

The p block elements-solutions

<u>Sol 1.</u>

(i) HBr is a reducing agent and it reduces $H_2SO_4t \; o \; SO_2$

(ii) Acids turn blue litmus red, so HClO also turns blue litmus red. The colour of litmus is decolorized because HClO is also a strong oxidizing agent.

<u>Sol 2.</u>

(i) $A1_2O_3 + 3CI_2 + 3C1_2 \rightarrow 2AIC1_3 + 3CO$ Alumina chloride (ii) $Ca(OH)_2 + C1_2 \rightarrow CaOCI_2 + H_2O$ Slaked lime bleaching powder (iii) $SnO_2 + 2C \rightarrow Sn + 2CO$ Cassiterite Tin (iv) $2NaCI+ MnO_2 + 2H_2SO_4$.Sodium chloride

 $\xrightarrow{\Delta} Na_2SO_4 + MnSO_4 + 2H_2O + CI_2$

(v) $3Cu + 8HNO_3 \rightarrow 2NO + 3Cu (NO_3)_2 + 4H_2O$ Nitric acid Nitric oxide

<u>Sol 3.</u>

(i) Sn + 4HNO₃ \rightarrow H₂SnO₃ + 4NO₂ + H₂O

Metastanic acid

(ii) $2AI + 2NaOH + 2H_2O \rightarrow 2NaAIO_2 + 3H_2$

Sod. aluminate

<u>Sol 4.</u>

(Conc. HNO_3 decomposes partially into NO2. NO2 is reddish brown in colour and is soluble in conc HNO_3 So, it imparts colour to conc HNO_3 .

(ii) : Mg can reduce CO_2 to C so it continues to burn in CO_2

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

(iii) Bleaching action of bleaching powder is due to chlorine present in it. When it is kept in open bottle for longtime it decomposes and chlorine is lost in atmosphere. Due to this it loses its bleaching property.

 $CaOCI_2 + H_2O \rightarrow ca(OH)_2 + CI_2 \uparrow$ Bleaching

<u>Sol 5.</u>



<u>Sol 6.</u>

(i) $HCO_3^- + AI^{3+} \rightarrow AI(OH)_3 + CO_3^{2-}$ (ii) $AIBr_3 + K_2Cr_2O_7 + H_3PO_4 \rightarrow K_3PO_4 + AIPO_4 + H_{2=0+Br}2 = + Cr^{3+}$

<u>Sol 7.</u>

(i) Carbon exists in various allotropic forms like diamond, graphite, coal, etc. Diamond consists of a three- dimensional structure of sp3 hybridized carbon atoms bonded through very strong covalent bonds. it makes it hard and useful as an abrasive.

Graphite, on the other hand, is made up of a two dimensional sheet like structure made of sp² hybridized carbon atoms. These layers of carbon atoms are held together by relatively weak van der Waal's

forces and can, therefore, slip over one another imparting lubricating properties to graphite. (ii) Sulphur consists of S_8 rings held together by weak van der Waal's forces. As sulphur melts at 119"C, these van der Waal's forces are overcome and S_8 rings slip and roll over one another giving rise to a clear mobile liquid. Above 160°C, the S_8 rings begin to open up and form long chains which gets tangled with each other, thereby gradually increasing the viscosity.

(iii) **NOTE** : : HI cannot be prepared by heating hydrogen iodide with conc. H_2SO_4 because it is a strong reducing agent and reduces H_2SO_4 to SO_2 and is itself oxidized to iodine.

$$H_2 SO_4 + 2HI \rightarrow SO_2 + I_2 \rightarrow 2H_2C$$

Hence HI is prepared by heating iodides with conc. phosphoric acid.

$$3KI + H3PO_4 \rightarrow K_3PO_4 + 3HI$$

(iv) In H_3PO_4 and H_3PO_3 the P atom is attached to 3 and 2 OH groups respectively. The H atom of these P – OH bonds are ionisable. This clearly shows that H_3PO_4 is tribasic and H_3PO_4 is tribasic and H_3PO_4 is tribasic.

(v) Liquor ammonia possesses high vapour pressure at room temperature and thus before opening a bottle of liquor ammonia, it should be cooled to lower the pressure of Nh_3 inside the bottle, otherwise NH_3 will bump out of the bottle.

(vi) Solid CO_2 is technically known as dry ice because it sublimes without leaving any stain on surface.

(vii) Anhydrous HCI, being a non – polar covalent compound, is a bad conductor however an aqueous solution of HCI is ionized (Fajan's rule) to give H⁺ and Cl⁻ ions and is a good conductor. (viii) In graphite, out of four valence electrons, only three form covalent bonds (sp²

hybridization) with three other carbon atoms. This forms hexagonal rings as sheets of one atom thickness. These sheets are held together by weak attractive forces. One electron of each carbon atom is free and this enables these thin sheets to slide over one another. For this reason graphite is a soft material with lubricating properties.

(ix) The standard reduction potential of fluorine is highest and thus it cannot be oxidized by any reagent.

(1/2) $F_2 + e \rightarrow F^-$; E_{RP}° = maximum

(x) The mixture of N_2H_4 and H_2O_2 (in presence of Cu (II) catalyst) is used as a rocket propellant because the reaction is highly exothermic and large volume of gases are evolved, which can propel a rocket.

 $\begin{array}{lll} \mathsf{N}_2\mathsf{H}_4 & + & 2\mathsf{H}_2\mathsf{O}_2 \xrightarrow{\mathcal{C}_{\mathcal{U}}(\mathrm{II})} \xrightarrow{\mathcal{C}_{\mathcal{U}}(\mathrm{II})} & \mathsf{N}_2(g) \uparrow + 4\mathsf{H}_2\mathsf{O}(g) \uparrow \\ \mathsf{Hydrazine} & \mathsf{Hydrogen} \end{array}$



Peroxide

(xi) Orthophosphorus acid is a dibasic acid as it has 2 -OH groups in its formula :

(xii) In MgCl₂, Mg is sp hybridized while in SnCl₂, Sn is sp² hybridized (hence the molecule is angular).

(xiii) **NOTE** : Oxygen is the 2nd most electronegative element after the, fluorine and thus invariably show negative oxidation state.

Further more, it has $2s^22p^4$ configuration and thus requires only two electrons to complete its octet to show -2.oxidation state. Although sulphur also possess ns^2np^4 configuration but due to availability of d-orbitals in their outer most shell -2,+2, +4, **+6** oxidation state-are also shown. Oxygen, however, shows only -2 oxidation state due to non-availability of d-orbitals in its outermost shell.

(xiv) **NOTE** : H₃PO₃ is a dibasic acid because it contains two OH groups in its molecule.

In the two P-OH bonds, the hydrogen is ionisable. [For structure see part (xi)]

(xv) **NOTE** : As compared to P, N atom bas higher electronegativity and small size and shows H - bonding.

Thus ammonia molecule show association where as phosphine does not.

(xvi) It is due to self ionization of NH₃, the reaction is

 $2NH_3 \rightarrow NH_4^+ + NH_2^-$

Thus on addition of NH₄Cl the concentration of NH_4^+ radical increase and therefore NH₄Cl acts as an acid in liquid NH₃.

(xvii) In excess of NaOH the hydroxide of AI becomes soluble due to the formation of metaaluminate.

(xviii) The repulsive forces between fluorine atoms are high due to its small size and high electronegativity. It makes dissociation of F - F bond easy. So bond dissociation energy of F_2 is less than Cl_2

(xix) The reducing nature of SO₂ is represented as

 $SO_2 + 2OH^- \rightarrow SO_4^{2-} + 2H^+ 2H^+ 2e^-$

Hence with the increase of OH⁻ (alkalinity) the forward reaction is favored.

(xx) Nitrogen and fluorine both are small and have high electron density, they repel the bonded pair of elections leading to larger bond length than expected.

(xxi) N³⁻ being smaller in size and high charge present on it make it more susceptible to hydrolysis :

 N^{3-} + $3H_2O \rightarrow NH_3$ + $3OH_-$

Cl⁻ being a weak conjugate base does not undergo hydrolysis. MgCl₂ is stronger electrolyte and so it is not hydrolyses

(xxii) In (SiH₃)N, lone pair of electrons on nitrogen is involved in $p\pi - d\pi$, back bonding is possible because of absence of d orbitals in carbon so (CH₃)₃N is more basic than (SiH₃)₃N.



<u>Sol 8.</u>

(i) Phosphine gas (PH₃) is evolved when white phosphorus is boiled with aqueous NaOH or alcoholic solution of potassium hydroxide. P_4 + 3naOH + 3H₂O \rightarrow NaH₂PO₂ + PH₃ \uparrow Sod. Hypophosphite (ii) This is a method used to prepare I_2 . $5NaHSO_3 + 2NaIO_3 \rightarrow 3 NaHSO_4 + 2Na_2SO_4 + I_2 + H_2O_3$ (iii) $4Sn + 10HNO_3 \rightarrow 4Sn(NO_3)_2 + NH_4 NO_3 + 3H_{2=0}$ (dilute) (iv) $2KMnO_4 + 3H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 3H_2O + 5[O]$ $5H_2C_2O_4 + 5^*O \rightarrow 10CO_2 \uparrow + 5H_2O$ (v) $2IO_3^- + 5HSO_3^- \rightarrow I_2 + H_2O_+ 3HSO_4^- + 2SO_4^{2-}$ (vi) $4P + 10HNO_3 + H_2O \rightarrow 5NO + 5NO_2 + 4H_3PO_4$ (vii) $2H_3PO_2 \xrightarrow{heat} PH_3 + H_3PO_4$ Phosphine (viii) NaBrO₃ + F₂ + 2NaOH \rightarrow NaBrO₄ + 2naF + H₂ (ix) NaClO₃ + SO₂ + 10H⁺ \rightarrow NaCl + S + 5H₂O (x) $3SiCl_4 + 4Al \longrightarrow 4AlCl_3 \uparrow + 3Si$ (molten) (xi) 15CaO + 4P₄ $\xrightarrow{\Delta}$ 5Ca₃P₂ + 3P₂O₅ \uparrow $\frac{Ca_{3}P_{2}+6H_{2}O\rightarrow 3Ca(\text{OH})_{2}+2PH_{3}^{+})*5}{15CaO+4p_{4}+30H_{2}O\rightarrow 15Ca(\text{OH})_{2}+3P_{2}O_{5}+10PH_{3}^{-}}$ (xii) CaSO₄ + 2NH₃ + CO₂ + H₂O \rightarrow CaCO₃ \downarrow + (NH₄)₂SO₄ (xiii) NaNO₂ + 6H $\xrightarrow{Zn/NaOH}$ NaOH + NH₃ H₂O (xiii) $2NaIO_3 + 5NaHSO_3 \rightarrow 2Na_2SO_4 + 3NaHSO_4 + I_2 + H_2O_3$ (xv) Na₂CO₃ + NO + NO₂ \rightarrow 2NaNO₂ + CO₂ (xvi) $4KMnO_4 + 2H_2O \rightarrow 4MnO_2 + 4KOH + 3O_2$ $4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O$ (xvii) $P_4 + 20HNO_3 \xrightarrow{I_2 \ as} 4H_3PO_4 + 20NO_2 + 4H_2O_4$ (xviii) $2H_2S + NaHSO_3 + H^+ \rightarrow 3S \downarrow + 3H_2O + Na^+$ (xix) $[2HNO_3 \rightarrow H_2O + 2NO_2 + [O]] * 10$ $P_4 + 10^*O \rightarrow P_4O_{10}$ (xx) 2AI+2NaOH+6H₂O \rightarrow 2NaAIO₂ +2H20+3H20 Sodium Melta-aluminate (xxi) $Al_2S_3 + 6H_2O \rightarrow 2AI(OH)_3 \downarrow + 3H_2S \uparrow$ (foul odour) Foul odour, on damping of Al_2S_3 is due to formation of H_2S gas, which smells like rotten eggs. (xxii) $P_4O_{10} + 6 PCI_5 \rightarrow 10 POCI_3$ (xxiii) $SnCl_4 + 2C_2H_5Cl + Na \rightarrow C_4H_{10} + Na_2[SnCl_6]$



<u>Sol 9.</u>

By boiling Na₂SO₃ solution with powder of sulphur in absence of air sodium thiosulphate is prepared. Unreacted S is removed, filtrate is evaporated to give crystals of sod thiosulphate. Na₂SO₃ + S \rightarrow Na₂S₂O₃

<u>Sol 10.</u>

Extraction of aluminum from bauxite : $4AIF_3 + (from cryolite) \rightleftharpoons 4Al^{3+} + 12f^{-}$ At cathode : $4Al^{3+} + 12e^{-} \rightarrow 4Al$ At anode : (i) $12F^{-} \rightarrow 6F_2 + 12e^{-}$ (ii) $2Al_2O_3 + 6F_2 \rightarrow 4AIF_3 + 3O_2$

<u>Sol 11.</u>

Al + NaOH $\xrightarrow{aq.}$ NaAlO₂ $\xrightarrow{2H_2O}$ Al(OH)₃ \xrightarrow{heat} Al₂O₃ (Alumina)

<u>Sol 12.</u>

N₂O has two principal resonance structures :

$$\vec{N} = \vec{N} = \vec{O}$$
: \iff $\vec{N} = \vec{N} = \vec{O}$.

<u>Sol 13.</u>

(i) $\text{KCIO}_3 + 2\text{H}_2\text{C}_2\text{O}_4 + \text{H}_2\text{SO} \rightarrow \text{KHSO}_4 + \text{HCI} + 6\text{CO}_2 + 3\text{H}_2\text{O}$ (ii) $(\text{NH}_4)_2\text{SO}_4 + \text{NO} + \text{NO}_2 \rightarrow 2\text{N}_2 + 3\text{H}_2\text{O} + \text{H}_2\text{SO}_4$

<u>Sol 14.</u>

(i) H_2S oxidizes into S, $SO_2 + 2H_2S \rightarrow 3S + 2H_2O$ (ii) $Sn + 4HNO_3 \rightarrow H_2SnO_3 + 4NO_2 + H_2O$ Conc. Meta stannic acid (iii) $Pb_3O_4 + 4HNO_3 \rightarrow 2Pb(NO_3)_2 + 2H_2O + PbO_2 \downarrow$

<u>Sol 15.</u>

(i) HI < HBr < HCI < HF

The strength of H-X bond decreases from HF to HI.

The larger is H-X bond length, lower is the bond energy, lesser is the bond strength.

(ii) $HOCI < HOCIO < HOCIO_2 < HOCIO_3$

As the number of oxygen atoms increase, the –ve charge dispersal becomes more and more form CI atom due to more electronegativity of oxygen atom and thus lesser is the charge on CI atom, more will be its stability.

(iii) $SiO_2 < CO_2 < N_2O_5 < SO_3$.

Among oxides of the non-metals, the acidic strength increases with oxidation state. Hence SO₃ (O.S of S = +6) is most acidic followed by N₂O₅ (O.S. of N = +5) and CO₂ and SiO₂ (O.S. of C and Si = +4). Further CO₂ is more acidic than SiO₂ because of small size of C-atom.

(iv) Since carbon has no d-orbital, it cannot extend its coordination number beyond four, its halides are not attacked (hydrolyses) by water. On the other hand, silicon have vacant d-orbitals to which water molecules can coordinate and hence their halides are hydrolyses by water.

NOTE : Increasing order of extent of hydrolysis \rightarrow CCl₄ < MgCl₂ < AICl₃ < SiCl₄ < PCl₅



<u>Sol 16.</u>

(i) $2\text{FeBr}_2 + 3\text{Cl}_2 \rightarrow 2\text{FeCl}_3 + 2\text{Br}_2$ (ii) $2\text{SnCl}_2 + 2\text{I}_2 \rightarrow \text{SnCl}_4 + \text{SnI}_4$ (iii) $\text{SO}_2 + \text{H}_2\text{O} + 1/2 \text{ O}_2 \rightarrow \text{H}_2\text{SO}_4$ $\text{H}_2\text{SO}_4 + 2\text{NaCl} \rightarrow \text{Na}_2\text{SO}_4 + 2\text{HCl}$

<u>Sol 17.</u>

The two resonating structures of ozone are :



<u>Sol 18.</u>

 $3PbS \xrightarrow{heat in} 2PbO + PbS \xrightarrow{heat in the absence of air (B)} 3Pb + SO_2$

<u>Sol 19.</u>

(i) $2P + 3I_2 + 6H_2O \rightarrow 2H_3PO_4 + 6HI$ (ii) $2KNO_3 + 10K \rightarrow 6+K_2O + N_2$ (iii) $2NH_3 + + NaOCI \rightarrow H_2N.NH_2 + NaCI + H_2O$

Hydrazine

(iv) Sn + 2KOH + $4H_2O \rightarrow K_2Sn(OH)_6 + 2H_2$

<u>Sol 20.</u>



Number of P – O single bonds = 12 Number of P – O double bonds = 4

<u>Sol 21.</u>

At first Bi(NO₃)₃ hydrolyses to give nitric acid which, being an oxidizing agent, oxidizes potassium iodide liberating free iodine responsible for dark brown precipitate. Iodine dissolved in excess of potassium iodide forming soluble KI₃ imparting yellow colour to solution. Bi(NO₃)₃ + H₂O \rightarrow *Bi(OH(NO₃)₂] + HNO₃

 $NO_{3}^{-} + 4 H^{+} + 3e^{-} \rightarrow NO_{2} + 2H_{2}O] * 2$ $2I^{-} \longrightarrow I_{2} + 2e^{-}] \times 3$ $2NO_{3}^{-} + 8H^{+} + 6I^{-} \longrightarrow 2NO + 4H_{2}O + 3I_{2} \downarrow (dark brown ppt)$ $Ki + I_{2} \rightarrow KI_{3}$ (vellow exclusion)

(yellow solution)



<u>Sol 22.</u>

(a) $2KI + CI_2 \rightarrow 2KCI + I_2$ Since CI_2 is more powerful oxidizing agent than I_2 , CI_2 , is able to displace I⁻ to form I_2 . $2I^- \rightarrow I_2 + 2e^-$, $E^0 = + 0.54 \vee \dots$ (i) $CI_2 + 2e^- \rightarrow 2CI^ E^0 = 1.36 \vee \dots$ (ii) On subtracting eq. (i) from eq. (ii), we get $CI_{2_{(g)}} + 2I^-_{(aq)} + \rightarrow 2CI^-_{(aq)} + I_{2_{(s)}}E^0 = 0.82V$

(b) $2\text{KCIO}_3 + \text{I}_2 \rightarrow 2\text{KIO}_3 + \text{CI}_2$ Here CIO_3^- is more powerful oxidizing agent than IO_3^- , so CI is displaced by I. $2IO_3^- + 12\text{H}^+ + 10\text{e}^- \rightarrow \text{I}_2 + 6\text{H}_2\text{O}, \text{E}^0 = 1.195\text{V} \dots$ (i) $2CIO_3^- + 12\text{H}^+ + 10\text{e}^- \rightarrow \text{CI}_2 + 6\text{H}_2\text{O}, \text{E}^0 = 1.47\text{V} \dots$ (ii) On subtracting eq. (i) from eq. (ii), we get $2CIO_3^- + \text{I}_2 \rightarrow 2IO_3^- + \text{CI}_2 \qquad \text{E}^0 = 0.275\text{V}$

<u>Sol 23.</u>

The poisonous element M may be As. So on the basis of the given facts,

 $\mathsf{AsCI}_3 + \mathsf{6H} \xrightarrow{Zn/H_2SO_4} \mathsf{AsH}_3 + \mathsf{3HCI}$

$$2AsH_3 \xrightarrow{\Delta} 2As + 3H_2 \uparrow$$
(M)

Hence $M = As; N = As H_3$

Sol 24.

In cyclic Si₃ O_9^{6-} , three tetrahedral of Si O_4^{2-} are joined together sharing two oxygen atoms per tetrahedron.



 $SOP_2 + PCI_5 \rightarrow SOCI_2 + POCI_3$

Thionyl chloride

 $\begin{aligned} & \mathsf{FeCI}_3 \ \mathsf{6H}_2\mathsf{O} + \mathsf{6SOCI}_2 \rightarrow \mathsf{FeCI}_3 + \mathsf{12HCI} + \mathsf{6SO}_2 \\ & \mathsf{FeCI}_3 \ \mathsf{6H}_2\mathsf{O} + \mathsf{6CH}_3 - \mathsf{C}(\mathsf{OCH}_3)_2 - \mathsf{CH}_3 \rightarrow \mathsf{FeCI}_3 + \mathsf{12CH}_3\mathsf{OH} + \mathsf{6CH}_3\mathsf{COOH}_3 \end{aligned}$

<u>Sol 26.</u>

 $7H_3PO_4 + Ca_5(PO_4)_3 F \rightarrow 5Ca(H_2PO_4)_2 + HF$ Triple superphosphate



<u>Sol 27.</u>

The reaction is $HNO_2 + 2H_2SO_3 + H_2O \rightarrow NH_2OH + 2H_2SO_4$ (A) (B) (C) (D) The structures of A, B, C and D are as follows. HO HO - S - OH H - N - OH HO - S - OH(A) (B) (C) (D) Sol 28

<u>Sol 28.</u>

Sulphar trioxide produced in the contact process is absorbed by sulphuric acid forming $H_2S_2O_7$. It is not dissolved in water as it gives a dense fog of sulphuric acid particle.

The catalyst used in the contact process is vanadium pent oxide.

<u>Sol 29.</u>

In such a case A = Ca(OH)₂, B = NH₄HCO₃, C = Na₂CO₃, D = NH₄CI and E = CaCl₂ CaO ++ H₂O \rightarrow Ca(OH)₂ (A) NH₃ + CO₂ + H₂O \rightarrow NH₄HCO₃ Sod. Bicarbonate(B) NH₄HCO₃ + NaCI \rightarrow NaHCO₃ +NH₄CI Amin. Chloride(D) 2NaHCO₃ $\xrightarrow{\Delta}$ Na₂CO₃ + H₂O + CO₂ Sod. Carbonate (C) Ca(OH)₂ + 2NH₄CI \rightarrow CaCl₂ + 2NH₃ + 2H₂O Can be used again Sol 20

<u>Sol 30.</u>

More electronegative halogen displaced lesser electronegative halogen from its halide. Thus, $Cl_2 + 2KBr \text{ (or } 2 \text{ KI)} \rightarrow 2KCI + Br_2 \text{ (or } l_2)$

<u>Sol 31.</u>

Use the formula H(hybridization), H = 1/2 (V + M - C + A) where V = number of electron in valence shell of central atom M = number f monovalent atoms surrounding the central atom C = Charge on cation A = Charge on anion XeF₂ : H = 1/2 (8 + 2 - 0 + 0) = 5 Hence hybridization is sp³d, and thus its structure is linear. XeF₄ : H = 1/2 (8 + 4 - 0 + 0) = 6, Hence hybridization is sp³d² and thus its structure is square planar.

 XeO_2F_2 : H = 1/2 (8 + 2 - 0 + 0) = 5, Hence hybridization is sp³d and shape is see saw.





<u>Sol 32.</u>

Elemental nitrogen exists-as a diatomic molecule because nitrogen can form $p\pi - p\pi$ multiple bonds which is not possible in case of phosphorus due to repulsion between, non-bonded electrons of the inner core. There is no such repulsion in case of smaller nitrogen atoms as they have only Is² electrons in their inner core.

<u>Sol 33.</u>

Since B_2O_3 is formed by reaction of (Y) with air, (Y) therefore should be B_2H_6 in which % of hydrogen is 21.72. The compound (X) on reduction with LiAIH₄ gives B_2H_6 . Thus it is boron trihalide. The reactions are show as:

 $4BX_3 + 3LiAIH_4 \rightarrow 2B_2H_6 + 3LiX + 3AIX_3$ (X)
(Y)
(X = Cl or Br) $B_2H_6 + 3O_2 \rightarrow B_2O_6 + 3H_2O + heat$ (Y)

Structure of B_2H_6 is as follows:



Thus the diborane molecular has four tow-centre- two – electron bonds (2c - 2e bonds) also called usual bonds and two three -centre -two –electron bonds (3c - 2e) also called banana bonds. Hydrogen attached to usual and banana bonds are called H_t (terminal H) and H_b (bridge H) respectively.



Sol 34. (i) SiCl₄ + 2Mg(or Zn) \rightarrow Si + 2MgC1₂ (or ZnCl₂) (ii) SiCl₄ + 2CH₃MgCl \rightarrow (CH₃)₂SiCl₂ + 2MgCl₂ H CI HOH H₂C 2HCI Dimethyl silanediol ЪĆ сі нюн ЪĆ СН Si-O-Si-OH НО -– OH CH₃ CH CH₁ Polymerization continues on both ends to give linear silicone. (iii) SiCl₄ + 2Mg \rightarrow Si + 2MgC1₂

Si + Na₂CO₃ \rightarrow Na₂SiO₃ + C SiCl₄ + Na₂CO₃ \rightarrow Na₂SiO₃ + C Si(OH)₂ \xrightarrow{heat} SiO₂ + 2H₂O

 $SiO_2 + 2NaOH \rightarrow Na_2SiO_3 + H_2O$

<u>Sol 35.</u>

(i) $AI_4C_3 + 12H_2O \rightarrow 4 AI(OH)_3 + 3CH_4 \uparrow$ (ii) $CaNCN + 3H_2O \rightarrow CaCO_3 \downarrow +2NH_3$ Ammonia formed dissolves in water to form NH_4OH $CaNCN + 5H_2O \rightarrow 2NH_4OH + CaCO_3 \downarrow$ (iii) $4BF_3 + 3H_2O \rightarrow 3HBF_4 + B(OH)_3$ (iv) $NCI_3 + 3H_2O \rightarrow NH_3 + 3HOCI$ (v) $3XeF_4 + 6H_2O \rightarrow XeO_3 + 2Xe + 3/2 O_2 + 12HF$

<u>Sol 36.</u>

NOTE : When hot concentrated HCI is added to borax ($Na_2B_4O_7$. $10H_2O$) the sparingly soluble H_3BO_3 is formed which on subsequent heating gives B_2O_3 which is reduced $Na_2B_4O_7$ (anhydrous) + 2HCI(hot, conc.)



 $B_2H_6 + HCI \rightarrow B_2H_5CI + H_2$ [**NOTE** : Normally this reaction takes place in the presence of Lewis acid (AICI₃)]



<u>Sol 37.</u>

 $\begin{array}{l} 2 PbS + 3O_2 \rightarrow 2 PbO + 2 SO_2 \\ PbS + 2O_2 \rightarrow PbSO_4 \\ PbS + 2 PbO \rightarrow 3 Pb + SO_2 \\ PbS + PbSO_4 \rightarrow 2 Pb + 2 SO_2 \\ Oxidation number of Pb in litharge (PbO) is + 2 \end{array}$

<u>Sol 38.</u>

 $Na_2CO_3 + 2SO_2 + H_2O \rightarrow 2 NaHSO_3 + CO_2$;

(A)

 $2NaHSO_3 + Na_2CO_3 \rightarrow 2 Na_2SO_3 + H_2O + CO_2$

(B)

 $Na_2SO_3 + S \rightarrow I_2 2Na_2S_4O_6 + 2Nal$

Oxidation states of 'S' are ; +4 in (A), (+6) in B and +2 in (C), +2.5 in (D)

<u>Sol 39.</u>

HF is weakly dissociated, while KF is highly dissociated giving a high concentration of F^- which leads to the formation of soluble AIF_6^{3-}

 $\mathsf{AIF}_3 + 3 \text{ KF} \rightarrow \mathsf{K}_3[\mathsf{AIF}_6]$

Since BF_3 is more acidic than AIF_3 , it pulls out F^- from AIF_6^{3-} reprecipitating AIF_3 .

 $K_3[AIF_6] + 3BF_3 \rightarrow 3KBF_4 + AIF_3 \downarrow$

<u>Sol 40.</u>

 $\begin{array}{l} 6\text{CaO} + P_4\text{O}_{10} \rightarrow 2\text{Ca}_3 \ (\text{PO}_4)_2\\ \text{Moles of } P_4\text{O}_{10} = 852/284 = 3\\ \text{Moles of } \text{CaO} = 3 \ ^* \ 6 = 18\\ \text{Wt. of } \text{CaO} = 18 \ ^* \ 56 = 1008 \ \text{g}\\ \text{For structure of } P_4\text{O}_{10} : \text{See question } 20 \ \text{of this Section.} \end{array}$

<u>Sol 41.</u>

 $(CH_3)_3$ N and (Me_3Si_3) N are not is structural, the former is pyramidal while the latter is trigonal planr. Silicon has vacant d orbitals which can accommodate lone pair of electrons from N (back bonding) leading to planar shape..





Sol 42.

A. Conc. H₂SO₄B. Br₂ c. NO₂⁺ D. Reaction involved are $2NaBr + 2H_2SO_4 + MnO_2$ (A) \rightarrow Na₂SO₄ + MnSO₄ + Br₂ \uparrow + 2 H₂O [B] Brown fumes and pungent smell $H_2SO_4 + HNO_3 \rightarrow HSO_4^- + NO_2^+ + H_{2=0}$ [C] CH₂ O₂N NO [D] Explosive (C) $O_2^{-}\sigma 1s^2$, $\sigma^* 1s^2$; $\sigma 2s^2 .\sigma^* 2s^2$; $\sigma 2p_x^2$, $\pi 2p_y^2 = \pi 2p_z^2$, $\pi^* 2p_y^2 = \pi^* 2p_z^1$ Bond order = 1.5 paramagnetic (D) $O_2 \sigma 1s^2$, $\sigma^* 1s^2$, $\sigma 2s^2$, $\sigma^* 2s^2$, $\sigma 2p_x^2$, $\pi 2p_y^2 = \pi 2p_z^2$, $\pi^* 2p_y^2 = \pi^* 2p_z^1$ Bond order = 2paramagnetic 4. (d) (P) $2PbO_2 + 2H_2SO_4 \xrightarrow{Warm} 2PbSO_4 + 2H_2O + 2H_2O + O_2$ (Q) $Na_2S_2O_3 + 5H_2O + 4CI_2 \rightarrow 2NaHSO_4 + 8HCI$ (R) $N_2H_4 + 2I_2 \rightarrow N_2 + 4HI$ (S) $XeF_2 + 2NO \rightarrow Xe + 2NOF$

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