S-Block Elements

1. What is the total number of *s*-block elements present in the modern periodic table?
   - 12
2. Name the elements present in group-1of the modern periodic table.
   - Group-1 of the periodic table consists of lithium (Li), sodium (Na), potassium (K), rubidium (Rb), cesium (Cs) and francium (Fr).
3. Name the elements present in group 2 of the modern periodic table.
   - The group-2 elements are beryllium (Be),magnesium (Mg), calcium (Ca), strontium(Sr), barium (Ba) and radium (Ra).
4. Name the radioactive elements present in *s*-block.
   - Fr and Ra
5. Why isthe size of the ions of alkali metals less than their respective atomic size?
   - Due to- i) removal of the outermost shell
     ii) increase in the effective nuclear charge.
6. Why does potassium show fluctuation from the normal trend of atomic density?
   - Due to unusual increase in atomic size.
7. Why alkali metals possess apparently low I.P?
   - Due to the large size of the atoms, the nuclear force of attraction on the valence electron is less and hence the electron can be easily removed.
   - After eliminating an electron it attains stable electronic configuration of nearest noble gas.
8. Why alkali metals possess a high 2^{nd} I.P?
   - M+ possess stable electronic configuration of nearest noble gas hence apparently large amount of energy is required to remove the next electron hence the second I.P of these elements are fairly large.
9. Why theions of alkali metals diamagnetic?
   - M+ possess noble gas electronic configuration hence it is diamagnetic (due to absence of unpaired electron).
10. Why alkali metals are good conductor of electricity?
    - Alkali metals are good conductors of heat and electricity due to the presence of loosely bounded valence electron.
11. Why alkali metals show colourful flame in flame test?
    Chlorides of alkali metals are volatile in nature.Whenheated in bunsen flame, the outermost valence electron jump to the higher state by absorbing energy. When the excited electrons return to the ground state, they release the absorbed energy as visible light(lower energy).
12. Why alkali metals possess high value of lattice energy?
    - Strong electrostatic force of attraction exist between the ions hence the lattice energy of the salts of alkali metals are quite high.
13. Why Lithium possess high reducing nature in aqueous form?
    - High reducing nature of lithium is due to large heat of hydration (due to its small size)
14. Why Li_2CO_3 easily decomposes on heating?
    - Due to strong polarising action of small Li+ ion the electron cloud on the oxygen-carbon bond of the carbonate radical get distorted, making the C-O bond weak. As a result, when heated Li_2CO_3 breaks to produce oxide and carbon dioxide.
15. Why LiCl shows an unusual solubility in water?
    - The unusual solubility of LiCl may be due to small size of Li+ ion and higher hydration energy.
16. Why LiCl shows an unusual variation in melting point?
    - The unusual variation of the LiCl may due to its covalent nature.
17. Which alkali metal can form complexes?
    - Lithium
18. Why common salt becomes wet in rainy season?

- Common salt contains $MgCl_2$ and $CaCl_2$ as impurities which are deliquescent substances. That's why common salt becomes wet in rainy season.

19. Why NaOH should be kept in air tight container?
    - NaOH is a deliquescent substance, it absorbs moisture from air, thus it should be kept in air tight container?
20. What is washing soda?
    - Decahydrated sodium carbonate ($Na_2CO_3.10H_2O$) is known as washing soda.
21. Which is the most abundant alkali and alkaline earth metal in the earth's crust?
    - Sodium and calcium respectively.
22. Which alkali metals form the strongest base?
    - Cesium
23. Which alkali metal carbonate on heating gives carbon dioxide?
    - Li_2CO_3
24. Name the elements present in group-2 of the modern periodic table.
    - Group-2 of the modern periodic table includes beryllium(Be), magnesium(Mg), calcium(Ca), strontium(Sr), barium(Ba) and radium(Ra).
25. What is the general electronic configuration of group-1 and 2 elements?
    - ns^1 and ns^2 respectively.
26. Why the size of group-2 elements small than group-1 elements?
    - Atomic sizes of group-2 elements are smaller than the corresponding alkali metals of the same period because with the addition of the new electron, the nuclear charge increases, pulling the outer orbit more close to the nucleus.
27. Why isthe density of the alkaline earth metals greater than that of alkali metals?
    - Due to close packing (which is because of small size and greater nuclear charge)
28. Why arethe melting point and boiling point values of alkaline earth metals higher than that of the alkali metals?
    - The melting point and boiling point values are higher than that of the alkali metals as they possess two valence electrons and the bond is stronger than that of the alkali metals.
29. Why the first I.P of the alkaline earth metals is higher than that of the alkali metals but the second I.P of the alkaline earth metals is lower than that of the alkali metals ?
    - The first I.P of the alkaline earth metals is higher than that of the alkali metals due to small size and higher effective nuclear charge. But the second I.P of the alkaline earth metals is lower than that of the alkali metals because after removing the first electron, alkali metals attain stable electronic configuration of nearest noble gas.
30. Although the 2nd I.P. of alkaline earth metals is quite high yet they show +2 states.Explain.
    - Although their 2^{nd} I.P. of alkaline earth metals is quite high yet they show +2 state as-
        i. The M^{2+} possess stable electronic configuration of nearest noble gas.
        ii. High nuclear charge and small size of M^{2+}ion form strong lattice structure and easily get hydrated in aqueous medium.
31. Why alkaline earth metals are good conductor of electricity?
    - Alkaline earth metals are good conductors of heat and electricity due to presence of two loosely bound valence electrons.
32. Arrange the alkaline earth metals in the increasing order of reducing power.
    - Be<Mg<Ca<Sr<Ba
33. How carbides of the alkaline earth metals react with water?
    - All carbides of alkaline earth metals produce alkane or alkene or alkyne when treated with water.

$$Be_2C + 4H_2O \rightarrow 2Be(OH)_2 + CH_4$$
$$CaC_2 + 2H_2O \rightarrow Ca(OH)_2 + C_2H_2$$
$$Mg_2C_3 + 4H_2O \rightarrow 2Mg(OH)_2 + CH_3C{\equiv}CH$$

34. What is the nature of bonds found in the oxide of the alkaline earth metals?
    - Except BeO all oxides of alkaline earth metals are ionic.

35. Why beryllium oxide and hydroxide is amphoteric in nature?
    - Due to its small size and high I.P beryllium oxide and hydroxide are amphoteric in nature.
36. What is lime light?
    - When heated at 2270K by oxy-hydrogen flame CaOemits brilliant white light called limelight.
37. What is slaking of lime?
    - CaO reacts with water producing huge amount of heat and a hissing sound to form fine powder, slaked lime. The process is called slaking of lime.

      $CaO + H_2O \rightarrow Ca(OH)_2$
38. What is soda lime mixture? Provide one use of it.
    - The mixture of CaO and NaOH is known as soda-lime mixture. It is used as in decarboxylation of carboxylic acid.
39. What is dead plaster?
    - When plaster of Paris is heated at 200^0C, it forms anhydrous calcium sulphate, which is called dead plaster or dead burnt and it does not solidify with water

$$2CaSO_4.H_2O \xrightarrow{200^0C} CaSO_4 \xrightarrow{1000^0C} CaO+SO_3$$

40. Why isgypsum added in the preparation of cement?
    - Gypsum slow down the setting process of cement, as a result the cement get harden.
41. $BaSO_4$ is insoluble in water but $BeSO_4$ is soluble in water. Why?
    - Due to the small size of Be^{2+} ion, its hydration energy is quite higher than its lattice energy. Thus it is soluble in water. But Ba^{2+} ion is quite large in comparison with Be^{2+} ion, its hydration energy is lower than its lattice energy, thus it is insoluble in water.
42. Why Li^+ion possess least mobility in aqueous solution among alkali metals?
    - Due to small size, Li^+ ions are most highly hydrated in aqueous solution consequently it bears lowest ionic mobility.
43. Why does alkali and alkaline earth metals impart colour to the flame?
    - Both alkali and alkaline earth metals have low I.P. Their valence electrons easily absorb energy from the flame and are excited to different higher energy levels. These electron when return to the ground state, they emit energy in the form of light of different frequencies imparting different colours.
44. Although lithium has highest I.P. in group-I elements, yet it is the strongest reducing agent in aqueous solution. Explain?
    - In aqueous solutions, the tendency of an element to lose electrons does not entirely depend upon its I.P. It also depends upon the enthalpy of hydration of the ion. The combined effects of these factors control the electrode potential. Since lithium has the most negative electrode potential among group-I elements, therefore, lithium is the strongest reducing agent.
45. How to extinguish fire caught in metallic sodium?
    - Sodium reacts violently with water producing heat and H_2 gas which also catches fire. As a result, the fire spreads rather than being extinguished. Pyrene can be used to cut off the fire in such case.
46. Why alkali metal and alkaline earth metal ions are colourless and diamagnetic?
    - Alkali and alkaline earth metal ions are colourless and diamagnetic due to the absence of unpaired electrons.
47. Why does basic strength of hydroxide of *s*-block metals increases down a group?
    - As we move down a group, size of the cations increases. This results in increased internuclear distance with increase in atomic number of the metal. Hence, there is greater separation of the OH^- ion from the

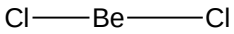
metal ion. As a consequence, degree of ionisation of the hydroxides increase and therefore, strength of the hydroxide ions increases.

48. Why superoxide of alkali metals is paramagnetic while normal oxides are diamagnetic?
    - Superoxides contain the O^-_2ionwhich has the structure containing three electron bonds, thus it is paramagnetic. Normal oxides containing the ion do not have any unpaired electrons and hence are diamagnetic.
49. Why do alkali metals cannot show higher oxidation state?
    - Alkali metals show +l oxidation state as they have only one electron which can be easily lost as alkali metal have low ionization energies to form monovalent ion, M^+, which has the stable configuration of an inert gas.
      To remove second electron form M^+ ion, apparently high energy is required. Therefore, alkali metals do not show higher oxidation states.
50. When does a cation possess high polarising power? Which alkali metal cation has the highest polarising power?
    - A cation possesses high polarising power if its charge/size ratio is very high. Because of its small size, Li^+ ion has the highest polarising power among the alkali metal ions.
51. Why $BeCl_2$ is covalent but $BaCl_2$ is ionic in nature?
    - Be^{2+} ion being smaller in size has high polarising power on large Cl^- ion and distorts the electron cloud of Cl^- ion making the molecule covalent. On the other hand, due to large size and low polarising power of Ba^{2+}ion ,$BaCl_2$ is an ionic.
52. Why lithium salts are often hydrated?
    - Due to small size and high charge density of Li^+ion, it can easily polarise water molecules. Polarised water molecules get easily attached with Li^+ as water of crystallisation. Thus most of the Li salts are hydrated.
53. Why does table salt get wet in rainy season?
    - Pure NaCl is not hygroscopic but table salt contains impurities like $MgSO_4$, $CaSO_4$, $MgCl_2$ and $CaCl_2$. These impurities being hygroscopic absorb moisture from air in rainy season and gets wet.
54. Between LiF and LiI, which has more covalent character?
    - LiI , because according to Fajan's rules , covalent character increases with the decrease in the size of cation and increase in the size of anion.
55. Why is calcium preferred over sodium to remove last traces of moisture from alcohol?
    - Both Na and Ca react with water to form their respective hydroxides and hydrogen. But Na also readily reacts with alcohol to form sodium ethoxidewhileCa reacts very slowly. Thus, when Ca is used, it will react more readily with water than with alcohol.

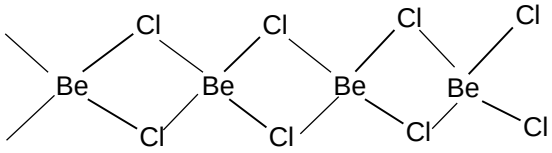
      $$2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2$$
56. Why Mg continues to burn in SO_2?
    - Magnesium ribbon continues to burn in SO_2 since it reacts to from MgO and S.

      $$2Mg+SO_2 \rightarrow 2MgO+S$$

      The heat produced in the reaction keeps the magnesium burning.
57. Why $BeCl_2$ fume in moist air but other alkaline earth metal halides do not.
    - $BeCl_2$ is a salt of a weak base, $Be(OH)_2$ and strong acid, HCl .It undergoes hydrolysis to form HCl which fumes in air. $BaCl_2$, on the other hand, is a salt of a strong base, $Ba(OH)_2$ and strong acid, HCl does not undergo hydrolysis to from HCl and hence does not fume in air.
58. Why potassium carbonate cannot be prepared by Solvay process?
    - During the process, carbon dioxide is passed through chloride solution in ammonia. When bicarbonate of the alkali metal is precipitated. If potassium chloride is taken, it forms potassium bicarbonate, which is soluble. Hence potassium carbonate cannot be prepared.
59. Identify the state of hybridisation of Be in $BeCl_2$? How does it change in the solid state?
    - In the vapour state at high temperature Be is sp-hybridized and hence $BeCl_2$ is linear. In the solid state, $BeCl_2$ is polymeric. In this structure, each Be has two covalent and two coordinate bonds. Therefore, in the solid state, Be has sp^3-hybridization.



Linear structure



Tetrahedral structure

60. What do you know about lithopone ?

- Lithopone is a mixture of $BaSO_4$ and ZnS
  Lithopone is prepared by mixing barium sulphide with an aqueous solution of zinc sulphate.BaS + $ZnSO_4 \rightarrow BaSO_4$ + ZnS
  The mixture formed is dried and then heated in a muffle furnace to redness .Then it is quenched with water. Finally it is ground to a find powder.
  It is used as a white pigment.

61. How do the physical properties of group-1 elements vary?

Property	How it changes down the group
Atomic size	Increases
Ionic size	Increases
Atomic volume	Increases
Ionisation potential	Decreases
Metallic nature	Increases
Density	Increases
Melting point	Decreases
Boiling point	Decreases
Lattice energy	Decreases
Hydration of ions	Decreases
Ionic conductance	Increases
Hydration energy	Decreases

62. How do the physical properties of group-2 elements vary?

Property	How it changes down the group
Atomic size	Increases
Ionic size	Increases
Atomic volume	Increases
Ionisation potential	Decreases
Metallic nature	Increases
Density	Decreases till Ca then increases
Melting point	Decreases
Boiling point	Decreases
Lattice energy	Decreases
Hydration of ions	Decreases
Ionic conductance	Increases
Hydration energy	Decreases

63. Why Lithium shows anomalous property?

- The anomalous behaviour is due the following reasons:
  i. Small size of Li atom and Li+ ion.
  ii. High polarising property.
  iii. High ionisation potential and low electropositive nature.
  iv. Absence of d orbital

v. Can form strong intermetallic bonding

64. Differentiate between Sodium carbonate and sodium bicarbonate.

Sodium carbonate	Sodium bicarbonate
When heated it melts	When heated it decomposes to carbonate and CO_2
Changes the colour of phenolphthalein to pink.	No change in colour of phenolphthalein.
A white ppt. is formed when $MgSO_4$ is added	No white ppt. is formed when $MgSO_4$ is added

65. What happen when sodium thiosulphate solution is treated with HCl?
    - When reacted with HCl, choking smell of SO_2 is produced with yellow ppt. of sulphur.

      $Na_2S_2O_3 + 2HCl \rightarrow 2NaCl + H_2O + SO_2 + S\downarrow$

66. Why hypo is used in photography?
    - Hypo forms a soluble complex with silver halides.

      $Na_2S_2O_3 + AgBr \rightarrow Na_3[Ag(S_2O_3)_2] + NaBr$

      This reaction is used in photography to remove the excess silver bromide present in the photographic plate.

67. How does lime water reacts with chlorine?
    - When dry chlorine gas is passed over dry slaked lime at 40^0C, bleaching powder is produced.

      $Ca(OH)_2 + Cl_2 \rightarrow Ca(OCl)Cl + H_2O$
    - With excess cold lime water, calcium hypochlorite is produced.

      $2Ca(OH)_2 + 2Cl_2 \rightarrow Ca(OCl)_2 + 2H_2O$
    - Excess chlorine reacts with hot milk of lime to produce calcium chloride and calcium chlorate.

      $6Ca(OH)_2 + 6Cl_2 \rightarrow 5CaCl_2 + Ca(ClO_3)_2 + 6H_2O$

68. Why magnesium and beryllium cannot impart colour to bunsen flame?
    - Due to small size and high I.P of these elements, the valence electrons of Mg and Be does not get excited to higher orbits (the heat imparted by bunsen flame is not enough to excite the electrons) and, hence they don't show any colour in Bunsen flame.