Chemistry Worksheet Class 11 on Chapter 10 The s-Block Elements with Answer – Set 3

Q1. What is the correct order of mobility of alkali metal in the aqueous solution?
(a) $Na^+ > K^+ > Rb^+ > Li^+$
(b) $K^+ > Rb^+ > Na^+ > Li^+$
(c) $Rb^+ > K^+ > Na^+ > Li^+$
(d) $Li^+ > K^+ > Na^+ > Rb^+$
Answer: (c) The correct order of mobility of alkali metal in the aqueous solution is $Rb^+ > K^+ > Na^+ > Li^+$.

Q2. Which of the following is formed as the main product when sodium burns in excess of air?
(a) Sodium oxide
(b) Sodium peroxide
(c) Sodium superoxide
(d) Sodium oxide and sodium nitrate
Answer: (b) Sodium peroxide is formed as the main product when sodium burns in excess of air.

Q3. Which of the following alkaline earth metal does not impart characteristic colour to flame?
(a) Beryllium
(b) Calcium
(c) Barium
(d) None of the above
Answer: (a) Beryllium does not impart characteristics of colour to a flame.

Q4. Which of the following alkaline earth metal has the smallest mobility in an aqueous solution?
(a) Magnesium ion
(b) Calcium ion
(c) Barium ion
(d) None of the above
Answer: (a) Magnesium ion has the smallest mobility in an aqueous solution.

Q5. Beryllium exhibits a diagonal relationship with _____.
(a) Boron
(b) Aluminium
(c) Magnesium
(d) None of the above
Answer: (b) Beryllium exhibits a diagonal relationship with aluminium.

Q6. What is the chemical formula of Epsom salt?

(a) Na_2SO_4. 10 H_2O
(b) $MgSO_4$. 7 H_2O
(c) $FeSO_4$. 7 H_2O
(d) None of the above
Answer: (b) The chemical formula of Epsom salt is $MgSO_4$. 7 H_2O.

Q7. Name a radioactive element of s-block elements.
Answer: Francium is a radioactive element of s-block elements.

Q8. Why is lithium hydride more stable than sodium hydride?
Answer: Lithium hydride is more stable than sodium hydride because the size of lithium is small. Thus, it has more force of attraction, requiring a lot of energy to break the bond. Therefore, it is more stable.

Q9. Name a group 1st element that floats on the water without any evident reaction.
Answer: Lithium is the group 1st element that floats on the water without any evident reaction.

Q10. Which of the following can be used to store an alkali metal?
Ethanol, Benzene, Water
Answer: Benzene can be used to store an alkali metal because other substances react with alkali metal as follows.
$Na + H_2O \rightarrow NaOH + ½ H_2$
$Na + C_2H_5OH \rightarrow C_2H_5ONa + ½ H_2$
$Na + C_6H_6 \rightarrow$ No Reaction

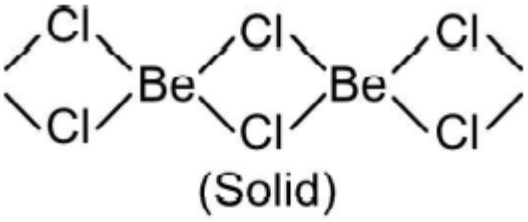
Q11. What is the oxidation state of sodium in Na_2O_2?
Answer: Sodium in Na_2O_2
Let the oxidation of sodium be x.
The oxidation state of oxygen = - 1 (as there is a peroxide bond).
Calculation:
2x + 2 X (-1) = 0
2x - 2 = 0
2x = 2
x = 1
Hence, the oxidation state of sodium in Na2O2
is + 1.

Q12. Why can we not prepare potassium carbonate using Solvay's process?
Answer: Potassium carbonate is soluble in water and does not precipitate when carbon dioxide is passed. Therefore Solvay process is not used for the preparation of potassium carbonate.

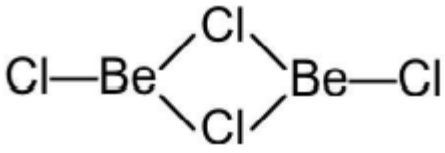
Q13. Why do beryllium and magnesium not give any characteristic colour to flame, whereas other alkaline metals do so?
Answer: Beryllium and magnesium have a small atomic size and high ionisation energies compared to other alkaline earth metals. The flame's energy is insufficient to excite the electrons of beryllium and magnesium to higher energy levels. Hence, beryllium and magnesium do not give any characteristic colour to Bunsen flame.

Q14. Draw the structure of beryllium chloride in vapour and solid state.

Answer:



(Solid)



(Vapour)

Q15. Answer the following questions.
(a) Why is sodium more useful than potassium?
(b) Why the electrolysis of their fused chloride prepares alkali metals?
Answer: (a) Sodium is more useful because it is less reactive than potassium. For this reason, we can control reactions of sodium with different substances and using sodium is far safer than potassium. Thus, sodium is more useful than potassium.
(b) Alkali metals are strong reducing agents. Therefore, we can not extract them by reducing their oxides. And due to their strong electropositive character alkali metals can not be replaced by any other elements from their salt. Due to this reason, alkali metals are prepared by electrolysis of their fused chlorides.

Q16. Compare the stability and thermal stability of the following compounds of the alkali metals with those of alkaline earth metals.
(a) Carbonate
(b) Nitrate
(c) Sulphate
Answer: (a) Carbonate:
Thermal stability:

The carbonates of alkali metals are stable towards heat. However, the lithium carbonate, when heated, decomposes to form lithium oxide. The carbonates of alkaline earth metals also decompose on heating to form oxide and carbon dioxide.

Na_2CO_3 + Heat → No Effect

Li_2CO_3 + Heat → Li_2O + CO_2

$MgCO_3$ + Heat → MgO + CO_2

Solubility:

Carbonates of alkali metals are soluble in water except for Li_2CO_3. Also, the solubility increases as we move down the group.

Carbonates of alkaline earth metals are insoluble in water.

(b) Nitrate:

Thermal stability:

Nitrates of alkali metals, except $LiNO_3$, decompose on strong heating to form nitrites.

$LiNO_3$, on decomposition, gives oxide.

Like lithium nitrate, alkaline earth metal nitrates also decompose to give oxides.

As we move down group 1 and group 2, the thermal stability of nitrate increases.

Solubility:

Nitrates of both group 1 and group 2 metals are soluble in water.

(c) Sulphate:

Thermal stability:

Sulphates of both group 1 and group 2 metals are stable towards heat.

Solubility:

Sulphates of alkali metals are soluble in water. However, sulphates of alkaline earth metals show varied trends.

$BeSO_4$ is fairly soluble,

$MgSO_4$ is soluble,

$CaSO_4$ is sparingly soluble,

$SrSO_4$ is insoluble

$BaSO_4$ is insoluble.

In other words, while moving down the alkaline earth metals, the solubility of their sulphates decreases.

Q17. What is a diagonal relationship? Why does lithium differs from its family members but resembles magnesium?

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.

Lithium differs from its family members but resembles magnesium because its size is closer to lithium. The diagonal relationship is formed due to the identical size of ions. As we move downward across a group in the periodic table, the size of the atoms gradually increases.
As we move right across a period in the periodic table, then the size of the atom reduces.
A diagonal relationship is said to exist between certain pairs of diagonally adjacent elements in the periodic table's second and third periods (first 20 elements).

Q18. Answer the following questions.
(a) Why is potassium oxide paramagnetic?
(b) Why does lithium form oxide, sodium form peroxide, while potassium and rubidium form superoxide?
(c) Why is barium oxide soluble in water, but barium sulphate is insoluble in water?
Answer: (a) Potassium oxide is superoxide which contains an odd number of electrons (unpaired electrons). Therefore potassium oxide is paramagnetic in nature.
(b) The lithium-ion is small in size. It cannot stabilise larger peroxide or superoxide ion. Thus when burnt in the air, lithium forms the monoxide, and others form peroxides or superoxides.
(c) Barium sulphate is insoluble in water because it has high lattice energy. On adding water to barium sulphate, its hydration energy decreases more rapidly than its lattice energy. And to be soluble in water, the component lattice energy should be less than its hydration energy.

Q19. Explain the various reactions in Solvay's process to manufacture sodium carbonate.
Answer: Solvay process is used to prepare sodium carbonate.
When carbon dioxide gas is bubbled through a brine solution saturated with ammonia, sodium hydrogen carbonate is formed. This sodium hydrogen carbonate is then converted to sodium carbonate.
Step 1: Brine solution is saturated with ammonia.
$2\ NH_3 + H_2O + CO_2 \rightarrow (NH_4)_2\ CO_3$.
This ammoniated brine is filtered to remove any impurities.
Step 2: Carbon dioxide is reacted with this ammoniated brine to form insoluble sodium hydrogen carbonate.
$NaCl\ +\ NH_4\ HCO_3 \rightarrow NaHCO_3 + NH_4Cl$
Step 3: The solution containing sodium bicarbonate crystals are filtered to obtain sodium bicarbonate.
Step 4: sodium bicarbonate is heated strongly to convert it into sodium carbonate.
$2\ NaHCO_3\ \rightarrow\ Na_2CO_3 + CO_2 + H_2O$
Step 5: To recover ammonia, the filtrate (after removing sodium bicarbonate) is mixed with calcium hydroxide and heated.
The overall reaction taking place in the Solvay process is
$2\ NaCl + CaCO_3 \rightarrow Na_2CO_3 + CaCl_2$

Q20. What is cement? What is its composition? How is it manufactured?

Answer: Cement is a powdery substance made with calcined lime and clay as major ingredients. The clay provides silica, alumina, and iron oxide, while calcined lime provides calcium oxide.

Manufacturing of cement:

Cement is obtained by combining calcium silicate and aluminates and small quantities of gypsum, which is set into a hard stone when treated with water.