{\Delta} (\text{Y})$$
  - $\text{Na}(\text{CN})_2$  and  $\text{Ca}(\text{CN})_2$
  - $\text{Ba}(\text{CN})_2$  and  $\text{CaCN}_2$
  - $\text{BaCN}_2$  and  $\text{CaCN}_2$
  - None of these
- In the reaction:  $\text{K}_4[\text{Fe}(\text{CN})_6] + \text{K}_2\text{CO}_3 \longrightarrow$  the product formed is:
  - $\text{FeCO}_3$
  - KCN
  - $\text{KFeCO}_3$
  - $\text{K}_3[\text{Fe}(\text{CN})_6]$



18.  $\text{CO}_2 + \text{NH}_3 + \text{H}_2\text{O} \longrightarrow X$   
 $X + \text{NaCl} \longrightarrow Y + \text{NH}_4\text{Cl}$   
 $2Y \longrightarrow Z + \text{H}_2\text{O} + \text{CO}_2$ . 'Z' is:  
 (a)  $\text{Na}_2\text{CO}_3$  (b)  $(\text{NH}_4)_2\text{CO}_3$   
 (c)  $\text{NH}_4\text{HCO}_3$  (d)  $\text{NaHCO}_3$
19. The aqueous solution of an inorganic compound (X) gives white precipitate with  $\text{NH}_4\text{OH}$  which does not dissolve in excess of  $\text{NH}_4\text{OH}$ . This aqueous solution also gives white precipitate with  $\text{AgNO}_3$  and the precipitate is soluble in dilute  $\text{HNO}_3$ . Here, (X) is:  
 (a)  $\text{AlCl}_3$  (b)  $\text{AlBr}_3$   
 (c)  $\text{AlN}$  (d)  $\text{Al}_2(\text{SO}_4)_3$
20. A compound (X) imparts a golden yellow flame and shows the following reactions:  
 Zn powder when boiled with a concentrated aqueous solution of (X) dissolves and  $\text{H}_2$  is evolved. What is X?  
 (a)  $\text{KOH}$  (b)  $\text{NaOH}$   
 (c)  $\text{Mg}(\text{OH})_2$  (d)  $\text{Ca}(\text{OH})_2$
21. For two ionic solids  $\text{CaO}$  and  $\text{KI}$ , identify the wrong statement among the following?  
 (a) Lattice energy of  $\text{CaO}$  is much higher than that of  $\text{KI}$   
 (b)  $\text{KI}$  is soluble in benzene  
 (c)  $\text{CaO}$  has high m.pt.  
 (d)  $\text{KI}$  has high m.pt.
22. Photoelectric effect is maximum in:  
 (a)  $\text{Cs}$  (b)  $\text{Na}$   
 (c)  $\text{K}$  (d)  $\text{Li}$
23. Which of the following metals has most stable carbonate?  
 (a)  $\text{Na}$  (b)  $\text{Mg}$   
 (c)  $\text{Al}$  (d)  $\text{Si}$
24. A sodium salt of unknown anion when treated with  $\text{MgCl}_2$  gives white precipitate only on boiling. The anion is:  
 (a)  $\text{SO}_4^{2-}$  (b)  $\text{HCO}_3^-$   
 (c)  $\text{CO}_3^{2-}$  (d)  $\text{NO}_3^-$
25. A solid compound 'X' on heating gives  $\text{CO}_2$  gas and a residue. The residue mixed with water forms 'Y'. On passing an excess of  $\text{CO}_2$  through 'Y' in water, a clear solution 'Z' is obtained. On boiling 'Z', compound 'X' is reformed. The compound 'X' is:  
 (a)  $\text{Ca}(\text{HCO}_3)_2$  (b)  $\text{CaCO}_3$   
 (c)  $\text{Na}_2\text{CO}_3$  (d)  $\text{K}_2\text{CO}_3$
26. One mole of magnesium nitride on reaction with an excess of water gives:  
 (a) One mole of ammonia  
 (b) One mole of nitric acid  
 (c) Two moles of ammonia  
 (d) Two moles of nitric acid
27. In certain matters, lithium differs from other alkali metals; the main reason for this is:  
 (a) Small size of lithium atom and  $\text{Li}^+$   
 (b) Extremely high electropositivity of  $\text{Li}$   
 (c) Greater hardness of  $\text{Li}$   
 (d) Hydration of  $\text{Li}^+$  ion
28. The stability of the following alkali metal chlorides follows the order:  
 (a)  $\text{LiCl} > \text{KCl} > \text{NaCl} > \text{CsCl}$   
 (b)  $\text{CsCl} > \text{KCl} > \text{NaCl} > \text{LiCl}$   
 (c)  $\text{NaCl} > \text{KCl} > \text{LiCl} > \text{CsCl}$   
 (d)  $\text{LiCl} > \text{NaCl} > \text{KCl} > \text{CsCl}$
29. Which of the following has the highest melting point?  
 (a)  $\text{NaCl}$  (b)  $\text{NaF}$   
 (c)  $\text{NaBr}$  (d)  $\text{NaI}$
30. Oxone is:  
 (a)  $\text{CaO}$  (b)  $\text{N}_2\text{O}$   
 (c)  $\text{Na}_2\text{O}_2$  (d)  $\text{NaBO}_3$
31. Which of the following has the least ionization potential among these metals?  
 (a)  $\text{Li}$  (b)  $\text{He}$   
 (c)  $\text{N}$  (d)  $\text{Zn}$
32. Sodium carbonate on heating gives:  
 (a)  $\text{CO}_2$  (b) Water vapors  
 (c) Carbon dioxide + water vapor  
 (d) None of these
33. The sodium is made by electrolysis of a molten mixture of 40%  $\text{NaCl}$  and 60%  $\text{CaCl}_2$  because:  
 (a)  $\text{CaCl}_2$  helps in the conduction of electricity  
 (b)  $\text{Ca}^{2+}$  can reduce  $\text{NaCl}$  to  $\text{Na}$   
 (c)  $\text{Ca}^{2+}$  can displace  $\text{Na}$  from  $\text{NaCl}$   
 (d) This mixture has a lower melting point than  $\text{NaCl}$
34. A chloride dissolves appreciably in cold water. When placed on a platinum wire in Bunsen flame, no distinctive color is noticed. Which one is cation?  
 (a)  $\text{Mg}^{2+}$  (b)  $\text{Ba}^{2+}$   
 (c)  $\text{Na}^+$  (d)  $\text{Ca}^{2+}$



35. Alkaline earth metal salt are:  
 (a) Paramagnetic (b) Diamagnetic  
 (c) Ferromagnetic (d) All of these
36. Halides of alkaline earth metals from hydrates such as  $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ ,  $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$ ,  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ , and  $\text{SrCl}_2 \cdot 2\text{H}_2\text{O}$ . This shows that halides of group II elements:  
 (a) Are hygroscopic in nature  
 (b) Act as dehydrating agents  
 (c) Can absorb moisture from air  
 (d) Cannot absorb moisture from air
37. Which of the following gives propyne on hydrolysis?  
 (a)  $\text{Al}_4\text{C}_3$  (b)  $\text{Mg}_2\text{C}_3$   
 (c)  $\text{B}_4\text{C}$  (d)  $\text{La}_4\text{C}_3$
38. A metal X on heating in nitrogen gas gives Y. Y on treatment with  $\text{H}_2\text{O}$  gives a colorless gas which when passed through  $\text{CuSO}_4$  solution gives a blue color. Y is:  
 (a)  $\text{Mg}(\text{NO}_3)_2$  (b)  $\text{Mg}_3\text{N}_2$   
 (c)  $\text{NH}_3$  (d)  $\text{MgO}$
39. As the nuclear charge increases from neon to calcium, the orbital energies:  
 (a) Increase (b) Increase very rapidly  
 (c) Increase very slowly (d) Fall
40. Ripening of fruits can be carried out in the presence of:  
 (a)  $\text{Na}_2\text{SO}_4$  (b)  $\text{NaCl}$   
 (c)  $\text{CaCl}_2$  (d)  $\text{CaC}_2$
41. What are the products formed when an aqueous solution of magnesium bicarbonate is boiled?  
 (a)  $\text{MgCO}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{CO}_2$  (b)  $\text{Mg}(\text{HCO}_3)_2$ ,  $\text{H}_2\text{O}$   
 (c)  $\text{Mg}(\text{OH})_2$ ,  $\text{H}_2\text{O}$  (d)  $\text{Mg}(\text{HO})_2$ ,  $\text{CO}_2$
42. The substance not likely to contain  $\text{CaCO}_3$  is:  
 (a) Dolomite (b) Sea shell  
 (c) Calcined gypsum (d) Marble statue
43. Bleaching powder is obtained by treating  $\text{Cl}_2$  with:  
 (a)  $\text{Ca}(\text{OH})_2$  (b)  $\text{CaO}$   
 (c)  $\text{CaCO}_3$  (d)  $\text{CaCl}_2$
44. Dead burnt plaster is:  
 (a)  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$  (b)  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$   
 (c)  $\text{CaSO}_4 \cdot 1/2 \text{H}_2\text{O}$  (d)  $\text{CaSO}_4$
45. Correct order of stability of group IIA metal carbonates is:  
 (a)  $\text{MgCO}_3 > \text{CaCO}_3 > \text{SrCO}_3 > \text{BaCO}_3$   
 (b)  $\text{BaCO}_3 > \text{SrCO}_3 > \text{CaCO}_3 > \text{MgCO}_3$   
 (c)  $\text{SrCO}_3 > \text{BaCO}_3 > \text{CaCO}_3 > \text{MgCO}_3$   
 (d)  $\text{CaCO}_3 > \text{MgCO}_3 > \text{BaCO}_3 > \text{SrCO}_3$
46. Which of the following carbides produces propyne on reaction with water?  
 (a)  $\text{CaC}_2$  (b)  $\text{Be}_2\text{C}$   
 (c)  $\text{Al}_4\text{C}_3$  (d)  $\text{Mg}_2\text{C}_3$
47. Which one of the following processes will produce hard water?  
 (a) Saturation of water with  $\text{CaCO}_3$   
 (b) Addition of  $\text{Na}_2\text{SO}_4$  to water.  
 (c) Saturation of water with  $\text{MgCO}_3$   
 (d) Saturation of water with  $\text{CaSO}_4$
48. Which of the following statements about anhydrous aluminium chloride is correct?  
 (a) It sublimes at  $100^\circ\text{C}$  under vacuum  
 (b) It exists as  $\text{AlCl}_3$  molecules  
 (c) It is a strong Lewis base  
 (d) It is not easily hydrolyzed
49. The oxidation states of the most electronegative element in the products of the reaction  $\text{BaO}_2$  with dil.  $\text{H}_2\text{SO}_4$  are:  
 (a) 0 and -1 (b) -1 and -2  
 (c) -2 and 0 (d) -2 and +1
50. Calcium imide on hydrolysis gives gas (P) which on oxidation by bleaching powder gives gas (Q). Gas (Q) on reaction with magnesium gives compound (R) which on hydrolysis again gives gas (P). Identify (P), (Q), and (R):  
 (a)  $\text{N}_2$ ,  $\text{NH}_3$ ,  $\text{MgNH}$  (b)  $\text{NH}_3$ ,  $\text{N}_2$ ,  $\text{Mg}_3\text{N}_2$   
 (c)  $\text{NH}_3$ ,  $\text{NO}_2$ ,  $\text{Mg}(\text{NO}_2)_2$  (d)  $\text{N}_2$ ,  $\text{N}_2\text{O}_5$ ,  $\text{Mg}(\text{NO}_3)_2$
51. In the electrolysis of aqueous  $\text{NaCl}$  solution, side reactions taking place are:  
 (I)  $2\text{OH}^- + \text{Cl}_2 \longrightarrow 2\text{OCl}^- + \text{H}_2\text{O}$   
 (II)  $2\text{Na} + 2\text{H}_2\text{O} \longrightarrow 2\text{NaOH} + \text{H}_2$   
 (III)  $4\text{OH}^- \longrightarrow \text{O}_2 + 2\text{H}_2 + 4\text{e}^-$   
 Select the correct alternate:  
 (a) (I) and (III) (b) (II) and (III)  
 (c) (I) and (II) (d) (I), (II), and (III)
52.  $\text{Salt (P)} + \text{(Q)} \longrightarrow \text{(R)} \xrightarrow[\text{White ppt.}]{\text{BaCl}_2}$   
 (P) is paramagnetic in nature and contains about 55% K, so (P) is:  
 (a)  $\text{KO}_2$  (b)  $\text{K}_2\text{O}$   
 (c)  $\text{K}_2\text{SO}_4$  (d)  $\text{K}_2\text{O}_2$
53.  $\text{(P)} + \text{H}_2\text{O} \longrightarrow \text{NaOH}$   
 $\text{(P)} \xrightarrow{\text{O}_2, 400^\circ\text{C}} \text{(Q)} \xrightarrow{\text{H}_2\text{O, at } 25^\circ\text{C}} \text{NaOH} + \text{O}_2$



- (Q) is used for oxygenating in submarine. (P) and (Q) are:
- (a)  $\text{Na}_2\text{O}_2$  and  $\text{O}_2$  (b)  $\text{Na}_2\text{O}$  and  $\text{O}_2$   
 (c)  $\text{Na}_2\text{O}_2$  and  $\text{Na}_2\text{O}$  (d)  $\text{Na}_2\text{O}$  and  $\text{Na}_2\text{O}_2$
54. Which of the following equations is correct?
- (a)  $3\text{LiNO}_3 \xrightarrow{\text{heat}} 2\text{LiNO}_2 + \text{O}_2$   
 (b)  $\text{NaNO}_3 + \text{NaNH}_2 \xrightarrow{80^\circ-90^\circ\text{C}} 2\text{NaOH} + \text{N}_2\text{O}$   
 (c) Potassium formate is heated with free exposure to air.  $2\text{HCOOK} + \text{O}_2 \longrightarrow \text{K}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$   
 (d) Solid  $\text{KBrO}_3$  is heated with powdered charcoal.  $2\text{KBrO}_3 + 3\text{C} \longrightarrow 2\text{KBr} + 3\text{CO}_2$
55. In the reaction:  $\text{Al}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O} \xrightarrow[\text{-18H}_2\text{O}]{\text{heat}} \text{A}$   
 $\xrightarrow{800^\circ\text{C}} \text{B} + \text{C}$ . The product A, B and C are respectively:
- (a)  $\text{Al}_2(\text{SO}_4)_3$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{SO}_3$  (b)  $\text{Al}_2\text{O}_3$ ,  $\text{Al}_2(\text{SO}_4)_3$ ,  $\text{SO}_3$   
 (c)  $\text{Al}_2\text{SO}_4$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{SO}_3$   
 (d)  $\text{Al}_2(\text{SO}_4)_3$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{SO}_2$
56. Which of the following reaction/s are correct here?
- (I)  $\text{B} + \text{NaOH} \longrightarrow 2\text{Na}_3\text{BO}_3 + \text{H}_2$   
 (II)  $\text{P}_4 + \text{NaOH} + \text{H}_2\text{O} \longrightarrow \text{NaH}_2\text{PO}_2 + \text{PH}_3$   
 (III)  $\text{S} + \text{NaOH} \longrightarrow \text{Na}_2\text{S}_2\text{O}_3 + \text{Na}_2\text{S} + \text{H}_2\text{O}$   
 (a) I only (b) III only  
 (c) II and III (d) I, II, and III
57. In the following sequence of reactions, identify the end product (D).
- $\text{Na}_2\text{CO}_3 \xrightarrow{\text{SO}_2} (\text{A}) \xrightarrow{\text{Na}_2\text{CO}_3} (\text{B})$   
 $\xrightarrow{\text{Elemental S, } \Delta} (\text{C}) \xrightarrow{\text{I}_2} (\text{D})$   
 (a)  $\text{Na}_2\text{SO}_4$  (b)  $\text{Na}_2\text{S}_4\text{O}_6$   
 (c)  $\text{Na}_2\text{S}$  (d)  $\text{Na}_2\text{S}_2\text{O}_3$
58. Consider the following reactions:
- $\text{X} + \text{HCl} \xrightarrow[\text{(addition)}]{\text{anhyd. AlCl}_3} \text{C}_2\text{H}_5\text{Cl} \xrightarrow[\text{(substitution)}]{\text{anhyd. ZnCl}_2/\text{HCl}} \text{Y}$   
 Y can be converted to X on heating with ..... at ..... temperature:
- (a) Cu,  $300^\circ\text{C}$  (b)  $\text{Al}_2\text{O}_3$ ,  $350^\circ\text{C}$   
 (c)  $\text{NaOH/I}_2$ ,  $60^\circ\text{C}$  (d)  $\text{Ca(OH)}_2 + \text{CaOCl}_2$ ,  $60^\circ\text{C}$
59. Consider the following reactions:
- I.  $2\text{Na} + 2\text{H}_2\text{O} \longrightarrow 2\text{NaOH} + \text{H}_2$   
 II.  $2\text{NaOH} + \text{Cl}_2 \longrightarrow \text{NaCl} + \text{NaOCl} + \text{H}_2\text{O}$   
 III.  $4\text{OH}^- \longrightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$   
 IV.  $2\text{Cl}^- \longrightarrow \text{Cl}_2 + 2\text{e}^-$
- In the diaphragm cell used for the electrolysis of brine, the reactions that occur would include:
- (a) 2, 3, 4 (b) 1, 3, 4  
 (c) 1, 2, 3 (d) 1, 2, 4
60. A soft metal (A) gives violet flame test. When burnt in  $\text{O}_2$ , (A) gives chrome yellow powder (B) which on reaction with water gives alkaline solution (C) and  $\text{O}_2$ . Identify the metal:
- (a) Na (b) Mg  
 (c) K (d) Ca
61. A hydrated colorless solid (A) is water soluble and finds use in medicine as a purgative. When a solution of (A) is treated with ammonium phosphate, a white precipitate is formed. (A) gives a pink mass-is cobalt nitrate test. What is (A)?
- (a)  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  (b)  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$   
 (c)  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$  (d)  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
62. Select the correct basic character:
- (a)  $\text{NiO} < \text{MgO} < \text{SrO} < \text{K}_2\text{O} < \text{Cs}_2\text{O}$   
 (b)  $\text{NiO} < \text{MgO} < \text{K}_2\text{O} < \text{BrO} < \text{Cs}_2\text{O}$   
 (c)  $\text{MgO} < \text{NiO} < \text{SrO} < \text{K}_2\text{O} < \text{Cs}_2\text{O}$   
 (d)  $\text{SrO} < \text{NiO} < \text{MgO} < \text{K}_2\text{O} < \text{Cs}_2\text{O}$
63. Calcium is obtained by the:
- (a) Roasting of limestone  
 (b) Electrolysis of a solution of calcium chloride in  $\text{H}_2\text{O}$   
 (c) Reduction of calcium chloride with carbon  
 (d) Electrolysis of molten anhydrous calcium chloride

### Multiple Correct Answers Type

1. 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
2. Be and Al have following resemblance due to diagonal relationship:
- (a) Have nearly equal electronegativity  
 (b) Form amphoteric oxides  
 (c) Have same charge/radius ratio  
 (d) Both form dimeric halides
3. The correct statement(s) is/are:
- (a)  $\text{BeCl}_2$  is a covalent compound  
 (b)  $\text{BeCl}_2$  can form dimer  
 (c)  $\text{BeCl}_2$  is an electron deficient molecule  
 (d) The hybrid state of Be in  $\text{BeCl}_2$  is  $sp^2$



4. Among the following, the diamagnetic compound is/are:
  - (a)  $\text{Na}_2\text{O}_2$  (b)  $\text{O}_3$
  - (c)  $\text{N}_2\text{O}$  (d)  $\text{KO}_2$
5. The carbonate that will decompose on heating is/are:
  - (a)  $\text{Na}_2\text{CO}_3$  (b)  $\text{CaCO}_3$
  - (c)  $\text{BaCO}_3$  (d)  $\text{SrCO}_3$
6. Highly pure dilute solution of sodium in liquid ammonia:
  - (a) Shows blue color
  - (b) Exhibits electrical conductivity
  - (c) Produces sodium amide
  - (d) Produces hydrogen gas
7. Identify the incorrect statement:
  - (a) Gypsum contains a lower percentage of calcium than Plaster of Paris
  - (b) Gypsum is obtained by heating Plaster of Paris
  - (c) Plaster of Paris is obtained by hydration of gypsum
  - (d) Plaster of Paris is obtained by partial oxidation of gypsum
8. Which one of the following processes is/are not used for the manufacture of calcium?
  - (a) Reduction of  $\text{CaO}$  with carbon
  - (b) Reduction of  $\text{CaO}$  with hydrogen
  - (c) Electrolysis of a mixture of anhydrous  $\text{CaCl}_2$
  - (d) Electrolysis of molten  $\text{Ca(OH)}_2$
9. Select the incorrect statement(s):
  - (a) Lattice energy  $\propto \frac{1}{r^2}$ , {where  $r$  is the interionic distance}
  - (b) Lattice energy  $\propto q_1 q_2$ , {where  $q_1$  and  $q_2$  are the charges of co-ions}
  - (c) Ionic mobility of the ions in aqueous state  $\propto \frac{1}{\text{radius of ions in gaseous state}}$
  - (d) Heat of formation of a compound depends on the number of steps involved in its formation reaction
10. Which of the following is/are amphoteric oxide?
  - (a)  $\text{BeO}$  (b)  $\text{BaO}$
  - (c)  $\text{Al}_2\text{O}_3$  (d)  $\text{CaO}$
11. 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
12. Select the correct statement(s) about barium:
  - (a) It shows photoelectric effect
  - (b) It is silvery white metal
  - (c) It forms  $\text{Ba(NO}_3)_2$  which is used in preparation of green fire
  - (d) Its ionization energy is less than radium
13. Mg and Zn have following resemblance:
  - (a)  $\text{MgO}$  and  $\text{ZnO}$  are amphoteric
  - (b)  $\text{MgCO}_3$  and  $\text{ZnCO}_3$  both on heating give corresponding oxide
  - (c) Both are d-block elements
  - (d) Both are used to prevent corrosion
14. When dissolving moderate amount of sodium metal in liquid  $\text{NH}_3$  at low temperature, which one of the following does occur?
  - (a) Blue colored solution is obtained
  - (b)  $\text{Na}^+$  ions are formed in the solution
  - (c) Liquid  $\text{NH}_3$  becomes good conductor of electricity
  - (d) Liquid  $\text{NH}_3$  remains diamagnetic
15. Which of the following oxides is/are expected to react with sodium hydroxide?
  - (a)  $\text{CaO}$  (b)  $\text{SiO}_2$
  - (c)  $\text{BeO}$  (d)  $\text{B}_2\text{O}_3$
16. The compound(s) formed upon combustion of sodium metal in excess air is (are):
  - (a)  $\text{Na}_2\text{O}_2$  (b)  $\text{Na}_2\text{O}$
  - (c)  $\text{NaO}_2$  (d)  $\text{NaOH}$
17. Kieserite is not an ore of:
  - (a) Cu (b) Fe
  - (c) Mg (d) Al
18. Highly pure dilute solution of sodium in liquid ammonia:
  - (a) Shows blue color
  - (b) Exhibits electric conductivity
  - (c) Produces sodium amide
  - (d) Produces hydrogen gas
19. 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



20. Which of the following element(s) is/are not react directly with nitrogen to form nitride?

- (a) Na (b) Li  
(c) K (d) Rb

21. Which of the following composition of minerals is/are correct:

- (a) Soda ash –  $\text{Na}_2\text{CO}_3$   
(b) Camallite –  $\text{KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$   
(c) Borax –  $\text{Na}_2\text{B}_4\text{O}_7 \cdot 7\text{H}_2\text{O}$   
(d) Glauber's salt –  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$

22. The pairs of compounds which cannot exist together in aqueous solution are:

- (a)  $\text{NaH}_2\text{PO}_4$  and  $\text{Na}_2\text{HPO}_4$   
(b)  $\text{Na}_2\text{CO}_3$  and  $\text{NaHCO}_3$   
(c)  $\text{NaOH}$  and  $\text{NaH}_2\text{PO}_4$   
(d)  $\text{NaHCO}_3$  and  $\text{NaOH}$

23. Which of the following is/are 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)  $\text{Mg}^{2+}$  cannot form complexes  
(d) Be can form complexes due to its very small size

### Comprehension Type

#### Comprehension-1: (Q. 1 to Q. 3)

A soft silver white metal (A) burns with golden yellow flame to give a yellow powder B which on treatment with water liberates oxygen giving a clear solution C. The solution placed on Al attacks this metal, liberating a gas D and forming a water soluble compound E. The metal (A) dissolves in liquid  $\text{NH}_3$  to form deep blue solution which is a good conductor and an excellent reducing agent.

- Identify C:  
(a) KOH (b)  $\text{Al}(\text{OH})_3$   
(c) NaOH (d) LiOH
- Identify D:  
(a)  $\text{N}_2$  (b)  $\text{Cl}_2$   
(c)  $\text{NH}_3$  (d)  $\text{H}_2$
- Identify E:  
(a) NaOH (b)  $\text{NaAlO}_2$   
(c)  $\text{Ca}(\text{AlO}_2)_2$  (d) None of these

#### Comprehension-2: (Q. 4 to Q. 6)

On the basis of E.N. difference of  $|X_{\text{O}} - X_{\text{E}}|$  and  $|X_{\text{O}} - X_{\text{H}}|$ , acidic and basic characters of  $\text{E}-\text{O}-\text{H}$  can be decided, and acidic and basic strengths are compared.

4. Correct order of acidic strength is:

- (a)  $\text{Na}-\text{O}-\text{H} > \text{K}-\text{O}-\text{H} > \text{Rb}-\text{O}-\text{H}$   
(b)  $\text{Na}-\text{O}-\text{H} < \text{K}-\text{O}-\text{H} < \text{Li}-\text{O}-\text{H}$   
(c)  $\text{H}-\text{O}-\text{K} > \text{H}-\text{O}-\text{Rb} > \text{Na}-\text{O}-\text{H}$   
(d) None of these

5. Correct order of basic strength is:

- (a)  $\text{H}-\text{O}-\text{I} < \text{H}-\text{O}-\text{Br} < \text{H}-\text{O}-\text{Cl}$   
(b)  $\text{H}-\text{O}-\text{Cl} > \text{H}-\text{O}-\text{I} > \text{H}-\text{O}-\text{Br}$   
(c)  $\text{H}-\text{O}-\text{I} > \text{H}-\text{O}-\text{Br} > \text{H}-\text{O}-\text{Cl}$   
(d) None of these

6. Strongest acid among the following:

- (a) HClO (b)  $\text{HClO}_2$   
(c)  $\text{HClO}_4$  (d)  $\text{HClO}_3$

#### Comprehension-3: (Q. 7 to Q. 11)

Alkali and alkaline earth metals along with hydrogen and helium constitute s-block elements. They have low ionization enthalpies and hence exhibit characteristic flame colorations. They have highly negative electrode potentials and hence are strong reducing agents. Their solutions in liquid ammonia are conducting and also act as strong reducing agents. Being stronger reducing agents than hydrogen, they are usually prepared by electrolysis of their fused chlorides. Their oxides are basic and the basic strength increases down the group. The solubility of carbonates and sulphates of alkali and alkaline earth metals shows opposite trends. The carbonates of alkaline earth metals and lithium carbonate decompose on heating while the carbonates of other alkali metals do not decompose on heating. The bicarbonates of both alkali and alkaline earth metals on heating give carbonates.

- The compound insoluble in acetic acid is:  
(a) Calcium oxide (b) Calcium carbonate  
(c) Calcium oxalate (d) Calcium hydroxide
- The following compounds have been arranged in order of their increasing thermal stabilities. Identify the correct order:  $\text{K}_2\text{CO}_3$  (I),  $\text{MgCO}_3$  (II),  $\text{CaCO}_3$  (III),  $\text{BeCO}_3$  (IV):  
(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)  $\text{II} < \text{IV} < \text{III} < \text{I}$



9. Property of alkaline earth metals that increases with their atomic number is:
- Ionization energy
  - Solubility of their hydroxides
  - Solubility of their sulphates
  - Electronegativity
10. Which of the following process is used in the extractive metallurgy of magnesium?
- Fused salt electrolysis
  - Self-reduction
  - Aqueous solution electrolysis
  - Thermite reduction
11. Identify the correct order of acidic strengths of  $\text{CO}_2$ ,  $\text{CuO}$ ,  $\text{CaO}$ ,  $\text{H}_2\text{O}$ :
- $\text{CaO} < \text{CuO} < \text{H}_2\text{O} < \text{CO}_2$
  - $\text{H}_2\text{O} < \text{CuO} < \text{CaO} < \text{CO}_2$
  - $\text{CaO} < \text{H}_2\text{O} < \text{CuO} < \text{CO}_2$
  - $\text{H}_2\text{O} < \text{CO}_2 < \text{CaO} < \text{CuO}$

#### Comprehension-4: (Q. 12 to Q. 14)

A colorless solid *A* liberates a brown gas *B* on acidification, a colorless alkaline gas *C* on treatment with  $\text{NaOH}$  solution, and colorless inactive gas *D* on heating.

12. What is the formula of colorless alkaline gas *C*?
- $\text{N}_2$
  - $\text{NH}_3$
  - $\text{NO}$
  - None of these
13. What is the formula of colorless inactive gas *D*?
- $\text{N}_2$
  - $\text{H}_2$
  - $\text{NH}_3$
  - $\text{NO}$
14. What is the formula of gas *B*?
- $\text{Br}_2$
  - $\text{N}_2$
  - $\text{N}_2\text{O}$
  - $\text{NO}_2$

#### Comprehension-5: (Q. 15 to Q. 17)

Calcium burns in nitrogen to produce a white powder which dissolves in sufficient water to produce a gas (*A*) and an alkaline solution. The solution on exposure to air produces a thin solid layer of (*B*) on the surface.

15. When  $\text{CO}_2$  gas passed into the alkaline solution, then which of the following product will be formed?
- $\text{BaCO}_3$
  - $\text{CaCO}_3$
  - $\text{SrCO}_3$
  - None of these
16. The gas *A* is:
- $\text{N}_2$
  - $\text{NH}_3$
  - $\text{N}_2\text{O}$
  - None of these
17. Find out *B*.
- $\text{CaO}$
  - $\text{CaCO}_3$
  - $\text{Ca}_3\text{N}_2$
  - None of these

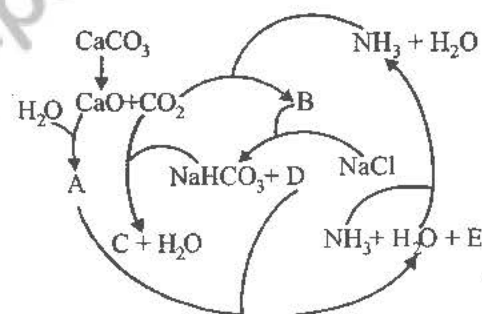
#### Comprehension-6: (Q. 18 to Q. 21)

A colorless water soluble crystalline solid (*A*) on heating gives  $\text{O}_2$  and gives a water soluble crystalline solid (*B*). Both *A* and *B* impart violet coloration to the Bunsen flame. When *B* is heated with  $\text{NH}_4\text{Cl}$ , inactive gas (*C*) is obtained but when *A* is heated with  $\text{NH}_4\text{Cl}$ , a gas (*D*) which supports combustion is formed. When gas (*D*) is heated with soda amide, solid substance *E* is obtained. The solid *E*, when heated with dil.  $\text{H}_2\text{SO}_4$ , forms a monobasic acid *F*; *F* and its salts are explosive.

18. Identify *A*:
- $\text{KNO}_2$
  - $\text{KNO}_3$
  - $\text{AgNO}_3$
  - $\text{NaNO}_2$
19. Identify *C*:
- $\text{N}_2$
  - $\text{H}_2$
  - $\text{O}_2$
  - $\text{N}_2\text{O}$
20. Identify *E*:
- $\text{K}_3\text{N}$
  - $\text{NaN}_3$
  - $\text{NaHSO}_4$
  - None of these
21. Identify *F*:
- $\text{HF}$
  - $\text{NH}_3$
  - $\text{HN}_3$
  - None of these

#### Comprehension-7: (Q. 22 to Q. 25)

The Solvay process can be represented by the following scheme:



22. Find out *A*:
- $\text{CaO}$
  - $\text{Ca(OH)}_2$
  - $\text{CaCO}_3$
  - None of these
23. Find out *B*:
- $(\text{NH}_4)_2\text{CO}_3$
  - $\text{NH}_4\text{HCO}_3$
  - $(\text{NH}_4)_2\text{C}_2\text{O}_4$
  - $\text{NH}_4\text{Cl}$
24. Find out *D*:
- $\text{NH}_4\text{Cl}$
  - $\text{CaCl}_2$
  - $\text{NH}_4\text{HCO}_3$
  - $\text{Ca(OH)}_2$
25. Find out *E*:
- $\text{NaCl}$
  - $\text{NaCO}_3$
  - $\text{CaCl}_2$
  - $\text{Ca(OH)}_2$



## Assertion-Reasoning Type

1. **Statement-1:** The ionic mobility of  $\text{Na}^+_{(\text{aq})}$  is lower than that of  $\text{K}^+_{(\text{aq})}$

**Statement-2:**  $r_{\text{Na}^+_{(\text{aq})}} > r_{\text{K}^+_{(\text{aq})}}$

- (a) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.  
 (b) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.  
 (c) Statement-1 is true, statement-2 is false.  
 (d) Statement-1 is false, statement-2 is true.

2. **Statement-1:** Lithium chloride is predominately covalent compound.

**Statement-2:** Electronegativity difference between Li and Cl is small.

- (a) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.  
 (b) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.  
 (c) Statement-1 is true, statement-2 is false.  
 (d) Statement-1 is false, statement-2 is true.

## Matching Column Type

1. Match the column:

Column-I	Column-II
(a) Li	(p) Radioactive
(b) Na	(q) Atomic number 11
(c) K	(r) Cation of element which has higher degree of hydration among the elements
(d) Fr	(s) $ns^1$ configuration
	(t) First element of group-I

2. Match the column:

Column-I	Column-II
(a) Cs	(p) Nitride formed when metal react with $\text{N}_2$
(b) K	(q) Cation which is formed mainly superoxide
(c) Li	(r) Salts of cation are mostly hydrated
(d) Mg	(s) Violet color in to the flame

3. Match the column:

Column-I	Column-II
(a) Flame coloration	(p) $\text{Be}(\text{OH})_2$
(b) Amphoteric character	(q) LiCl
(c) Soluble in organic solvents	(r) $\text{BeCl}_2$
(d) Evolves $\text{CO}_2$ on heating	(s) $\text{Al}(\text{OH})_3$
(e) Forms superoxide on heating with oxygen	(t) K
	(u) $\text{Li}_2\text{CO}_3$

4. Match the column:

Column-I	Column-II
(a) Ionic compound	(p) HCl (vap.)
(b) Non-polar covalent compound	(q) $\text{SiO}_2$
(c) Polar covalent compound having sigma bond only	(r) $\text{KNO}_3$
	(s) NO

5. Match the column:

Column-I	Column-II
(a) $\text{Li}^+(\text{aq})$	(p) Metal(s) readily react vigorously with halogens to form ionic halides
(b) $\text{Na}^+(\text{aq})$	(q) Highest ionic mobility among the ions
(c) $\text{K}^+(\text{aq})$	(r) Highest hydrated size among the ions
(d) $\text{Rb}^+(\text{aq})$	(s) Highest hydration energy among the cation
	(t) Lowest ionic mobility among the ion

6. Match the column:

Column-I	Column-II
(a) Be	(p) Show diagonal relationship with other elements
(b) Mg	(q) Highest hydration energy of cation among the element
(c) Ca	(r) Cation has lowest hydrated size in aqueous solution
(d) Sr	(s) Metal(s) which dissolve in liquid ammonia to give deep blue solution
	(t) s-block elements

7. Match the column:

Column-I	Column-II
(a) Li	(p) Metal(s) dissolve in liquid ammonia giving deep blue solution
(b) Na	(q) Very low solubility of fluoride salts in water
(c) K	(r) Diagonal relationship with Mg
(d) Cs	(s) Golden yellow color in flame
	(t) Superoxide ion is stable in the presence of larger cation(s)



## 8. Match the column:

## Column-I

- (a) Alkali metal carbonate which does not decompose on heating  
 (b) Alkali metal carbonate which decomposes on heating  
 (c) K/liq.  $\text{NH}_3$  is blue color solution which conducts electricity

## Column-II

- (p)  $\text{MgCO}_3$   
 (q)  $\text{Na}_2\text{CO}_3$   
 (r)  $\text{Li}_2\text{CO}_3$   
 (s) Solvated electrons

## Integer Answer Type

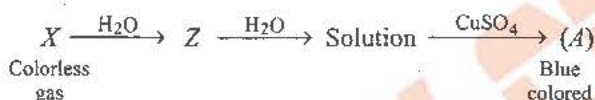
- The number of covalent bonds formed by beryllium is \_\_\_\_\_.
- Find the number of amphoteric hydroxide(s) from the following:  
 $\text{Be}(\text{OH})_2$ ,  $\text{Mg}(\text{OH})_2$ ,  $\text{Al}(\text{OH})_3$ ,  $\text{LiOH}$ ,  $\text{B}(\text{OH})_3$ ,  $\text{Zn}(\text{OH})_2$
- Find the number of chloride(s) which do not impart color to the flame from the following:  
 $\text{BeCl}_2$ ,  $\text{SrCl}_2$ ,  $\text{MgCl}_2$ ,  $\text{CaCl}_2$ ,  $\text{BaCl}_2$
- Find the number of element(s) which is/are present in group-II:  
 $\text{Ba}$ ,  $\text{K}$ ,  $\text{Ca}$ ,  $\text{Cs}$ ,  $\text{Rb}$ ,  $\text{Na}$
- What is the most common oxidation state of alkali metals?
- How many  $3\text{C} - 4e^-$  bonds are present in dimer of  $\text{BeCl}_2$ ?
- How many water molecule(s) is/are present in gypsum?
- Find the number of peroxide molecule(s) in the following:  
 $\text{MgO}$ ,  $\text{CaO}$ ,  $\text{Li}_2\text{O}$ ,  $\text{BaO}_2$
- Find the number of element(s) which is/are present in group-I:  
 $\text{Be}$ ,  $\text{Li}$ ,  $\text{Mg}$ ,  $\text{Al}$ ,  $\text{Na}$ ,  $\text{Ca}$ ,  $\text{Cs}$
- What is the most common oxidation state of alkaline earth metals?
- When  $\text{Mg}_3\text{N}_2$  react with  $\text{H}_2\text{O}$ , then how many type of gaseous product(s) is/are formed?
- How many water molecule(s) is/are present in dead burnt plaster?
- When  $\text{Mg}_2\text{C}_3$  undergoes hydrolysis, how many carbon atoms is/are present in product?
- When  $\text{BeCl}_2$  undergoes hydrolysis in alkaline medium, then what is the co-ordination number of  $\text{Be}$  in product?

15. When  $\text{CaC}_2$  undergoes hydrolysis, then how many  $\pi$  bonds are present in gaseous product?

16. When alkaline earth metals react with phosphorous, then how many phosphorus atom(s) is/are present in product side?

17. How many  $p$ -orbital(s) is/are involved in hybridization of solid  $\text{BeCl}_2$ ?

18.  $\text{Mg} + \text{N}_2 \xrightarrow{\text{Heat}} \text{X}$



What is the coordination number of the central atom of compound having blue colored solution?

## NCERT Exemplar Exercises

## Single Correct Answer Type

- The alkali metals are low melting. Which of the following alkali metal is expected to melt if the room temperature rises to  $30^\circ\text{C}$ ?  
 (a)  $\text{Na}$  (b)  $\text{K}$   
 (c)  $\text{Rb}$  (d)  $\text{Cs}$
- Alkali metals react with water vigorously to form hydroxides and dihydrogen. Which of the following alkali metals reacts with water least vigorously?  
 (a)  $\text{Li}$  (b)  $\text{Na}$   
 (c)  $\text{K}$  (d)  $\text{Cs}$
- The reducing power of a metal depends on various factors. Suggest the factor which makes  $\text{Li}$ , the strongest reducing agent in aqueous solution.  
 (a) Sublimation enthalpy  
 (b) Ionization enthalpy  
 (c) Hydration enthalpy  
 (d) Electron-gain enthalpy
- Metal carbonates decompose on heating to give metal oxide and carbon dioxide. Which of the metal carbonates is most stable thermally?  
 (a)  $\text{MgCO}_3$  (b)  $\text{CaCO}_3$   
 (c)  $\text{SrCO}_3$  (d)  $\text{BaCO}_3$
- Which of the carbonates given below is unstable in air and is kept in  $\text{CO}_2$  atmosphere to avoid decomposition.  
 (a)  $\text{BeCO}_3$  (b)  $\text{MgCO}_3$   
 (c)  $\text{CaCO}_3$  (d)  $\text{BaCO}_3$



6. Metals form basic hydroxides. Which of the following metal hydroxide is the least basic?
  - (a)  $\text{Mg}(\text{OH})_2$
  - (b)  $\text{Ca}(\text{OH})_2$
  - (c)  $\text{Sr}(\text{OH})_2$
  - (d)  $\text{Ba}(\text{OH})_2$
7. Some of the Group 2 metal halides are covalent and soluble in organic solvents. Among the following metal halides, the one which is soluble in ethanol is:
  - (a)  $\text{BeCl}_2$
  - (b)  $\text{MgCl}_2$
  - (c)  $\text{CaCl}_2$
  - (d)  $\text{SrCl}_2$
8. The order of decreasing ionization enthalpy in alkali metals is:
  - (a)  $\text{Na} > \text{Li} > \text{K} > \text{Rb}$
  - (b)  $\text{Rb} < \text{Na} < \text{K} < \text{Li}$
  - (c)  $\text{Li} > \text{Na} > \text{K} > \text{Rb}$
  - (d)  $\text{K} < \text{Li} < \text{Na} < \text{Rb}$
9. The solubility of metal halides depends on their nature, lattice enthalpy and hydration enthalpy of the individual ions. Amongst fluorides of alkali metals, the lowest solubility of  $\text{LiF}$  in water is due to:
  - (a) Ionic nature of lithium fluoride
  - (b) High lattice enthalpy
  - (c) High hydration enthalpy for lithium ion
  - (d) Low ionization enthalpy of lithium atom
10. Amphoteric hydroxides react with both alkalies and acids. Which of the following Group 2 metal hydroxides is soluble in sodium hydroxide?
  - (a)  $\text{Be}(\text{OH})_2$
  - (b)  $\text{Mg}(\text{OH})_2$
  - (c)  $\text{Ca}(\text{OH})_2$
  - (d)  $\text{Ba}(\text{OH})_2$
11. In the synthesis of sodium carbonate, the recovery of ammonia is done by treating  $\text{NH}_4\text{Cl}$  with  $\text{Ca}(\text{OH})_2$ . The by-product obtained in this process is:
  - (a)  $\text{CaCl}_2$
  - (b)  $\text{NaCl}$
  - (c)  $\text{NaOH}$
  - (d)  $\text{NaHCO}_3$
12. When sodium is dissolved in liquid ammonia, a solution of deep blue color is obtained. The colour of the solution is due to:
  - (a) Ammoniated electron
  - (b) Sodium ion
  - (c) Sodium amide
  - (d) Ammoniated sodium ion
13. By adding gypsum to cement:
  - (a) Setting time of cement becomes less
  - (b) Setting time of cement increases
  - (c) Color of cement becomes light
  - (d) Shining surface is obtained
14. Dead burnt plaster is:
  - (a)  $\text{CaSO}_4$
  - (b)  $\text{CaSO}_4 \cdot 4\text{H}_2\text{O}$
  - (c)  $\text{CaSO}_4 \cdot \text{H}_2\text{O}$
  - (d)  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
15. Suspension of slaked lime in water is known as:
  - (a) Lime water
  - (b) Quick lime
  - (c) Milk of lime
  - (d) Aqueous solution of slaked lime
16. Which of the following elements does not form hydride by direct heating with dihydrogen?
  - (a) Be
  - (b) Mg
  - (c) Sr
  - (d) Ba
17. The formula of soda ash is:
  - (a)  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$
  - (b)  $\text{Na}_2\text{CO}_3 \cdot 2\text{H}_2\text{O}$
  - (c)  $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$
  - (d)  $\text{Na}_2\text{CO}_3$
18. A substance which gives brick red flame and breaks down on heating to give oxygen and a brown gas is
  - (a) Magnesium nitrate
  - (b) Calcium nitrate
  - (c) Barium nitrate
  - (d) Strontium nitrate
19. Which of the following statements is true about  $\text{Ca}(\text{OH})_2$ ?
  - (a) It is used in the preparation of bleaching powder
  - (b) It is a light blue solid
  - (c) It does not possess disinfectant property
  - (d) It is used in the manufacture of cement
20. A chemical A is used for the preparation of washing soda to recover ammonia. When  $\text{CO}_2$  is bubbled through an aqueous solution of A, the solution turns milky. It is used in white washing due to disinfectant nature. What is the chemical formula of A?
  - (a)  $\text{Ca}(\text{HCO}_3)_2$
  - (b)  $\text{CaO}$
  - (c)  $\text{Ca}(\text{OH})_2$
  - (d)  $\text{CaCO}_3$
21. Dehydration of hydrates of halides of calcium, barium and strontium i.e.,  $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$ ,  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ ,  $\text{SrCl}_2 \cdot 2\text{H}_2\text{O}$ , can be achieved by heating. These become wet on keeping in air. Which of the following statements is correct about these halides?
  - (a) Act as dehydrating agent
  - (b) Can absorb moisture from air
  - (c) Tendency to form hydrate decreases from calcium to barium
  - (d) All of the above