# Chemistry Worksheet Class 11 on Chapter 10 The s-Block Elements – Set 1

**Q1.** Which of the following is most basic?
(a) CsOH
(b) RbOH
(c) KOH
(d) LiOH
**Answer:** (a) CsOH
**Explanation:** The more electropositive the central atom, the more basic the hydroxide is. As we move down the group, the tendency to lose electrons increases and thus, the metallic character (electropositivity) increases. Thus, the basic character increases as we move down the group. Hence, CsOH is the most basic, followed by Rboh, KOH and LiOH.

**Q2.** Lithium shows a diagonal relationship with _____.
(a) Beryllium
(b) Magnesium
(c) Calcium
(d) None of the above
**Answer:** (b) Lithium shows a diagonal relationship with magnesium.

**Q3.** Which of the following element is extracted by Dow's process?
(a) Sodium
(b) Magnesium
(c) Both (a) and (b)
(d) None of the above
**Answer:** (a) Sodium is extracted by Dow's process.

**Q4.** What is the chemical formula of carnallite?
(a) KCl $MgCl_2$. $6H_2O$
(b) $Ca_2B_6O_{11}$. $2H_2O$
(c) $Ca_2Mg_2Si_6O_{22}(OH)_2$
(d) None of the above
**Answer:** (a) The chemical formula of carnallite is KCl $MgCl_2$. $6H_2O$.

**Q5.** Which of the following compound is extracted by using Solvay's process?
(a) Sodium carbonate
(b) Sodium hydroxide
(c) Sodium chloride

(d) None of the above
**Answer:** (b) Sodium carbonate is extracted by using Solvay's process.

**Q6.** Name the element which is invariably bivalent and whose oxide is soluble in excess of sodium hydroxide, and its positive ion has a noble gas configuration.
**Answer:** Berrylium is invariably bivalent, its oxide is soluble in excess of sodium hydroxide, and its positive ion has a noble gas configuration.
Beryllium oxide (BeO) dissolves in sodium hydroxide to form sodium beryllate.
$BeO + 2\ NaOH \rightarrow Na_2BeO_2 + H_2O$

**Q7.** Why is magnesium ion much more heavily hydrated than sodium ion?
**Answer:** The extent of hydration depends on the charge density. The magnesium ion is smaller than the sodium ion and has twice the charge as the sodium ion. Hence, magnesium has a higher charge density than sodium ions. Therefore, a magnesium ion is much more heavily hydrated than a sodium ion.

**Q8.** Why are halides of beryllium polymeric?
**Answer:** The halides of beryllium are electron deficient as their octet are not complete. Therefore to complete their octet, the halides polymerise. Thus, their halides are polymeric.

**Q9.** What is the chemical formula of quicklime, slaked lime and lime water?
**Answer:**

| S. No. | Compound | Chemical formula |
|---|---|---|
| 1. | Quicklime | CaO |
| 2. | Slaked lime | $Ca(OH)_2$ |
| 3. | Lime water | Aqueous solution of slaked lime $[Ca(OH)_2]$. |

**Q10.** What is dead burnt plaster? How is it synthesised?
**Answer:** Anhydrous calcium sulphate ($CaSO_4$) is known as dead burnt plaster. It can be synthesised by heating the plaster of paris ($CaSO_4$. ½ $H_2O$).
$CaSO_4$. ½ $H_2O$ (Plaster of paris) → $CaSO_4$ (Dead burnt plaster) + ½ $H_2O$

**Q11.** Why does the first element in each group show anomalous properties?
**Answer:** The first element in each group shows anomalous properties for the following reasons.
1. Small size of the atom and its ions.
2. High ionisation enthalpy and electronegativity.
3. High polarising power of cations.

4. Non-availability of d orbitals.

**Q12.** Why is lithium chloride soluble in organic solvents?
**Answer:** Lithium chloride is soluble in organic solvents because lithium ion has a very high polarising power; therefore, lithium chloride is covalent in nature. Being covalent in nature, it is soluble in organic solvents.

**Q13.** Why do we keep sodium metal under kerosene?
**Answer:** We keep sodium metal under kerosene because it is very reactive. When exposed to air, it reacts with oxygen, moisture and carbon dioxide present in the air.
$4\ Na\ (s) + O_2 \rightarrow 2\ Na_2O$ (Sodium oxide)
$2\ Na_2O$ (Sodium oxide) $+ 2\ H_2O \rightarrow 4$ NaOH (Sodium hydroxide)
4 NaOH (Sodium hydroxide) $+ 2\ CO_2 \rightarrow 2\ Na_2CO_3$ (Sodium carbonate) $+ 2\ H_2O$
Therefore to prevent these reactions and protect the metal, sodium metal is kept under kerosene.

**Q14.** Answer the following questions.
(a) Why does beryllium chloride give an acidic solution when dissolved in water?
(b) Why are salts of alkaline earth metals colourless and diamagnetic?
**Answer:**
(a) Beryllium chloride gets hydrolysed in water forming hydrochloric acid, which gives $H^+$ ions, making the solution acidic.
$BeCl_2\ (s) + 2\ H_2O \rightarrow Be(OH)_2 + HCl + H^+ + Cl^-$
(b) Alkaline earth metals form dipositive ions in their salts. These dipositive ions have noble gas configurations with no unpaired electrons. Therefore, the salts of alkaline earth metals are colourless and diamagnetic.

**Q15.** Answer the following questions.
(a) Why is lithium iodide less stable than caesium iodide?
(b) Differentiate the structure of calcium hydride and beryllium hydride.
**Answer:** (a) The large cation stabilises a large anion in its lattice. Therefore, lithium iodide is less stable due to the lattice energy effect than caesium iodide, as both caesium and iodide are big in size.
(b) Calcium hydride is an ionic solid consisting of calcium cation and hydride anion having a slightly distorted hcp arrangement. On the other hand, beryllium hydride has a polymeric bridged structure $(BeH_2)_n$.

**Q16.** What happens when sodium dioxide reacts with water? Write the balanced chemical equation for the reaction.
**Answer:** When sodium dioxide reacts with water, an alkaline solution containing hydrogen peroxide is formed, and oxygen gas is evolved.
$Na_2O_2 + 2\ H_2O \rightarrow 2$ NaOH $+ H_2O_2$

**Q17.** What happens when potassium dioxide reacts with water? Write the balanced chemical equation for the reaction.
**Answer:** When potassium dioxide reacts with water, an alkaline solution containing hydrogen peroxide is formed, and oxygen gas is evolved.
$2\ KO_2 + 2\ H_2O \rightarrow 2\ KOH + H_2O_2 + O_2$
Or, $2\ O_2^- + 2\ H_2O \rightarrow 2\ OH^- + H_2O_2 + O_2$

**Q18.** What is the oxidation state of
(a) Lithium in $Li_2O$
(b) Sodium in $Na_2O_2$
(c) Potassium in $KO_2$
**Answer:** The oxidation state of

(a) Lithium in $Li_2O$.
Let the oxidation of lithium be x.
The oxidation state of oxygen = - 2
**Calculation:**
2x + (-2) = 0
2x - 2 = 0
2x = 2
x = 1
Hence, the oxidation state of lithium in $Li_2O$ is + 1.

(b) Sodium in $Na_2O_2$
Let the oxidation of sodium be x.
The oxidation state of oxygen = - 1 (as there is a peroxide bond).
**Calculation:**
2x + 2 X (-1) = 0
2x - 2 = 0
2x = 2
x = 1
Hence, the oxidation state of sodium in $Na_2O_2$ is + 1.

(c) Potassium in $KO_2$
Let the oxidation of potassium be x.
The oxidation state of oxygen = - 1 (as there is a superoxide bond)
**Calculation:**
2x + 2 X (-1) = 0
2x - 2 = 0
2x = 2
x = 1.

Hence, the oxidation state of potassium in $KO_2$ is + 1.

**Q19.** What is a diagonal relationship? What is its cause?
**Answer:** Diagonal relationship is the similarity in the properties of elements presents diagonally. A diagonal relationship exists between specific pairs of diagonally adjacent elements in the periodic table's second and third periods.

Three important diagonal pairs are
1. Lithium (Li) and magnesium (Mg)
2. Beryllium (Be) and aluminium (Al)
3. Boron (B) and silicon (Si)

**Cause of Diagonal Relationship:**

The cause of diagonal relationship is the similarity in properties such as electronegativity, ionisation enthalpy, size or charge/radius ratio, etc., between the diagonal elements.

For example, on moving from left to right across a period, electronegativity increases, and electronegativity decreases while moving down a group. Therefore, the two opposing tendencies almost cancel out on moving diagonally, and the electronegativity values remain almost the same as we move diagonally. Thus, the diagonal pairs have many similar properties.

**Q20.** Discuss evidence to show the diagonal relationship between lithium and magnesium.
**Answer: Evidence of Diagonal Relationship of Lithium with Magnesium**
1. The electronegativities of lithium and magnesium are nearly identical.
2. Lithium and Magnesium are both covalent.
3. Lithium has a boiling point of 1603 K, comparable to magnesium, i.e. 1373 K.
4. Hydroxides of lithium and magnesium are weak bases that readily break down when heated.
   $2\ LiOH \rightarrow LiO_2 + H_2O$
   $Mg(OH)_2 \rightarrow MgO + H_2O$
5. Aqueous hydrates of lithium chloride and magnesium chloride crystallise after they deliquesce.
6. Lithium and magnesium chloride are covalent and soluble in ethanol.
7. Lithium and magnesium ions have a high degree of hydration.
8. Lithium and magnesium hydroxide, carbonate, phosphate, and fluoride are sparingly soluble in water.
9. Lithium and magnesium do not form solid bicarbonates.
10. Lithium and magnesium perchlorate is soluble in ethanol.