

# S – block elements, P – block elements and chemical bonding -1

## Key Answers

1 .Ans. Option c.

I group elements Li, Na, K, Rb, and Cs are highly reactive, hence they do not occur in free state.

2. Ans. Option c.

Group I elements are called alkali metals because they dissolve in water to form soluble hydroxides called alkali's.

Noble metals are Silver Gold and platinum

Group II elements are called Alkaline earth metals because their oxides are alkaline and occur in earth crust.

3. Ans. B

Due to addition of new shell of electrons, atomic radius increases down the group

4. Ans. Option C

The electronic configuration of alkali metals can be written as [ rare gas ]  $ns^1$  i.e. penultimate shell has octet electronic configuration

In option C penultimate shell (  $2^{nd}$  shell d orbital ) contains 10 electrons , hence this is not an electronic configuration of alkali metals .

5.Ans .Option A

Density = mass / volume

Density of alkali metals increases down the group . Lithium is the lightest metal .But there is exception. Density of potassium is less than that of sodium. This is due to abnormal increase in atomic size of potassium

Density of Li –  $0.534 \text{ g / cm}^3$

Na -  $0.972 \text{ g / cm}^3$  ( At. Radius of Na – 186 pm)

K -  $0.869 \text{ g / cm}^3$  ( At radius of K - 227 pm)

6. Ans. Option b .

Strong reducing agents readily give electrons for reduction reactions. ( Reduction is addition of electrons)

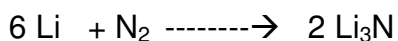
In alkali metals the valence s - electron can be easily removed , hence they are strong reducing agents

7. Ans. B

Ionization potential decreases down the group as size increases down the group. Lithium has small size, hence highest ionization potential.

8. Ans. C

Lithium reacts with nitrogen gas and gives lithium nitride



Other alkali metals do not react with nitrogen gas.

9. Ans. Option d

Electropositive character (i.e. metallic property) increases down the group, due to decrease in ionization potential.

10. Ans. Option b. Because alkali metals have large atomic radius.

11. Ans. Option b

Ionization potential is the amount of energy required to remove the outermost electron from an isolated gaseous neutral atom.

Sodium has highest second ionization potential, hence second electron removal from sodium is difficult.

1<sup>st</sup> ionization potential of sodium is 495.2 kJ/mole whereas 2<sup>nd</sup> I.P is 4560 kJ/mole

12. Ans. Option d

Lithium cannot be stored in kerosene oil, because it is the lightest metal and it floats on its surface and reacts with air. Therefore it is kept wrapped in paraffin wax.

13. Ans. Option C

In alkali metals electropositive nature increases from Li to Cs, hence reactivity with water also increases.

14. Ans. Option c

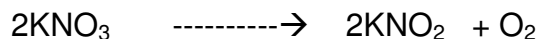
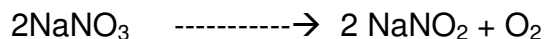
Except Be and Mg, all other s-block metals impart color to the flame due to their low ionization potential.

15. Ans. Option c

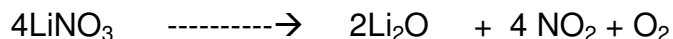
Sodium salts give golden yellow color flame. Potassium salts give violet color flame. Potassium carbonate solution in water is alkaline, hence it turns red litmus paper blue.

16. Ans. Option c.

First two compounds  $\text{NaNO}_3$  and  $\text{KNO}_3$  decomposes and gives their nitrites and oxygen gas,



But  $\text{LiNO}_3$  decomposes and gives lithium oxide, nitrogen dioxide and oxygen.



17. Ans option d .

Lithium resemble next group second element i.e. Mg.

18. Ans. Option d.

Alkali metals have lowest I.P . Hence they emit electrons even when exposed to light (This phenomenon is known as photoelectric effect).

Due to lowest ionization potential Cs shows maximum photo electric effect.

19. Ans. Option d.

Carbon has limited covalence of four because of non availability of d- orbital electrons

Carbon forms double bond , triple bond with carbon and other elements .

Its tendency of forming long chain is a catenation property . ( Self linking property)

All other elements of this group have d – orbital in penultimate shell.

20. Ans. Option a.

Catenation is the self-linking property of the elements to form covalent bonds. It depends upon the strength of the metal- metal bond . Carbon shows maximum catenation property as the bond energy of C – C is very high ( 335 kJ / mole) due to small size.

25. Ans. Option c

E.g. In  $\text{CCl}_4$  O.s. of carbon is + 4

In  $\text{CH}_4$  O.s of carbon is - 4

In CO and  $\text{CHCl}_3$  O.s of carbon is +2

22. Ans . option C

Carbon has number of allotropes i.e. diamond, graphite, coal, wood charcoal, lamp black, fullerene, coke

Si, Ge and Sn also show allotropy. Whereas Pb exists only in metallic form.

23. Ans. option d.

Crystalline forms of carbon is Diamond, graphite and fullerene

Amorphous form of carbon is Charcoal, Coal , coke and lamp black

24. Ans. Option c.

Diamond is non conductor where as graphite is conductor of electricity.

Carbon atoms in diamond are  $sp^3$  hybridized hence it has tetragonal 3D structure

Carbon atoms in Graphite are  $sp^2$  hybridized hence it has planar structure

Nature of bonding is common in both i.e. covalent bonding

Density of diamond is  $3.51 \text{ g/cm}^3$  , that of graphite is  $2.25\text{g/cm}^3$

25. Ans. Option b.

Diamond has high refractive index (i.e. 2.45) White light passing through the crystal undergoes total internal reflection along with dispersion , this explains the brilliance of diamond and hence it is used as gem.

26. Ans. Option c.

$C_{60}$  contains 12 five membered rings and 20 six membered rings

27. Ans. Option c

Pentavalent impurities like phosphorous gives extra electrons which are responsible for conduction of electricity.

28. Ans. Option c.

Noble gases are the most stable elements, because they have octet structure i.e. eight electrons in the outermost orbit. ( $ns^2 np^6$ ). Hence octet structure is considered as the most stable electronic structure. Other atoms also try to attain this structure by forming chemical bonds

29. Ans. Option b

Only valence shell electrons are participating in chemical bonding

30. Ans. Option b

Anions are formed by gaining of one more electrons by the atoms.

And cations are formed by losing one or more electrons

These two types of ions are held by an electrostatic force of attraction and form an ionic bond.

31. Ans. Option b.

In melting of ice and boiling of water hydrogen bonds are broken, in melting of solid iodine Vander Waals force is broken (since solid iodine is a molecular crystal) but in the melting of sodium chloride crystals ionic bond is broken.

32. Ans. Option a.

Covalent bonds are formed by sharing of electrons between atoms.

33. Ans. option d

$Mg^{2+} SO_4^{2-}$ ,  $K^+ Cl^-$  and  $Ca^{2+} O^{2-}$  are ionic compounds

whereas in ammonia, nitrogen atom forms covalent bond with three hydrogen atoms hence it is covalent compound.

34. Ans. option b

Dry ice is solid carbon dioxide, it contains covalent bond.

35. Ans. Option b.

In hydrogen chloride molecule s orbital of hydrogen overlaps with the p orbital of chlorine atom and forms HCl molecule.

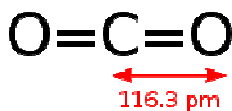
36. Ans. Option c.

In methane carbon is  $sp^3$  hybridized (tetrahedral) bond angle is  $109^\circ 28'$

In water shape of the molecule is triangular (V-shaped) bond angle is  $104^\circ 5'$

In ammonia the shape is trigonal pyramidal bond angle is  $107^\circ$

Whereas in carbon dioxide the shape is linear – bond angle is  $180^\circ$



37. Ans. Option c

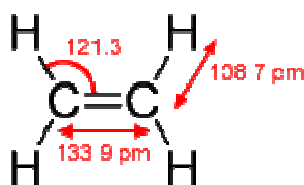
In methane carbon atom is  $sp^3$  hybridized, whereas in  $\text{CO}_2$  carbon is  $sp$  hybridized and in  $\text{BF}_3$  boron atom is  $sp^2$  hybridized.

38. Ans. Option d.

In boron trifluoride boron atom is  $sp^2$  hybridized hence bond angle is  $120^\circ$

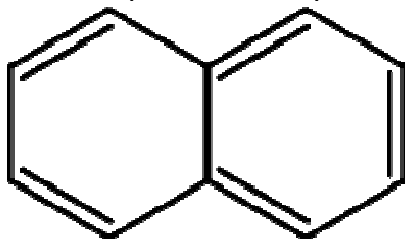
39. Ans. Option c.

In ethene between two carbon atoms there is only one sigma and one pi bond



40. Ans. Option c.

5  $\pi$  bonds are present in naphthalene



41. Ans. option d.

Benzene contains 3  $\pi$  bonds, ethyne & nitrogen contains two  $\pi$  bonds whereas Ethene contains only one  $\pi$  bond.

42. Ans. Option a.

According to VSEPR (valence shell electron pair repulsion theory) theory electron repulsion is of the order : lone pair – lone pair > lone pair – bond pair > bond pair – bond pair

43 . Ans. C

In ammonium chloride between nitrogen form dative bond (coordinate bond) with proton  $\text{NH}_3 \rightarrow \text{H}^+ = \text{NH}_4^+$

44. Ans. Option c.

For example  $\text{NH}_3 \rightarrow \text{H}^+ = \text{NH}_4^+$  or  $\text{H}_2\text{O} + \text{H}^+ \rightarrow \text{H}_3\text{O}^+$

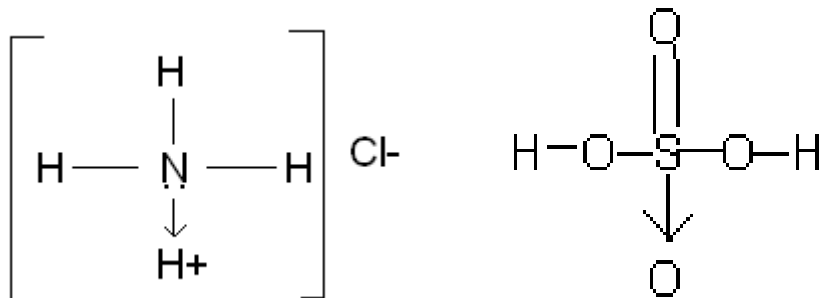
45. Ans. Option b.

To form dative bond one of the atom in one species to a donor – which donates pair of electrons and other atom in another species to acceptor – which accepts pair of electrons.

In option b oxygen atom in water is a donor, but carbon or hydrogen in methane molecule is not an acceptor.

46. Ans. a

In ammonium chloride ionic bond is between ammonium ion and chloride ion, covalent bond is between nitrogen and three hydrogen and coordinate bond is between  $\text{NH}_3$  and  $\text{H}^+$  to form  $\text{NH}_4^+$ . Similarly in sulphuric acid ionic bond is between  $\text{H}^+$  ion and sulphate ion, covalent bond is between sulphur and three oxygen atoms, coordinate bond is between sulphur and one oxygen.



47. Ans. Option c

Glycerine contains many hydrogen bonds, hence it is highly viscous. Water and hydrogen fluoride also contain hydrogen bonds. Whereas in hydrogen sulphide, sulphur cannot form hydrogen bonds.

48. Ans. Option a.

S – orbital is spherical in shape, hence it can overlap in lateral ways (or sideways).

P – orbitals can overlap sideways.

In water molecule two hydrogen atoms form two hydrogen bonds and one oxygen atom forms two hydrogen bonds. Therefore there are four hydrogen bonds in a molecule of water.

49. Ans. Option d. metals are electropositive they form metallic bond

50. Ans. Option c

According to VSEPR theory lone pair – lone pair , lone pair – bond pair and bond pair – bond pair repulsion determines the shapes of the molecules.

51. Ans. Option d

Water is polar molecule, nitrogen and methane are nonpolar, whereas in hydrogen peroxide O – O bond is nonpolar and O – H bond is polar.

52. Ans. Option d.

Both Mg. and Li have same polarization power i.e. charge to size ratio is same

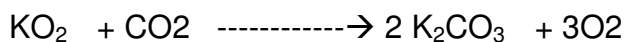
53. Ans. Option C.

i.e. lead shows inert pair effect

Inert pair effect is a phenomenon where s- electrons of the outermost shell remain inert and do not take part in bonding

54. Option b

KO<sub>2</sub> combine with CO<sub>2</sub> and produce oxygen gas.



55. Ans. Option c

Lamp black is the softest form of carbon

56. Ans. Option d.

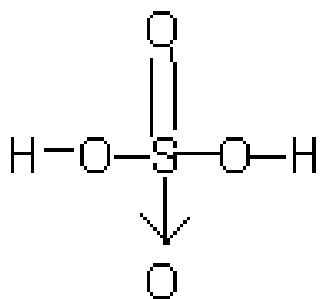
The electronegativity difference between sodium and fluorine is maximum , hence they form ionic bond.

57. Ans. Option d.

Difference in electronegativity between chlorine and hydrogen is  $3.0 - 2.1 = 0.9$  where as between Na and Cl =  $3.0 - 1.0 = 2.0$  . Hence NaCl is ionic and HCl is covalent.

58. Ans. option d





In sulphuric acid ionic bond is between  $\text{H}^+$  ion and sulphate ion. Between sulphur and three oxygen atoms covalent bond is present and coordinate bond is between sulphur and one oxygen atom

59. Ans Option a

60. Ans Option c