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T.D.C. Part-I (Hons)

**Group 14 Elements:**

The outer most electronic configuration of the elements is ns2np2 . The electronic configuration of element of group 14 are shown below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ELEMENT | ATOMIC NO. | ELECTRONIC CONFIGURATION | Class | Periode  |
| C | 6 | [He]2S22P2 | IV | 2 |
| Si | 14 | [Ne]3S23P2 | IV | 3 |
| Ge | 32 | [Ar]3d104S24P2 | IV | 4 |
| Sn | 50 | [Kr]4d105S25p2 | IV | 5 |
| Pb  | 82 | [Xe]4f145d106S26P2 | IV | 6 |

**COMPARATIVE STUDY**

**Hydride of Carbon:** Carbon forms a number of hydride kown as alkane,alkene and alkyne.

**Hydride of Silicon:** The number of silicon hydride is also much less than the number of hydride of carbon. These are called silanes.

**Halides:** All the element of this group from tetrahailides which are mostly co-valents. It is a solid.

**Oxides:** The elements of this group from two types of oxide namely monoxide of the formula MO (CO,SiO,SnO&PbO) and dioxide MO2 (CO2,SiO2,GeO2,SnO2 & PbO).

**Silicon:**

**Ore’s of Silicon**

1. Feldspar : K2OAl2O3.6SiO2
2. Asbestos : CaO.3MgO.4SiO2

**Preparation:**

**1.**SiO2 reacts with Mg and then give Si

SiO2 + 2Mg → Si + 2MgO

2. SiO2 reacts with C and then give Si.

 SiO2 + 2C → Si + 2CO

**PROPERTIES:**

1.It is a hard.

2.It has the same appearance as graphite.

**3.Reaction with Mg:** Si reacts with Mg and then give Mg2Si.

2Mg + Si → Mg2Si

**4.Reaction with H2o:** Si reacts with H2o and then give SiO2.

Si + O2 → SiO2 + 2H2

**5.Reaction with F2:** It react with F2 and gives SiF4

Si + 2F2 → SiF4

**6.Reaction with O2:**It react with O2 and then give SiO2.

Si + O2 → SiO2

**7. Reaction with Cl2:** It react with Cl2 and gives SiCl4

Si + 2Cl2 → SiCl4

**Uses:**

1.It is used in the lubrication.

2. It is used in transistor.

**Silica [SiO2]**

**PREPARATION:**

1. SiCl4 reacts with H2O and then gives Si(OH)4. Which on heating then gives SiO2.

SiCl4 + 4H2O → Si(OH)4 + 4HCl

Si(OH)4 → SiO2 + 2H2O

1. Si reacts with O2 and then gives SiO2.

Si + O2→ SiO2

**PROPERTIES:**

1. It is insoluble in water.

2. **Reaction with NaOH:** It reacts with NaOH and then gives Na2SiO3.

2NaOH + SiO2 = Na2SiO3 + H2O

**3.Reaction with HF:** It reacts with HF and then gives H2[SiF6]

SiO2 + 2HF = 2 H2O + SiF~~4~~

SiF~~4~~ + 2HF=H2[SiF6]

**4.Reaction with CH3OH:** It reacts with CH3OH and then gives Si(OCH3)4.

SiO2 +4 CH3OH = Si(OCH3)4 + 2 H2O

**5.Reaction with Na2CO3:** It reacts with Na2CO3 and then gives Na2SiO3 .

Na2CO3 + Sio2 = Na2SiO3 +CO2

**6. Reaction wth Na2SO4 :** It is reacts with Na2SO4 and then gives Na2SiO3.

Na2SO4 + Sio2 = Na2SiO3

**7. Reaction with Ca3( PO4)2 :** it reacts with Ca3(PO4)2  and then gives 3CaSio3 .

Ca3(PO4)2 + 3SiO2 = 3CaSio3  + P2O5

**Uses :**

1. It is extensively used in the manufacture of silica glass wares .

2.It is used in the manufacture of optical instruments .

**[Silicon tetra fluoride] (SiF4)**

**Preparation :**

1. Silicon react with fluorine and then gives SiF4.

 Si + 2F2 = SiF4

2. SiO2 reacts with carbon and then gives Silicon. Silicon react with fluorine and then gives SiF4.

SiO2 + 2C = Si + 2CO

Si + 2F2 = SiF4

 **PROPESTIES**

1. It is colourless .

2. It is fumes wit air.

**3. Reaction with Na:** silicon tetra fluoride reacts with sodium and then gives Na2[Si F6] .

2 SiF4 + 4Na = Na2[SiF6] + 2NaF + Si

**4. Reaction with K:** Silicon tetra fluoride reacts with potassium and then gives k2[Si F6] .

2 SiF4 + 4K = K2[SiF6] + 2KF + Si

**5.Reaction with NH3**: SiF4  reacts with NH3 and then gives SiF4.2NH3.

SiF4 + 2NH3 = SiF4.2NH3

**6 .Reaction with H2o:** Silicon tetra fluoride reacts with H2O and then gives H2[Si F6].

SiF4 + 2HF = H2[SiF6]

**Silicic Acid [SiO2xH2O]**

**Preparation :**

**1.**SiCl4 reacts with H2O and then gives Si(OH)4.Which on heating then gives Silicic acid.

SiCl4 + 4H2O = Si(OH)4 + 4HCl + Si(OH)4

Si(OH)4 SiO2.2H2O

2.Sodium silicate reacts HCl and then silicic acid

2NaSiO3 + 2HCl = SiO2.H2O + 2NaCl

**Properties:**

**1. Action of heat:** Which on heating then gives SiO2.

SiO2.xH2O = SiO2 + xH2O

**2.Reaction with NaOH:** SiO2 reacts with NaOH and then gives sodium silicate.

2NaOH + SiO2 = Na2SiO3 + H2O

**Uses:**

**1.** It is used in the manufacture of silica and silica gel.

**Hydrofluosilicic acid \_H2[SiF6]**

**Preparation :**

**1. Reaction with HF:** SiF4 : SiF4 reacts with HF and then gives H2[SiF6] .

SiF4 + 2HF = H2[SiF6]

**2. Reaction with H2SO4 :** CaF2 reacs with H2SO4  and then gives CaSO4 and HF.

CaF2 + H2SO4 = CaSO4 +2HF

SiO2 reacts withHF and then gives SiF4.

SiO2 + 4 HF = SiF4 + 2H2O

SiF4 reacts with HF and then gives H2[SiF6].

SiF4 + 2HF = H2[SiF6]

**PROPERTIES :**

1. It is an acids.

2.It is soluble in water.

**3. Action of heat:** on heating with H2[SiF6] then gives SiF4 and HF.

H2[SiF6] SiF4 + 2HF

**4. Reaction with H2O:** H2[SiF6] reacts with H2O and then gives H2SiO3

H2[SiF6] + 3H2O = H2SiO3 + 6HF

**USES :**

1. It is used to give wood a stone like surface .

2.It is used as an antiseptic .

**Silicates**

Silicates is predicated on the fundamental chemical unit SiO44-, polyhedron formed anionic cluster. The central chemical element particle incorporates a charge of positive four whereas every element incorporates a charge of negative 2 (-2) and therefore every silicon-oxygen bond is up to one [\*fr1] (½ ) the full bond energy of element. This condition leaves the oxygens with the choice of bonding to a different chemical element particle and so linking one SiO44- polyhedron to a different.

In the extreme case, the tetrahedra ar organized in a very regular, orderly fashion forming a three-dimensional network. . If silicon oxide within the liquid state is cooled terribly slowly it crystallizes at the temperature. however if liquid silicon oxide is cooled faster, the ensuing solid may be a disorderly arrangement that is named glass, typically conjointly known as quartz.

**Sturcture of Silicate[SiO4-4]**

TVE = 4+ 64+4 = 32

NB = TOTAL ELEMENT - 1 = 5-1= 4

EO = NB $×$ 8 = 4$×$ 8 = 32

LPE = $\frac{TVE-EO}{2}$ =$\frac{32-32}{2}$ = 0

TOR =NB + LPE = 4+0 = 4

HYBRIDISAION = SP3

STRUCTURE =Tetrahedral

 O 4-

 Si

 O O

 O

 **TIN [Sn]**

**Position in the periodic table**

Symble: Sn

Atomic number: 50

Electronic configuration: [Kr]4d105S25P2

Class: IVA

Periode:5th

**Important ores of tin**

The chife ore of tin is cassiterite or tin stone ( SnO2).

**Extraction:**

The powdered ore is firstly washed in a current of water when lighter impurities wash away while the heavier ore particles get settled to the bottom . Th washed ore is then calcined in an inclined revolving furnace ,where impurities As , S etc are removed as their volatile oxide and Fe and Cu pyrites get themselves oxidized to oxides or sulphate .

4As + 3O2 = 2As2O3

S+ O2 = SO2

CuS + 2O2 = CuSO4

FeS + 2O2 = FeSO4

 The calcined ore is then washed in a current of water to remove soluble CuSO4 , FeSO4 etc . The washed ore contain 70% tin as oxide and is called black tin. The oxide is reduced to metal while silica .

SnO2 + 2C = Sn + 2CO

CaO + SiO2 = CaSiO3

**PROPERTIES :**

1.It is a silver white luster.

2.white tin is malleable but not ductile .

**3. ACTION OF AIR :** Sn reacts with O2 and then gives SnO2 .

Sn + O2 = SnO2

**4.Reaction with HCl :** Sn reacts with HCL and then gives Sncl2 .

Sn + HCl = SnCl2 + H2

**5. Reaction with dil H2SO4 :** Sn reacts with dil H2SO4 and then gives SnSO4.

Sn + H2SO4 = SnSO4+ H2

**6. Reaction with cone H2SO4 :** Sn reacts with cone H2SO4  and then gives SnSO4 .

Sn +2 H2SO4 = SnSO4 + SO2 + 2H2O

 **7. Reaction with dil HNO3:** Sn reacts with dil HNO3 and then gives 4Sn(NO3)2 .

 4Sn + 10HNO3 = 4Sn(NO3)2 + NH4NO3 + H2O

**8. Reacton with con HNO3:** Sn reacts with con HNO3 and then gives H2SnO3.

Sn + 4HNO3 = H2SnO3  + 4NO2 + H2O

**9. Reaction with Cl2 :** Sn reacts with Cl2 and then gives SnCl4.

 Sn + Cl2 = SnCl4

**USES :**

1. It is uses of tin is for tin plating sheets of Iron .

2. It is uses in wrapping cigarettes

**MOSAIC GOLD (SnS2)** :

**PREPARATION**

**1. Reaction with HCl :**SnCl4 reacts with H2S and then gives SnS2 .

SnCl4 + 2H2S = SnS2 + 4HCl

**Porprties :**

 **1.Rreaction with H2S :** SnS2 reacts with HCl and then. gives SnCl4

 SnS2 + 4HCl = SnCl4 + 2H2S

**2. Reaction with( NH4)2S :** SnS2 reacts with (NH4)2S and then gives (NH4)2Sns3 .

 SnS2 + (NH4)2S = (NH4)2SnS3

**USES**

1. It is used for bronzine .

2. It is sold under the name of tin bronze.

**TIN CRY** :

Tin is that the metal that's number fifty on the table. Tin cry is that the sound that's created once a bar of tin metal is bent. The sound is caused by the cutting of the crystals within the metal. once tin solidifies, crystal biparous happens, wherever separate crystals share lattice points and overgrow one another. The tin cry truly could be a comparatively soft sound, style of a noise whine.