CBSE Test Paper-01

Class - 12 Chemistry (The p - Block Elements)

1. The structure of ClF_3 is
   a. Octahedral
   b. T-shaped
   c. Pyramidal
   d. Tetrahedral
2. Xenon difluoride has _____ shape.
   a. Linear
   b. Trigonal
   c. Angular
   d. Pyramidal
3. Which of the following is Paramagnetic?
   a. N_2O
   b. N_2O_4
   c. NO
   d. N_2O_5
4. Which of the following is an amphoteric oxide?
   a. Cr_2O_3
   b. V_2O_5
   c. Cl_2O_7
   d. SnO_2
5. Which gas is evolved when urea is treated with NaOH?
   a. Nitrogen
   b. Ammonia
   c. Nitrous oxide
   d. Laughing gas
6. What is the maximum covalence shown by N?
7. Explain why inspite of nearly the same electronegativity, oxygen forms hydrogen

bonding while chlorine does not.

8. What happens when H_3PO_3 is heated?

9. Complete and Balance-
   a. $P_4 + 8SOCl_2 \rightarrow$
   b. $3CH_3COOH + PCl_3 \rightarrow$
   c. $P_4 + 10SO_2Cl_2 \rightarrow$
   d. $POCl_3 + 3H_2O \rightarrow$
   e. $Sn + PCl_5 \rightarrow$
   f. $4AgNO_3 + 2H_2O + H_3PO_2 \rightarrow$

10. Explain the bleaching action of chlorine.

11. Draw the structure of $XeOF_4$.

12. Describe the manufacture of H_2SO_4 by contact process?

13. Explain why NH_3 is basic while BiH_3 is only feebly basic.

14. Describe the following about halogen family (Group 17 elements:
    i. Relative oxidising power.
    ii. Relative strength of their hydrides.
    iii. Oxyacids and their related oxidising ability.
15. 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.
    iii. F_2 is a stronger oxidizing agent than Cl_2

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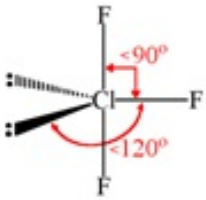
Solutions

1. b. T-shaped

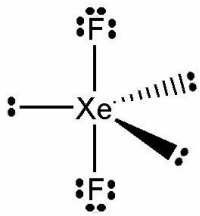
   Explanation: CN=0.5(V+M-C+A) For. ClF_3 CN= 5 so hybridisation is sp3d. The structure is trigonal bipyramidal.

   ClF_3 has 10 electrons around the central atom. this means there are 5 electron pairs arranged in a trigonal bipyramidal shape with a 90^0 F-Cl-F bond angle. There are 2 equatorial lone pairs making the final structure T- shaped.



2. a. Linear

   Explanation: CN=0.5(V+M-C+A) For XeF_2 CN = 5 .So shape will be linear and structure will be trigonal bipyramidal. Xenon and the two fluorine atoms lie in a straight line while the three equatorial positions are occupied by three lone pairs of electrons. Hence it has a linear shape.



3. c. NO

   Explanation: NO is paramagnetic. Its due unpaired electron present in antibonding molecular orbital.

4. a. Cr_2O_3

   Explanation: Higher oxidation state oxides are acidic while lower oxidation state oxides are basic. Intermediate oxidation state oxides are amphoteric. In other words, it behaves acidic with bases and as basic with acids.

   The oxidation state of Cr in Cr_2O_3 is +3, Vanadium in V_2O_5 is +5, Cl in Cl_2O_7 is +7

and Sn in SnO_2 is +4.

5. b. Ammonia

   Explanation: Urea on reaction with NaOH liberates ammonia.

   $NH_2CONH_2 + 2NaOH \rightarrow Na_2CO_3 + 2NH_3\uparrow$

6. Nitrogen shows a maximum covalence of +4 because only four orbitals in its valence, i.e. one s and three p- orbitals are available for bonding in Nitrogen.
7. Both chlorine and oxygen have almost the same electronegativity values, but chlorine rarely forms hydrogen bonding. This is because in comparison to chlorine, oxygen has a smaller size and as a result, a higher electron density per unit volume.
8. Orthophosphoric acid, when heated gives phosphine and orthophosphoric acid as follows:

$$\underset{\text{Orthophorphloric acid}}{4H_3PO_3} \xrightarrow{heat} \underset{\text{phosphine}}{PH_3} + \underset{\text{Orthophorphloric acid}}{H_3PO_4}$$

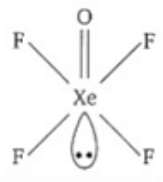
9. a. $P_4 + 8SOCl_2 \rightarrow 4PCl_3 + 4SO_2 + 2S_2Cl_2$
   b. $3CH_3COOH + PCl_3 \rightarrow 3CH_3COCl + H_3PO_3$
   c. $P_4 + 10SO_2Cl_2 \rightarrow 4PCl_5 + 10SO_2$
   d. $POCl_3 + 3H_2O \rightarrow H_3PO_4 + 3HCl$
   e. $Sn + PCl_5 \rightarrow SnCl_4 + 2\,PCl_3$
   f. $4AgNO_3 + 2H_2O + H_3PO_2 \rightarrow 4Ag + 4HNO_3 + H_3PO_4$
10. The bleaching action of chlorine water is due to its tendency to give nascent oxygen so that the substance gets oxidized.

$$Cl_2 + H_2O \rightarrow \left[\underset{(\text{yellow})}{HCl + HClO}\right] \rightarrow \underset{(\text{colourless})}{2HCl} + \underset{\text{Nascent}}{2[O]}$$

    So, it helps to bleach the given substance. i.e.

    Coloured substances + [O] $\rightarrow$ Colourless substance.

11. Structure of $XeOF_4$ square pyramidal as shown below:



(Square Pyramidal)

12. **Contact process:** It involves the following steps:
    i. Burning of sulphur or sulphide ores in presence of oxygen to produce SO_2.

$S + O_2 \rightarrow SO_2$

$4FeS_2 + 11O_2 \rightarrow 2Fe_2O_3 + 8SO_2$

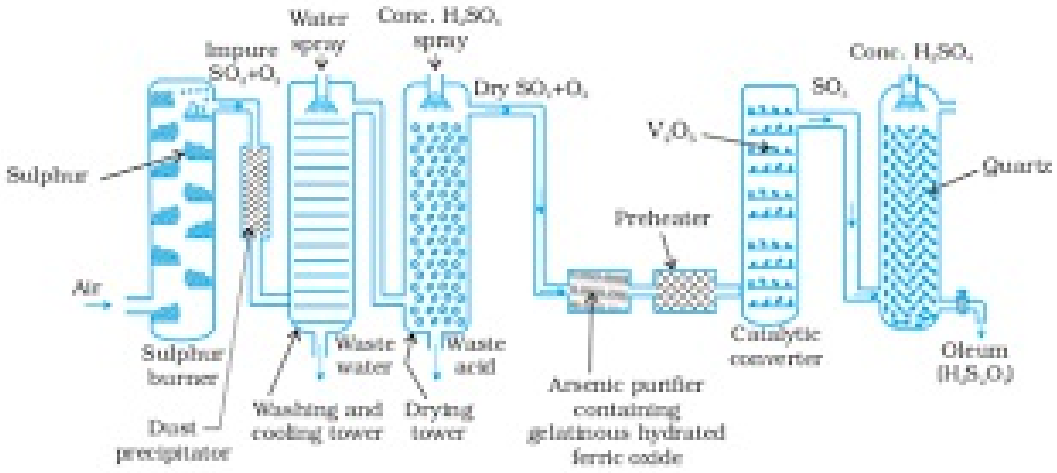
ii. SO_2 is reacted with O_2 in presence of V_2O_5 as a catalyst to form SO_3. $2SO_2 + O_2 \overset{V_2O_5}{\leftrightarrow} 2SO_3$,

$\Delta_r H$ = -196.6 kJ mol^{-1} .The plant is operated at a pressure of 2 bar and a temperature of 720 K.

iii. SO_3 is absorbed in H_2SO_4 to give oleum which is $H_2S_2O_7$. $SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$.

iv. Dilution of oleum with water gives H_2SO_4 of required concentration. $H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$

The sulphuric acid obtained by contact process is 96 - 98% pure.



Flow diagram for the manufacture of sulphuric acid

13. NH_3 is distinctly basic while BiH_3 is feebly basic. Nitrogen has a small size due to which the lone pair of electrons is concentrated in a small region. This means that the charge density per unit volume is high. On moving down a group, the size of the central atom increases and the charge gets distributed over a large area decreasing the electron density. Hence, the electron donating capacity of group 15 element hydrides decreases on moving down the group.
14. The decreasing order of the property for the elements of Group 17 is given below:
    i. $F_2 > Cl_2 > Br_2 > I_2$ is decreasing order to oxidising power.
    ii. HI > HBr > HCl > HF is decreasing order of strength of an acid.
    iii. The order of oxidising power of different oxyacids is given below:
    $HClO > HClO_2 > HClO_3 > HClO_4$

also; HOI > HOBr > HOCl

HOF does not exist at room temperature.

15. i. Due to the presence of lone pair of electrons on the centre atom both NH_3 and PH_3 are Lewis Bases. When NH_3 or PH_3 accepts a proton, an additional N - H or P - H bond is formed.

$H_3N + H^+ \rightarrow NH_4^+, H_3P + H^+ \rightarrow PH_4^+$

Due to smaller size of N than P, N - H bond thus formed is much stronger than P - H bond. As a result NH_3 has more tendency than PH_3 to accept a proton.

Therefore, NH_3 is a stronger base than PH_3.

ii. The property of catenation depends upon the strength of the element - element bond. Since sulphur S - S bond strength is much more than O - O bond strength. So sulphur has greater tendency for catenation than oxygen.

iii. Since F_2 has smaller size than Cl_2 and there is absence of d-orbital in fluorine, that's why F_2 is stronger oxidizing agent than Cl_2.