UNIT – 2 p-BLOCK ELEMENTS-I

I. CHOOSE THE CORRECT ANSWER

1. An aqueous solution of borax is
   a) neutral b) acidic c) basic d) amphoteric
2. Boric acid is an acid because its molecule
   a) contains replaceable H^+ ion b) gives up a proton
   c) combines with proton to form water molecule d) accepts OH^- from water ,releasing proton.
3. Which among the following is not a borane?
   a)B_2H_6 b)B_3H_6 c)B_4H_{10} d) none of these
4. Which of the following metals has the largest abundance in the earth's crust?
   a) Aluminium b) calcium c) Magnesium d) sodium
5. In diborane, the number of electrons that accounts for banana bonds is
   a) six b) two c) four d) three
6. The element that does not show catenation among the following p-block elements is
   a) Carbon b) silicon c) Lead d) germanium
7. Carbon atoms in fullerene with formula C-60 have
   a) sp^3 hybridised b) sp hybridised
   c) sp^2 hybridised d) partially sp^2 and partially sp^3 hybridised
8. Oxidation state of carbon in its hydrides
   a) +4 b) -4 c) +3 d) +2
9. The basic structural unit of silicates is
   a) $(SiO_3)^{2-}$ b) $(SiO_4)^{2-}$ c) $(SiO)^-$ d) $(SiO_4)^{4-}$
10. The repeating unit in silicone is
    a) SiO_2 b) –Si(R)(R)-O- c) R-O-Si(R)(R)-O- d)- Si(R)(R)-O-O-R
11. Which of these is not a monomer for a high molecular mass silicone polymer?
    a) Me_3SiCl b) $PhSiCl_3$ c) $MeSiCl_3$ d) Me_2SiCl_2
12. Which of the following is not sp2 hybridised?
    a) Graphite b) graphene c) Fullerene d) dry ice
13. The geometry at which carbon atom in diamond are bonded to each other is
    a) Tetrahedral b) hexagonal c) Octahedral d) none of these
14. Which of the following statements is not correct?
    a) Beryl is a cyclic silicate b) Mg_2SiO_4 is an orthosilicate
    c) SiO_4^{4-} is the basic structural unit of silicates d) Feldspar is not aluminosilicate
15. Match items in column - I with the items of column – II and assign the correct code.

Column-I		Column-II	
A	Borazole	1	$B(OH)_3$
B	Boric acid	2	$B_3N_3H_6$
C	Quartz	3	$Na_2[B_4O_5(OH)_4]\ 8H_2O$
D	Borax	4	SiO_2

	A	B	C	D
a	**2**	**1**	**4**	**3**
b	**1**	**2**	**4**	**3**
c	**1**	**2**	**4**	**3**
d	**None of these**			

16. Duralumin is an alloy of
a) Cu,Mn b) Cu,Al,Mg c) Al,Mn d) Al,Cu,Mn,Mg

17. The compound that is used in nuclear reactors as protective shields and control rods is
a) Metal borides b) metal oxides c) Metal carbonates d) metal carbide

18. The stability of +1 oxidation state increases in the sequence
a) Al < Ga < In < Tl b) Tl < In < Ga < Al c) In < Tl < Ga < Al d) Ga< In < Al < Tl

ANSWER

1	2	3	4	5	6	7	8	9	10
c	*d*	*b*	*a*	*c*	*c*	*c*	*a*	*d*	*b*
11	12	13	14	15	16	17	18		
a	*d*	*a*	*d*	*a*	*d*	*a*	*a*		

II. Answer the following questions:

1. Write a short note on anamolous properties of the first element of p-block.

(i) Small size of the first member .
(ii) High ionization enthalpy and high electronegativity.
(iii) Absences of d-orbital in their valence shell.

2. Describe briefly allotropism in p- block elements with specific reference to carbon.

Carbon exists in many allotropic forms. Graphite and diamond are the most common allotropes. Other important allotropes are graphene, fullerenes and carbon nanotubes.

Graphite:

Most stable allotropic form of carbon at normal temperature and pressure.
It is soft and conducts electricity.
Flat two dimensional sheets of carbon atoms is a hexagonal net of sp^2 hybridised carbon atoms.
C-C bond length of 1.41Å.
The successive carbon sheets are held together by weak Vander Waals forces.

Diamond

Diamond is very hard. There is no free electrons for conductivity.
The tetrahedral arrangement around each carbon atom in diamond are sp^3 hybridised.
C-C bond length of 1.54Å.

Fullerenes

These allotropes are discrete molecules such as C_{32}, C_{50}, C_{60}, C_{70}, C_{76} etc.
They have cage like structures.
Carbon atom is sp^2 hybridised
The C_{60} molecules have a soccer ball like structure and is called buckminster fullerene or buckyballs.
It has a fused ring structure consists of 20 six membered rings and 12 five membered rings.

Carbon nanotubes.

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Another recently discovered allotropes, have graphite like tubes with fullerene ends.
Along the axis, these nanotubes are stronger than steel and conduct electricity.
Another allotrophic form of carbon is graphene.

It has a single planar sheet of sp^2 hybridised carbon atoms that are densely packed in a honeycomb crystal lattice.

3. Boron does not react directly with hydrogen. Suggest one method to prepare diborane from BF_3.

Boron does not react directly with hydrogen. However, it forms a variety of hydrides called boranes. The simplest borane is diborane - B_2H_6. Other larger boranes can be prepared from diborane. Treatment of gaseous boron trifluoride with sodium hydride around 450 K gives diborane.

To prevent subsequent pyrolysis, the product diborane is trapped immediately.

$$2BF_3 + 6NaH \xrightarrow{450K} B_2H_6 + 6\,NaF$$

4. Give the uses of Borax.

i) Borax is used for the identification of coloured metal ions.
ii) In the manufacture optical and borosilicate glass, enamels and glazes for pottery.
iii) It is also used as a flux in metallurgy and also acts as a good preservative.

5. What is Catenation ? describe briefly the catenation property of carbon.

Catenation is an ability of an element to form chain of atoms.
The following conditions are necessary for catenation.

(i) Valency of element is greater than or equal to two,
(ii) Element should have an ability to bond with itself
(iii) The self bond must be as strong as its bond with other elements
(iv) Kinetic inertness of catenated compound towards other molecules.

Carbon possesses all the above properties and forms a wide range of compounds with itself and with other elements such as H, O, N, S and halogens.

6. Write a note on Fisher tropsch synthesis.

The reaction of carbon monoxide with hydrogen at pressure of less than 50 atm using metal catalysts at 500 − 700K yields saturated and unsaturated hydrocarbons

$$nCO + (2n+1)H_2 \rightarrow C_nH_{(2n+2)} + nH_2O$$
$$nCO + 2nH_2 \rightarrow C_nH_{2n} + nH_2O$$

Carbon monoxide forms complex compounds with transition metals. **EX** : Nickel tetracarbonyl.

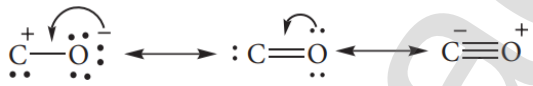
7. Give the structure of CO and CO_2.

Structure of CO

• It has a linear structure.

• The C−O bond distance is 1.128A_o.

. Bonding can explain by Molecular orbital theory.

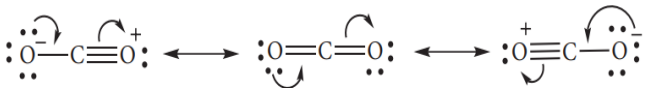


Structure of CO_2

• It has a linear structure.

• It has equal bond distance for both C−O bonds.

. Bonding can not explain by Molecular orbital theory.



8. Give the uses of silicones.

i) Silicones are used for high temperature oil baths.
ii) They are used for making water proofing clothes.
iii) They are used as insulting material in electrical motor and other electrical appliances.
iv) They are mixed with paints and enamels to make them resistant towards high temperature, sunlight, dampness and chemicals.

9. $AlCl_3$ behaves like a lewis acid. Substantiate this statement.

$AlCl_3$ is electron deficient. Al forms three bonds with chloride and hence outer shell has six electron. It needs two more electrons to complete its octet. So readily accept a pair of electrons. Hence $AlCl_3$ is a Lewis acid and forms addition compounds with ammonia and phosphate.

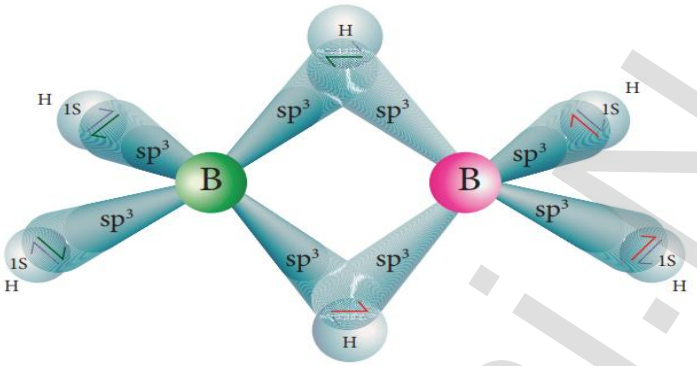
10. Describe the structure of diborane.

In diborane two BH_2 units are linked by two bridged hydrogens. Therefore, it has eight B-H bonds. However, diborane has only 12 valence electrons and are not sufficient to form normal covalent bonds.

The four terminal B-H bonds **(two centre – two electron bond or 2c-2e bond)** are normal covalent bonds.

The remaining four electrons have to be used for the bridged bonds. i.e. **two** three centred B-H-B bonds utilize two electrons each. **Hence, these bonds are three centre –two electron bonds (3c-2e)**

The bridging hydrogen atoms are in a plane. In diborane, the boron is **sp^3** hybridised.



11. Write a short note on hydroboration.

Diborane adds on alkenes and alkynes in ether solvent at room temperature. This reaction is called hydroboration.

$$B_2H_6 + 6RCH = CHR \rightarrow 2B(RCH - CH_2R)_3$$

Diborane trialkyl borane

12. Give one example for each of the following: (i) icosogens (ii) tetragen (iii) prictogen (iv) chalcogen

(i) Icosogens : Boron & Aluminium
(ii) Tetragen : Carbon & Silicon
(iii) Prictogen : Nitrogen & Phosphorous
(iv) Chalcogen : Oxygen & Sulphur

13. Write a note on metallic nature of p-block elements.

The tendency of an element to form a cation by losing electrons is known as electropositive or metallic character.

This character depends on the ionisation energy. Generally on descending a group the ionisation energy decreases and hence the metallic character increases.

In p-block, the elements present in lower left part are metals while the elements in the upper right part are non-metals.

Elements of group 13 have metallic character except the first element boron which is a metalloid, having properties intermediate between the metal and nonmetals.

The atomic radius of boron is very small and it has relatively high nuclear charge.

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14. Complete the following reactions:

a) $B(OH)_3 + NH_3 \longrightarrow BN + 3\,H_2O$
Boron Nitride

b) $Na_2B_4O_7 + H_2SO_4 + 5\,H_2O \longrightarrow Na_2SO_4 + 4H_3BO_3$
Boric acid

c) $B_2H_6 + 2\,NaOH + 2\,H_2O \longrightarrow 2\,NaBO_2 + 6H_2$
(Borax Beads)

d) $B_2H_6 + 6\,CH_3OH \longrightarrow 2\,B(OCH_3)_3 + 6H_2$
Trialkyl borate

e) $4\,BF_3 + 9\,H_2O \longrightarrow 4\,H_3BO_3 + 3\,H^+ + 3\,[BF_4]^-$
Boric acid

f) $HCOOH + H_2SO_4 \longrightarrow CO + H_2O + H_2SO_4$

g) $2\,SiCl_4 + NH_3 \xrightarrow{330\ K\ /\ Ether} Cl_3\,Si\text{-}NH\text{-}SiCl_3$
Chlorosilazanes

h) $SiCl_4 + 4\,C_2H_5OH \longrightarrow Si(OC_2H_5)_4 + 4\,HCl$
Tetraethoxy silane

i) $2B + 6\,NaOH \longrightarrow 2Na_3BO_3 + 3H_2$
Sodium Borate

j) $H_2B_4O_7 \xrightarrow{Red\ Hot} 2B_2O_3 + H_2O$
Boric anhydride

15. How will you identify borate radical?

When boric acid is heated with ethyl alcohol in presence of conc. H_2SO_4, an ester, trialkyl borate is formed.

The vapour of this ester burns with a **green edged flame** and this reaction is used to identify the presence of borate.

$$4\,H_3BO_3 + 3\,C_2H_5OH \xrightarrow{Con\text{-}H_2SO_4} B(OC_2H_5)_3 + H_2O$$

16. Write a note on Zeolites.

Zeolites are three-dimensional crystalline solids containing aluminium, silicon, and oxygen in their regular three dimensional framework.

They are hydrated sodium alumino silicates with general formula $NaO.(Al_2O_3).x(SiO_2).yH_2O$ (x=2 to 10; y=2 to 6).

Zeolites have **porous structure** in which the monovalent sodium ions and water molecules are loosely held.

The Si and Al atoms are tetrahedrally coordinated with each other through shared oxygen atoms.

Zeolites are similar to clay minerals but they differ in their crystalline structure.

Zeolites have a **3D crystalline structure looks like a honeycomb** consisting of a network of interconnected tunnels and cages. Water molecules moves freely in and out of these pores but the zeolite framework remains rigid. Another special aspect of this structure is that the pore/channel sizes are nearly uniform, allowing the crystal to act as a molecular sieve. We know that **the removal of permanent hardness of water** using zeolites.

17. How will you convert boric acid to boron nitride?

Fusion of urea with $B(OH)_3$, in an atmosphere of ammonia at 800 - 1200 K gives boron nitride.

$$B(OH)_3 + NH_3 \longrightarrow BN + 3\,H_2O$$

Boron Nitride

18. A hydride of 2nd period alkali metal (A) on reaction with compound of Boron (B) to give a reducing agent (C). identify A , B and C.

Solution:

A hydride of 2nd period alkali metal (A) Boron is B_2H_6 **(Diborane) (B).**

$$B_2H_6 + 2\,LiH \xrightarrow{\text{Ether}} 2\,LiBH_4$$

(B) (C)

Answer:

A	B	C
Boron	**Diborane**	**Lithiumborohydride**

19. A double salt which contains fourth period alkali metal (A) on heating at 500K gives (B). Aqueous solution of (B) gives white precipitate with $BaCl_2$ and gives a red colour compound with alizarin. Identify A and B.

Solution:

A double salt which contains fourth period alkali metal (A) is Potash Alum.

$$K_2SO_4.\,Al_2(SO_4)_3.24\,H_2O \xrightarrow{500K} K_2SO_4.\,Al_2(SO_4)_3. + 24\,H_2O$$

(A) (B)

Due to the presence of sulphate ions B gives white precipitate with $BaCl_2$ and the same contains aluminium ion and hence gives red colour with **Alizarin.**

20. CO is a reducing agent . justify with an example.

Carbon monoxide acts as a strong reducing agent.
Carbon monoxide thus has a relatively high tendency to be oxidised to form carbon dioxide.

$$CO + Fe_2O_3 \longrightarrow 2Fe + 3CO_2$$

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ONE MARK FROM INSIDE THE LESSON

1. …… compound is not undergoing hydrolysis reaction

a) Boron trifluoride b) Boron trichloride c) Boron triiodide d) all of these

2. Which one of the following is more stable?

a) Ti^{+4} b) Ti^{+3} c) Ti^{+} d) Ti

3. Halo acids have no reaction with ----------

a) B b) C c) Zn d) Al

4. Thermal decomposition of benzene diazonium tetrafluoro borate , it gives----------

a) BF_3 b) BCl_3 c) B_2H_6 d) H_3BO_3

5. Potash Alum converted to Burnt Alum at which temperature?

a) 375 K b) 365 K c) 475K d) 600K

6. The mixture of CO + N_2 is called as ……..

a) Water gas b) Producer gas c) Liquid gas d) All of these

7. An aqueous solution of Aluminium chloride is ……. in nature.

a) Acidic b) Basic c) Neutral d) None

8. In oxo process, ethene is mixed with carbon monoxide and hydrogen gas to produce .....

a) Propanol b) Methanol c) Methanal d) propanal

9. When silicon tetrachloride is hydrolysed with moist ether form.....

a) Linear perchloro siloxanes b) Crossed linked mono alkyl siloxane
c) Three dimentional siloxane d) Silicone oil

10. Phenacite is an example of ..... silicate.

a) Ortho b) Pyro c) Neso d) both a and c

11. Phosgene is used in the synthesis of

a) Isocynates b) Amines c) Ether d) Ester

12. Boron trifluoride is used for preparing

a) BF_4 b) HBF_4 c) F_2 d) Cl_2

13. Diborane reacts with Ammonia at high temperature to give

a) Boron b) Tetra Borane c) Silicates d) Borazine

14. Food preservative from the following

a) Silicates b) Boric acid c) Alum d) All of these

15. $Na_2B_4O_7$ is also known as

a) Borax b) Borax beads c) borax glass d) Boric acid

ANSWER

1	2	3	4	5	6	7	8	9	10
a	*c*	*a*	*a*	*c*	*b*	*a*	*d*	*a*	*d*
11	**12**	**13**	**14**	**15**					
a	***b***	***d***	***b***	***c***					

ADDITIONAL QUESTIONS AND ANSWERS

1. What is inert pair effect ?

In P-block, the pair of s-electrons becomes chemical inert and do not take part in bonding. This is called as Inert pair effect.

2. How Boron reacts with oxidising acids?

Halo acids have no reaction with boron. However, boron reacts with oxidising acids such as sulphuric acid and nitric acids and forms boric acid.

$$2B + 3H_2SO_4 \longrightarrow 2H_3BO_3 + 3SO_2$$
$$B + 3HNO_3 \longrightarrow H_3BO_3 + 3NO_2$$

3. List out the Uses of boron.

1. Boron has the capacity to absorb neutrons. Hence, its isotope 10B5 is used as moderator in nuclear reactors.
2. Amorphous boron is used as a rocket fuel igniter.
3. Boron is essential for the cell walls of plants.
4. Compounds of boron have many applications. For example eye drops, antiseptics, washing powders etc.. contains boric acid and borax. In the manufacture of Pyrex glass , boric oxide is used.

4. How to Prepare Borax from Colemanite?

Borax is a sodium salt of tetraboric acid. It is obtained from colemanite ore by boiling its solution with sodium carbonate.

$$2Ca_2B_6O_{11} + 2NaCO_3 + H_2O \xrightarrow{\Delta} 3Na_2B_4O_7 + 3CaCO_3 + Ca(OH)_2$$

5. Write a note about action of heat on Borax.

On heating it forms a transparent borax beads.

$$Na_2B_4O_7.10H_2O \xrightarrow[-10H_2O]{\Delta} Na_2B_4O_7 \longrightarrow 2NaBO_2 + B_2O_3$$

6. What happen when Boric acid is heated?

Boric acid when heated at 373 K gives metaboric aid and at 413 K, it gives tetraboric acid.

When heated at red hot, it gives boric anhydride which is a glassy mass.

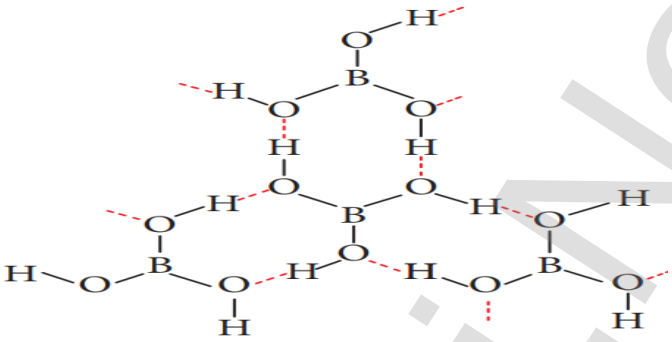
$4H_3BO_3 \xrightarrow{373\ K} 4HBO_2 + H_2O$

$4HBO_2 \xrightarrow{413\ K} H_2B_4O_7 + H_2O$

$H_2B_4O_7 \xrightarrow{Red\ hot} 2B_2O_3 + H_2O$

7. Structure of Boric acid:

Boric acid has a two dimensional layered structure. It consists of $[BO3]^{3-}$ unit and these are linked to each other by hydrogen bonds.



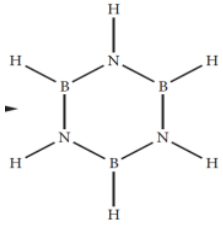
8. What is the action of air with Diborane?

At room temperature pure diborane does not react with air or oxygen but in impure form it gives B_2O_3 along with large amount of heat.

$B_2H_6 + 3O_2 \longrightarrow B_2O_3 + 3H_2O \qquad \Delta H = -2165\ KJ\ mol^{-1}$

9. What is Inorganic benzene? How it is obtained?

When treated with excess ammonia at low temperatures diborane gives diboranediammonate. On heating at higher temperatures it gives borazole.



$3B_2H_6 + 6NH_3 \xrightarrow{-153\ K} 3B_2H_6.2NH_3$ (or) $3[BH_2(NH_3)_2]+[BH_4]-$

$3B_2H_6+2NH_3 \xrightarrow{High\ temp\ /\ Clossed\ vesse} 2B_3N_3H_6$

(Borazole or Borazine - Inorganic benzene)

10. List out the uses of Diborane

i) Used as High energy fuel for Propellants

ii) Used as reducing agent in organic chemistry.

iii) Used in welding.

11. Give the Laboratary preparation of Boron Tri fluoride.

It is prepared from Benzene Diazonium tetra fluoro borate.

$Ph\text{-}N_2BF_4 \longrightarrow BF_3 + PhF + N_2$

12. Explain McAfee process

Aluminium chloride is obtained by heating a mixture of alumina and coke in a current of chlorine

$Al_2O_3 + 3C + 3Cl_2 \xrightarrow{heat} 2AlCl_3 + 3CO_2$

On industrial scale it is prepared by chlorinating aluminium around 1000K

$2Al + 3Cl_2 \xrightarrow{1000K} 2AlCl_3$

13. What are the uses of Aluminum chloride?

i) Used as catalyst in Friedel craft reaction.
ii) Used as catalyst to prepare Dyes and Perfumes.
iii) Used to prepare petrol by cracking.

14. Give the preparation of Potash Alum (Alum)

It is prepared by Alum stone. [$K_2SO_4.Al_2(SO_4)_3 .4Al(OH)_3$]
Alum stone is treated with sulphuric acid.
Calculated amount of Potassium sulphate is added.
The solution is crystallized and purified by recrystallization.

$$K_2SO_4.Al_2(SO_4)_3 .4Al(OH)_3 + 6H_2SO_4 \longrightarrow K_2SO_4 + Al_2(SO_4)_3 + 12\ H_2O$$
$$K_2SO_4 + Al_2(SO_4)_3 + 24\ H_2O \longrightarrow K_2SO_4.Al_2(SO_4)_3.24\ H_2O$$

15. What is Burnt Alum

When potash alum is heated at 500K, it loses all the water molecules and swells up. This swollen mass is called as Burnt alum.

$$K_2SO_4.Al_2(SO_4)_3.24\ H_2O \xrightarrow{500\ K} K_2SO_4.Al_2(SO_4)_3 + 24\ H_2O$$

16. How to prepare Carbon monoxide ?

Carbon monoxide can be prepared by the reaction of carbon with limited amount of oxygen.

$$2C + O_2 \longrightarrow 2CO$$

17. What is producer gas?

On industrial scale carbon monoxide is produced by the reaction of carbon with air.
The carbon monoxide formed will contain nitrogen gas also and the mixture of nitrogen and carbon monoxide is called producer gas.

$$2C + O_2/N_2\ (air) \longrightarrow 2CO + N_2$$
Producers Gas

18. What are the uses of Ccarbon monoxide?

1. Equimolar mixture of hydrogen and carbon monoxide - water gas and the mixture of carbon monoxide and nitrogen - producer gas are important industrial fuels
2. Carbon monoxide is a good reducing agent and can reduce many metal oxides to metals.
3. Carbon monoixde is an important ligand and forms carbonyl compound with transition metals.

19. Write a note about the Reducing behaviour of Carbon monoxide.

At elevated temperatures, it acts as a strong reducing agent. For example,

$$CO_2 + Mg \longrightarrow 2MgO + C$$

20. What is Water gas equilibrium?

The equilibrium involved in the reaction between carbon dioxide and hydrogen, has many industrial applications and is called water gas equilibrium.

$$CO_2 + H_2 \longrightarrow CO + H_2O$$
Water gas

21. Explain the Types of silicones?

(i) Liner silicones:

They are obtained by the hydrolysis and subsequent condensation of dialkyl or diaryl silicon chlorides.

a) Silicone rubbers: These silicones are bridged together by methylene or similar groups

b) Silicone resins: They are obtained by blending silicones with organic resins such as acrylic esters.

(ii) Cyclic silicones

These are obtained by the hydrolysis of R_2SiCl_2.

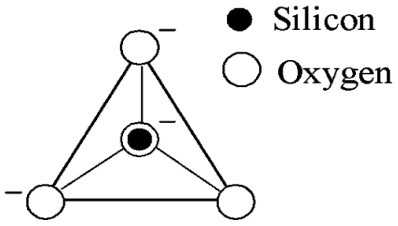
(iii) Cross linked silicones

They are obtained by hydrolysis of $RSiCl_3$.

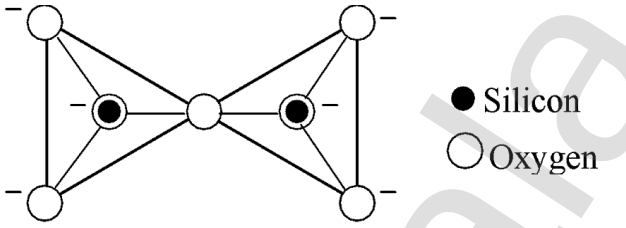
22. What are Silicates and Explain its types?

Silicates are minerals containing silicon and oxygen with $[SiO4]^{-4}$ units.

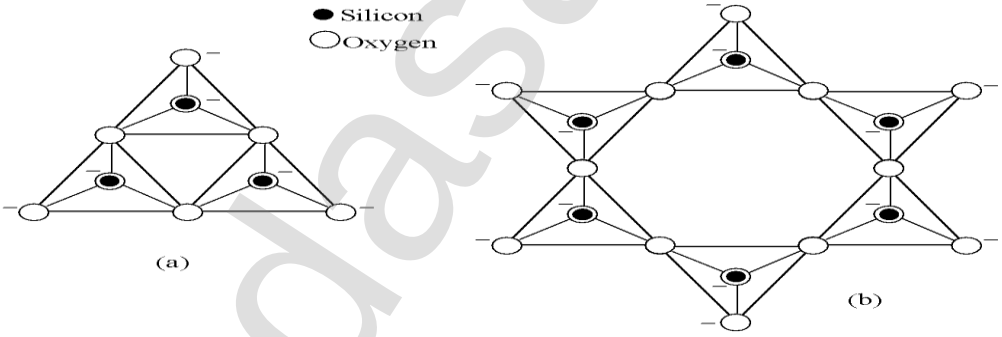
(i) Ortho silicates (or) Neso silicates: Discrete $[SiO_4]^{4-}$ tetrahedral units. **Eg :** Phenacite (Be_2SiO_4)



(ii)Pyro silicate (or) Soro silicates: Silicates which contain $[Si_2O_7]^{6-}$ ions, **Eg** : Thortveitite ($Sc_2Si_2O_7$)

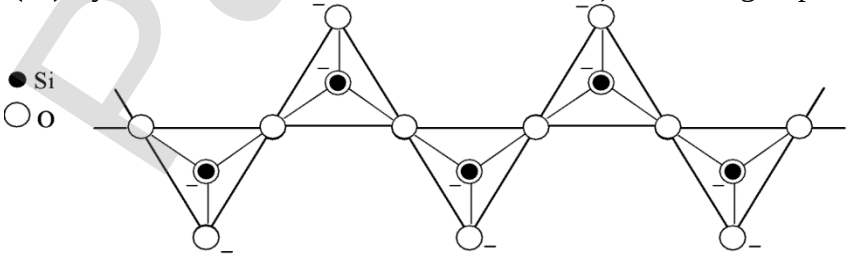


(iii)Cyclic silicate (or) Ring silicates: Silicates which contain $(SiO_3)n^{2n-}$ ions. **Eg** : Beryl $[Be_3Al_2(SiO_3)_6]$

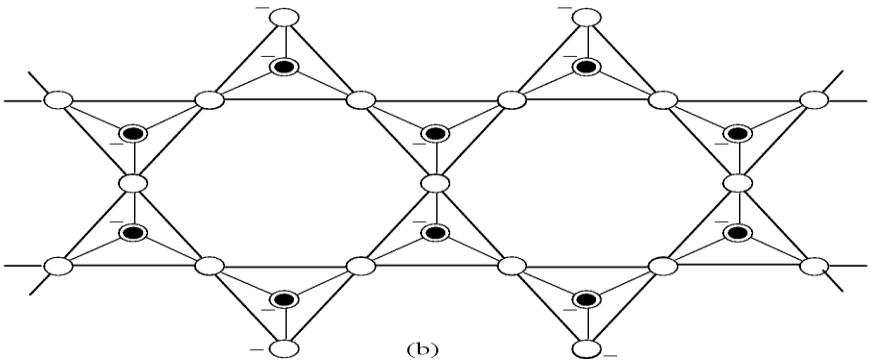


(iv)Inosilicates: Silicates which contain 'n' number of silicate units liked by two or more oxygen atoms.

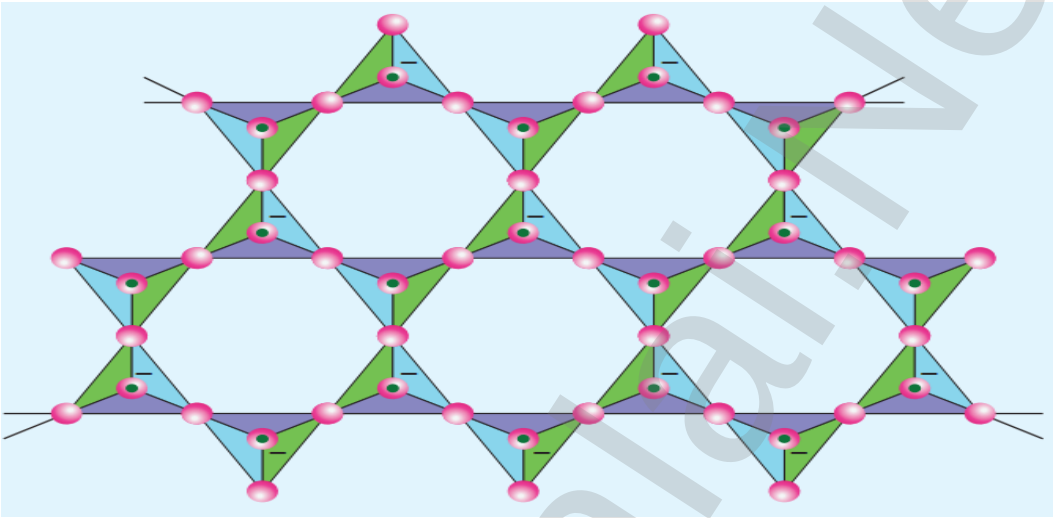
(v)Chain silicates (or) Pyroxenes: These silicates contain $[SiO_3)]^{2n-}$ ions Eg : Spodumene – $LiAl(SiO_3)_2$.



(vi) Double chain silicates(or) amphiboles: These silicates contain $[Si_4O_{11}]^{6n-}$ ions. **Eg :** Asbestos.

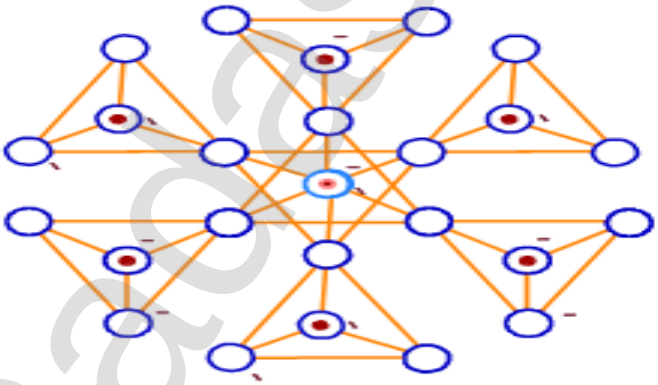


(vii) Sheet (or) phyllo silicates:Silicates which contain $(Si_2O_5)n^{2n-}$ ions. **Eg :** Talc, Mica etc...



(viii)Three dimensional silicates (or) tecto silicates:$[SiO_4]^{4-}$ tetrahedral are shared with other tetrahedralto form three-dimensional network are called three dimensional silicate.

They have general formula (SiO_2) n. **Eg** : Quartz.



23. A colourless, nonflammable gas and is heavier than air is compound A. A on reaction with Hydrogen to gives an industrially useful mixture of B.Identify A and B.

Solution:

A colourless, nonflammable gas and is heavier than air compound (A) is CO_2. Carbon dioxide.

The equilibrium involved in the reaction between carbon dioxide and hydrogen, has many industrial applications and is called water gas equilibrium.

$CO_2 + H_2 \leftrightharpoons CO + H_2O$

(A) (B) Water gas

24. A colourless, hygroscopic substance A on reaction with Ammonia to give compound B. Identify A and B.

Solution:

A colourless, hygroscopic substance (A) is Anhydrous aluminium chloride. $AlCl_3$.

$$AlCl_3 + 3NH_4OH \longrightarrow Al(OH)_3 + 3NH_4Cl$$

(A) (B)

25. Convert Boric Acid into Boron trifluoride.

Boric acid reacts with calcium fluoride in presence of conc. sulphuric acid and gives boron trifluoride.

$$CaF_2 + 3H_2SO_4 + 2\ B(OH)_3 \longrightarrow 3CaSO_4 + 2BF_3 + 6H_2O$$

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