	INDIAN SCHOOL AL WADI AL KABIR	
Class XI	**Department of Science 2020-2021** **SUBJECT: CHEMISTRY**	**Date of Submission: 11.01.2021**
Work sheet No.:10 WITH ANSWERS	**Chapter: s block elements**	**Note: A4 File format**
Name of the student:	**Class & Section:**	**Roll No.**

Objective type Questions (1 mark)

1. Alkali metals react with water vigorously to form hydroxides and hydrogen. Which of the following alkali metal reacts with water least vigorously?
   a. Na
   b. *K*
   c. Li
   d. Cs
2. Write the general electronic configuration of s block elements

3. Which of the following alkaline earth metals does not impart characteristic colour to the flame?
   a. Be b. Ca c. Ba d. Sr

4. Which of the following alkaline earth metal Ion has least mobility in aqueous solution
   a. Mg^{2+} b. Ca^{2+} c. Sr^{2+} d. Ba^{2+}
5. Be exhibits diagonal relationship with
   a. B b. Al c. Mg d. Si
6. Which of the following is most stable
   a. $BeCO_3$ b. $MgCO_3$ c. $SrCO_3$ d. $CaCO_3$
7. Which of the following is most basic?
   a. CsOH b. KOH c. LiOH d. RbOH

Assertion- Reasoning Questions

(A) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.
(B) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.
(C) Assertion is correct, but reason is wrong statement.
(D) Assertion is wrong, but reason is correct statement.

8. Assertion (A): Sodium sulphate is soluble in water while Barium sulphate is insoluble
Reason (R): Lattice energy of Barium sulphate exceeds its hydration energy

9.Assertion: Alkali metals impart colour to the flame
Reason: Alkali metals have low ionization energy

Two marks Questions

10.(a)How do you account for the strong reducing power of lithium in aqueous solutions
(b)What makes Lithium to show properties uncommon to the rest of the alkali metals?
11. Arrange the following alkali metal ions in decreasing order of their mobility
Li^+, Na+, K+, Rb+, Cs+
12. Why are Barium sulphate and Magnesium sulphate readily soluble in water while Calcium sulphate, Strontium sulphate and Barium sulphate are insoluble?
13. All compounds of alkali metals are easily soluble in water but Lithium compounds are more soluble in organic solvents. Explain
14. Explain why
(i) Alkali metals are good reducing agents
(ii) Alkali metals are soft and can be cut with the help of a knife
15. The crystalline salts of alkaline earth metals contain more water of crystallization than the corresponding alkali metal salts why?
16.Describe the nature and properties of solutions of alkali metals in liquid ammonia

Three marks Questions

17. Give reasons for the following
(i) In aqueous solution Li+ ion has the lowest ionic mobility among all the alkali metals
(ii) LiCl has lower melting point than NaCl
(iii) NaCl has higher melting point than KCl
18. 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**.**

Five marks Questions

19. Explain why
(i) Beryllium carbonate is less stable than magnesium carbonate
(ii) The hydroxides and carbonates of sodium and potassium are easily soluble in water whereas that of magnesium and Calcium are sparingly soluble in water
(iii) Beryllium and Magnesium do not give characteristic flame colouration while other elements in the same group give.
(iv) How does the basic character of hydroxides of alkali metals vary on descending the group? Explain
(v) Lithium has the highest ionization enthalpy among alkali metals yet it is the strongest reducing agent. Explain why
20. Comment on each of the following observations:
(a) The ionic mobility of the alkali metal ions is in the following order:

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

(b) The only metal that can form a nitride directly is Lithium.

(c) E^0 for $M^{2+}_{(aq)} + 2e^- \rightarrow M_{(s)}$ (where M = Ca, Sr or Ba) is nearly constant.

(d) Why is LiF almost insoluble in water whereas LiCl soluble not only in water but also in Acetone?

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

A**nswers :**

1. (c) Li
2. $ns^{(1-2)}$
3. (a) Be
4. (a) Mg^{2+}
5. (b) Al
6. (a) BeCO3
7. (a) CsOH
8. (A) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.
9. (A) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.
10. (a) Li is the strongest reducing agent in aqueous solution mainly because of its high enthalpy of hydration.
    (b) Lithium exhibits distinct properties due to the tiny size of the atom, high polarizing power which is a ratio of charge to radius.
11. $Li^+ < Na^+ < K^+ < Rb^+ < Cs^+$
12. Due to smaller size of Be^{2+} and Mg^{2+}, their lattice enthalpies are high but their greater hydration enthalpies overcome the lattice enthalpies and they become soluble in water. Ca, Sr and Ba sulphates are insoluble in water due to lower hydration enthalpies.
13. Smallest size of Li^+ ion and its high polarising power are the two factors which develop covalent character in the lithium compounds (Fajan's rule).
14. (i) Alkali metals are known as good reducing agents because they have their only one valence electron in their outermost shell. Thus, they lose electrons and get oxidized themselves, hence reducing other compounds. Lesser the number of electrons in the valence shell, stronger will be the reducing agent.
    (ii) Due to the presence of weak metallic bonding alkali metals are soft and can be cut with a knife
15. The crystalline salts of alkaline earth metals contain more water of crystallization than the corresponding alkali metal salts, because the size of alkaline earth metal ions is lower than

the size of alkali metal ions. The lower the size of the cation, the higher is the hydration energy.

16. Alkali metals dissolve in liquid ammonia giving deep blue solutions, which conduct electricity. The blue colour of the solution is due to ammoniated electrons, which absorb energy in the visible region of light.
17. (i) Lithium ions are highly hydrated in aqueous solution due to its smaller size. So, the extent of hydration is more and due to which ionic radii in water is more, which results in low mobility in aqueous solutions.

    (ii) The reason LiCl has lower melting point than NaCl because Li+ has a higher charge density and thus polarises Cl- to a greater extent resulting in a covalent character in the lattice structure. This covalent character causes the full lattice structure to become weaker and hence LiCl requires less energy to break its structure.

    (iii) Higher lattice energy of NaCl
18. Nitrates, carbonates and sulphates of alkali metals are water soluble. On moving down the group, the solubility increases. This is because their lattice energies decrease 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 decrease 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.

    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.

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

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

    On moving down the group, the stability of alkaline earth metal carbonates increases.

    Because of diagonal relationship, lithium carbonate decomposes similar to magnesium carbonate.

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

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

19. (i)Be^{2+} has more polarising power compared to Mg^{2+}. Therefore, unstable and hence decomposes easily

(ii) The atomic size of sodium and potassium is larger than that of magnesium and calcium. Thus, the lattice energies of carbonates and hydroxides formed by calcium and magnesium are much more than those of sodium and potassium. Hence, carbonates and hydroxides of sodium and potassium dissolve readily in water whereas those of calcium and magnesium are only sparingly soluble.

(iii)Since the electrons in beryllium and magnesium are too strongly bound it cannot get excited by flame. Hence Beryllium and magnesium do not give colour to flame.

(iv) On moving down the group of alkali earth metals, the basic character of hydroxides increases from LiOH to CsOH. As the size of the metal cation increases, the internuclear distance between metal cation and the oxygen of the hydroxide group increases. This increases the ease of ionization of the hydroxide ion.

(v) Lithium ion is small in size on account of which more solvent molecules can easily surround around the cationic sphere. so, large amount of hydration energy is released and on account of Large amount of hydration energy makes it strongest reducing agent inspite of its highest ionisation enthalpy.

20. (a) On moving down the group, the atomic and ionic sizes of alkali metals increase. 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) The small size of Li+ ion makes it more compatible with N^{3-} bonding. Lattice energy

released is very high

(c) The electrode potential of any alkaline earth metal E^0 for $M^{2+}_{(aq)} + 2e^- \rightarrow M_{(s)}$ (where M = Ca, Sr or Ba) depends on two factors-(1) Ionisation enthalpy and (2) Hydration enthalpy. For the second group elements, the combined effect of these two enthalpies are almost same. 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.

(d) 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.

(e) Lithium is the smallest in size among the alkali metals. Hence, Li^+ ion can polarize water molecules more easily than other alkali metals. As a result, water molecules get attached to lithium salts as water of crystallization. Hence, lithium salts are hydrated.

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