**#423447**

**Topic:** Alkali metals

What are the common physical and chemical features of alkali metals ?

**Solution**

Common physical features of alkali metals:

(1) They are soft and can be easily cut.

(2) They have silvery white appearance. They are light coloured.

(3) Due to large atomic size, they have low density. On moving down the group the density increases with exception of K which has lower density than Na.

(4) Due to weak metallic bonding, alkali metals have low melting and boiling points.

(5) They provide characterisitc colour to flames.

(6) They show photoelectric effect. On irradiation with lightCs and K lose electrons.

Common chemical features of alkali metals:

Due to low ionization enthalpy, akali metals have high reactivity.

On moving down the group, the reactivity increases.

(1) On reaction with water, oxides and hydroxides are formed.

On moving down the group, the reaction becomes more and more vigorous.

(2) On reaction with water, hydroxide and hydrogen are formed.

$2M + 2H_2O \rightarrow 2MOH + H_2$

(3) On reaction with hydrogen, hydrides are formed.

$2M + H_2 \rightarrow MH$

(4) They directly combine with halogens to form ionic halides. Li is an exception.

$2M + Cl_2 \rightarrow 2MCl,\ (M = Li, K, Rb, Cs)$

(5) They are strong reducing agents. On moving down the group, the reducing power increases with exception of Li. Due to high hydration energy, Li is the strongest reducing agent among alkali metals.

(6) They dissolve in liquid ammonia. The solution is deep blue in colour due to presence of ammoniated electrons.

**#423448**

**Topic:** Alkaline earth elements

Discuss the general characteristics and gradation in properties of alkaline earth metals.

**Solution**

General characteristics of alkaline earth metals:

(1) They have valence shell electronic configuration of $ns^2$.

(2) They lose two valence electron to form dipositive metal ions. Thus, they attain stable noble gas electronic configuration.

(3) The atomic and ionic radii of alkaline earth metals are smaller than the atomic and ionic radii of alkali metals.

(4) Due to large atomic size, the ionization enthalpy value of alkaline earth metals are very low. The first ionization enthalpy values are higher than those of alkali metals.

(5) They have metallic luster and silvery white appearance. Compared to alkali metals, alkaline earth metals have lower softness.

(6) The atomic size of alkaline earth metals is lower than that of alkali metals. Also the metallic bonds are stronger due to presence of 2 valence electrons. Hence, alkaline earths have higher melting and boiling points than alkali metals.

(7) Due to lower ionization enthalpy values, the alkaline earths are highly electopositive in nature. On moving down the group, the electopositive nature increases from Be to Ba.

(8) With exception of Be and Mg, the alkaline earths (Ca, Sr and Ba) provide characteristic colour to flame. Ca, Sr and Ba provide Brick red, Crimson red and Apple green colour to the flame respectively. Be and Mg cannot be excited in the flame as the electrons are tightly held.

The gradation in properties of alkaline earth metals:

The chemical reactivity of alkaline earth metals is lower than the chemical reactivity of alkali metals. On moving down the group, the chemical reactivity increases.

(1) Reaction with air and water: Be and Mg form an inert layer of oxide on their surface. Hence, they are inert to air and water.

(i) In air, powdered Be burns to form its oxide and nitride.

(ii) Mg burns in air with dazzling spark to form oxide and nitride.

(iii) Ca, Sr and Ba readily react with air to form oxides and nitrides.

(iv) Ca, Sr and Ba vigorously react with cold water.

(2) On reaction with halogen at high temperature, alkaline earths form halides.

(3) On reaction with hydrogen, alkaline earths (except Be) form hydrides.

(4) On reaction with acids, alkaline earths form salts and liberate hydrogen.

(5) They act as strong reducing agents. They are weaker reducing agents than alkali metals. On moving down the group, the reducing ability increases.

(6) They dissolve in liquid ammonia. The solution is deep blue in colour due to presence of ammoniated electrons.

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**#423449**

**Topic:** Alkali metals

Why are alkali metals not found in nature?

**Solution**

Alkali metals have low ionization enthalpy values. Hence they readily lose their valence electrons and are highly reactive. Hence, in nature, they are not found in elemental state. In combined state, they are present in the form of halides, oxides, silicates, borates and nitrates.

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**#423453**

**Topic:** Alkali metals

Find out the oxidation state of sodium in $Na_2O_2$.

**Solution**

Let x be the oxidation station of sodium in $Na_2O_2$.

It contains a peroxide linkage in which each $O$ atom has the oxidation number of -1.

$2x+2(-1)=0$

$x=+1$

Thus, the oxidation state of sodium in $Na_2O_2$ is +1.

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**#423456**

**Topic:** Alkali metals

Explain why is sodium less reactive than potassium.

**Solution**

Potassium has lower ionization enthalpy (496 kJ/mol) than sodium (520 kJ /mol).

Thus, the ease with which K loses an electron is higher than the ease with which Na loses an electron. Hence, sodium is less reactive than potassium. The standard reduction potential of potassium (-2.925 V) is more negative than that of sodium (-2.714 V). This also indicates lower reactivity of sodium as compared to potassium.

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**#423458**

**Topic:** Lithium

In what ways lithium shows similarities to magnesium in its chemical behaviour?

**Solution**

Chemical similarities between $Li$ and $Mg$:

(1) Their reaction with cold water is slow.

(2) The solubility of the oxides of $Li$ and $Mg$ in water is low. At high temperature, the hydroxides decompose.

$2LiOH \xrightarrow{Heat} Li_2O + H_2O$

$Mg(OH)_2 \xrightarrow{Heat} MgO + H_2O$

(3) They form nitrides by reaction with nitrogen.

$6Li + N_2 \xrightarrow{heat} 2Li_3N$

$3Mg + N_2 \xrightarrow{heat} Mg_3N_2$

(4) They do not form peroxides or superoxies.

(5) They form covalent carbonates which decompose on heating.

$Li_2CO_3 \xrightarrow{heat} Li_2O + CO_2$

$MgCO_3 \xrightarrow{heat} MgO + CO_2$

(6) They do not form solid bicarbonates.

(7) Their covalent chlorides are soluble in ethanol.

(8) Their chlorides are deliquescent and crystallize from aqueous solution as hydrates such as $LiCl_2.2H_2O$ and $MgCl_2.8H_2O$

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**#423459**

**Topic:** Alkaline earth elements

Explain why can alkali and alkaline earth metals not be obtained by chemical reduction methods?

**Solution**

Alkali and alkaline earth metals have high reduction potentials. Hence, they are very strong reducing agents. Hence, other reducing agents cannot reduce oxides or other compounds of alkali and alkaline earth metals. Hence, chemical reduction is not possible.

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**#423461**

**Topic:** Alkali metals

Why are potassium and caesium used, rather than lithium used in photoelectric cells?

**Solution**

The ionization potentials of potassium and cesium are lower than that of lithium. On exposure to light, potassium and caesium easily emit electrons however lithium does not. Hence, potassium and caesium are used in the photoelectric cell.

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**#423463**

**Topic:** Alkali metals

When an alkali metal dissolves in liquid ammonia the solution can acquire different colours. Explain the reasons for this type of colour change.

**Solution**

Different concentrations of alkali metals in liquid ammonia results in different colours. The dilute solutions are blue in colour due to presence of ammoniated electrons. The concentrated solutions have copper bronze colour as ammoniated metal ions are bound by free electrons.

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**#423465**

**Topic:** Alkaline earth elements

Beryllium and magnesium do not give colour to flame whereas other alkaline earth metals do so. Why?

**Solution**

Be and Mg have small atomic size and high ionization energies when compared to other alkaline earth metals. The energy of flame is not sufficient to excite the electrons of Be and Mg to higher energy level. Hence, Be and Mg do not give any color in Bunsen flame.

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**#423466**

**Topic:** Sodium and potassium

Discuss the various reactions that occur in the Solvay process.

**Solution**

In Solvay process, also known as ammonia soda process, carbon dioxide is passed through a brine solution (containing about 28 % NaCl) which is saturated with ammonia to form sodium carbonate.

$2NH_3 + H_2O + CO_2 \rightarrow (NH_4)_2CO_3$

$(NH_4)_2CO_3 + H_2O + CO_2 \rightarrow 2NH_4HCO_3$

$NH_4HCO_3 + NaCl \rightarrow NaHCO_3 \downarrow + NH_4Cl$

The precipitate of sodium bicarbonate is filtered, dried and ignited to form sodium carbonate.

$2NaHCO_3 \xrightarrow{heat} Na_2CO_3 + CO_2 + H_2O$

The carbon dioxide required for the reaction can be obtained by heating limestone (calcium carbonate) to 1300 K in a lime klin. Lime dissolves in water to form calcium hydroxide which is then transferred to the ammonia recovery tower.

$CaCO_3 \xrightarrow{heat} CaO + CO_2$

$CaO + H_2O \rightarrow Ca(OH)_2$

Ammonia required for the process can be prepared by heating ammonium chloride with calcium hydroxide.

$2NH_4Cl + Ca(OH)_2 2NH_3 + CaCl_2 + H_2O$

Hence, the only byproduct of the reaction is calcium chloride.

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**#423467**

**Topic:** Sodium and potassium

Potassium carbonate cannot be prepared by Solvay process. Why ?

**Solution**

The solubility of potassium carbonate is higher than the solubility of sodium carbonate. Hence, when carbon dioxide is passed through concentrated KCl solution contained ammonia, potassium carbonate is not precipitated. Hence, it cannot be prepared by Solvay process.

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**#423469**

**Topic:** Alkali metals

Why is $Li_2CO_3$ decomposed at a lower temperature whereas $Na_2CO_3$ at higher temperature?

**Solution**

Lithium carbonate is less stable than sodium carbonate as Li is less electropositive than sodium. As lithium carbonate is not stable to heat, it decomposes at lower temperature. Small sized Li polarizes large carbonate ion which leads to formation of $Li_2O$ and $CO_2$. Since, sodium carbonate is very stable, it decomposes at high temperature.

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**#423471**

**Topic:** Alkaline earth elements

Compare the solubility and thermal stability of the following compounds of the alkali metals with those of the alkaline earth metals. (a) Nitrates, (b) Carbonates, (c) Sulphates.

**Solution**

(i) Solubility

Nitrates, carbonates and sulphates of alkali metals are water soluble. On moving down the group, the solubility increases. This is because their lattice energies decreases more rapidly than their hydration energies.

Alkaline earth metal nitrates are water soluble. On moving down the group, their solubility decreases. This is because their hydration energies decreases more rapidly than their lattice energies.

Alkaline earth metal carbonates and sulphates have lower solubility than alkali metal carbonates and sulphates. The solubility of alkaline metal carbonates and sulphates decreases with decrease in hydration energy as we move down the group.

(ii) Thermal stability

Alkali and alkaline earth metal nitrates decompose on heating. On heating alkali metal (Na, K, Rb and Cs) decompose to form metal nitrites and oxygen.

$2MNO_3 \xrightarrow{heat} 2MnO_2 + O_2$

Alkaline earth metal nitrates decompose on heating to give metal oxide, nitrogen dioxide and oxygen.

$2M(NO_3)_2 \xrightarrow{heat} 2MO + 4NO_2 + O_2 (M = Be, Mg, Ca, Sr, Ba)$

Lithium nitrate (like magnesium nitrate) decomposes to form metal oxide, nitrgen dioxide and oxygen.

$4LiNO_3 \xrightarrow{Heat} 2Li_2O + 4NO_2 + O_2$

This is because small sized Li+ ion cannot stabilize nitrate ion.

Alkaline earth metal carbonates have less stability towards heat and decompose to carbon dioxide.

$MCO_3 \rightarrow MO + CO_2$

On moving down the group, the stability of alkaline earth metal carbonates increases. Because of diagonal relationship, lithium carbonate decomposes similar to magnesium carbonate.

$Li_2CO_3 \xrightarrow{heat} Li_2O + CO_2$

Other alkali metal carbonates being stable to heat do not decompose.

On heating, alkaline earth metal sulphates decompose to form $SO_3$

$MSO_4 \xrightarrow{heat} MO + SO_3$

On moving down the group, the electropositive characteer and the thermal stability of alkaline earth metal sulphates increases.

Except $Li_2SO_4$, the alkali metal sulphates are stable and do not decompose easily.

$Li_2SO_4$ decomposes like $MgSO_4$ to give $SO_3$

$Li_2SO_4 \xrightarrow{heat} Li_2O + SO_3$

$MgSO_4 \xrightarrow{heat} MgO + SO_3$

**#423472**

**Topic:** Sodium and potassium

Starting with sodium chloride how would you proceed to prepare (i) sodium metal, (ii) sodium hydroxide, (iii) sodium peroxide, (iv) sodium carbonate?

**Solution**

(i) Preparation of sodium metal:

Electrolysis of fused mixture of 40% NaCl and 60% $CaCl_2$ in Down cell at 873K using graphite anode and iron cathode gives sodium metal at anode. At cathode, chlorine is obtained.

$Na^+(melt) + e^- \rightarrow Na(l)$

$2Cl^-(melt) \rightarrow Cl_2 + 2e^-$

(ii) Preparation of sodium hydroxide:

Electrolysis of sodium chloride (brine) in Castner Kellner cell, using carbon anode and mercury cathode gives sodium hydroxide. At cathode, sodium metal is discharged which combines with mercury to form sodium amalgam. At anode, chlorine gas is obtained.

$Na^+ + e^- \rightarrow Na$

$2Na + Hg \rightarrow NaHg(amalgam)$

$2Cl^- \rightarrow Cl_2 + 2e^-$

Sodium amalgam, on reaction with water produces NaOH and hydrogen gas.

$2NaHg + 2H_2O \rightarrow 2NaOH + 2Hg + H_2$

(iii) Preparation of sodium peroxide:

Sodium is heated in excess of oxygen to form sodium peroxide. Initially, sodium oxide is obtained which reacts with more oxygen to form sodium peroxide.

$4Na + O_2 \rightarrow 2Na_2O$

$2Na_2O + O_2 \rightarrow Na_2O_2$

(iv) Preparation of sodium carbonate:

Sodium carbonate is obtained by Solvay process of ammonia soda process.

In this process, carbon dioxide is passed through a brine solution (containing about 28 % NaCl) which is saturated with ammonia to form sodium carbonate.

$2NH_3 + H_2O + CO_2 \rightarrow (NH_4)_2CO_3$

$(NH_4)_2CO_3 + H_2O + CO_2 \rightarrow 2NH_4HCO_3$

$NH_4HCO_3 + NaCl \rightarrow NaHCO_3 \downarrow + NH_4Cl$

The precipitate of sodium bicarbonate is filtered, dried and ignited to form sodium carbonate.

$2NaHCO_3 \xrightarrow{heat} Na_2CO_3 + CO_2 + H_2O$

The carbon dioxide required for the reaction can be obtained by heating limestone (calcium carbonate) to 1300 K in a lime klin. Lime dissolves in water to form calcium hydroxide which is then transferred to the ammonia recovery tower.

$CaCO_3 \xrightarrow{heat} CaO + CO_2$

$CaO + H_2O \rightarrow Ca(OH)_2$

Ammonia required for the process can be prepared by heating ammonium chloride with calcium hydroxide.

$2NH_4Cl + Ca(OH)_2 2NH_3 + CaCl_2 + H_2O$

Hence, the only byproduct of the reaction is calcium chloride.

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**#423475**

**Topic:** Beryllium, calcium and magnesium

What happens when (i) magnesium is burnt in air (ii) quick lime is heated with silica (iii) chlorine reacts with slaked lime (iv) calcium nitrate is heated ?

**Solution**

(i) Magnesium is burnt in air to form magnesium oxide and magnesium nitride.

$2Mg + O_2 \rightarrow 2MgO$

$3Mg + N_2 \rightarrow Mg_3N_2$

(ii) quick lime is heated with silica to obtain calcium silicate

$CaO + SiO_2 \xrightarrow{\text{above 1273 K}} CaSiO_3$

(iii) chlorine reacts with slaked lime to form calcium hypochlorite- a constituent of bleaching powder.

$2Ca(OH)_2 + 2Cl_2 \rightarrow \underbrace{CaCl_2 + Ca(OCl)_2}_{Bleachingpowder} + 2H_2O$

(iv) calcium nitrate is heated to obtain $CaO, NO_2$ and $O_2$.

$2Ca(NO_3)_2 \rightarrow 2CaO + 4NO_2 + O_2$

**#423476**

**Topic:** Beryllium, calcium and magnesium

Describe two important uses of each of the following: (i) caustic soda (ii) sodium carbonate (iii) quicklime.

**Solution**

(i) Caustic soda is used in the

(a) manufacture of soap, artificial silk, paper and other chemicals.

(b) textile industry for mercerizing cotton fabrics.

(ii) Sodium carbonate is used for

(a) softening hard water

(b) washing purposes in laundry.

(iii) Quicklime is used

(a) in the manufacture of sodium carbonate from NaOH

(b) as flux in metallurgy.

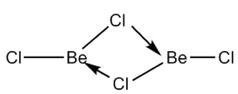
**#423478**

**Topic:** Alkaline earth elements

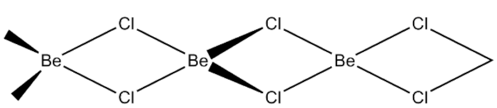
Draw the structure of (i) $BeCl_2$ (vapour) (ii) $BeCl_2$ (solid).

**Solution**

The required structures are shown below.




Dimer in vapour state




Polymer in solid state containing chlorobridges

**#423479**

**Topic:** Alkaline earth elements

The hydroxides and carbonates of sodium and potassium are easily soluble in water while the corresponding salts of magnesium and calcium are sparingly soluble in water. Explain?

**Solution**

The atomic/ionic size of Na and K is larger than that of Mg and Ca.

Hydroxides and carbonates of Na and K have lower lattice enthalpies than those of Ca and Mg. This results in high solubility for hydroxides and carbonates of Na and K whereas those of Mg and Ca are sparingly soluble.

**#423480**

**Topic:** Alkaline earth elements

Describe the importance of the following : (i) limestone (ii) cement (iii) plaster of paris.

**Solution**

(i) Limestone is used

(a) as a building material in the form of marble.

(b) in the preparation of quicklime.

(c) as a raw material in ammonia soda process for the manufacture of sodium carbonate.

(d) as a constituent of toothpaste.

(e) as a filler in cosmetics.

(ii) Cement is used in

(a) concrete and reinforced concrete.

(b) plastering.

(c) the construction of buildings, bridges , dams, etc.

(iii) Plaster of paris is used

(a) in building industry.

(b) in plasters.

(c) for making statues, models and other decorative materials.

(d) in surgical bandages (plasters) for immobilizing the fractured base in the body.

**#423482**

**Topic:** Alkali metals

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

**Solution**

Among alkali metal ions, Li(I) has smallest size due to which it can easily polarize water molecules. Li salts get bonded to water of crystallization. The lithium chloride contains 2 water molecules per mole of LiCl. The other alkali metals being bigger in size cannot easily polarize water molecules. Hence, there salts do not get bonded to water of crystallization.

**#423483**

**Topic:** Alkali metals

Why is $LiF$ almost insoluble in water whereas $LiCl$ soluble not only in water but also in acetone?

**Solution**

The lattice energy of LiF is very high due to small size of $Li^+$ ions and $F^-$ ions. The hydration energy of LiF is lower than lattice energy. In case of LiCl, the hydration energy is higher than the lattice energy. Hence, LiCl is water soluble. Due to higher polarization, LiCl has some covalent character. Hence, it is soluble in non polar solvents such as acetone.

**#423485**

**Topic:** Beryllium, calcium and magnesium

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

**Solution**

The cations of Na and K are present in red blood cells. The concentration gradient (the ratio $K^+ : Na^+$) in mammals (humans, rabbits, rats and horses) is $7 : 1$. This ratio in cats and dogs is $1 : 15$. Work has to be done to establish this concentration gradient. This is done by various mechanisms involving sodium pump and potassium pump. These gradients control the development and functioning of nerve cells.

Chlorophyll contains $Mg^{2+}$ ions. Chlorophyll absorbs sunlight and carries the process of photosynthesis.

$Ca^{+2}$ ions are present as phosphates in bones of humans and animals. They play an important role in muscle contraction. Their deficiency causes malnutrition in children.

Both $Ca^{2+}$ and $Mg^{2+}$ ions catalyze the formation of pyrophosphate linkages which control the various biological systems.

**#423487**

**Topic:** Alkali metals

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 ?

**Solution**

(i) When sodium metal is dropped in water, an exothermic reaction occurs due to which the evolved hydrogen gas catches fire.

$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2$

(ii) sodium metal is heated in free supply of air to form sodium peroxide and sodium oxide.

$2Na(s) + O_2(g) \rightarrow Na_2O(s)$ minor product

$Na_2O_2(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2O_2(l)$

(iii) sodium peroxide dissolves in water to form hydrogen peroxide.

$Na_2O_2(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2O_2(l)$

**#423499**

**Topic:** Alkali metals

Comment on each of the following observations:

(a) The mobilities of the alkali metal ions in aqueous solution are $Li^+ < Na^+ < K^+ < Rb^+ < Cs^+$.

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

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

**Solution**

(a) On moving down the group, the atomic and ionic sizes of alkali metals increases. As the size increases, the extent of hydration decreases.

The extent of hydration and ionic mobility are inversely proportional.

Hence, the increasing order of the ionic mobilities of alkali metals is

$Li^+ < Na^+ < K^+ < Rb^+ < Cs^+$.

(b) Small sized Li ion is most compatible with nitride ion. Thus, in formation of lithium nitride, large amount of lattice energy is released. This energy overcomes the high amount of energy required for formation of nitride ion.

(c) Following factors are responsible for the electrode potential value.

(a) Ionization enthalpy

(ii) Hydration enthalpy

(iii) Enthlpy of vaporisation.

For $Ba, Sr$ and $Ca,$ the net effect of above factors is same.

Hence, their electrode potentials are nearly constant.

**#423502**

**Topic:** Sodium and potassium

State as to why:

(a) a solution of $Na_2CO_3$ is alkaline ?

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

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

**Solution**

(a) Hydrolysis of sodium carbonate in aqueous solution gives hydroxide ions. Hence, the solution is alkaline.

$CO_3^{2-} + H_2O \rightarrow HCO_3^- + OH^-$

(b) During electrolysis of aqueous solution of alkali metal chlorides, hydrogen (having lower discharge potential) is preferentially evolved than alkali metal at cathode. Hence, Electrolysis of fused alkali metal chlorides is carried out to prepare alkali metals.

(c) Sodium ions are present in blood plasma and interstititial fluids which surround the cell. Potassium ions are present in intracellular fluids. Sodium ions help in transmission of nerve signals, regulate water flow across cell membranes. Hence, sodium is more useful than potassium.

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**#423507**
**Topic:** Alkali metals

Write balanced equations for reactions between:

(a) $Na_2O_2$ and water

(b) $KO_2$ and water

(c) $Na_2O$ and $CO_2$.

**Solution**

The balanced chemical equations are given below.

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

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

$Na_2O + CO_2 \rightarrow Na_2CO_3$

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**#423509**
**Topic:** Alkaline earth elements

How would you explain the following observations?

(i) $BeO$ is almost insoluble but $BeSO_4$ is soluble in water.

(ii) $BaO$ is soluble but $BaSO_4$ is insoluble in water.

(iii) $LiI$ is more soluble than $KI$ in ethanol.

**Solution**

(i) Due to high lattice enthalpy and covalent nature, $BeO$ is insoluble in water. In case of ionic $BeSO_4$, the hydration enthalpy is much more than its lattice enthalpy. Hence, it is water soluble.

(ii) Oxide ion has smaller size than sulphate ion. $BaO$ has smaller lattice energy than $BaSO_4$ as bigger cation stablizes bigger anion to greater extent than smaller cation stabilizes bigger anion. Hence, $BaO$ is water soluble and $BaSO_4$ is water insoluble.

(iii) As per Fajan rules, smaller $Li^+$ ion polarizes bigger $I^-$ to a greater extent than $K^+$ ion. Hence, $LiI$ is more covalent than KI and hence, more soluble in organic solvents such as ethanol.

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**#423515**
**Topic:** Alkali metals

Which of the alkali metal is having least melting point ?

**A** Na

**B** K

**C** Rb

$\boxed{\text{D}}$ Cs

**Solution**

Among the given alkali metals, Cs has least melting point. Cs ha large atomic size and weaker mettalic bonds. Hence, it has low melting point.

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**#423516**
**Topic:** Alkali metals

Which one of the following alkali metals gives hydrated salts?

A $Li$

B $Na$

C $K$

D $Cs$

**Solution**

$Li$ gives hydrated salts. Small sized $Li^+$ ion has high charge density and hence, maximum extent of hydration.

**#423519**

**Topic:** Alkaline earth elements

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

A $MgCO_3$

B $CaCO_3$

C $SrCO_3$

D $BaCO_3$

**Solution**

Barium carbonate is thermally the most stable. On moving down the group, the electropositive character of alkaline earth metals increases. Due to this, their thermal stability also increases. The smaller the positive ion, the higher the charge density, and the greater effect it will have on the carbonate ion. As the positive ions get larger down the group, their affect on the carbonate ions near them decreases. More heat must be supplied for the carbon dioxide to leave the metal oxide. In other words, the carbonates become more thermally stable down the group. Hence, $BaCO_3$ is the most stable.

**#423540**

**Topic:** Beryllium, calcium and magnesium

Write reactions to justify amphoteric nature of aluminium.

**Solution**

Aluminium is amphoteric in nature as it reacts with acids as well as alkalies.

$2Al + 6HCl \rightarrow 2Al^{3+} + 6Cl^- + 3H_2$

$2Al + 2NaOH + 6H_2O \rightarrow 2Na[Al(OH)_4]^- + 3H_2$

**#464711**

**Topic:** Sodium and potassium

A milkman adds a very small amount of baking soda to fresh milk.

(a) Why does he shift the $pH$ of the fresh milk from $6$ to slightly alkaline?

(b) Why does this milk take a long time to set as curd?

**Solution**

a) When the milk is made more alkaline by adding a base to it, it is basically done to prevent it for more time to turning to curd. That's why milkman shifts the $pH$ of fresh milk to slightly alkaline by adding a very small amount of baking soda to it as baking soda is alkaline in nature and it neutralizes the acidic nature of milk.

b) As this milk is slightly more alkaline than other, therefore, acid produced to set into curd will be neutralized by baking soda added by milkman. Hence, this milk takes a longer time to set as curd.

**#464712**

**Topic:** Beryllium, calcium and magnesium

Plaster of Paris should be stored in a moisture-proof container. Explain why?

**Solution**

Plaster of Paris, quick-setting gypsum plaster consisting of a fine white powder (calcium sulphate hemihydrate), which hardens when moistened and allowed to dry because plaster of Paris turns into Gypsum after reacting with moisture present in air. That's why plaster of Paris should be stored in a moisture-proof container.

**#464715**

**Topic:** Sodium and potassium

Give two important uses of washing soda and baking soda.

**Solution**

(a) Two important uses of washing soda:

(i) It is used in the manufacture of soap and glass.

(ii) It is used to remove the permanent hardness of water.

(b) Two important uses of baking soda:

(i) It is used for making baking powder.

(ii) It is used in soda-fire extinguishers.