

CHEMISTRY STUDY MATERIALS FOR CLASS 12
(NCERT Based Reasoning of Chapter -07)
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P – block elements

Question 85: Explain the following:

- (i) Nitrogen is much less reactive than phosphorus.
- (ii) NF_3 is an exothermic compound but NCl_3 is an endothermic compound.

Answer:

- (i) Due to presence of weak single bond in P – P than N = N, phosphorous is more reactive than nitrogen and also because of high bond dissociation enthalpy of N = N.
- (ii) Due to smaller size of F as compared to Cl, the N – F bond is much stronger than N – Cl bond while bond dissociation energy of F_2 is much lower than that of Cl_2 . Therefore, energy released during the formation of NF_3 molecule is more than the energy needed to break N_2 and F_2 molecules into individual atoms. In other words, formation of NF_3 is an exothermic reaction. The energy released during the formation of NCl_3 molecule is less than the energy needed to break N_2 and Cl_2 molecules into individual atoms. Thus formation of NCl_3 is an endothermic reaction.

Question 86: What happens when:

- (i) SO_2 gas is passed through an aqueous solution of Fe^{3+} salt?
- (ii) XeF_4 reacts with SbF_5 ?

Answer:

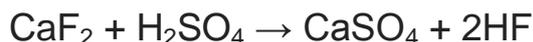
- (i) In this sulphur dioxide acts as a reducing agent and reduces Fe^{3+} to Fe^{2+} .
$$2\text{Fe}^{3+} + \text{SO}_2 + 2\text{H}_2\text{O} \rightarrow 2\text{Fe}^{2+} + \text{SO}_4^{2-} + 4\text{H}^+$$
- (ii) $\text{XeF}_4 + \text{SbF}_5 \rightarrow [\text{XeF}_3]^+ [\text{SbF}_6]^-$

Question 88: What happens when:

- (i) Concentrated H_2SO_4 is added to calcium fluoride?
- (ii) SO_3 is passed through water?

Answer:

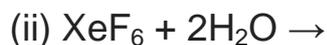
(i) Cone. H_2SO_4 reacts with CaF_2 giving Hydrogen Fluoride



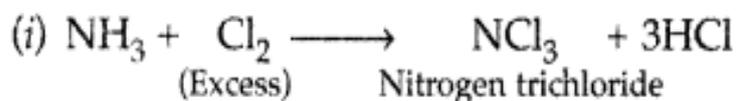
(ii) SO_3 passed in water giving Sulphuric Acid



Question 89: Complete the following reactions:

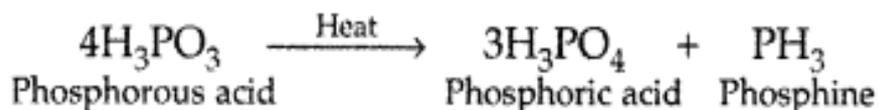


Answer:



Question 90: What happens when H_3PO_3 is heated?

Answer:



Question 91.

(a) What is the covalence of nitrogen in N_2O_5 ?

(b) BiH_3 is a stronger reducing agent than SbH_3 , why?

Answer:

(a) The covalency of nitrogen in N_2O_5 is 4 because each nitrogen atom has four shared pairs of electrons.

(b) BiH_3 : Because it is a stronger reducing agent as its tendency to liberate H is maximum.

Question 92.

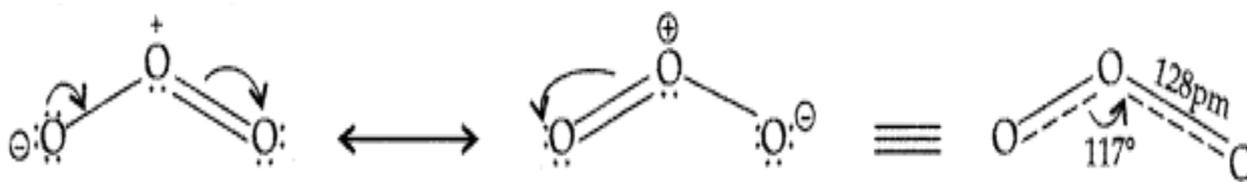
Account for the following:

(i) The two oxygen-oxygen bond lengths in ozone molecule are identical.

(ii) Most of the reactions of fluorine are exothermic.

Answer:

(i) Due to resonance the two oxygen atoms have partial double bond character and thus have same bond length i.e. 128 pm



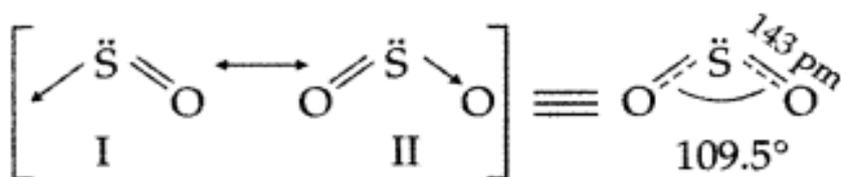
(ii) Due to much higher electrode potential, high electro-negativity and low bond dissociation enthalpy of F_2 .

Question 93. Account for the following :

(i) Two S-O bond lengths in SO_2 are equal.

(ii) Fluorine shows only -1 oxidation state in its compounds.

Answer: (i) Due to resonance in SO_2 the double bond (π) electrons are distributed equally in both resonating structures as a result of which the bond length of two S-O becomes equal.



Because it is most electronegative element and does not have d-orbitals for octet expansion, therefore it shows only a negative oxidation state of -1.

Question 94. Account for the following:

(i) Bond angle in NH_4^+ is higher than that in NH_3 .

(ii) ICl is more reactive than I_2 .

Answer:

(i) Because in NH_4^+ ion there is no lone pair of electrons which is present in NH_3 due to which lone pair-bond pair repulsion occurs and bond angle decreases from $109^\circ 28'$ to 107.3° .

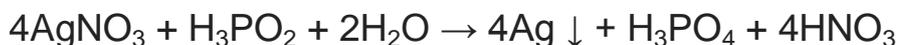
(ii) Because I-Cl bond is weaker than I-I bond as a result of which ICl breaks easily to form halogen atoms which readily bring about the reaction, hence more reactive.

Question 95.

“Orthophosphoric acid (H_3PO_4) is not a reducing agent whereas hypophosphorous acid (H_3PO_2) is a strong reducing agent.” Explain and justify the above statement with the help of a suitable example.

Answer:

Orthophosphoric acid (H_3PO_4) is not a reducing agent because it doesn't contain any P-H bond whereas hypophosphorous acid (H_3PO_2) is a strong reducing agent as it contains two P-H bonds. H_3PO_2 can reduce silver nitrate (AgNO_3) into metallic silver which H_3PO_4 can not.



The p-Block Elements Class 12 Important Questions Short Answer Type -II [SA-II]

Question 96.

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 F_2 is less than that of Cl_2 .

Answer:

(i) Since both P and N contain lone pairs of electrons but due to small size and high electronegativity of Nitrogen in NH_3 , the electron density is much higher than PH_3 , therefore it can easily donate electrons and acts as strong Lewis base than PH_3 .

(ii) The greater catenation tendency of sulphur is due to two reasons :

- (a) The lone pair of electrons feels more repulsion in O-O bond than S-S bond due to its small size and thus S-S forms strong bond.
- (b) As the size of atom increases down the group from O – PO, the strength of bond increases and therefore catenation tendency also increases.

(iii) Due to smaller size of F than Cl as a result of which electron-electron repulsions between the lone pairs of electrons are very large than that of Cl, hence bond dissociation energy of F_2 is less than that of Cl_2 .

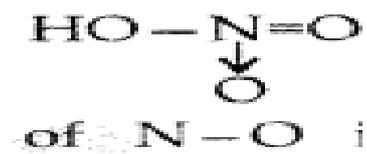
Question 97.

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:

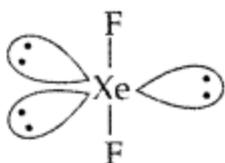
(i)



In the structure the bond length of N-O is shorter due to formation of coordinate bond and double bond while in N-OH the bond is single covalent due to which its bond length is greater than other N-O bond.

(ii) In SF_4 , due to less steric hindrance by four F atoms, H_2O molecules can attack easily while in SF_6 the S atom is completely protected by six F atoms and does not allow H_2O molecules to attack the S atom.

(iii) In XeF_2 there are 2 bond pairs and 3 lone pairs and thus show $\text{sp}^3 \text{d}$ hybridization. It has linear geometry.



Question 98. 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) Because it is most electronegative element and does not have d-orbitals for octet expansion, therefore it shows only a negative oxidation state of -1.

(ii) Because xenon has least ionization energy among noble gases and hence it readily forms chemical compounds particularly with oxygen and fluorine.

(iii) Because P-P single bond is much weaker than N = N triple bond and the bond length of nitrogen is small and bond dissociation energy is very large which makes it inert and unreactive and thus phosphorus becomes more reactive.
