



Question 22. Why are lithium salts commonly hydrated and those of the other alkali metal ions usually anhydrous?

Answer: Due to smallest size,  $\text{Li}^+$  can polarize water molecules easily than the other alkali metal ions.

Question 23. Why is  $\text{LiF}$  almost insoluble in water whereas  $\text{LiCl}$  soluble not only in water but also in acetone?

Answer: It is due to high lattice energy of  $\text{LiF}$  as compared to  $\text{LiCl}$ .  $\text{LiCl}$  is soluble in water because its hydration energy is higher than its lattice energy.

Question 24. Explain the significance of sodium, potassium, magnesium and calcium in biological fluids.

Answer: Sodium ions:

- $\text{Na}^+$  ions participate in the transmission of nerve signals, in regulating the flow of water across cell membranes.
- In the transport of sugars and amino acids into cell.

Potassium ions:

- They activate many enzymes.
- Participate in the oxidation of glucose to produce ATP.

Magnesium ions:

- All enzymes that utilise ATP in phosphate transfer require magnesium as a cofactor.
- $\text{Mg}$  is the main pigment for the absorption of light in plants.

Calcium:

- $\text{Ca}^{2+}$  ions are present in bones.
- plays important roles in neuromuscular function.

Question 25. What happens when

(i) Sodium metal is dropped in water?

(ii) Sodium metal is heated in free supply of air?

(iii) Sodium peroxide dissolves in water?

Answer: (i)  $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$

(ii)  $2\text{Na} + \text{O}_2 \rightarrow \text{Na}_2\text{O}_2$

(iii)  $\text{Na}_2\text{O}_2 + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2\text{O}_2$

Question 26. Comment on each of the following observations:

(a) The mobilities of the alkali metal ions in aqueous solution are

$\text{Li}^+ < \text{Na}^+ < \text{K}^+ < \text{Rb}^+ < \text{Cs}^+$

(b) Lithium is the only alkali metal to form a nitride directly.

(c)  $E^\circ$  for  $\text{M}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{M}(\text{s})$  (where  $\text{M} = \text{Ca}, \text{Sr}, \text{or Ba}$ ) is nearly constant.

Answer:

(a) Smaller the size of the ion, more highly it is hydrated and hence greater is the mass of the hydrated ion and thus the ionic mobility become lesser. The extent of hydration decreases in the order.

$\text{Li}^+ < \text{Na}^+ < \text{K}^+ < \text{Rb}^+ < \text{Cs}^+$

Thus the mobility of  $\text{Cs}^+$  will be the highest.

(b) Due to its smaller size lithium can form nitride directly.

(c) It is because reduction potential depends upon sublimation energy, ionisation energy and hydration energy. Their resultant is almost constant for these ions.

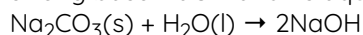
Question 27. State as to why

(a) a solution of  $\text{Na}_2\text{CO}_3$  is alkaline?

(b) alkali metals are prepared by electrolysis of their fused chlorides?

(c) Sodium is found to be more useful than potassium?

Answer: (a)  $\text{Na}_2\text{CO}_3$  is a salt of a weak acid, carbonic acid ( $\text{H}_2\text{CO}_3$ ) and a strong base  $\text{NaOH}$ . Thus it undergoes hydrolysis to produce strong base  $\text{NaOH}$  and its aqueous solution is alkaline in nature.



(b) Because the discharge potential of alkali metals is much higher than that of hydrogen, therefore when the aqueous solution of any alkali metal chloride is subjected to electrolysis,  $\text{H}_2$ , instead of the alkali metal, is produced at the cathode. Therefore alkali metals are prepared by electrolysis of their fused chlorides.

(c) Since potassium is more reactive than sodium and it is found in nature to a less extent than  $\text{Na}$ , sodium is found to be more useful.

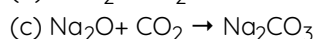
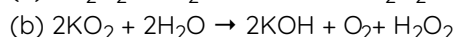
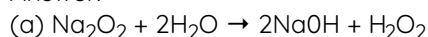
Question 28. Write balanced equations for reactions between.

(a)  $\text{Na}_2\text{O}_2$  and water

(b)  $\text{KO}_2$  and water

(c)  $\text{Na}_2\text{O}$  and  $\text{CO}_2$

Answer:



Question 29. How would you explain the following observations?

(i)  $\text{BeO}$  is almost insoluble but  $\text{BeSO}_4$  is soluble in water.

(ii)  $\text{BaO}$  is soluble but  $\text{BaSO}_4$  is insoluble in water.

(iii)  $\text{LiI}$  is more soluble than  $\text{KI}$  in ethanol.

Answer:

(i) Lattice energy of  $\text{BeO}$  is comparatively higher than the hydration energy. Therefore, it is almost insoluble in water. Whereas  $\text{BeSO}_4$  is ionic in nature and its hydration energy dominates the lattice energy.

(ii) Both  $\text{BaO}$  and  $\text{BaSO}_4$  are ionic compounds but the hydration energy of  $\text{BaO}$  is higher than the lattice energy therefore it is soluble in water.

(iii) Since the size of  $\text{Li}^+$  ion is very small in comparison to  $\text{K}^+$  ion, it polarises the electron cloud of  $\text{I}^-$  ion to a great extent. Thus  $\text{LiI}$  dissolves in ethanol more easily than the  $\text{KI}$ .

Question 30. Which of the alkali metal is having least melting point?

(a)  $\text{Na}$  (b)  $\text{K}$  (c)  $\text{Rb}$  (d)  $\text{Cs}$

Answer: Size of  $\text{Cs}$  is the biggest thus, its melting point is the lowest, (d) is correct.

Question 31. Which one of the following alkali metals give hydrated salts?

(a)  $\text{Li}$  (b)  $\text{Na}$  (c)  $\text{K}$  (d)  $\text{Cs}$

Answer:  $\text{Li}^+$  is the smallest. Thus, it has the highest charge density and hence attracts the water molecules more strongly.

Question 32. Which one of the following alkaline earth metal carbonates is thermally most stable?

(a)  $\text{MgCO}_3$

(b)  $\text{CaCO}_3$

(c)  $\text{SrCO}_3$

(d)  $\text{BaCO}_3$

Answer: (d)  $\text{BaCO}_3$

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