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TEXTBOOK QUESTIONS SOLVED

Question 1. What are the common physical and chemical features of alkali metals?
Answer: Physical properties of alkali metals:

- Alkali metals have low ionization enthalpies.
- Alkali metals are highly electropositive in nature.
- Alkali metals exhibit +1 oxidation states in their compounds.
- Alkali metals impart characteristic colours to the flame.

Chemical properties of alkali metals:

- Alkali metals are highly reactive in nature.
- Alkali metals hydroxides are highly basic in nature.
- Alkali metals dissolve in liquid ammonia to form blue and conducting solution.

Question 2. Discuss the general characteristics and gradation in properties of alkaline earth metals.
Answer:

- Atomic size goes on increasing down the group.
- Ionisation energy goes on decreasing down the group.
- They are harder than alkali metals.
- They are less electropositive than alkali metals.
- Electropositive character increases on going down the group.

Question 3. Why are alkali metals not found in nature?
Answer: Alkali metals are highly reactive in nature. That's why they always exist in combined state in nature.

Question 4. Find out the oxidation state of sodium in Na_2O_2.
Answer: Let x be the oxidation state of Na in Na_2O_2
2x + 2 (-1) = 0
2x - 2 = 0
2x = 2 x = +1.

Question 5. Explain why is sodium less reactive than potassium.
Answer: It is because ionization enthalpy ΔH_i of potassium = 419 kJ mol $^{-1}$.
Ionization enthalpy of sodium = 496 KJ mol. Since Ionization enthalpy of potassium is less than that of sodium, potassium is more reactive than sodium.

Question 6. Compare the alkali metals and alkaline earth metals with respect to (i) ionization enthalpy, (ii) basicity of oxides, (iii) solubility of hydroxides.
Answer:
(i) Ionization enthalpy. Because of high nuclear charge the ionization enthalpy of alkaline earth metals are higher than those of the corresponding alkali metals.
(ii) Basicity of oxides. Basicity of oxides of alkali metals are higher than that of alkaline earth metals.
(iii) Solubility of hydroxides of alkali metals are higher than that of

alkaline earth metals. Alkali metals due to lower ionization enthalpy are more electropositive than the corresponding group 2 elements.

Question 7. In what ways lithium shows similarities to magnesium in its chemical behaviour?
Answer:

- Both react with nitrogen to form nitrides.
- Both react with 02 to form monoxides.
- Both the elements have the tendency to form covalent compounds.
- Both can form complex compounds.

Question 8. Explain why can alkali and alkaline earth metals not be obtained by chemical reduction method.
Answer: Alkali and alkaline earth metals are themselves better recucing agents, and reducing agents better than alkali metals are not available. That is why these metals are not obtained by chemical reduction methods.

Question 9. Why are potassium and caesium, rather than lithium used in photoelectric cells?
Answer: Potassium and caesium have much lower ionization enthalpy than that of lithium. As a result, these metals easily emit electrons on exposure to light. Due to this, K and Cs are used in photoelectric cells rather than lithium.

Question 10. When alkali metal dissolves in liquid ammonia, the solution can acquire different colours. Explain the reason for this type of colour change.
Answer: Alkali metals dissolve in liquid ammonia and give deep blue solutions which are conducting in nature because ammoniated electrons absorb energy in the visible region of light and impart blue colour.

$$M + (x + y)\,NH_3 \longrightarrow [M(NH_3)_x]^+ + \underbrace{e^-(NH_3)_y}_{\text{Ammoniated electrons}}$$

Question 11. Beryllium and magnesium do not give colour to flame whereas other alkaline earth metals do so. Why?
Answer: Due to small size, the ionization enthalpies of Be and Mg are much higher than those of other alkaline earth metals. Therefore, a large amount of energy is needed to excite their valence electron, and that's why they do not impart colour to the flame.

Question 12. Discuss the various reactions that occur in the Solvay process.
Answer:

$$CaCO_3\,(s) \xrightarrow{\text{heat}} CaO + CO_2$$
$$NH_3 + H_2O \longrightarrow NH_4^+ + OH^-$$
$$NaCl + NH_4OH + CO_2 \longrightarrow NaHCO_3 + NH_4Cl$$
$$2\,NaHCO_3 \xrightarrow{\text{heat}} Na_2CO_3 + CO_2 + H_2O$$
$$Na_2CO_3 + 10\,H_2O \longrightarrow Na_2CO_3 \cdot 10\,H_2O$$

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