p-Block Elements

Most Expected questions for CBSE Exam-2016

Type -1

Draw the structure of the following compound:

a) $XeOF_4$
b) XeF_2
c) BrF_3
d) XeF_4
e) BrF_5
f) SF_4

Hints:-----

Structure depends on number of sum of bond pair and lone pair.

If bp + lp = 2, Molecule should be linear.

If bp + lp = 3, Molecule should be trigonal planner.

If bp + lp = 4, Molecule should be tetrahedral.

If bp + lp = 5, Molecule should be trigonal bipyramidal.

If bp + lp = 6, Molecule should be octahedral.

In case of trigonal bipyramidal lone pair prefers equatorial position and in octahedral it prefers axial position. Presence of lone pair destroys the actual structure.

Example: -----

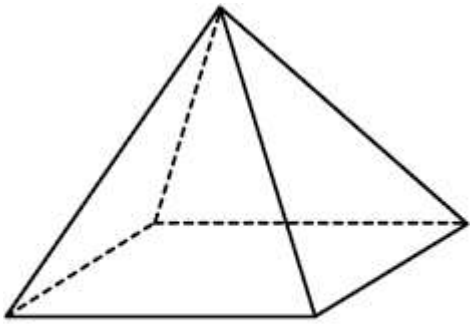
$XeOF_4$

Here, Total valence electron = 8+6+28= 42

TVE/8, Q= 5(bp) , R/2 is lone pair. Here it is 2/2= 1

Thus bp+lp = 5+1= 6

Structure should be octahedral, but due to lone pair it becomes square pyramidal.



square pyramid
rectangular pyramid

Type—2.

Complete the following chemical equation:

a) $Ca_3P_2 + H_2O \rightarrow$

b) $Cu + H_2SO_4(conc) \rightarrow$

c) $\mathbf{SO_2 + MnO_4^- + H_2O \rightarrow}$

d) $\mathbf{Cu + HNO_3(dilute) \rightarrow}$

e) $\mathbf{XeF_2 + PF_5 \rightarrow}$

f) $\mathbf{NaOH(aq.\ hot\ \&\ Conc.) + Cl_2 \rightarrow}$

g) $\mathbf{XeF_6 + H_2O \rightarrow}$

h) $\mathbf{P_4 + SO_2Cl_2 \rightarrow}$

i) $\mathbf{XeF_4 + H_2O \rightarrow}$

j) $\mathbf{HgCl_2\ (aq) + PH_3\ (g) \rightarrow}$

k) $\mathbf{AgCl\ (s) + NH_3\ (aq) \rightarrow}$

l) $\mathbf{P_4\ (s) + 3NaOH\ (aq) + 3H_2O\ (l) \rightarrow}$

Answer :

a) $Ca_3P_2 + 6H_2O \rightarrow 3\ Ca(OH)_3 + 2\ \mathbf{PH_3}$

b) $Cu + 2H_2SO_4(conc) \rightarrow \mathbf{CuSO_4 + SO_2 + 2H_2O}$

c) $5SO_2 + 2MnO_4^- + 2H_2O \rightarrow 5SO_4^- + 4H^+ + \mathbf{2\ Mn^{2+}}$

d) $3\mathbf{Cu + 8\ HNO_3(dilute) \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O}$

e) $\mathbf{XeF_2 + PF_5 \rightarrow \lceil XeF \rfloor^+ \lceil PF_5 \rfloor^-}$

f) $\mathbf{6NaOH(aq.\ hot\ \&\ Conc.) + 3Cl_2 \rightarrow 5NaCl + NaClO_3 + 3H_2O}$

g) $\mathbf{XeF_6 + H_2O \rightarrow XeO_3 + 3H_2O}$

h) $\mathbf{P_4 + 10\ SO_2Cl_2 \rightarrow 4PCl_5 + 10\ SO_2}$

i) $6\ \mathbf{XeF_4 + 12\ H_2O \rightarrow XeO_2 + Xe + 24HF + 4O_2}$

j) $3\mathbf{HgCl_2\ (aq) + 2PH_3\ (g) \rightarrow Hg_3P_2 + 6HCl}$

k) $\mathbf{AgCl\ (s) + NH_3\ (aq) \rightarrow \lceil Ag(NH_3)_2 \rfloor Cl}$

l) $P4 + 3NaOH + 3\ H_2O \rightarrow PH_3 + 3NaH_2PO_2$

Type-3

Basicity of Oxo-Acid of Phosphorus and sulphur.

Name	Formula	Oxidation State	Basicity
Hypophosphorus acid	H_3PO_2	+1	Monobasic
Phosphorus acid	H_3PO_3	+3	Dibasic
Orthophosphoric acid	H_3PO_4	+5	**Trabasic**
Hypophosphoric acid	$H_4P_2O_6$	**+4**	**Tetrabasic**
Pyrophosphoric acid	$H_4P_2O_7$	**+5**	**Tetrabasic**
Peroxodisulphuric acid	$H_2S_2O_8$	**+6**	**Dibasic**
Pyrosulphuric acid	$H_2S_2O_7$	**+6**	**Dibasic**
Peroxomonosulphuric acid	H_2SO_5	**+6**	**Dibasic**

Example:

What is basicity of peroxodisulphuric acid.

Ans: Dibasic(no of ionisable hydrogen=2).

Draw the structure of hypophosphoric acid.

Hint:- Keep in mind it is tetrabasic and each phosphorus atom has two –OH bond and maximum valency of phosphorus is five.

Type-4

Reasoning

1. How would you account for the following:

   (i) NCl_3 is an endothermic compound while NF_3 is an exothermic one.

   (ii) All the P – Cl bonds in PCl_5 are not equivalent.

   (iii) The electron gain enthalpy with a negative sign for fluorine is less than that for chlorine; still fluorine is a stronger oxidizing agent than chlorine.

Ans: (i) It is because of F_2 is strong oxidizing agent than Cl_2.

(ii) PCl5 molecule contains two type of bond that is axial and equatorial. And axial bond are longer than equatorial.

iii) This is due to small size of fluorine and strong inter electronic repulsion.

2. How would you account for the following:

   (i) Phosphorous shows greater tendency for catenation than nitrogen.

   (ii) Fluorine never acts as the central atom in a polyatomic inter-halogen compounds.

   (iii) The electron gain enthalpy with a negative sign for oxygen is less than that for sulphur.

   Ans: i) Due to N-N single bond is weaker than P-P single bond.

   ii) Due to strongest electronegativity of fluorine.

   iii) Due to small size of oxygen

3. How would you account for the following:

   (i) Among the halogens fluorine is the strongest oxidizing agent.

(ii) Fluorine exhibits only -1 oxidation state where as other halogens exhibit higher positive oxidation states also.

(iii) Acidity of oxo-acids of chlorine is HOCl < HOClO < $HOClO_2$ < $HOClO_3$.

Ans: i) Due to small size and highest electronegativity of fluorine.

ii) Due to very large value of ionization enthalpy and highest electonegativity of fluorine.

iii) Acidity depends on oxidation number of central atom of oxo-acid. As oxidation number increases acidity increases.

4. Account for the following:

(a) Chlorine water has both oxidizing and bleaching properties.

(b) H_3PO_2 and H_3PO_3 act as good reducing agents while H_3PO_4 does not.

(c) On addition of ozone gas to KI solution, violet vapours are obtained.

Ans: a) Due it gives nescent oxygen with water.

b) Due to lack of P-H bond in H_3PO_4

c) Due to evolution I_2 gas .

5. Give reasons for the following:

(a) NO_2 demerises to form N_2O_4.

(b) ICl is more reactive than I_2.

(c) Sulphur in vapour state exhibit para-magnetism.

Ans: a) NO_2 is odd electron molecule and to get stability it demerises.

b) Due to lower bond dissociation enthalpy.

c) Due to presence of unpaired electron in anti-bonding molecular orbital in Sulphur in vapour state that is S_2.

6. Account for the following:

(a) NH_3 is a stronger base than PH_3.

(b) Sulphur has greater tendency for catenation than oxygen.

(c) Bond dissociation energy of F_2 is less than that of Cl_2.

Ans :(a) Due to small size of nitrogen that's why lone pair electron easily available for donation.

(b) This is due to S-S single bond is more stable than O-O single bond.

(c) Due to stronger inter electronic repulsion in F_2 , this due to smaller size of fluorine.

7. Explain the following situations:

(a) In the structure of HNO_3 molecule, the N-O bond (121 pm) is shorter than N-OH bond (140 pm).

(b) SF_4 is easily hydrolyzed where as SF_6 is not easily hydrolyzed.

(c) XeF_2 has a straight linear structure and not a bent angular structure.

Ans: a) Since N-O bond contain double bond character due to resonance.

b) Due to steric hinderance.

c) Due to presence of three lone pair on central atom.

8. Explain the following observations:

(a) Fluorine does not exhibit any positive oxidation state.

(b) The majority of known noble gas compounds are those of Xenon.

(c) Phosphorus is much more reactive than nitrogen.

Ans: a) Due to very large value of ionization enthalpy and highest electonegativity of fluorine.

b) Its ionization enthalpy is nearly equivalent to the oxygen molecule.

c) It is due to higher bond dissociation enthalpy of nitrogen molecule.

9. Explain the following observations:

(a) HF has much higher boiling point than HCl.

(b) Helium does not form any chemical compound.

(c) NH_3 has much higher boiling point than PH_3.

Ans : a) Due hydrogen bonding.

b) Due to ionization enthalpy and electron gain enthalpy.

c) Due hydrogen bonding.

Type – 5

TREND IN PROPERTIES

Stability - $NH_3>PH_3>AsH_3>SbH_3>BiH_3$

Bond Dissociation Enthalpy- $NH_3>PH_3>AsH_3>SbH_3>BiH_3$

Reducing character - $NH_3>PH_3>AsH_3>SbH_3>BiH_3$

Basic character- $NH_3>PH_3>AsH_3>SbH_3>BiH_3$

Acidic character-$H_2O<H_2S<H_2Se<H_2Te$

Thermal stability-$H_2O>H_2S>H_2Se>H_2Te$

Reducing character-$H_2S<H_2Se<H_2Te$

Boiling point-$H_2S<H_2Se<H_2Te<H_2O$

Oxidizing property – $F_2>Cl_2>Br_2>I_2$

Acidic strength- HF<HCl<HBr<HI

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