CHAPTER 10

The s-Block Elements

10.1 Group 1 Elements : Alkali Metals

1. Ionic mobility of which of the following alkali metal ions is lowest when aqueous solution of their salts are put under an electric field?
(a) K (b) Rb
(c) Li (d) Na *(NEET 2017)*

2. Which one of the alkali metals, forms only, the normal oxide, M_2O on heating in air?
(a) Rb (b) K
(c) Li (d) Na *(2012)*

3. The ease of adsorption of the hydrated alkali metal ions on an ion-exchange resins follows the order
(a) $Li^+ < K^+ < Na^+ < Rb^+$
(b) $Rb^+ < K^+ < Na^+ < Li^+$
(c) $K^+ < Na^+ < Rb^+ < Li^+$
(d) $Na^+ < Li^+ < K^+ < Rb^+$ *(2012)*

4. The sequence of ionic mobility in aqueous solution is
(a) $Rb^+ > K^+ > Cs^+ > Na^+$
(b) $Na^+ > K^+ > Rb^+ > Cs^+$
(c) $K^+ > Na^+ > Rb^+ > Cs^+$
(d) $Cs^+ > Rb^+ > K^+ > Na^+$ *(2008)*

5. When a substance (*A*) reacts with water it produces a combustible gas (*B*) and a solution of substance (*C*) in water. When another substance (*D*) reacts with this solution of (*C*), it also produces the same gas (*B*) on warming but (*D*) can produce gas (*B*) on reaction with dilute sulphuric acid at room temperature. Substance (*A*) imparts a deep golden yellow colour to a smokeless flame of Bunsen burner. Then (*A*), (*B*), (*C*) and (*D*) respectively are
(a) Ca, H_2, $Ca(OH)_2$, Sn
(b) K, H_2, KOH, Al
(c) Na, H_2, NaOH, Zn
(d) CaC_2, C_2H_2, $Ca(OH)_2$, Fe *(1998)*

6. Which one of the following properties of alkali metals increases in magnitude as the atomic number rises?
(a) Ionic radius (b) Melting point
(c) Electronegativity
(d) First ionization energy *(1989)*

10.2 General Characteristics of the Compounds of the Alkali Metals

7. In the case of alkali metals, the covalent character decreases in the order
(a) $MF > MCl > MBr > MI$
(b) $MF > MCl > MI > MBr$
(c) $MI > MBr > MCl > MF$
(d) $MCl > MI > MBr > MF$ *(2009)*

8. The alkali metals form salt-like hydrides by the direct synthesis at elevated temperature. The thermal stability of these hydrides decreases in which of the following orders?
(a) NaH > LiH > KH > RbH > CsH
(b) LiH > NaH > KH > RbH > CsH
(c) CsH > RbH > KH > NaH > LiH
(d) KH > NaH > LiH > CsH > RbH *(2008)*

9. Which compound will show the highest lattice energy? (b) CsF
(c) NaF (d) KF *(1993)*

10.3 Anomalous Properties of Lithium

10. Which of the alkali metal chloride (MCl) forms its dihyrate salt ($MCl.2H_2O$) easily?
(a) LiCl (b) CsCl
(c) RbCl (d) KCl
(Odisha NEET 2019)

10.4 Some Important Compounds of Sodium

11. Crude sodium chloride obtained by crystallisation of brine solution does not contain

(a) $MgSO_4$ (b) Na_2SO_4
(c) $MgCl_2$ (d) $CaSO_4$
(Odisha NEET 2019)

12. In Castner-Kellner cell for production of sodium hydroxide
(a) brine is electrolyzed using graphite electrodes
(b) molten sodium chloride is electrolysed
(c) sodium amalgam is formed at mercury cathode
(d) brine is electrolyzed with Pt electrodes.
(Karnataka NEET 2013)

13. Which of the following statements is incorrect?
(a) Pure sodium metal dissolves in liquid ammonia to give blue solution.
(b) NaOH reacts with glass to give sodium silicate.
(c) Aluminium reacts with excess NaOH to give $Al(OH)_3$.
(d) $NaHCO_3$ on heating gives Na_2CO_3.
(Mains 2011)

14. In which of the following processes, fused sodium hydroxide is electrolysed at a 330 °C temperature for extraction of sodium?
(a) Castner's process (b) Down's process
(c) Cyanide process (d) Both (b) and (c).
(2000)

15. Which of the following is known as fusion mixture?
(a) Mixture of $Na_2CO_3 + NaHCO_3$
(b) $Na_2CO_3.10H_2O$
(c) Mixture of $K_2CO_3 + Na_2CO_3$
(d) $NaHCO_3$ *(1994)*

16. Washing soda has formula
(a) $Na_2CO_3.7H_2O$ (b) $Na_2CO_3.10H_2O$
(c) $Na_2CO_3.3H_2O$ (d) Na_2CO_3 *(1990)*

10.5 Biological Importance of Sodium and Potassium

17. The following metal ion activates many enzymes, participates in the oxidation of glucose to produce ATP and with Na, is responsible for the transmission of nerve signals.
(a) Iron (b) Copper
(c) Calcium (d) Potassium
(NEET 2020)

18. The function of "Sodium pump" is a biological process operating in each and every cell of all animals. Which of the following biologically important ions is also a constituent of this pump?
(a) K^+ (b) Fe^{2+}
(c) Ca^{2+} (d) Mg^{2+} *(2015, Cancelled)*

10.6 Group 2 Elements : Alkaline Earth Metals

19. Magnesium reacts with an element (X) to form an ionic compound. If the ground state electronic configuration of (X) is $1s^2\ 2s^2\ 2p^3$, the simplest formula for this compound is
(a) Mg_2X_3 (b) MgX_2
(c) Mg_2X (d) Mg_3X_2 *(NEET 2018)*

20. Electronic configuration of calcium atom may be written as
(a) [Ne] $4p^2$ (b) [Ar] $4s^2$
(c) [Ne] $4s^2$ (d) [Ar] $4p^2$ *(1992)*

21. Compared with the alkaline earth metals, the alkali metals exhibit
(a) smaller ionic radii
(b) highest boiling points
(c) greater hardness
(d) lower ionization energies. *(1990)*

22. Which of the following atoms will have the smallest size?
(a) Mg (b) Na
(c) Be (d) Li *(1989)*

10.7 General Characteristics of Compounds of Alkaline Earth Metals

23. HCl was passed through a solution of $CaCl_2$, $MgCl_2$ and NaCl. Which of the following compound(s) crystallise(s)?
(a) Both $MgCl_2$ and $CaCl_2$
(b) Only NaCl
(c) Only $MgCl_2$
(d) NaCl, $MgCl_2$ and $CaCl_2$ *(NEET 2020)*

24. Which of the following is an amphoteric hydroxide?
(a) $Be(OH)_2$ (b) $Sr(OH)_2$
(c) $Ca(OH)_2$ (d) $Mg(OH)_2$
(NEET 2019)

25. Among CaH_2, BeH_2, BaH_2, the order of ionic character is
(a) $BeH_2 < CaH_2 < BaH_2$
(b) $CaH_2 < BeH_2 < BaH_2$
(c) $BeH_2 < BaH_2 < CaH_2$
(d) $BaH_2 < BeH_2 < CaH_2$ *(NEET 2018)*

26. On heating which of the following releases CO_2 most easily?
(a) Na_2CO_3 (b) $MgCO_3$
(c) $CaCO_3$ (d) K_2CO_3 *(2015)*

27. Solubility of the alkaline earth metal sulphates in water decreases in the sequence
(a) Sr > Ca > Mg > Ba (b) Ba > Mg > Sr > Ca
(c) Mg > Ca > Sr > Ba (d) Ca > Sr > Ba > Mg
(2015, Cancelled)

28. Which of the following compounds has the lowest melting point?
(a) $CaCl_2$ (b) $CaBr_2$
(c) CaI_2 (d) CaF_2 *(2011)*

29. Which of the following alkaline earth metal sulphates has hydration enthalpy higher than the lattice enthalpy?
(a) $CaSO_4$ (b) $BeSO_4$
(c) $BaSO_4$ (d) $SrSO_4$ *(2010)*

30. Which one of the following compounds is a peroxide?
(a) KO_2 (b) BaO_2
(c) MnO_2 (d) NO_2 *(2010)*

31. Property of the alkaline earth metals that increases with their atomic number
(a) solubility of their hydroxides in water
(b) solubility of their sulphates in water
(c) ionization energy
(d) electronegativity *(2010)*

32. Which of the following oxides is not expected to react with sodium hydroxide?
(a) CaO (b) SiO_2
(c) BeO (d) B_2O_3 *(2009)*

33. The correct order of increasing thermal stability of K_2CO_3, $MgCO_3$, $CaCO_3$ and $BeCO_3$ is
(a) $BeCO_3 < MgCO_3 < CaCO_3 < K_2CO_3$
(b) $MgCO_3 < BeCO_3 < CaCO_3 < K_2CO_3$
(c) $K_2CO_3 < MgCO_3 < CaCO_3 < BeCO_3$
(d) $BeCO_3 < MgCO_3 < K_2CO_3 < CaCO_3$ *(2007)*

34. In which of the following the hydration energy is higher than the lattice energy?
(a) $MgSO_4$ (b) $RaSO_4$
(c) $SrSO_4$ (d) $BaSO_4$ *(2007)*

35. The solubility in water of sulphate down the Be group is Be > Mg > Ca > Sr > Ba. This is due to
(a) decreasing lattice energy
(b) high heat of solvation for smaller ions like Be^{2+}
(c) increase in melting points
(d) increasing molecular weight. *(1995)*

36. All the following substances react with water. The pair that gives the same gaseous product is
(a) K and KO_2 (b) Na and Na_2O_2
(c) Ca and CaH_2 (d) Ba and BaO_2. *(1994)*

37. Which of the following statement is false?
(a) Strontium decomposes water readily than beryllium.
(b) Barium carbonate melts at a higher temperature than calcium carbonate.
(c) Barium hydroxide is more soluble in water than magnesium hydroxide.
(d) Beryllium hydroxide is more basic than barium hydroxide. *(1994)*

10.8 Anomalous Behaviour of Beryllium

38. In context with beryllium, which one of the following statements is incorrect?
(a) It is rendered passive by nitric acid.
(b) It forms Be_2C.
(c) Its salts rarely hydrolyse.
(d) Its hydride is electron-deficient and polymeric. *(NEET-II 2016)*

10.9 Some Important Compounds of Calcium

39. The 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. *(NEET-II 2016)*

40. The product obtained as a result of a reaction of nitrogen with CaC_2 is
(a) $CaCN_3$ (b) Ca_2CN
(c) $Ca(CN)_2$ (d) CaCN *(NEET-I 2016)*

41. Which one of the following is present as an active ingredient in bleaching powder for bleaching action?
(a) $CaOCl_2$ (b) $Ca(OCl)_2$
(c) CaO_2Cl (d) $CaCl_2$ *(2011)*

42. Match List-I with List-II for the compositions of substances and select the correct answer using the code given :

List-I (Substances)	List-II (Composition)
(A) Plaster of Paris	(i) $CaSO_4 \cdot 2H_2O$
(B) Epsomite	(ii) $CaSO_4 \cdot 1/2\,H_2O$
(C) Kieserite	(iii) $MgSO_4 \cdot 7H_2O$
(D) Gypsum	(iv) $MgSO_4 \cdot H_2O$
	(v) $CaSO_4$

(a) (A)-(iii), (B)-(iv), (C)-(i), (D)-(ii)
(b) (A)-(ii), (B)-(iii), (C)-(iv), (D)-(i)
(c) (A)-(i), (B)-(ii), (C)-(iii), (D)-(v)
(d) (A)-(iv), (B)-(iii), (C)-(ii), (D)-(i) *(Mains 2011)*

43. The compound *A* on heating gives a colourless gas and a residue that is dissolved in water to obtain *B*. Excess of CO_2 is bubbled through aqueous solution of *B*, *C* is formed which is recovered in the solid form. Solid *C* on gentle heating gives back *A*. The compound is
(a) $CaCO_3$ (b) Na_2CO_3
(c) K_2CO_3 (d) $CaSO_4 \cdot 2H_2O$ *(Mains 2010)*

44. Which of the following represents calcium chlorite?
(a) $Ca(ClO_3)_2$ (b) $Ca(ClO_2)_2$
(c) $CaClO_2$ (d) $Ca(ClO_4)_2$ *(1996)*

45. Identify the correct statement.
(a) Plaster of Paris can be obtained by hydration of gypsum.
(b) Plaster of Paris is obtained by partial oxidation of gypsum.
(c) Gypsum contains a lower percentage of calcium than Plaster of Paris.
(d) Gypsum is obtained by heating Plaster of Paris. *(1995)*

46. Bleaching powder is obtained by the action of chlorine gas and
(a) dilute solution of $Ca(OH)_2$
(b) concentrated solution of $Ca(OH)_2$
(c) dry CaO
(d) dry slaked lime. *(1988)*

10.10 Biological Importance of Magnesium and Calcium

47. Enzymes that utilize ATP in phosphate transfer require an alkaline earth metal (*M*) as the cofactor. *M* is
(a) Sr (b) Be
(c) Mg (d) Ca *(NEET 2019)*

48. Which of the following statements is false?
(a) Ca^{2+} ions are not important in maintaining the regular beating of the heart.
(b) Mg^{2+} ions are important in the green parts of the plants.
(c) Mg^{2+} ions form a complex with ATP.
(d) Ca^{2+} ions are important in blood clotting. *(NEET-I 2016)*

49. Which of the following metal ions play an important role in muscle contraction?
(a) K^+ (b) Na^+
(c) Mg^{2+} (d) Ca^{2+} *(1994)*

ANSWER KEY

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

Hints & Explanations

1. (c) : The hydration enthalpy of alkali metal ions decreases with increase in ionic sizes *i.e.*,
$Li^+ > Na^+ > K^+ > Rb^+ > Cs^+$
Hence, lithium having maximum degree of hydration will be least mobile.
The order of ionic mobility is
$[Li_{(aq)}]^+ < [Na_{(aq)})]^+ < [K_{(aq)}]^+ < [Rb_{(aq)}]^+$

2. (c) : When alkali metals heated in atmosphere of oxygen, the alkali metals ignite and form oxides. On combustion Li forms Li_2O; sodium gives the peroxide Na_2O_2 and potassium and rubidium give superoxide (MO_2).

3. (b) : The order of decreasing hydration enthalpy of alkali metal ions is : $Li^+ > Na^+ > K^+ > Rb^+$
Thus, ease of adsorption of hydrated ions is in the order : $Rb^+ < K^+ < Na^+ < Li^+$.

4. (d) : Smaller the size of cation, higher will be the hydration and its effective size will increase and hence mobility in aqueous solution will decrease. Hence, the correct sequence of ionic mobility in aqueous solution of the given cations is $Cs^+ > Rb^+ > K^+ > Na^+$.

5. (c) : Only 'Na' imparts golden colour to Bunsen flame, therefore, *A* = Na, *B* = H_2, *C* = NaOH, *D* = Zn.

$$\underset{(A)}{2Na} + 2H_2O \rightarrow \underset{(C)}{2NaOH} + \underset{(B)}{H_2}$$

$$\underset{(D)}{Zn} + \underset{(C)}{2NaOH} \rightarrow \underset{(B)}{Na_2ZnO_2} + H_2$$

$$\underset{(D)}{Zn} + H_2SO_4(dil.) \rightarrow ZnSO_4 + \underset{(B)}{H_2}$$

6. (a) : In a group, ionic radius increases with increase in atomic number whereas the m.pt. decreases down in a group due to weakening of metallic bonds. Similarly,

electronegativity and ionization energy also decrease down the group.

7. (c) : Alkali metals are highly electropositive and halogens are electronegative. Thus, for the halides of a given alkali metal, the covalent character decreases with increase in electronegativity of halogens.

∴ Order of covalent character of halides is

$MI > MBr > MCl > MF$.

8. (b) : The ionic character of the bonds in hydrides increases from LiH to CsH due to weakening of M—H bond so, thermal stability of these hydrides decreases in the order of LiH > NaH > KH > RbH > CsH.

9. (c) : With the same anion, smaller the size of the cation, higher is the lattice energy. Therefore, NaF will show the highest lattice energy among the given compounds.

10. (a) : LiCl is deliquescent and crystallises from aqueous solution as hydrates, $LiCl.2H_2O$.

11. (a) : Crude sodium chloride, generally obtained by crystallisation of brine solution contains sodium sulphate (Na_2SO_4), calcium sulphate ($CaSO_4$), calcium chloride ($CaCl_2$) and magnesium chloride ($MgCl_2$) as impurities. Crude sodium chloride does not contain $MgSO_4$.

12. (c) : In Castner-Kellner cell, sodium amalgam is formed at mercury cathode.

A brine solution is electrolysed using a mercury cathode and a carbon anode.

13. (c) : Al reacts with NaOH to give sodium aluminate.

14. (a) : In Castner's process, for production of sodium metal, sodium hydroxide (NaOH) is electrolysed at temperature 330 °C.

15. (c) : K_2CO_3 and Na_2CO_3 mixture is called as fusion mixture.

16. (b) : $Na_2CO_3.10H_2O$ is washing soda.

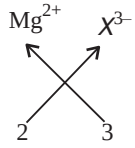
17. (d) : Potassium ions are the most abundant cations within cell fluids, where they activate many enzymes, participate in the oxidation of glucose to produce ATP and, with sodium, are responsible for the transmission of nerve signals.

18. (a)

19. (d) : Electronic configuration of X is $1s^2, 2s^2 2p^3$.

So, valency of X will be 3.

Magnesium ion = Mg^{2+}



Formula : Mg_3X_2

20. (b) : $_{20}Ca \longrightarrow 1s^2, 2s^2 2p^6, 3s^2 3p^6, 4s^2$

$_{18}Ar \longrightarrow 1s^2, 2s^2 2p^6, 3s^2 3p^6$

Hence, $_{20}Ca \longrightarrow [Ar]4s^2$

21. (d) : The alkali metals are larger in size and have smaller nuclear charge thus they have lower ionization energy in comparison to alkaline earth metals.

22. (c) : The atomic size decreases within a period from left to right, therefore Li > Be and Na > Mg. The size increases in a group from top to bottom. Hence, the size of Na is greater than Li. Overall order Na > Mg > Li > Be. Thus, Be has smallest size.

23. (b) : $CaCl_2$ and $MgCl_2$ are more soluble than NaCl. Thus, when HCl was passed through a solution containing $CaCl_2$, $MgCl_2$ and NaCl, only NaCl got crystallised.

24. (a) : $Be(OH)_2$ is amphoteric in nature as it reacts with acid and alkali both.

$Be(OH)_2 + 2OH^- \rightarrow [Be(OH)_4]^{2-}$

$Be(OH)_2 + 2HCl + 2H_2O \rightarrow [Be(OH)_4]Cl_2$

25. (a) : $BeH_2 < CaH_2 < BaH_2$

On moving down the group, metallic character of metals increases. So, ionic character of metal hydrides increases. Hence, BeH_2 will be least ionic.

26. (b) : Stability of carbonates increases down the group with increase in the size of metal ion. Also the alkali metal carbonates are more stable than alkaline earth metal carbonates.

Hence, $MgCO_3$ is least stable and it releases CO_2 most easily.

$$MgCO_3 \xrightarrow{\Delta} MgO + CO_2$$

27. (c) : Solubility of alkaline earth metal sulphates decreases down the group because hydration energy decreases.

28. (c) : As the covalent character in compound increases and ionic character decreases, melting point of the compound decreases. So, CaI_2 has the highest covalent character and lowest melting point.

29. (b) : The hydration enthalpy of $BeSO_4$ is higher than its lattice energy. Within group 2, the hydration energy decreases down the group while lattice energy is almost the same.

30. (b) : BaO_2 has peroxide linkage.

31. (a) : The solubility of an ionic compound depends on two factors :

(a) lattice energy, and (b) hydration energy

In case of alkaline earth metal hydroxides, the lattice energy decreases as we move down the group. This decrease is more than the decrease in the hydration energy down the group.

32. (a) : CaO being a basic oxide does not react with NaOH, however SiO_2 (acidic oxide), BeO (amphoteric oxide) and B_2O_3 (acidic oxide) react with NaOH.

33. (a) : In all cases, for a particular set of group 1 or group 2 compounds, the thermal stability increases down the group as the ionic radius of the cation increases, and its polarising power decreases.

Group 1 compounds tend to be more thermally stable than group 2 compounds because group 1 cation has a smaller charge and a larger ionic radius, and so, a lower polarising power, particularly when adjacent metals on the same period are compared.

Hence, the order of increasing thermal stability of K_2CO_3, $MgCO_3$, $CaCO_3$ and $BeCO_3$ is

$BeCO_3 < MgCO_3 < CaCO_3 < K_2CO_3$.

34. (a) : When hydration energy exceeds lattice energy, the compound becomes soluble in water. The solubility of alkaline earth metal sulphates decreases in the order :

$$\underset{\text{very high}}{BeSO_4} > \underset{\text{high}}{MgSO_4} > \underset{\text{sparingly soluble}}{CaSO_4} > SrSO_4 > BaSO_4 > RaSO_4$$

(almost insoluble)

The solubilities of $BeSO_4$ and $MgSO_4$ are due to high energy of solvation of smaller Be^{2+} and Mg^{2+} ions.

35. (b) : As we move down the group from $BeSO_4$ to $BaSO_4$, the enthalpy of hydration of the positive ion becomes smaller due to increase in ionic size. Salts of heavier metal ions are less soluble than those of lighter ions.

36. (c) : The pair which gives the same gaseous product is Ca and CaH_2.

$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

$CaH_2 + 2H_2O \rightarrow Ca(OH)_2 + 2H_2$

Whereas, K gives H_2 while KO_2 gives O_2 and H_2O_2.

$2K + 2H_2O \rightarrow 2KOH + H_2$

$2KO_2 + 2H_2O \rightarrow 2KOH + O_2 + H_2O_2$

Similarly, Na gives H_2, while Na_2O_2 gives H_2O_2.

$2Na + 2H_2O \rightarrow 2NaOH + H_2$

$Na_2O_2 + 2H_2O \rightarrow 2NaOH + H_2O_2$

Likewise Ba gives H_2 while BaO_2 gives H_2O_2.

$Ba + 2H_2O \rightarrow Ba(OH)_2 + H_2$

$BaO_2 + 2H_2O \rightarrow Ba(OH)_2 + H_2O_2$

37. (d) : Beryllium hydroxide although amphoteric, is however less basic than barium hydroxide.

38. (c) : Due to very small size of Be^{2+}, beryllium salts are readily hydrolysed because of high hydration energy.

$BeCl_2 + 2H_2O \rightarrow Be(OH)_2 + 2HCl$

39. (c) : $\underset{\text{Quick lime}}{CaO} + H_2O \longrightarrow \underset{\text{Slaked lime}}{Ca(OH)_2} + \text{Heat}$

This process is known as slaking of lime.

The paste of lime in water (*i.e.*, suspension) is called milk of lime while the filtered and clear solution is known as lime water.

40. (c) : Read $Ca(CN)_2$ as $CaCN_2$.

$CaC_2 + N_2 \longrightarrow \underset{\text{Nitrolim}}{CaCN_2} + C$

41. (b) : Active ingredient in bleaching powder for bleaching action is $Ca(OCl)_2$.

42. (b) : Plaster of Paris - $CaSO_4 \cdot \frac{1}{2} H_2O$

Epsomite	- $MgSO_4 \cdot 7H_2O$
Kieserite	- $MgSO_4 \cdot H_2O$
Gypsum	- $CaSO_4 \cdot 2H_2O$

43. (a) : The reactions can be summarised as follows :

$A \xrightarrow{\Delta}$ colourless gas + residue

$\text{Residue} + H_2O \rightarrow B \xrightarrow[\text{excess } CO_2]{} C \xrightarrow{\Delta} A$

This is possible only when *A* is $CaCO_3$. The reactions are as follows :

$\underset{(A)}{CaCO_3} \xrightarrow{\Delta} \underset{\text{(colourless gas)}}{CO_2} + \underset{\text{(residue)}}{CaO}$

$CaO + H_2O \longrightarrow \underset{(B)}{Ca(OH)_2} \xrightarrow[\text{(excess)}]{CO_2}$

$\underset{(C)}{Ca(HCO_3)_2} \xrightarrow{\Delta} \underset{(A)}{CaCO_3}$

44. (b) : Since the valency of calcium is 2 and a chlorite ion is ClO_2^-, therefore calcium chlorite is $Ca(ClO_2)_2$.

45. (c) : Gypsum is $CaSO_4 \cdot 2H_2O$ and Plaster of Paris is $(CaSO_4)_2 \cdot H_2O$. Therefore, gypsum contains a lower percentage of calcium than Plaster of Paris.

46. (d) : Cl_2 gas reacts with dry slaked lime, $Ca(OH)_2$ to give bleaching powder.

$Ca(OH)_2 + Cl_2 \xrightarrow{\Delta} CaOCl_2 + H_2O$

47. (c) : All enzymes that utilise ATP in phosphate transfer require magnesium as the cofactor.

48. (a) : Ca^{2+} ions are required to trigger the contraction of muscles and to maintain the regular beating of the heart.

49. (d) : Calcium is an essential element for the contraction of muscles.