Important Questions for CBSE Class 12 Chemistry –

The p-Block Elements

Very Short Answer Type Questions [1 Mark]

Question 1:
Write the formulae of any two oxoacids of phosphorus.
Answer:
H_3P0_3 and H_3PO_4.

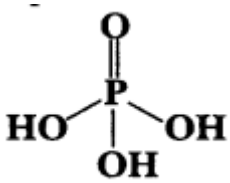
Question 2:
Write the formulae of any two oxoacids of chlorine.
Answer:
$HClO_3$ and $HCl0_4$.

Question 3:
H_3P0_3 disproportionates while H_3P0_4 does not, why?
Answer:
It is because in H_3P0_3, 'P' is in +3, intermediate oxidation state which can increase to +5 and decrease to -3, whereas in H_3P0_4, 'P' is in highest oxidation state +5 which can only gain electrons, i.e. undergoes reduction only, acts as oxidising agent and cannot disproportionate.

Question 4:
Out of white phosphorus and red phosphorus, which one is more reactive and why?
Answer:
White phosphorus because it is monomeric and has low bond dissociation enthalpy due to angle of strain (bond angle 60°).

Question 5:
What is the basicity of H_3P0_4?

Answer:
Three.

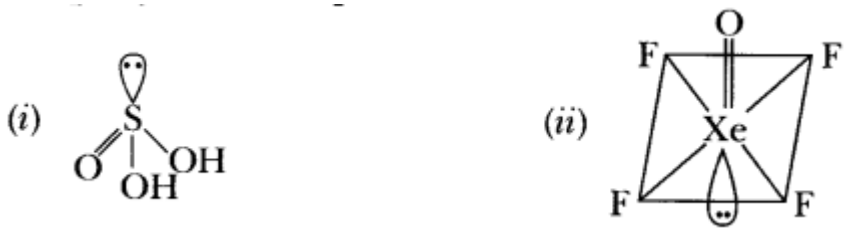


Question 6:
Write the formulae of any two oxoacids of sulphur.
Answer:
H_2S0_4 and H_2SO_3.

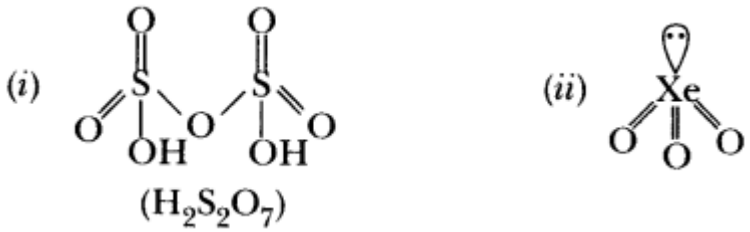
Question 7:
Which allotrope of sulphur is thermally stable at room temperature?
Answer:
Rhombic sulphur.

Short Answer Type Questions [I] [2 Marks]

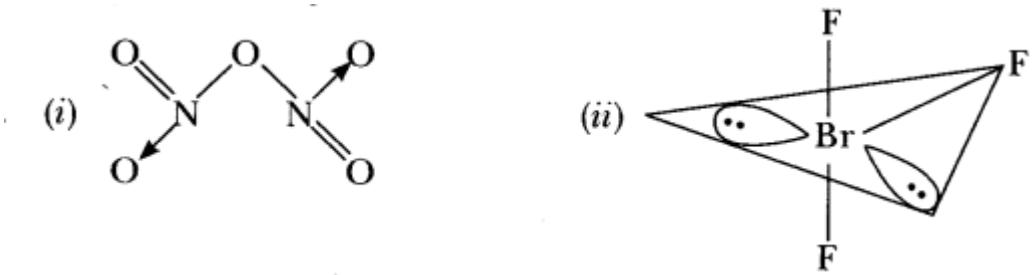
Question 8:
Write the structures of the following molecules: (i) H_2SO_3 (ii) $XeOF_4$
Answer:



Question 9:
Write the structures of the following:
(i) $H_2S_2O_7$ (ii) $Xe0_3$
Answer:



Question 10:
Write the structures of the following:
(i) N_2O_5 (ii) BrF_3
Answer:



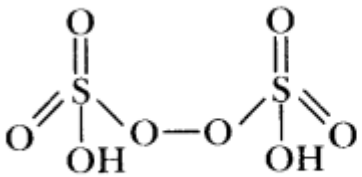
Short Answer Type Questions [II] [3 Marks]

Question 11:
Give reasons for the following:
(i) N_2 is less reactive at room temperature.
(ii) H_2Te is the strongest reducing agent amongst all the hydrides of group 16-elements.
(iii) Helium is used in diving apparatus as a diluent for oxygen.
Answer:
(i) It is due to presence of triple bond which has high bond dissociation enthalpy.
(ii)H_2Te has longest bond length which has lowest bond dissociation enthalpy.
(iii) It is because helium is less soluble than N_2 in blood and does not cause pain.

Question 12:
Give reasons for the following:
(i) NH_3 has a higher boiling point than PH_3.
(ii) H_2Te is more acidic than H_2S.
(iii) Chlorine water on standing loses its yellow colour.
Answer:
(i) NH_3 is associated with inter molecular H-bonding, PH_3 is not.
(ii) H_2Te has lower bond dissociation enthalpy than H_2S due to longer bond length.
(iii) Cl_2+H_2O ——> HCL+HOCL
If forms HCl and HOCl, both are colourless.

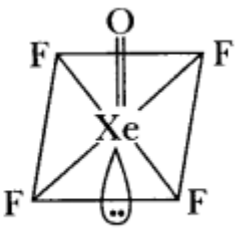
Question 13:
(a) Account for the following:
(i) Bond angle in NH_4 is greater than that in NH_3.
(ii)Reducing character decreases from $S0_2$ to TeO_2.
(iii) $HClO_4$ is a stronger acid than HCIO.
(b) Draw the structures of the following:
(i) $H_2S_2O_8$
(ii) $XeOF_4$.
Answer:
(a) (i) NH_3 has lone pair of electron, so, bond angle is 107°, whereas NH^{+4} does not, therefore, bond angle is 109.5°.
(ii) It is due to stability of higher oxidation state which decreases due to inert x , effect.
(iii) It is because ClO_4^- is more stable than CIO- due to more dispersal charge on four oxygen atoms.

(b) (i)



Tetrahedral

(ii)



Square pyramidal

Question 14:

(a) Which poisonous gas is evolved when white phosphorus is heated with Cone. NaOH solution? Write the chemical equation.
(b) Write the formula of first noble gas compound prepared by N. Bartlett. What inspired N. Bartlett to prepare this compound?
(c) Fluorine is a stronger oxidising agent than chlorine. Why?
(d)Write one use of chlorine gas.
(e)Complete the following equation:
$CaF_2 + H_2S0_4$ ———>

Answer:

(a) Phosphine gas is formed.

$$P_4 + 3NaOH + 3H_2O \longrightarrow \underset{\text{Sodium hypophosphite}}{3NaH_2PO_2} + \underset{\text{Phosphine}}{PH_3}$$

(b)Xe+PtFg. The comparable ionisation enthalpy of 02 molecule (1175 KJ mol-1) and Xe (1170 KJ mol-1) inspired Neil Bartlett to prepare this compound.
(c) It is due to low bond dissociation enthalpy, higher hydration energy of F- and high electron gain enthalpy.
(d) It is used as bleaching agent and disinfectant.
(e) $CaF_2 + H_2S0_4$ ————> $CaS0_4 + 2HF$.

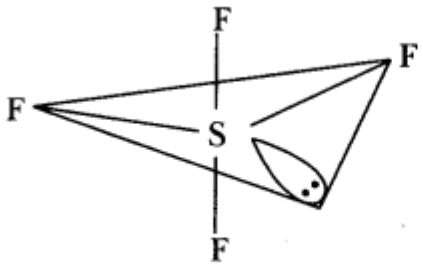
Question 15:

(a) Account for the following:
(i) Bi(V) is stronger oxidizing agent than Sb(V).
(ii) H—O—I is a weaker acid than H—O—Cl.
(iii) Bond angle decreases from H_2O to H_2S.
(b)Draw the structures of the following:
(i) SF_4
(ii) XeF_2

Answer:

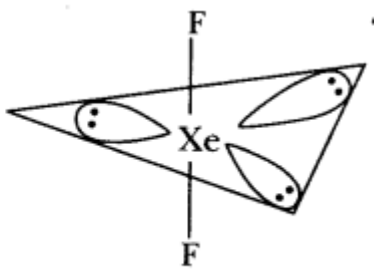
(a) (i) Bi3+ is more stable than Sb3+ due to inert pair effect. Bi5+ can gain 2 electrons to form Bi3+. That is why Bi5+ is stronger oxidising agent than Sb5+.
(ii) It is because 'Cl' is more electronegative than 'I'.
(iii) It is because oxygen is more electronegative and smaller in size than sulphur.

(b) (i)



See-Saw

(ii)



Linear

Question 16:

(i) Why does PCl_5 fume in moisture?
(ii) Write the name of the allotrope of sulphur which is stable at room temperature.

(iii) Chlorine water on standing loses its yellow colour. Why?
(iv) Write the disproportionation reaction of H_3P0_3.
(v) Complete the following equation: $F_2 + H_20$ ———>

Answer:

(i) It is because it gets hydrolysed to form HCl which fumes is moist air.

$$PCl_5 + H_2O \longrightarrow POCl_3 + 2HCl$$

(ii) Rhombic sulphur (α-sulphur)

(iii) $Cl_2 + H_2O \longrightarrow HCl + HOCl$

It is due to loss of chlorine which changes into HCl and HOCl which are colourless.

(iv) $4H_3\overset{+3}{P}O_3 \longrightarrow H_3\overset{+5}{P}O_4 + \overset{-3}{P}H_3$

(v) $2F_2 + 2H_2O \longrightarrow 4HF + O_2$

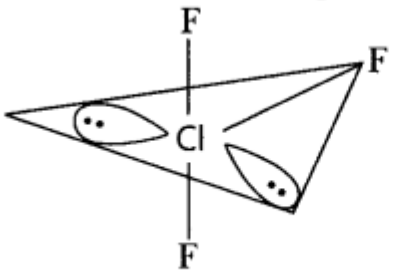
Question 17:

(a) (i) Acidic character increases from HF to HI.
(ii) There is large difference between the melting and boiling points of oxygen and sulphur.
(iii) Nitrogen does not form pentahalide.
(b) Draw the structures of the following:
(i) ClF_3 (ii) XeF_4

Answer:

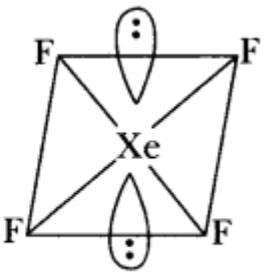
(a) (i) It is because bond dissociation energy decreases due to increase in bond length as atomic size of halogen increases from HF to HI.
(ii) Oxygen is diatomic gas having weak van der Waals' forces, whereas sulphur is octaatomic (S_8) solid, therefore, it has more van der Waals' forces of attraction. Hence sulphur has higher melting and boiling points than oxygen.
(iii) It is because nitrogen does not have d-orbitals.

(b) (i)



T-shaped

(ii)



Square planar

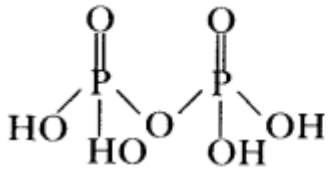
Question 18:

(i) Which allotrope of phosphorus is more reactive and why?
(ii) How the supersonic jet aeroplanes are responsible for the depletion of ozone layers?
(iii) F_2 has lower bond dissociation enthalpy than Cl_2. Why?
(iv) Which noble gas is used in filling balloons for meteorological observations?
(v) Complete the equation:
$XeF_2 + PF_5$ ——->

Answer:
(i) White phosphorus because it is monomeric and has low bond dissociation enthalpy due to angle of strain (bond angle 60°).
(ii) Supersonic jet aeroplanes release NO which is responsible for the depletion of ozone layer. $NO + 0_3 \longrightarrow N0_2 + 0_2$
(iii) It is due to more inter electronic repulsion between lone pair of electrons
(iv) Helium.
(v) $XeF_2 + PF_5 \longrightarrow [XeF]+ [PF]-$

Question 19:
(a) Account for the following:
(i) Bond angle in NH4+ is higher than NH_3.
(ii) H_2S has lower boiling point than H_20.
(iii) Reducing character decreases from $S0_2$ to TeO_2.
(b) Draw the structure of the following
(i) $H_4P_20_7$ (pyrophosphoric acid) (ii) XeF_2
Answer:
(a) (i) Refer Ans. to Q. 13 (a) (i).
(ii) H_2S molecules are not associated with intermolecular H-bonding and have weak van der Waals' forces of attraction, therefore, H_2S has lower boiling point than H_20 in which molecules are associated with intermolecular H-bonding.
(iii) Refer Ans. to Q. 13 (a) (ii).

(b) (i)



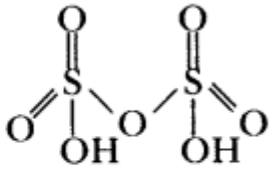
$(H_4P_2O_7)$
(Pyrophosphoric acid)
Tetrahedral

(ii) Refer Ans. to Q.15 (b) (ii).

Question 20:
(a) Draw the structures of the following:
(i) XeF_4 (ii) $H_2S_20_7$
(b) Account for the following:
(i) Iron on reaction with HCl forms $FeCl_2$ and not $FeCl_3$.
(ii) $HC0_4$ is a stronger acid than HClO.
(iii) BiH_3 is the strongest reducing agent amongst all the hydrides of group 15.
Answer:

(a) (i) Refer Ans. to Q.17 (b) (ii).

(ii)



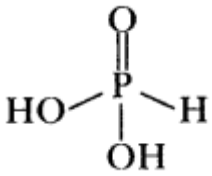
$(H_2S_2O_7)$
(Pyrosulphuric acid)

(b) (i) Fe reacts with HCl to form $FeCl_2$ because HCl is not an oxidising agent. Secondly, if any $FeCl_3$ is formed, it will be reduced to $FeCl_2$ by [H] [nascent

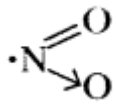
hydrogen],
(ii) Refer Ans. to Q.13 (a) (iii)
(iii) BiH_3 has lowest bond dissociation enthalpy due to longer bond length. Therefore, it acts as strongest reducing agent.

Very Short Answer Type Questions [1 Mark]

Question 21:
What is the basicity of H_3P0_3?
Answer:
H_3PO_3 is dibasic acid. Its basicity is 2.



Question 22:
Why does $N0_2$ dimerise?
Answer:
It is because NO_2 has unpaired (odd) electron, therefore, it is unstable and forms dimer to become stable.



Question 23:
Why does NH_3 act as a Lewis base?
Answer:
It is because in NH_3, there is lone pair of electrons on 'N' therefore, it acts as Lewis base.

Question 24:
Why is the single N—N bond weaker than the single P—P bond?
Answer:
There is more repulsion between lone pair of electrons on smaller 'N' atoms in :N—N: bond due to which it is weaker than :P—P: bond.

Question 25:
Arrange the following in the increasing order of their basic character:
NH_3, PH_3, ASH_3, SbH_3, BiH_3
Answer:
$BiH_3 < SbH_3 < ASH_3 < PH_3 < NH_3$.

Short Answer Type Questions [I] [2 Marks]

Question 26:
Complete the following chemical equations:
(i) $Ca_3P_2 + H_20$ ——->
(ii) $Cu + H_2S0_4$ (Conc.) ———->
Answer:
(i)$Ca_3P_2 + 6H_2O$——-> $3Ca(OH)_2 + 2PH_3$
(ii) $Cu + 2H_2S0_4$(conc.) ———> $CuS0_4 + S0_2 + 2H_20$

Question 27:
Arrange the following in the order of property indicated against each set:
(i) HF, HCl, HBr, HI – increasing bond dissociation enthalpy.
(ii) H_20, H_2S, H_2Se, H_2Te – increasing acidic character
Answer:
(i) HI < HBr < HCl < HF is the increasing order of bond dissociation enthalpy.
(ii) $H_2O < H_2S < H_2Se < H_2Te$ is the increasing order of acidic character.

Question 28:
Complete the following equations:
(i) $P_4 + H_2O$ ———>
(ii) $XeF_4 + O_2F_2$ ———->
Answer:

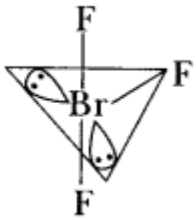
$$(i)\quad P_4 + 16H_2O \xrightarrow{\text{Heat}} 4H_3PO_4 + 10H_2$$

$$(ii)\quad XeF_4 + O_2F_2 \longrightarrow XeF_6 + O_2$$

Question 29:
Draw the structures of the following:
(i) XeF_2 (ii) BrF_3
Answer:

(i) Refer Ans. to Q.15 (b) (ii).

(ii)



T-shaped

Question 30:
Complete the following equations:
$Ag + PCl_5$ ———>
$CaF_2 + H_2SO_4$ ——>
Answer:

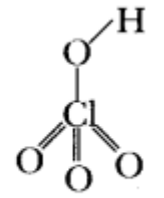
$$(i)\quad 2Ag + PCl_5 \longrightarrow 2AgCl + PCl_3$$

$$(ii)\quad CaF_2 + H_2SO_4 \longrightarrow CaSO_4 + 2HF$$

Question 31:
Draw the structures of the following:
(i) XeF_4 (ii) HCO_4
Answer:

(*i*) Refer Ans. to Q.17 (*b*) (*ii*).

(*ii*)



(Tetrahedral)

Question 32:
Complete the following equations:
(i) C+ conc. H_2S0_4 ——->
(ii) $XeF_2 + H_20$ ——->
Answer:

(*i*) $C + 2H_2SO_4(conc.) \longrightarrow CO_2 + 2H_2O + 2SO_2$

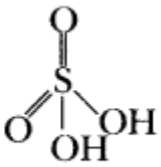
(*ii*) $2XeF_2 + 2H_2O \longrightarrow 4HF + 2Xe + O_2$

Question 33:
Draw the structures of the following:
(i) $Xe0_3$ (ii) H_2SO_4
Answer:

(*i*)

Pyramidal

(*ii*)



Tetrahedral

Question 34:
Name the two most important allotropes of sulphur. Which one of the two is stable at room temperature? What happens when the stable form is heated above 370 K?
Answer:
(i) Rhombic sulphur (α-sulphur)
(ii) Monoclinic sulphur (β-sulphur)
Rhombic sulphur is more stable at room temperature.
When Rhombic sulphur is heated above 370 K, it changes to monoclinic sulphur.

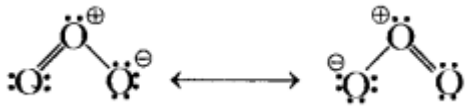
Question 35:
(i) Write the conditions to maximize the yield of H2S04 by contact process.
(ii) Why is $K_{a1} < < K_{a2}$ for H_2S0_4 in water?
Answer:
(i) (a) High pressure, 2 bar (b) Temperature, 720
(c) V_2O_5, catalyst. (d) Excess of oxygen.
(ii) $H_2S0_4$is a strong acid, therefore, its K is very high as it dissociates into H_3O+ and

$HS0_4$ almost completely.
The dissociation of $HS0_4$ to H_30+ and SO-2 is slow, therefore, is much lower than K_{a1}

Short Answer Type Questions [II] [3 Marks]

Question 36:
36. (a) Draw the structures of the following molecules:
(i) $XeOF_4$ (ii) H_2S0_4
(b) Write the structural difference between white phosphorus and red phosphorus.
Answer:
(a) (i) Refer Ans. to Q. 13 (b) (ii).
(ii) Refer Ans. to Q.33 (ii).
(b) White phosphorus is monomeric, whereas red phosphorus is polymeric.

Question 37:
Account for the following:
(i) PCl_5 is more covalent than PCl_3.
(ii) Iron on reaction with HCl forms $FeCl_2$ and not $FeCl_3$.
(iii) The two O—O bond lengths in the ozone molecule are equal.
Answer:
(i) P5+ has more polarizing power than P3+, therefore, PCl_5 is more covalent than PCl_3 according to Fajan's rule.
(ii) Refer Ans. to Q.20 (b) (i).
(iii) It is due to resonance.



Question 38:
(a) Draw the structures of the following:
(i) XeF_2 (ii) BrF_3
(b) Write the structural difference between white phosphorus and red phosphorus.
Answer:
(a) (i) Refer Ans. to Q. 15 (b) (ii).
(ii) Refer Ans. to Q.29 (ii).
(b) White phosphorus is monomeric, whereas red phosphorus is polymeric.

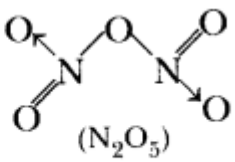
Question 39:
39. Account for the following:
(i) Bi(V) is a stronger oxidizing agent than Sb(V).
(ii) N—N single bond is weaker than P—P single bond. *'
(iii) Noble gases have very low boiling points.
Answer:
(i) Refer Ans. to Q.15 (a) (i).
(ii) It is due to more repulsion between valence electrons of smaller size of N atoms than P atoms.
(iii) It is due to weak van der Waals' forces of attraction as these are non-polar.

Question 40:

40. (a) Draw the structures of the following compounds:
(i) XeF_4 (ii) N_20_5
(b) Write the structural difference between white phosphorus and red phosphorus.

Answer:

(a) (i) Refer Ans. to Q.17 (b) (ii). (ii)



(N_2O_5)

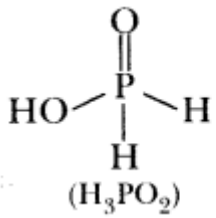
(b) White phosphorus is monomeric, whereas red phosphorus is polymeric.

Question 41:

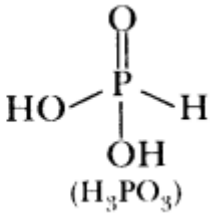
Account for the following:
(i) Sulphur in vapour form exhibits paramagnetic behaviour.
(ii) $SnCl_4$ is more covalent than $SnCl_2$.
(iii) H_3PO_2 is a stronger reducing agent than H_3P0_3.

Answer:

(i) Sulphur exists as S_2 molecule like O_2 in vapour state and has two unpaired electrons. Therefore, it is paramagnetic.
(ii) Sn4+ has more polarising power than Sn2+ due to smaller size and higher charge. ,
(iii) It is because H_3PO_2 has two P—H bonds, whereas H_3P0_3 has only one P—H bond



(H_3PO_2)



(H_3PO_3)

Question 42:

Give reasons for the following:
(i) $(CH3)_3P=0$ exists but $(CH3)_3$ N=0 does not.
(ii) Oxygen has less electron gain enthalpy with negative sign than sulphur.
(iii) H_3P0_2 is a stronger reducing agent than H_3P0_3.

Answer:

(i) It is because 'N' does not have d-orbitals, whereas 'P' has rf-orbitals.
(ii) It is due to more inter-electronic repulsion in smaller oxygep atoms than sulphur atoms.
(iii) Refer Ans. to Q.41 (iii).

Long Answer Type Questions [5 Marks]

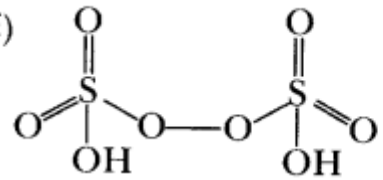
Question 43:
(a) Account for the following:
(i) Bi is a strong oxidizing agent in the +5 state.
(ii) PCl_5 is known but NCl_5 is not known.
(iii) Iron dissolves in HCl to form $FeCl_2$ and not $FeCl_3$.
(b) Draw the structures of the following:
(i) $XeOF_4$(ii) $HClO_4$

Answer:
(a) (i) Bi5+can gain 2 electrons to form Bi3+which is more stable due to inert pair effect.
(ii) 'P' has ef-orbitals, whereas 'N' does not have cf-orbitals.
(iii) Refer Ans. to Q.20 (b) (i)
(b) (i) Refer Ans. to Q. 13 (b) (ii).
(ii) Refer Ans. to Q.31 (ii).

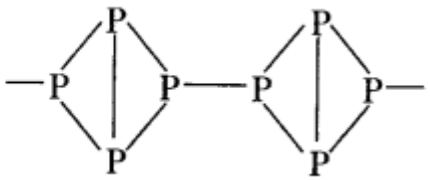
Question 44:
(a) Draw the structures of the following:
(i) $H_2S_2O_8$(ii) Red P_4
(b) Account for the following:
(i) Sulphur in vapour state exhibits paramagnetism.
(ii) Unlike xenon, no distinct chemical compound of helium is known.
(iii) H_3P0_2 is a stronger reducing agent than H_3P0_3.

Answer:

(a) (i)



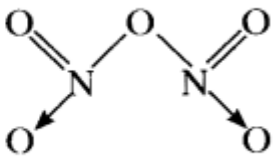
(ii)



(b) (i) Refer Ans. to Q.41 (i).
(ii) Helium (He) has the highest ionisation enthalpy and least polarising power due to smaller size as compared to Xe, therefore, it does not form chemical compound.
(iii) Refer Ans. to Q.41 (iii).

Question 45:
What is the covalency of nitrogen in N_2O_5?

Answer:
Four.



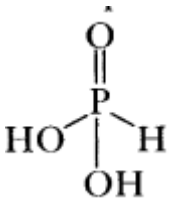
It can form four covalent bonds.

Very Short Answer Type Questions [1 Mark]

Question 46:
Very Short Answer Type Questions [1 Mark]

What inspired N. Bartlett for carrying out reaction between Xe and PtF_6
Answer:
The ionisation enthalpy of O_2 and Xe are nearly same, therefore, he prepared Xe+[PtF_6]- like 02+ [PtF_6]-

Question 47:
What is the basicity of H_3P0_3 and why?
Answer:
It is dibasic acid because it has two replaceable hydrogen attached with oxygen.



Question 48:
Name two poisonous gases which can be prepared from chlorine gas.
Answer:
(i) Chloropicrin (ii) Phosgene (iii) Mustard gas

Question 49:
Which aerosol depletes ozone layer?
Answer:
Chlorofluorocarbons (CFCs).

Short Answer Type Questions [I] [2 Marks]

Question 50:
What happens when
(i)PCl_5 is heated? (ii) H_3P0_3 is heated?
Write the reactions involved.

Answer:

(*i*) PCl_5 dissociates into PCl_3 and Cl_2.

$$PCl_5 \xrightarrow{\text{heat}} PCl_3 + Cl_2$$

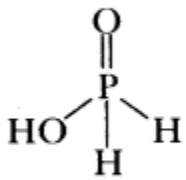
(*ii*) Phosphoric acid and Phosphine (Phosphane) gas are formed.

$$4H_3PO_3 \longrightarrow 3H_3PO_4 + PH_3$$

Question 57:
Give reasons for the following:
(i) Though nitrogen exhibits +5 oxidation state, it does not form pentahalide.
(ii) Electron gain enthalpy with negative sign of fluorine is less than that of chlorine.
(iii) The two oxygen-oxygen bond lengths in ozone molecule are identical.
Answer:
(i) It is because it does not have cf-orbitals.
(ii) It is due to more inter electronic repulsion in smaller size of'F' as compared to Cl.
(iii) It is due to resonance.

Question 58:
Give reasons for the following:
(i) Oxygen is a gas but sulphur is a solid.
(ii) O_3 acts as a powerful oxidising agent.
(iii) BiH_3 is the strongest reducing agent amongst all the hydrides of Group 15 elements.
Answer:
(i) It is because oxygen is diatomic and has less intermolecular forces of attraction, whereas sulphur is octa-atomic (S_8) and has more intermolecular forces of attraction.
(ii) It is because Os has low bond dissociation energy and it is more reactive. Therefore, it liberates nascent oxygen easily.
O_3 ———> O_2+ [O]
(iii) Refer Ans. to Q.20 (b) (iii).

Question 59:
Draw the structures of the following molecules:
(i) N_2O_5 (ii) H_3PO_2 (iii) XeF_6
Answer:
(i) Refer Ans. to Q.40 (a) (ii).
(ii)

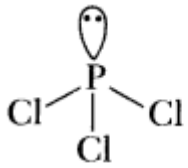


(iii) Refer Ans. to Q.51 (i).

Question 60:
Account for the following:
(i) White phosphorus is more reactive than red phosphorus.
(ii) $SnCl_4$ is more covalent than $SnCl_2$.
(iii) O_3 is a powerful oxidising agent.
Answer:
(i) It is because white phosphorus is monomeric and has less bond dissociation energy, whereas red phosphorus is polymeric and has more bond dissociation energy.
(ii) Refer Ans. to Q.41 (ii).
(iii) Refer Ans. to Q.58 (ii).

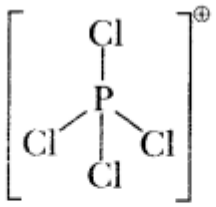
Question 61:
Complete the following equations:
(i) $PCl_3 + H_20$ ———-> (ii) $XeF_2 + PF_5$ ———-> (iii) NaN_3 ———>
Answer:
(i) $PCl_3 + 3H_20$ ——-> $H_3PO_3 + 3HCl$
(ii) $XeF_2 + PF_5$ ——> $[XeF]+[PF_6]-$
(iii) $2NaN_3$———> $2Na + 3N_2$

Question 62:
62. Draw the structures of the following molecules:
(i) PCl_3(ii) $H_4P_20_7$ (iii) ClF_3
Answer:
(i)

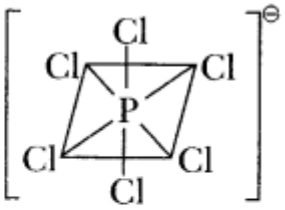


(ii) Refer Ans. to Q.19 (b) (i).
(iii) Refer Ans. to Q.17 (b) (i).

Question 63:
Draw the structures of the following:
(i) Solid PCl_5 (ii) $H_2S_2O_8$ (iii) Xe0
Answer:
(i) $[PCl_4^+]\ [PCl_6]^-$



Tetrahedral cation



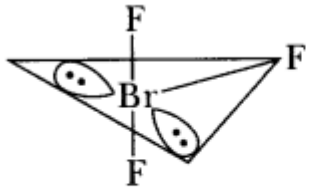
Octahedral anion

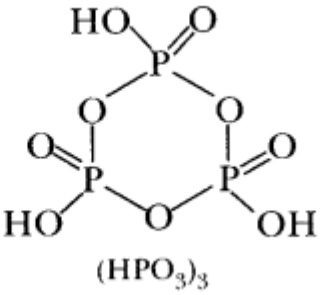
(ii) Refer Ans. to Q.44 (a) (i).
(iii) Refer Ans. to Q.33 (i).

Long Answer Type Questions [5 Marks]

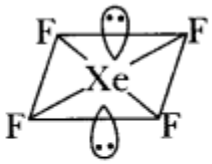
Question 64:
(a) Give reasons for the following:
(i) Bond enthalpy of F_2 is lower than that of Cl_2.
(ii) PH_3 has lower boiling point than NH?.
(b) Draw the structures of the following molecules:
(i) BrF_3 (ii) $(HP0_3)_3$ (iii) XeF_4
Answer:
(a) (i) It is due to more repulsion between valence electrons of F than Cl due to exceptionally small size.
(ii) PH_3 molecules are not associated with H-bonding, whereas NH_3 molecules are

associated with H-bonding.

(b) (i) 

(ii) 

$(HPO_3)_3$

(iii) 

Question 65:
(a) Account for the following:
(i) Helium is used in diving apparatus.
(ii) Fluorine does not exhibit positive oxidation state.
(iii) Oxygen shows catenation behaviour less than sulphur.
(b) Draw the structures of the following molecules:
(i) XeF_2 (ii) $H_2S_2O_8$

Answer:
(a) (i) It is less soluble in blood than nitrogen and does not cause bends (pain) in body under the pressure of water.
(ii) Fluorine is the most electronegative element and does not have ri-orbitals.
(iii) It is due to more repulsion between valence electrons of two oxygen atoms in 0-0 than S-S due to smaller atomic size. Therefore, 0-0 bonds is weaker than S-S bonds.
(b) (i) Refer Ans. to Q.15 (b) (ii).
(ii) Refer Ans. to Q.44 (a) (i).

Very Short Answer Type Questions [1 Mark]

Question 66:
Which one of PCl-4 and PCl_4 is not likely to exist and why?

Answer:
PCl_4 does not exist because octet of 'P' is not complete and it is unstable.

Question 67:
Of PH_3 and H_2S which is more acidic and why?

Answer:
H_2S is more acidic due to lower bond dissociation enthalpy. 'S' is more electronegative than phosphorus.

Question 68:
Although the H-bonding in hydrogen fluoride is much stronger than that in water yet water has a much higher boiling point than hydrogen fluoride. Why ?

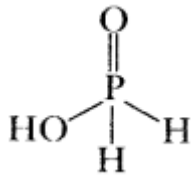
Answer:
It is because the extent of hydrogen bonding is more in H_2O (can form four H-bonds) than HF (can form two H-bonds), therefore, H_20 has higher boiling point than HF.

Question 69:
Draw the structure of XeF_6.
Answer:
Refer Ans. to Q.51 (i).

Question 70:
Despite lower value of its electron gain enthalpy with negative sign, fluorine (F_2) is a stronger oxidising agent than Cl_2.
Answer:
It is due to higher standard reduction potential of F_2 which is due to low bond dissociation energy of F—F bond because of repulsion among small size F atoms, high electron gain enthalpy and highest hydration enthalpy.

Question 71:
Which is a stronger reducing agent, SbH_3 or BiH_3, and why?
Answer:
BiH_3 is a stronger reducing agent because it has low bond dissociation energy than SbH_3 due to longer bond length.

Question 72:
What is the basicity of H_3P0_2 acid and why?
Answer:
It is monobasic acid because it has only one replaceable hydrogen atom



Question 73:
Complete the following chemical equation:
$NH_4Cl(aq) + NaNO_2(aq) \longrightarrow$
Answer:
$NH_4Cl(aq) + NaNO_2(aq) \longrightarrow NaCl(aq) + N_2(g) + 2H_2O(l)$

Question 74:
Which is a stronger acid in aqueous solution, HF or HCl, and why?
Answer:
HCl because bond dissociation energy of H—Cl is lower than HF.

Question 75:
Which is more acidic and why, H_20 or H_2S?
Answer:
H_2S is more acidic than H_20 due to low bond dissociation enthalpy due to longer bond length than H_20.

Short Answer Type Questions [I] [2 Marks]

Question 76:
Explain the following giving an appropriate reason in each case.
(i) O_2 and F_2 both stabilize higher oxidation states of metals but 0_2 exceeds F_2 in doing so.
(ii) Structures of Xenon fluorides cannot be explained by Valence Bond approach
Answer:
(i) It is due to higher lattice energy of oxides as compared to fluorides as oxide ion is dinegative, whereas fluoride ion is mononegative.
(ii) It is because Xenon (Xe) is a noble gas and has lone pair of electrons in its d-orbitals. The size of bd orbital in Xe is large enough for effective overlapping, bp and bd orbitals of Xe differ by 960 kj mol-1, that is, sp5/ hybridisation, contribution of bd orbital is objectionable. SO, valence bond approach is not suitable.

Question 77:
Explain the following facts giving appropriate reason in each case:
(i) NF_3 is an exothermic compound whereas NCl_3 is not.
(ii) All th bonds in SF4 are not equivalent.
Answer:
(i) It is because F_2 is stronger oxidising agent than Cl_2, therefore, NF_3 is exothermic compound, whereas NCl_3 is endothermic as N—F bond is stronger than N—Cl bond.
(ii) In SF_4, bonds are in different planes, therefore, they are not equivalent.

Question 78:
Explain the following:
(i) The chemical reactivity of nitrogen is much less than that of phosphorus.
(ii) SF_6 is kinetically inert.
Answer:
(i) It is because nitrogen has triple bond which has high bond dissociation enthalpy than single bond in phosphorus.
(ii) SF_6 is stearically protected, therefore, kinetically inert.

Question 79:
Draw the molecular structures of the following species:
(i) H_3PO_3 (ii) BrF_3
Answer:
(i) Refer Ans. to Q.53 (ii).
(ii) Refer Ans. to Q.29 (ii).

Question 80:
Draw the molecular structures of the following species:
(i) $H_2S_2O_8$ (ii) XeF_2
Answer:
(i) Refer Ans. to Q. 13 (b) (i).
(ii) Refer Ans. to Q.15 (b) (ii).

Question 81:
State a reason for each of the following statements:
(i) Fluorine never exhibits any positive oxidation state.
(ii) Helium does not form any real chemical compounds.
Answer:
(i) Fluorine is the most electronegative and does not have c?-orbitals, therefore, it does not show +ve oxidation state.
(ii) Helium has highest ionization enthalpy, so, it does not form any real compound.

Short Answer Type Questions [II] [3 Marks]

Question 82:

Complete the following chemical equations:

(i) $NH_4Cl(aq) + NaNO_2(aq) \longrightarrow$

(ii) $P_4 + NaOH + H_2O \longrightarrow$

(iii) $Xe(g) + F_2(g) \xrightarrow[1\ Bar]{673\ K}$

Answer:

(i) $NH_4Cl(aq) + NaNO_2(aq) \longrightarrow N_2(g) + 2H_2O(l) + NaCl(aq)$

(ii) $P_4 + 3NaOH + 3H_2O \longrightarrow 3NaH_2PO_2 + PH_3$

(iii) $Xe(g) + F_2(g) \xrightarrow[1\ Bar]{673\ K} XeF_2(s)$

Question 83:

Complete the following chemical equations:

(i) $HgCl_2 + PH_3 \longrightarrow$

(ii) $NaOH\ (cold\ \&\ dil) + Cl_2 \longrightarrow$

(iii) $XeF_4 + O_2F_2 \xrightarrow{143\ K}$

Answer:

(i) $3HgCl_2 + 2PH_3 \longrightarrow Hg_3P_2 + 6HCl$

(ii) $2NaOH\ (cold\ \&\ dil) + Cl_2 \longrightarrow NaCl + NaClO + H_2O$

(iii) $XeF_4 + O_2F_2 \xrightarrow{143\ K} XeF_6 + O_2$

Question 84:

Complete the following chemical equations:

(i) $Sn + 2PCl_5 \xrightarrow{heating}$ **(ii)** $Fe^{3+} + SO_2 + H_2O \longrightarrow$

(iii) $XeF_2(s) + H_2O(l) \longrightarrow$

Answer:

(*i*) $Sn + 2PCl_5 \xrightarrow{\text{heating}} SnCl_4 + 2PCl_3$

(*ii*) $Fe^{3+} + 2SO_2 + H_2O \longrightarrow 2Fe^{2+} + SO_4^{2-} + 4H^+$

(*iii*) $2XeF_2(s) + 2H_2O(l) \longrightarrow 2Xe + 4HF + O_2$

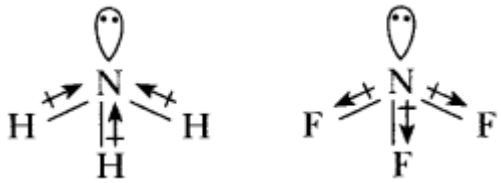
Long Answer Type Questions [5 Marks]

Question 85:

(a) Draw the molecular structures of the following compounds:
(i) XeF6 (ii) $H_2S_2O_8$
(b) Explain the following observations:
(i) The molecules NH_3 and NF_3 have dipole moments which are of opposite direction.
(ii) All the bonds in PCl_5 molecules are not equivalent.
(iii) Sulphur in vapour state exhibits paramagnetism.

Answer:

(a) (i) Refer Ans. to Q.51 (i).
(ii) Refer Ans. to Q. 13 (b) (ii).
(b) (i) "N' is more electronegative than 'H' but F is more electronegative than N.



(ii) It is because these are not in the same plane. Axial bonds are longer and weaker than Equatorial bonds due to more repulsion.
(iii) Refer Ans. to Q.41 (i).

Question 86:

(a) Complete the following reaction
(i) $XeF_4 + SbF_5$ ———> (ii) $Cl_2 + F_2$ (excess) ——>
(b) Explain each of the following:
(i) Nitrogen is much less reactive than phosphorus.
(ii) The stability of +5 oxidation state decreases down in group 15.
(iii) The bond angles (O-N-O) are not of the samevalue inN02- and N02+

Answer:

(a) (i) XeF4+ SbF- ——> $[XeF_3]+ |SbF_6]-$
(ii) $Cl_2 + 3F_2$(excess) ——-> $2ClF_3(g)$
(b) (i) Is is due to high bond dissociation enthalpy of N = N (triple bond) than single bond in P_4.
(ii) It is due to inert pair effect.
(iii) It is due to more repulsion in $N0_2$ than in $N0_2$ due to presence of lone pair of electron.

Question 87:

(a) Complete the following chemical equations:
(i) Cu + HNO_3 (dilute) ——->

(ii) $XeF_4 + O_2F_2$ ———->
(b) Explain the following observations:
(i) Phosphorus has greater tendency for catenation than nitrogen.
(ii) Oxygen is a gas but sulphur is a solid.
(iii) The halogens are coloured. Why ?

Answer:

(a) (i) $3Cu + 8HNO_3(dil.) \longrightarrow 3Cu(NO_3)_2(aq) + 2NO(g) + 4H_2O(l)$

(ii) $XeF_4 + O_2F_2 \longrightarrow XeF_6 + O_2$

(b) (i) It is because N—N bond is weaker than P—P bond due to more interelectronic repulsion due to smaller size.
(ii) Refer Ans. to Q.58 (i).
(iii) They are coloured because their molecules absorb light from visible region and outer electrons get excited to higher energy level. When they come back to lower energy level, they radiates complementary colours.

Question 88:

(a) Complete the following chemical reaction equations:

(i) $P_4 + SO_2Cl_2 \longrightarrow$ (ii) $XeF_6 + H_2O \longrightarrow$

(b) Predict the shape and the asked angle (90° or more or less) in each of the following cases:

(i) SO_3^{2-} and angle O—S—O

(ii) ClF_3 and the angle F—Cl—F

(iii) XeF_2 and the angle F—Xe—F. **[Delhi]**

Answer:

(a) (i) $P_4 + 10SO_2Cl_2 \longrightarrow 4PCl_5 + 10SO_2$

(ii) $XeF_6 + 3H_2O \longrightarrow XeO_3 + 6HF$

(b) (i) more than 90°.

(ii) less than 90°.

(iii) more than 90°.

Question 89:

(a) Complete the following chemical equations:

(i) NaOH (hot & Conc.) + $Cl_2 \longrightarrow$

(ii) $XeF_4 + O_2F_2 \longrightarrow$

(b) Draw the structures of the following molecules:

(i) H_3PO_2

(ii) $H_2S_2O_7$

(iii) $XeOF_4$

Answer:

(a) (i) $6NaOH + 3Cl_2 \xrightarrow[\text{(hot \& Conc.)}]{} 5NaCl + NaClO_3 + 3H_2O$

(ii) Refer Ans. to Q.83 (in).
(b) (i) Refer Ans. to Q.59 (ii).
(ii) Refer Ans. to Q.51 (ii).
(iii) Refer Ans. to Q. 13 (b) (ii).

Question 90:
(a) Draw the molecular structures of the following compounds:
(i) N_2O_5 (ii) $XeOF_4$
(b) Explain the following observations:
(i) Sulphur has a greater tendency for catenation than oxygen.
(ii) ICl is more reactive than I_2.
(iii) Despite lower value of its electron gain enthalpy with negative sign, fluorine (F_2) is a stronger oxidising agent than Cl_2.
Answer:
(a) (i) Refer Ans. to Q.40 (a) (ii).
(ii) Refer Ans. to Q.13 (b) (ii).
(b) (i) Refer Ans. to Q.65 (iii).
(ii) It is due to low bond dissociation enthalpy due to less effective overlapping in ICl than I_2.
(iii) Refer Ans. to Q.70.

Question 91:
(a) Draw the structures of the following compounds:
(i) H_3P0_2 (ii) ClF_3
(b) Explain the following observations:
(i) Nitrogen is much less reactive than phosphorus.
(ii) Despite having greater polarity, hydrogen fluoride boils at a lower temperature than water.
(iii) Sulphur has greater tendency for catenation than oxygen in the same group.
Answer:
(a) (i) Refer Ans. to Q.59 (ii).
(ii) Refer Ans. to Q. 17 (b) (i).
(b) (i) Refer Ans. to Q.86 (b) (i).
(ii) It is because extent of H-bonding is more in H_20 than HF because each water molecule can form four H-bonds.
(iii) Refer Ans. to Q.65 (in).

Question 92:
(a) Draw the structures of the following molecules:
(i) N_2O_5 (ii) $HClO_4$
(b) Explain the following observations:
(i) H_2S is more acidic than H_2O.
(ii) Fluorine does not exhibit any positive oxidation state.
(iii) Helium forms no real chemical compound
Answer:
(a) (i) Refer Ans. to Q.40 (a) (ii).
(ii) Refer Ans. to Q.31 (ii).

(b) (i) It is because bond dissociation energy of H—S bond is less than H—O bond due to longer bond length.
(ii) Refer Ans. to Q.65 (a) (ii).
(iii) Refer Ans. to Q.81 (ii).

Very Short Answer Type Questions [1 Marks]

Question 93:
Arrange F_2, Cl_2, Br_2 and I_2 in the order of increasing bond dissociation enthalpy.
Answer:
$I_2 < F_2 < Br_2 < Cl_2$

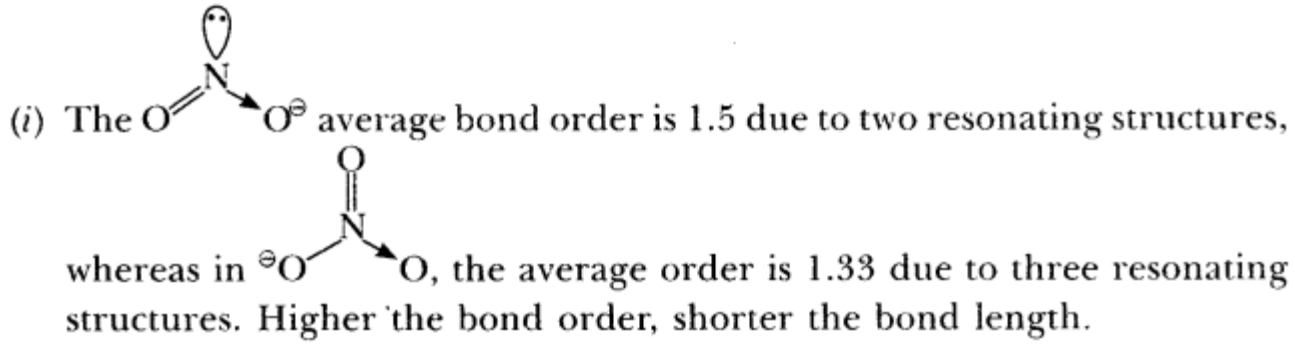
Question 94:
Draw the structure of XeF_2 molecule.
Answer:
Refer Ans. to Q. 15 (b) (ii).

Question 95:
Draw the structure of XeF_4molecule.
Answer:
Refer Ans. to Q.17 (b) (ii).

Question 96:
Draw the structure of BrF_3 molecule.
Answer:
Refer Ans. to Q.29 (ii).

Short Answer Type Questions [I] [2 Marks]

Question 97:
State reasons for each of the following:
(i) The N—O bond in NO_2^- is shorter than the N—O bond in $N0_3$.
(ii) SF_6 is kinetically an inert substance.
Answer:



(ii) It is because SF_6 is stearically protected, therefore, it is an inert substance.

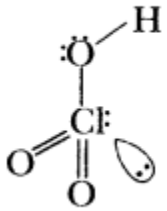
Question 98:
State reasons for each of the following:
(i) All the P—Cl bonds in PCl_5 molecule are not equivalent.
(ii) Sulphur has greater tendency for catenation than oxygen.
Answer:
(i) Refer Ans. to Q.85 (b) (ii).
(ii) Refer Ans. to Q.65 (iii).

Question 99:
How would you account for the following:
(i) The following order of increase in strength of acids:
$PH_3 < H_2S < HCl$
(ii) The oxidising power of oxoacids of chlorine follows the order:
$HClO_4 < HClO_3 < HClO_2 < HClO$
Answer:
(i) It is because greater the difference in electronegativity, more will be the polarity and hence, more will be acidic character.
(ii) It is because HClO is least stable and gives [O] most easily, whereas tendency to give oxygen in $HClO_4$ is least where number of oxygen are maximum and oxidising power is least.

Question 100:
Draw the structures of the following molecules:
(i) $XeOF_4$ (ii) $HOClO_2$
Answer:

(i) Refer Ans. to Q.13 (b) (ii).

(ii)



(Chloric acid)

Question 101:
Complete the following reaction equation:
(i) $XeF_4 + H_20 \longrightarrow$ (ii) $I_2 + H_20 + Cl_2 \longrightarrow$
Answer:

(i) $6XeF_4 + 12H_2O \longrightarrow 4Xe + 2XeO_3 + 24HF + 3O_2$

(ii) $I_2 + 6H_2O + 5Cl_2 \longrightarrow 2HIO_3 + 10HCl$

Question 102:
Complete the following reaction equation:
(i) $XeF_6 + H_20 \longrightarrow$
(ii) $FeSO_4 + H_2SO_4 + Cl_2 \longrightarrow$

Answer:

$(i)\ XeF_6 + 3H_2O \longrightarrow XeO_3 + 6HF$

$(ii)\ 2FeSO_4 + H_2SO_4 + Cl_2 \longrightarrow Fe_2(SO_4)_3 + 2HCl$

Question 103:

Explain giving a reason each for the following situations:
(i) In aquesous medium HCl is a stronger acid than HF.
(ii) White phosphorus is more reactive than red phosphorus.

Answer:

(i) Refer Ans. to Q.74.
(ii) Refer Ans. to Q.60 (i).

Question 104:

Complete the following reaction equation:
(i) $XeF_2(s) + H_2O(l)$ ———->
(ii) NaOH(cold & dilute) + Cl_2 ——>

Answer:

(i) Refer Ans. to Q.84 (iii).
(ii) Refer Ans. to Q.83 (ii).

Short Answer Type Questions [II] [3 Marks]

Question 105:

How would you account for the following:
(i) H_2S is more acidic than H_2O.
(ii) The N—O bond in $N0_2$ is shorter than the N—O bond in $N0_3$.
(iii) Both O_2 and F_2 stabilize high oxidation states but the ability of oxygen to stabilize the higher oxidation state exceeds that of fluorine

Answer:

(i) It is because bond dissociation energy of H—S bond is less than H—O bond due to longer bond length.
(ii) Refer Ans. to Q.97 (i).
(iii) It is because oxygen can gain two electrons, therefore, lattice energy can overcome ionisation energy of the metal to show higher oxidation state.

Question 106:

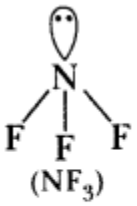
How would you account for the following:
(i) NF_3 is an exothermic compound but NCl_3 is not.
(ii) The acidic strength of compounds increases in the order:
$PH_3 < H_2S < HCl$
(iii) SF_6 is kinetically inert.

Answer:

(i) Refer Ans. to Q.77 (i).
(ii) It is because bond dissociation energy of HCl is lower than H_2S which is lower than PH_3 due to greater polarity in HCl than H_2S and H_2S has more polarity than PH_3, due to more difference in electronegativity.
(iii) It is because SF_6 is stearically protected, therefore, an inert substance.

Question 107:
(a) Mention the optimum conditions for the industrial manufacture of ammonia by Haber's process.
(b) Explain the following giving appropriate reasons:
(i) Sulphur vapour exhibits paramagnetic behaviour:
(ii) Red phosphorus is less reactive than white phosphorus
Answer:
(i) High pressure, 200 atm.
(ii) Temperature —700 K.
(iii) Catalyst, such as Iron oxide with small amount of K_2O and Al_2O_3.
(b) (i) Refer Ans. to Q.41 (i).
(ii) Refer Ans. to Q.60 (i).

Question 108:
Draw the structures of the following molecules:
(i) NF_3 (ii) $H_2S_2O_8$ (iii) H_3PO_3
Answer:
(i)



(NF_3)

(ii) Refer Ans. to Q.44 (a) (i).
(iii) Refer Ans. to Q.53 (ii).

Question 109:
Complete the following chemical equations:
(i) $P_4 + S0_2Cl_2$ ——>
(it) $Fe3+ + S0_2 + H_20$ ———>
(iii) $XeF_6 + H_20$(excess) ———>
Answer:
(i) Refer Ans. to Q.88 (a) (i).
(ii) Refer Ans. to Q.84 (ii).
(ii) Refer Ans. to Q.88 (a) (ii).

Question 110:
Account for the following:
(i) Nitrogen does not form pentahalides.
(ii) The two oxygen-oxygen bond lengths in ozone (O_3) molecule are same.
(iii) ICl is more reactive than I_2.
Answer:
(i) It is because nitrogen does not have vacant d-orbitals.
(ii) Refer Ans. to Q.57 (iii).
(iii) Refer Ans. to Q.90 (b) (ii).

Question 111:
Account for the following:
(i) Ammonia is more basic than phosphine.
(ii) Elements of Group 16 generally show lower value of first ionisation enthalpy compared to the elements in the corresponding periods of Group 15.
(iii) Electron gain enthalpy with negative sign for fluorine is less than that for chlorine.
Answer:
(i) It is because 'N' is smaller in size and lone pair of electron is readily available for protonation.
(ii) It is because group 15 elements have half filled p-orbitals which are more stable, therefore, they have higher ionisation enthalpy than group 16 elements.
(iii) Refer Ans. to Q.57 (ii).

Question 112:
Account for the following:
(i) PCl_5 can act as an oxidising agent but not as a reducing agent.
(ii) Dioxygen is a gas but sulphur is a solid.
(iii) Halogens are coloured.
Answer:
(i) It is because 'P' has +5 oxidation in PCl_5. It cannot show higher oxidation state, therefore, it can not act as reducing agent. It can act as oxidising agent as it can gain electron to show lower oxidation state.
(ii) Refer Ans. to Q.58 (i).
(iii) It is because they absorb light from visible region and radiate complementary colour.

Question 113:
Account for the following:
(i) NH_3acts as a good ligand.
(ii) H_2S is more acidic than water.
(iii) Fluorine forms the largest number of interhalogen compounds amongst the halogens.
Answer:
(i) NH_3 acts as a good ligand due to presence of lone pair of electron which it can readily donate.
(ii) Refer Ans. to Q.75.
(iii) It is because fluorine is the most electronegative and strongest oxidising agent.

Question 114:
Account for the following:
(i) $BiCl_3$ is less covalent than PCl_3.
(ii) O_3 acts as a powerful oxidising agent.
(iii) F_2 is a stronger oxidising agent than Cl_2.
Answer:
(i) It is because ionisation enthalpy of Bi is lower than phosphorus, therefore, Bi forms ionic $BiCl_3$; whereas PCl_3 is covalent.
(ii) Refer Ans. to Q.58 (ii).
(iii) It is because F_2 has highest standard reduction potential, higher than Cl_2.

Question 115:
Account for the following:
(i) BiH_3 is the strongest reducing agent amongst all the hydrides of Group 15 elements.
(ii) $K_{a2} << K_{a1}$ for H_2S0_4 in water.
(iii) Fluorine forms only one oxoacid, HOF.
Answer:
(i) It is due to low bond dissociation energy which is due to longer bond length.
(ii) Refer Ans. to Q.35 (ii).
(iii) Fluorine is the most electronegative and small in size, therefore, it does not show positive oxidation state. It forms only HOF at -40°C.

Question 116:
How would you account for the following:
(i) NCl_3 is an endothermic compound while NF_3 is an exothermic one.
(ii) XeF_2 is a linear molecule without a bend.
(iii) The electron gain enthalpy with negative sign for fluorine is less than that for chlorine, still fluorine is a stronger oxidising agent than chlorine.
Answer:
(i) Refer Ans. to Q.77 (i).
(ii)XeF_2 is linear because it has two bonded pair which are at 180° where as 3 lone pair of electrons are at 120°.
(iii) Refer Ans. to Q.70.

Question 117:
How would you account for the following:
(i) The electron gain enthalpy with negative sign is less for oxygen than that for sulphur.
(ii) Phosphorus shows greater tendency for catenation than nitrogen.
(iii) Fluorine never acts as the central atom in polyatomic inter-halogen compounds.
Answer:
(i) It is due to more interelectronic repulsion in oxygen than sulphur due to small size of oxygen atom.
(ii) P—P bond is stronger than N—N bond due to less repulsion between valence electrons.
(iii) 'F' does not show higher oxidation state due to absence of ef-orbitals.

Long Answer Type Questions [5 Marks]

Question 118:
(a) Explain the following:
(i) NF_3 is an exothermic compound whereas NCl_3 is not.
(ii) F_2 is most reactive of all the four common halogens.
(b) Complete the following chemical equations:
(i) $C + H_2S0_4$ (conc.) ———>
(ii) $P_4 + NaOH + H_2O$ ———>
(iii) $Cl_2 + F_2$ ———>
Answer:

(a) (i) It is because NF_3 is more stable due to stronger N—F bond than NCl_3 because F_2 is stronger oxidising agent than Cl_2.
(ii) It is due to low bond dissociation energy, high hydration energy and high electron affinity.

(b) (i) $C + 2H_2SO_4(conc.) \longrightarrow CO_2 + 2SO_2 + 2H_2O$

(ii) $P_4 + 3NaOH + 3H_2O \longrightarrow 3NaH_2PO_2 + PH_3$

(iii) $\underset{\text{Chlorine}}{Cl_2} + \underset{\text{(excess)}}{3F_2} \longrightarrow \underset{\text{chlorine trifluoride}}{2ClF_3}$

Question 119:
(a) Account for the following:
(i) The acidic strength decreases in the order HCl > H_2S > PH_3
(ii) Tendency to form pentahaUdes decreases down the group in group 15 of the periodic table.
(b) Complete the following chemical equations:
(i) $P_4 + SO_2Cl_2$ ———>
(ii) $XeF_2 + H_2O$ ——->
(iii) $I_2 + HNO_3$ (conc.) ————>

Answer:
(a) (i) It is because bond dissociation energy of HCl is lower than H_2S which is lower than PH_3. This is due to greater polarity in HCl than H_2S and H_2S has more polarity than PH_3, due to more difference in electronegativity.
(ii) It is because inert pair effect, e.g. Bi3+ is more stable than Bi5+.

(b) (i) $P_4 + 10SO_2Cl_2 \longrightarrow 4PCl_5 + 10SO_2$

(ii) $2XeF_2 + 2H_2O \longrightarrow 2Xe + 4HF + O_2$

(iii) $I_2 + \underset{\text{(Conc.)}}{10HNO_3} \longrightarrow 2HIO_3 + 10NO_2 + 4H_2O$

Question 120:
(a) Draw the structures of the following molecules:
(i) $(HPO_3)_3$ (ii) BrF_3
(b) Complete the following chemical equations :
(i) $HgCl_2 + PH_3 \rightarrow$ (ii) $SO_3 + H_2SO_4 \rightarrow$ (iii) $XeF_4 + H_2O \rightarrow$

Answer:
(a) (i) Refer Ans. to Q.64 (b) (ii).
(ii) Refer Ans. to Q.64 (b) (i).

(b) (i) $3HgCl_2 + 2PH_3 \longrightarrow Hg_3P_2 + 6HCl$

(ii) $SO_3 + H_2SO_4 \longrightarrow H_2S_2O_7$

(iii) $6XeF_4 + 12H_2O \longrightarrow 2XeO_3 + 4Xe + 24HF + 3O_2$

Question 121:

(a) What happens when

(i) chlorine gas is passed through a hot concentrated solution of NaOH?

(ii) sulphur dioxide gas is passed through an aqueous solution of a Fe (III) salt?

(b) Answer the following:

(i) What is the basicity of H_3P0_3 and why?

(ii) Why does fluorine not play the role of a central atom in interhalogen compounds?

(iii) Why do nobel gases have very low boiling points?

Answer:

(a) (i) Sodium Chlorate ($NaClO_3$) is formed.

$$6NaOH(conc.) + 3Cl_2(g) \longrightarrow 5NaCl + NaClO_3 + 3H_2O.$$

(ii) Fe^{3+} gets redcued to Fe^{2+}, SO_2 gets oxidised to SO_4^{2-}

$$2Fe^{3+} + SO_2 + 2H_2O \longrightarrow 2Fe^{2+} + SO_4^{2-} + 4H^+$$

(b) (i) Refer Ans. to Q.47.

(ii) Refer Ans. to Q. 117 (iii).

(iii) It is due to weak van der Waals' force of attraction between atoms of noble gases.

Question 122:

(a) Complete the following chemical equations:

(i) $NaOH(aq) + Cl_2(g) \longrightarrow$ **(hot & conc.)** **(ii)** $XeF_6(s) + H_2O(l) \longrightarrow$

(b) How would you account for the following?

(i) The value of electron gain enthalpy with negative sign for sulphur is higher than that for oxygen.

(ii) NF_3 is an exothermic compound but NCl_3 in endothermic compound.

(iii) ClF_3 molecular has a T-shaped structure and not a trigonal planar one.

Answer:

(a) (i) Refer Ans. to Q.89 (a) (i).

(ii) Refer Ans. to Q.88 (a) (ii).

(b) (i) Refer Ans. to Q.117 (i).

(ii) Refer Ans. to Q.77 (i).

(iii) ClF_3 has two lone pair and 3 bonded pair, therefore, it is T-shaped and not a trigonal planar.

Question 123:

(a) Complete the following chemical equations:

(i) $P_4 + S0_2Cl_2$ ——-> (ii) $XeF_4 + H_20$ ———>

(b) Explain the following observations giving appropriate reasons:

(i) The stability of + 5 oxidation state decreases down the group in group 15 of the periodic table.

(ii) Solid phosphorus pentachloride behaves as an ionic compound.

(iii) Halogens are strong oxidising agents.

Answer:

(a) (i) Refer Ans. to Q.119 (b) (i).

(ii) Refer Ans. to Q. 120 (b) (iii).
(b) (i) Refer Ans. to Q.86 (b) (ii).
(ii) It exists as $[PCl_4]^+ [PCl_6]^-$ in solid state, therefore, it behaves like ionic compound.
(iii) It is because they have high electron gain enthalpies, therefore, they can gain electron easily.

Very Short Answer Type Questions [1 Mark]

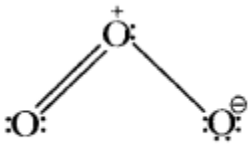
Question 124:
Why does $N0_2$ dimerise?
Answer:
Refer Ans. to Q.22.

Question 125:
What is the oxidation number of phosphorus in H_3PO_2 molecule?
Answer:

$$(+1) \times 3 + x + 2 \times (-2) = 0$$

$$x - 1 = 0 \Rightarrow x = +1$$

Question 126:
Draw the structure of 0_3 molecule.
Answer:



It is bent molecule.

Question 127:
Fluorine does not exhibit any positive oxidation state. Why?
Answer:
It is because it is most electronegative element and best oxidising agent.

Question 128:
Nitrogen is relatively inert as compared to phosphorus. Why?
Answer:
It is due to presence of triple bond in nitrogen (N==N), which has high bond dissociation energy as compared to single (P-P) bond.

Question 129:
Which is a stronger acid in aqueous solution, HCl or HI, and why?
Answer:
HI is stronger acid than HCl in aqueous solution because it has lower bond dissociation energy.

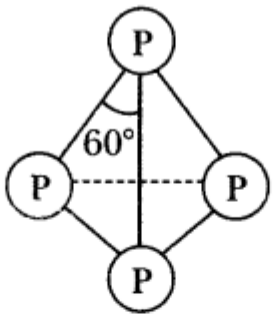
Question 130:
What is the covalency of nitrogen in N_2O_5?
Answer:
It is four.

Question 131:
Why are pentahalides of a metal more covalent than its trihalides?
Answer:
It is because pentavalent metal ion has higher polarising power than trivalent metal ion

Question 132:
Why is BiH3 the strongest reducing agent amongst all the hydrides of Group 15 elements?
Answer:
It is due to its lowest bond dissociation energy due to longer bond length.

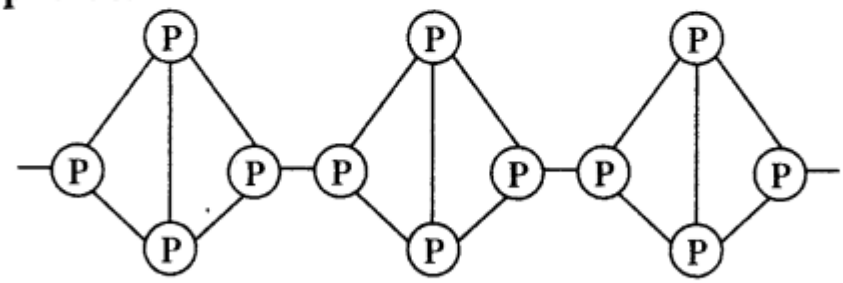
Short Answer Type Questions [I] [2 Marks]

Question 133:
Draw the structures of white phosphorus and red phosphorus. Which one of these two types of phosphorus is more reactive and why?
Answer:
White Phosphorus:



Structure of white phosphorus

Red Phosphorus:



Structure of red phosphorus

White phosphorus is more reactive than red phosphorus because it has monomeric tetrahedral structure having angular strain and requires less energy to break the bond.

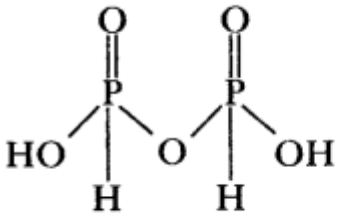
Question 134:
Draw the structural formulae of molecules of following compound:
(i) BrF_3 and (ii) XeF_4
Answer:
(i) Refer Ans. to Q.29 (ii).
(ii) Refer Ans. to Q.17 (b) (ii).

Question 135:
Complete the following chemical reaction equations:
(i) $I_2 + HNO_3 \longrightarrow$ (conc.)
(ii) $HgCl_2 + PH_3 \longrightarrow$
Answer:
(i) Refer Ans. to Q.119 (b) (iii).
(ii) Refer Ans. to Q.120 (b) (i)

Short Answer Type Questions [II] [3 Marks]

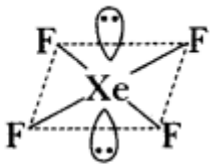
Question 136:
Draw the structural formulae of the following compounds:
(i) $H_4P_2O_5$ (ii) XeF_4
Answer:

(i)



$(H_4P_2O_5)$

(ii)

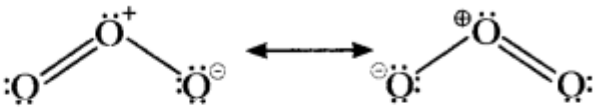


(XeF_4)
Square planar

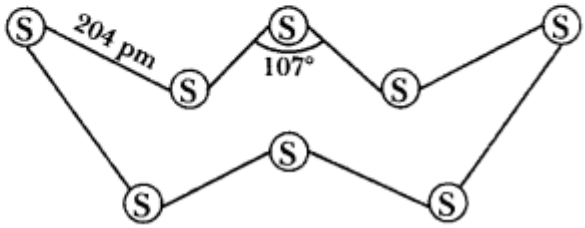
Question 137:
Complete the following chemical reaction equations:
(i) $NaOH + Cl_2 \longrightarrow$ (Cold and dilute)
(ii) $XeF_6 + H_2O$ (excess)
Answer:
(i) Refer Ans. to Q.83 (ii).
(ii) Refer Ans. to Q.102 (i).

Question 138:
Draw the structures of the following molecules:
(i) BrF_3 (it) $XeOF_4$
Answer:
(i) Refer Ans. to Q.29 (ii).
(ii) Refer Ans. to Q.13 (b) (ii).

Question 139:
Draw the structure of O_2 and S_8 molecules Ozone (O_3):
Answer:
Ozone (O_3):



Sulphur (S_8):



Question 140:
Draw the structures of the following molecules:
(i) XeF_2 (ii) $HClO_4$
Answer:
(i) Refer Ans. to Q.15 (b) (ii).
(ii) Refer Ans. to Q.31 (ii).

Question 141:
Draw the structure and predict the shape of (i) XeO_3 and (ii) BrF_3
Answer:
(i) Refer Ans. to Q.33 (i).
(ii) Refer Ans. to Q.29 (ii).

Short Answer Type Questions [II] [3 Marks}

Question 142:
Give reasons for the following:
(i) N_2 is not particularly reactive.
(ii) Halogens are strong oxidising agents.
(iii) Sulphur hexafluoride is less reactive than sulphur tetrafluroide.
Answer:
(i) It is due to high bond dissocadon energy which is due to presence of triple bond.
(ii) Halogens can gain electron easily, have high electron affinity and reduction potential, therefore, they are strong oxidising agents.
(iii) SF_6 is stearically protected, therefore, less reactive than SF_4 which is not stearically protected.

Question 143:
Explain the following observations giving appropriate reasons:
(i) The stability of +5 oxidation state decreases down the group in group 15 of the periodic table.
(ii) Solid phosphorus pentachloride behaves as an ionic compound.

(iii) Halogens are strong oxidizing agents.

Answer:

(i) It is due to inert pair effect, +3 oxidation state becomes more stable than + 5.
(ii) It exists as $[PCl_4]+ [PCl_6]-$ in solid state, therefore, it behaves like ionic compound.
(iii) Halogens can gain electron easily and have high standard reduction potential, therefore, good oxidising agents.

Long Answer Type Questions [5 Marks]

Question 144:

(a) Complete the following chemical reaction equations:
(i) $HgCl_2$ (aq) + PH_3 (g) ——->
(ii) $Si0_2$ (g) + HF (g) ————>
(b) Explain the following observations:
(i) Sulphur in vapour state exhibits paramagnetic behaviour.
(ii) The stability of +3 state increases down the group in group 15 of the periodic table.
(iii) XeF2 has a linear shape and not a bent structure.

Answer:

(a) (i) $3HgCl_2$ (aq) + $2PH_3$ (g) ——-> Hg_3P_2 (5) + 6HCl(aq)
(ii) $Si0_2$ (5) + 6HF (g) ————> H_2SiF_6 (s) + $2H_20$(l)
(b) (i) It is due to presence of two unpaired electrons in S_2 like in O_2 in vapour state.
(ii) It is due to inert pair effect.
(iii) It is due to presence of two bonded pairs and three lone pairs of electrons.

Question 145:

(a) Complete the following chemical reaction equations:
(i) AgCl (s) + NH_3 (aq) ——->
(ii) P_4(s) + NaOH(aq) + H_20(l) ———>
(b) Explain the following observations:
(i) H_2S is less acidic than H_2Te.
(ii) Fluorine is a stronger oxidising agent than chlorine.
(iii) Noble gases are the least reactive elements

Answer:

(a) (i) AgCl(s) + $2NH_3$(aq) ———> $[Ag(NH_3)_2]$+Cl-(aq)
(ii) P_4(s) + 3NaOH(aq) + $3H_2O$(l) ———> $3NaH_2P0_2$(s) + PH_3(g)
(b) (i) It is because bond dissociation energy of H-Te bond is less than H-S bond due to longer bond length.
(ii) It is due to higher standard reduction potential, low bond dissociation energy, high electron affinity and higher enthalpy of hydration.
(iii) It is due to stable electronic configuration, i.e. their octet is complete except in He which has duplet, i.e. 1st shell is complete having 2 electrons.

Very Short Answer Type Questions [1 Mark]

Question 146:

Why is Bi (V) a stronger oxidant than Sb(V)?

Answer:

Refer Ans. to Q. 15 (a) (i).

Question 147:
Why is red phosphorus less reactive than white phosphorus?
Answer:
Refer Ans. to Q.60 (i).

Question 148:
Assign a reason for each of the following statements:
Phosphorus (P_4) is more reactive than nitrogen (N_2).
Answer:
It is due to single bond in phosphorus which has less bond dissociation energy as compared to nitrogen which has triple bond (N=N) has high bond dissociation energy, so, nitrogen is unreactive

Question 149:
Which one has higher electron gain enthalpy with negative sign, sulphur or oxygen?
Answer:
Sulphur.

Short Answer Type Questions [I] [2 Marks]

Question 150:
Complete the following chemical reaction equations:

(i) $P_4(s) + NaOH(aq) + H_2O(l) \longrightarrow$

(ii) $I^-(aq) + H_2O(l) + O_3(g) \longrightarrow$

Answer:

(i) $P_4(s) + 3NaOH(aq) + 3H_2O(l) \longrightarrow 3NaH_2PO_2 + PH_3$

(ii) $2I^-(aq) + H_2O(l) + O_3(g) \longrightarrow 2OH^-(aq) + I_2(s) + O_2(g)$

Question 151:
State reasons for each of the following:
(i) All the P—Cl bonds in PCl_5 molecule are not equivalent.
(ii) Sulphur has greater tendency for catenation than oxygen.
Answer:
(i) Refer Ans. to Q.85 (b) (ii).
(ii) Refer Ans. to Q.65 (iii).

Question 152:
Answer the following:
(i) Which neutral molecule would be isoelectronic with CO-?
(ii) Of Bi(V) and Sb(V) which may be a stronger oxidising agent and why?
Answer:
(i) OF_2 and ClF are neutral molecules isoelectronic with ClO-.
(ii) Bi(V) is stronger oxidising agent due to inert pair effect as Bi(III) is more stable as compared to Sb(III).

Question 153:
Complete the following chemical reaction equations:
(i) $XeF_2 + H_20$ ——> (ii) $PH_3 + HgCl_2$ ——>
Answer:
(i) Refer Ans. to Q.84 (ii).
(ii) Refer Ans. to Q.83 (i).

Question 154:
Draw the structural formulae of molecules of following compound:
(i) BrF_3 and (ii) XeF_4
Answer:
(i) Refer Ans. to Q.29 (ii).
(ii) Refer Ans. to Q. 17 (b) (ii).

Short Answer Type Questions [III] [3 Marks]

Question 155:
Account for the following:
(i) NH_3 is a stronger base than PH_3.
(ii) Sulphur has a greater tendency for catenation than oxygen.
(iii) Bond dissociation energy of F2 is less than that of Cl?
Answer:
(i) Refer Ans. to Q.111 (i).
(ii) Refer Ans. to Q.65 (ii).
(iii) It is due to interelectronic repulsion between valence electrons of smaller size 'F' atom than Cl.

Question 156:
Explain the following situations:
(i) In the structure of HNO_3 molecule, the N—O bond (121 pm) is shorter than N—OH bond (140 pm).
(ii) SF_4 is easily hydrolysed whereas SF_6 is not easily hydrolysed.
(iii) XeF_2 has a straight linear structure and not a bent angular structure
Answer:
(i) There is double bond character in N—O bond, therefore, it is shorter than N—OH bond which has purely single bond.
(ii) SF_4 is easily hydrolysed because it is unstable due to repulsion between 'F' atoms and also due to vacant d-orbitals, whereas SF_6 is exceptionally stable due to steric reason.
(iii) XeF_2 has sp3d hybridisation with three lone pairs of electrons at corners of equilateral triangle, it has linear shape to have minimum repulsion and maximum stability.

Question 157:
Explain the following observations:
(i) Fluorine does not exhibit any positive oxidation state.
(ii) The majority of known noble gas compounds are those of Xenon.
(iii) Phosphorus is much more reactive than nitrogen.

Answer:
(i) Refer Ans. to Q.127.
(ii) Xe has lowest ionisation enthalpy and high polarizing power* Therefore, it can form compounds easily.
(iii) Refer Ans. to Q.148.

Question 158:
Draw the structures of the following molecules:
(i) BrF_3
(ii) H_2S_2O7
Answer:
(i) Refer Ans. to Q.29 (ii).
(ii) Refer Ans. to Q.20 (a) (ii).

Question 159:
Draw the structures of the following molecules:
(i) XeF_4 (ii) $H_2S_2O_7$
Answer:
(i) Refer Ans. to Q. 17 (b) (ii).
(ii) Refer Ans. to Q.20 (a) (ii).

Long Answer Type Questions [5 Marks]

Question 160:
(a) Complete the following chemical reaction equations:
(i) $HgCl_2$ (aq) + PH_3 (g) ——->
(ii) SiO_2 (g) + HF (g) ——->
(b) Explain the following observations:
(i) Sulphur in vapour state exhibits paramagnetic behaviour.
(ii) The stability of +3 state increases down the group in group 15 of the periodic table.
(iii) XeF_2 has a linear shape and not a bent structure.
Answer:
(a) (i) $3HgCl_2$ (aq) + $2PH_3$ (g) ——-> Hg_3P_2 (s) + 6HCl (aq)
(ii) SiO_2 (s) + 6HF (g) ——-> H_2SiF_6 (s) + $2H_20$(l)
(b) (i) It is due to presence of two unpaired electrons in S_2 like in O_2 in vapour state.
(ii) It is due to inert pair effect.
(iii) It is due to presence of two bonded pairs and three lone pairs of electrons.

Question 161:
(a) Draw the structures of the following:
(i) $H_2S_2O_8$ (ii) $HClO_4$
(b) How would you account for the following:
(i) NH_3 is a stronger base than PH_3.
(ii) Sulphur has a greater tendency for catenation than oxygen.
Answer:
(a) (i) Refer Ans. to Q. 13 (b) (i).
(ii) Refer Ans. to Q.31 (ii).

(b) (i) Refer Ans. to Q.111 (i).
(ii) Refer Ans. to Q.65 (iii).

Question 162:
(a) Draw the structures of the following:
(i) XeF_4(ii) $H_2S_2O_7$
(b) Explain the following observations:
(i) Phosphorus has a greater tendency for catenation than nitrogen.
(ii) The negative value of electron gain enthalpy is less for fluorine than that for chlorine.
(iii) Hydrogen fluoride has a much higher boiling point than hydrogen chloride.
Answer:
(a) (i) Refer Ans. to Q. 17 (b) (ii).
(ii) Refer Ans. to Q.20 (a) (ii).
(b) (i) It is because P—P single bond is stronger than the single N—N bond.
(ii) It is because there is more interelectronic repulsion between valence electrons in 'F' atoms as compared to 'CP atoms.
(iii) It is because HF molecules are associated with intermolecular H-bonding while HCl is not, that is why, HF is liquid and has higher boiling point than HCl which is a gas.

Question 163:
(a) Complete the following reaction equations:
(i) PCl_5 + H_20 (excess) ——>
(ii) F_2 + H_20 ———>
(b) Explain the following observations:
(i) No distinct chemical compound of helium is known.
(ii) Phosphorus has a greater tendency for catenation than nitrogen.
(iii) In solution of H_2S0_4 in water, the second dissociation constant $K0_2$, is less than the first dissociation constant K .
Answer:

$$(a)\ (i)\ PCl_5 + \underset{\text{(excess)}}{4H_2O} \longrightarrow H_3PO_4 + 5HCl$$

$$(ii)\ 2F_2 + \underset{\text{Cold}}{2H_2O} \longrightarrow 4HF + O_2$$

(b) (i) It is because helium is smallest in size, has higher ionisation energy and therefore, due to stable electronic configuration. It has least polarizing power.
(ii) It is because of strong bond strength of P-P than N-N bond.
(iii) Refer Ans. to Q.35 (ii).

Question 164:
(a) Complete the following reaction equations:
(i) P_4 + NaOH + H_20 ———>
(ii) Cu + HNO_3 (dilute) ———>
(b) Explain why
(i) H_2O is a liquid while, inspite of a higher molecular mass, H_2S is a gas.
(ii) Iron dissolves in HCl to form $FeCl_2$ and not $FeCl_3$.

(iii) Helium is used in diving equipment.

Answer:

(a) (i) $P_4 + 3NaOH + 3H_20 \longrightarrow PH_3 + 3NaH2PO_2$

(ii) $3Cu + 8HN0_3(dilute) \longrightarrow 3Cu(N0_3)_2(aq) + 2NO(g) + 4H_20(l)$

(b) (i) It is because H_20 is associated with intermolecular H-bonding, whereas H_2S is not.

(ii) Refer Ans. to Q.20 (b) (i).

(iii) It is because helium does not dissolve as it is inert and lighter in blood therefore, does not cause bends or pain.

Question 165:

(a) Draw the structures of the following:

(i) N_2O_5 (ii) XeOF4

(b) Explain the following observations:

(i) The electron gain enthalpy of sulphur atom has greater negative value than that of oxygen atom.

(ii) Nitrogen does not form pentahalides.

(iii) In aqueous solution HI is a stronger acid than HCl.

Answer:

(a) (i) Refer Ans. to Q.40 (ii).

(ii) Refer Ans. to Q.13 (b) (ii).

(b) (i) Refer Ans. to Q.117 (i).

(ii) Refer Ans. to Q.17 (a) (iii).

(iii) It is because H—I has lower bond dissociation enthalpy thajn HCl due to longer bond length.

Question 166:

(a) Draw the structures of the following:

(i) H_3PO_2 (ii) BrF_3

(b) How would you account for the following observations:

(i) Phosphorus has a greater tendency for catenation than nitrogen.

(ii) Bond dissociation energy of fluorine is less than that of chlorine.

(iii) No chemical compound of helium is known.

Answer:

(a) (i) Refer Ans. to Q.59 (ii).

(ii) Refer Ans. to Q.64 (b) (i).

(b) (i) Refer Ans. to Q.87 (b) (i).

(ii) Refer Ans. to Q. 18 (iii).

(iii) Refer Ans. to Q.81 (ii).

Question 167:

(a) Draw the structures of the following:

(i) $PCl_5(s)$

(ii) $S0_32-$

(b) Explain the following observations:

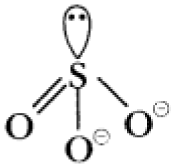
(i) Ammonia has a higher boiling point than phosphine.

(ii) Helium does not form any chemical compound.
(iii) Bi(V) is a stronger oxidising agent than SB(V).

Answer:

(*a*) (*i*) Refer Ans. to Q.63 (*i*).

(*ii*)



(b) (i) Ammonia molecules are associated with intermolecular H-bonding. Whereas PH_3 does not for H-bond.
(ii) Refer Ans. to Q.81 (ii).
(iii) Refer Ans. to Q. 15 (a) (i).

Question 168:

(a) Complete the following reaction equations:
(i) $XeF_2 + PF_5$ ——>
(ii) Cl_2(g) + NaOH(aq)(hot & conc.) ————>
(b) Explain the following observations:
(i) + 3 oxidation state becomes more and more stable from As to Bi in the group.
(ii) Sulphur in vapour state exhibits paramagnetism.
(iii) Fluorine does not exhibit any positive oxidation state.

Answer:

(a) (i) $XeF_2 + PF_5$ ———> [XeF]+ [PF_6]-
(ii) Refer Ans. to Q.89 (a) (i).
(b) (i) It is due to inert pair effect.
(ii) Refer Ans. to Q.41 (i).
(iii) Refer Ans. to Q.65 (a) (ii).

Question 169:

(a) Complete the following reaction equations:
(i) SO_2 + Mn04- + $H_2$0 ——->
(ii) $HgCl_2 + PH_3$ ————>
(b) Explain the following observations:
(i) Sulphur has a greater tendency for catenation than oxygen.
(ii) Fluorine is a stronger oxidising agent than chlorine.
(iii) The +5 oxidation state becomes less stable down the group in group 15 of the periodic table.

Answer:

(a) (i) $5SO_2$ + 2MnO- + $2H_2O$ ———> $5SO_4$– + 2Mn2+ + 4H+
(ii) Refer Ans. to Q.83 (i).
(b) (i) Refer Ans. to Q.65 (a) (iii).
(ii) Refer Ans. to Q. 145 (b) (ii).
(iii) Refer Ans. to Q.86 (b) (ii).

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