Q. 1. Sodium is kept under kerosene and not under water. Why ?

Ans. Sodium has a high redox potential (E^0 for $Na / Na^+ = 2{\cdot}71$ volt) and it reacts with water vigorously to form $NaOH$ and hydrogen.

$$2Na + 2H_2O \longrightarrow 2NaOH + H_2\uparrow$$

So, it cannot be kept under water. Sodium is inert towards kerosene and is denser than kerosene and so it is kept under kerosene.

Q. 2. Sodium cannot be obtained by the electrolysis of solid $NaCl$. Why ?

Ans. Sodium cannot be obtained by the electrolysis of solid $NaCl$ as in the solid state $NaCl$ is a non-conductor of electricity. In the solid state Na^+ and Cl^- ions cannot move since they are rigidly fixed in the lattice positions under electrostatic force of attraction.

Q. 3. $CaCl_2$ is added to $NaCl$ in the electrolytic manufacture of Na. Why ?

Ans. $CaCl_2$ is added to $NaCl$ in the electrolytic manufacture of Na in order to increase the conductivity and decrease the m.p. Lowering of m.p. minimises the electricity consumption and prevents the dissolution of Na in $NaCl$ and vaporisation of Na.

Q. 4. An aqueous solution of iodine becomes colouriess on adding $NaOH$ solution. Why ?

Ans. Iodine reacts with $NaOH$ to form colourless NaI and $NaOI$, so violet iodine solution yields colourless I^- and OI^- ions.

$$I_2 + 2OH^- \longrightarrow I^- + OI^- + H_2O$$

Q. 5. $NaNO_3$ does not react with water to form $NaOH$ and HNO_3. Why ?

Ans. $NaNO_3$ is a salt of strong acid (HNO_3) and strong base $(NaOH)$ and so it does not undergo hydrolysis.

$$H^+ + OH^- \longrightarrow H_2O$$

Q. 6. When fused NaH is electrolysed, H_2 gas is liberated at anode. Why ?

Ans. In *NaH*, hydrogen exists as the anion H^-, so it is liberated at anode. $2H^- - 2e = H_2(g)$ at anode

$Na^+ + e = Na$ at cathode

Q. 7. Commercial common salt becomes damp on keeping. Why ?

Ans. Commercial common salt becomes damp on keeping due to presence of hygroscopic impurities like $MgCl_2$.

Q. 8. *Na* is soft but *NaCl* is hard. Why ?

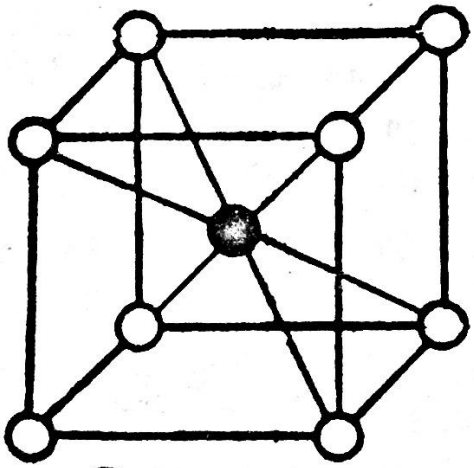
Ans. *Na* with lose simple cubic struture is soft but *NaCl* with compact face centred cubic structure is hard.

Q. 9. *NaCl* is soluble in water. Why ?

Ans. Ionic compounds dissolve in polar solvents because the lattice breaks and at the same time the ions get solvated. In case of *NaCl*, the sum of hydration energies ($Na^+ \rightarrow 95$ k cal/mol, $Cl^- \rightarrow 89$ k cal/mol) is almost equal to its lattice energy (*186* k cal/mol). The *NaCl* is soluble in water due to entropy increase on dissolution.

Q. 10. Co-ordination number of Na^+ or Cl^- in *NaCl* is *6*, but of Cs^+ or Cl^- in *CsCl* it is *8*. Why ?

Ans. Co-ordination number depends on cation to anion radius ratio (r^+/r^-). Radius ratio for *NaCl* is *0·5;* so co-ordination number is *6*, but for *CsCl,* it is more than *0·732*, so co-ordination number is *8*, for which they arrange in different ways. *NaCl* has a simple cubic structure whereas *CsCl* has body centred cubic structure with co-ordination number *6* and *8* respectively.



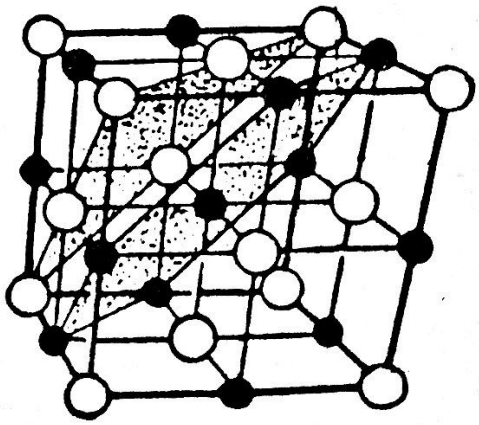
● → Cs^+

○ → Cl^-

$r_{Cs^+} = 1{\cdot}67$ Å

$r_{Cl^-} = 1{\cdot}81$Å

So, $\frac{r^+}{r^-} = 0{\cdot}92$



● → Na^+

○ → Cl^-

$r_{Na^+} = 0{\cdot}98$Å

$r_{Cl^-} = 1{\cdot}81$Å

So, $\frac{r^+}{r^-} = 0{\cdot}54$.

Q. 11. Why alkali metals are so called ?

Ans. Alkali metals are so called as they produce strong alkali when put into water. $2M + 2H_2O \rightarrow 2MOH + H_2$

$MOH \rightarrow M^+ + OH^-$

Q. 12. Standard electrode potential, (E^0) for *Li* is equal to *Cs*. Why ?

Ans. E^0 depends on sublimation energy, ionisation energy and hydration energy. Higher values of ΔH_{sub} and ionisation energy for small *Li* in comparison to larger *Cs* is compensated by higher value for ΔH_{hyd} of Li^+ in comparison to Cs^+ and hence E^0 values become equal.

Q. 13. Liquid lithium cannot be kept in a glass vessel. Why ?

Ans. Due to small size and high reactivity of lithium, its liquid rapidly cuts a way through the glass vessel and hence cannot be kept in it.

Q. 14. Reducing power of *Li* and *Cs* are equal. Why ?

Ans. *Li* and *Cs* have almost equal standard redox potential, E^0 value, so they have equal reducing power.

$$E^0\ (Li^+, Li) = -3{\cdot}02v,\ E^0(Cs^+, Cs) = -2{\cdot}99v$$

Q. 15. *Li* reacts with oxygen to give only Li_2O, *Na* gives Na_2O and Na_2O_2. Again *K* gives K_2O, K_2O_2 and the superoxide KO_2. Why ?

Ans. As the size of alkali metal cations increases, they tend to form stable compounds with bigger anions, so Li^+ combines with O^{--} whereas Na^+ combines with O_2^{--} and K^+ combines with O_2^-.

Q. 16. Li^+ resembles in properties to Mg^{2+}. Why ?

Ans. The Li^+ ion is exceptionally small and has therefore, an exceptionally high charge density which is comparable to that of Mg^{2+}. Hence the properties of a number of lithium compounds are similar to that of magnesium compounds. This is called diagonal relationship.

Q. 17. Salts of Li^+ with small anions are very stable but with large anions are unstable. Why ?

Ans. Li^+ is small cation and so its salts with small anions are very stable due to lattice energy effects whereas increasing difference in size and charge of cation and anion causes a decrease in stability due to decrease in lattice energy.

Q. 18. Na_2CO_3 is thermally stable Li_2CO_3 is not. Why ?

Ans. Na_2CO_3 is thermally stable as it has a very high lattice energy but Li_2CO_3 is not stable as its lattice energy is low, the great difference in size between Li^+ and CO_3^{--} is mainly responsible for it.

Q. 19. Alkali metals are soft and low melting. Why ?

Ans. Alakali metals are soft and low melting because there is only one valence electron per metal atom, the binding energy in the closed packed metal lattices are relatively weak and consequently alkali metals are soft and low melting.

Q. 20. *Li* is expected to be an excellent coolant due to its extraordinarily high specific heat, but is not used so. Why ?

Ans. *Li* cannot be used as a coolant as it is corrosive.

Q. 21. Very recently alkali metals have been started to be used as anode materials. Why ?

Ans. Due to their high electrode potential they are suitable for electrodes. Difficulties in using them as electrodes due to their high reactivities have been removed by making their alloys and their use as anodes is gaining importance.

Q. 22. The solution of alkali metals in liquid ammonia is blue. Why ?

Ans. The solution is blue as it absorbs red portion of the visible light. The absorption is needed for transfer of solvated electron from one energy level to higher energy levels.

Q. 23. Density of *K* is lower than that of *Na*. Why ?

Ans. The two metals do not crystallize with the similar crystal structure, the structure of *K* being comparatively loose, results in a decrease of density.

Q. 24. Conductivity of metals decreases with increasing temperature. Why ?

Ans. Resistance arises in the metal due to lattice vibrations which increase with increasing temperature disturbing arrangement of valence electron and causing reduction in conductivity.

Q. 25. Golden yellow flame of sodium appears colourless when viewed through blue glass. Why ?

Ans. Blue glass absorbs yellow light, so golden yellow flame of sodium appears colourless when viewed through blue glass.

Q. 26. Alkali metals in general show a fixed oxidation state of *+1* in its compounds. Why ?

Ans. Alkali metals in general show a fixed oxidation state of *+1* in its compounds due to very low *1st I.P.* and very high *2nd I.P.*

Q. 27. The chemistry of alkali metals is mainly ionic. Why ?

Ans. Low *I.P.* for the outer electrons and low polarisability of the resulting M^+ ion make the chemistry of alkali metals mainly ionic.

Q. 28. Natural abundance of francium is very low. Why ?

Ans. All its isotopes are radioactive and half lives are small, so abundance is low.

Q. 29. Potassium soaps are more costly than sodium soaps. Why ?

Ans. Potassium soaps are more costly than sodium soaps as the potassium hydroxide used for making soap is more costly than *NaOH*.

Q. 30. Molten sodium is poured into hollow valve stems of aeroplane engines. Why ?

Ans. Because the sodium, molten at operating temperature conducts the heat away from the valve head to prevent warping.

Q. 31. Sodium is used in Vapour lamps. Why ?

Ans. The characteristic yellow light of *Na* is visible at greater distances even in foggy nights. So sodium is used in vapour lamps.

Q. 32. When saturated aqueous solution of *NaCl* is electrolysed, Cl_2 is obtained at anode and not O_2. Why ?

Ans. Saturated aqueous solution of *NaCl* contains Na^+, Cl^- and H_2O. At anode competition between following reactions takes place:

$$\begin{aligned} Cl^- &\longrightarrow \tfrac{1}{2}Cl_2 + e \qquad E^0 = -1{\cdot}36 \text{ v} \quad \ldots\ldots (1) \\ H_2O &\longrightarrow \tfrac{1}{2}O_2 + 2H^+ + 2e \qquad -1{\cdot}23 \text{ v} \quad \ldots\ldots (2) \end{aligned}$$

According to E^0 value, *2nd* reaction should take place but due to larger concentration of Cl^-, *1st* reaction predominates over the *2nd*.

N. B. : $E^0 \propto$ *concentration of active species.*

Q. 33. Sodium and other alkali metals are used in photoelectric light meter tubes. Why ?

Ans. When light falls on sodium, electrons are ejected from it due to its low *I.P.* and electric circuit is completed.

Q. 34. Alkali and alkaline earth metal salts are found in sea water. Why ?

Ans. Alkali and alkaline earth metal salts are soluble in water and dissolved salts are carried by the rivers to the sea.

Q. 35. Chile Saltpiter, an ore of sodium is found in deserts of Chile. Why ?

Ans. Soluble $NaNO_3$ is found in deserts of Chile as there is no rain in the desert and chance of dissolution and transportation to the sea is not possible. The desert is also very near to sea.

Q. 36. Potassium salts are more abundant in soil than sodium salts. Why ?

Ans. Plants absorb potassium salts in preference to sodium salts, so they are more abundant than sodium salts in soil.

Q. 37. Alkali metals are not extracted by carbon or hydrogen reduction method. Why ?

Ans. Alkali metals are stronger reducing agents than C or H_2 and hence, they are not extracted from their compounds by carbon or hydrogen reduction method.

Q. 38. Liquid sodium is being used as a coolant in nuclear reactors. Why ?

Ans. Liquid sodium is being used as a coolant in nuclear reactors in order to remove heat from the core due to its high thermal conductivity and high specific heat.

Q. 39. Sodium peroxide is used in air purifiers in sub-marines or portable breathing apparatuses. Why ?

Ans. Because sodium peroxide reacts with CO_2 to form Na_2CO_3 liberating O_2. $2Na_2O_2 + 2CO_2 \longrightarrow 2Na_2CO_3 + O_2$

Q. 40. Glass stoppers are not used for reagent bottles containing concentrated *NaOH* solutions. Why ?

Ans. *NaCH* reacts with SiO_2 of glass, forms Na_2SiO_3 and stoppers are eroded. So rubber or plastic stoppers are used in place of glass stoppers for *NaOH* reagent bottles.

$$2NaOH + SiO_2 = Na_2SiO_3 + H_2O$$

Q. 41. Glauber's salt are used in many properietary health salts. Why ?

Ans. Glauber's salt $(Na_2SO_4.10H_2O)$ is used in many health salts due to its **laxative** action.

Q. 42. Alkali metal salts are, in general, colourless but $KMnO_4$ and $K_2Cr_2O_7$ or Na_2CrO_4 are coloured. Why ?

Ans. The colour of $KMnO_4$, $K_2Cr_2O_7$ or Na_2CrO_4 is not due to alkali metal cations but due to charge transfer taking place in anions, MnO_4^-, $Cr_2O_7^{--}$ and CrO_4^{--}.

Q. 43. An aqueous solution of *NaCl* is conductor of electricity while a solution of urea is a non-conductor. Why ?

Ans. *NaCl*, an ionic compound is almost completely ionised in aqueous solution making it a good conductor but urea being a molecular compound does not ionise and hence solution is non-conductor.

Q. 44. *KOH* is stronger alkali than *NaOH*. Why ?

Ans. Ionic potential of Na^+ is greater than that of K^+, so covalent character of *NaOH* is greater than for *KOH* and hence chance of ionisation to give OH^- is lower for *NaOH* than *KOH*. That's why *KOH* is stronger alkali than *NaOH*.

Q. 45. $NaHCO_3$ and $KHCO_3$ are not prepared by the same method. Why ?

Ans. $NaHCO_3$ is less soluble than NH_4Cl, so it is precipitated. But $KHCO_3$ is more soluble than NH_4Cl, so NH_4Cl is precipitated and not $KHCO_3$. Hence $KHCO_3$ cannot be prepared by the method as $NaHCO_3$.

Q. 46. Potassium superoxide is used at high altitude ?

Ans. Potassium superoxide is used at a high altitude as it is a good source of oxygen.

Q. 47. Why *HCl* is used in the purification of common salt ?

Ans. When *HCl* gas is passed through a saturated solution of *NaCl*, pure common salt is salted out due to common ion effect of Cl^-.

Q. 48. KNO_3 is used in explosive, not $NaNO_3$. Give reason.

Ans. It is because, $NaNO_3$ is hygroscopic viz. it becomes moist in atmosphere, but KNO_3 is not. Hence KNO_3 is used in explosive but not $NaNO_3$.

Q. 49. Though *I.P.* of *Li* is greater than that of *Na*, *Li* is better reducing agent than *Na*. Why ?

Ans. Because, the greater value of hydration energy for Li^+ in comparison to Na^+ compensates more than the energy required in *I.P.*; hence *Li* has more reducing character than *Na*.

Q. 50. Potassium metal catches fire when dropped on water. Why ?

Ans. When *'K'* metal is dropped on water, it reacts with H_2O violently producing *KOH* and H_2 accompained by a large amount of heat i.e. the reaction is exothermic. H_2 catches fire as heat of the reaction is sufficient to ignite it.

$$2K + 2H_2O = 2KOH + H_2 \uparrow + Q$$

Q. 51. *Na* belongs to *s*-block of the periodic table. Why ?

Ans. The last electron of sodium that is, *11th* electron enters into *s*-orbitals, so it belongs to *s*-block of the periodic table.

$$_{11}Na \longrightarrow 1s^2, 2s^2 2p^6, 3s^1$$

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