CBSE Test Paper-04

Class - 12 Chemistry (The p - Block Elements)

1. Which of the following hydrides is the most acidic?
   a. H_2S
   b. H_2Se
   c. H_2Te
   d. H_2O
2. Which among the following forms basic oxide?
   a. Nitrogen
   b. Antimony
   c. Phosphorous
   d. Bismuth
3. Of the following hydrides which is the strongest reducing agent?
   a. PH_3
   b. AsH_3
   c. BiH_3
   d. NH_3
4. Fluorine reacts with H_2S to produce
   a. SF_6 and HF
   b. SF_4 and HF
   c. SF_6 ,S and HF
   d. SF_2 and HF_4
5. Bleaching powder is treated with CO_2
   a. It absorbs the gas
   b. CaO is formed
   c. $CaCl_2$ is formed
   d. $CaCO_3$ and Cl_2 is formed
6. Balance the following equation: $XeF_6 + H_2O \rightarrow XeO_2F_2 + HF$.

7. Which is the strongest oxidizing agent among ClO_4^- , BrO_4^- and IO_4^- ? Given Reduction potentials E° for ClO_4^- , BrO_4^- and IO_4^- are 1.19 , 1.74 and 1.65 V respectively.

8. Give he disproportionation reaction of H_3PO_3 .

9. Halogens have maximum negative electron gain enthalpy in the respective periods of the periodic table. Why?

10. Complete the following reactions:
    i. $C_2H_4 + O_2 \rightarrow$
    ii. $4Al + 3O_2 \rightarrow$

11. What happens when sulphur dioxide is passed through an aqueous solution of Fe (III) salt?

12. Draw the structure of XeF_4.

13. Draw the structure of H_3PO_2 .

14. Why is $K_{a2} << K_{a1}$ for H_2SO_4 in water?

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. c. H_2Te

   Explanation: H_2Te. Acidic strength increases from H_2O to H_2Te . This is because the dissociation energies decreases as bond length of M-H increases from oxygen and tellurium.

2. d. Bismuth

   Explanation: As we move down the group in periodic table, metallic character increases so Bi is a metal thus its oxide is basic.

3. c. BiH_3

   Explanation: The reducing character of the hydrides of Group 15 elements increases from NH_3 to BiH_3(Bismuthine) because the reducing character depends upon the stability of the hydride. The greater the unstability of hydride, the greater is its reducing character. Since the BiH_3 is least stable (because the size of a central atom is greatest & therefore its tendency to form stable covalent bond with small hydrogen atom decreases, as a result, the bond strength decreases) in this series, BiH_3 is a strongest reducing agent.

4. a. SF_6 and HF

   Explanation: $4F_2 + \ H_2S \rightarrow SF_6 + \ 2HF$

5. d. $CaCO_3$ and Cl_2 is formed

   Explanation: $CaCO_3$ and Cl_2 is produced when Bleaching powder is treated with CO_2.

   $Ca(OCl)_2 \ + \ CO_2 \rightarrow CaCO_3 \ + \ Cl_2 \uparrow$

6. Balanced equation: $XeF_6 + H_2O \rightarrow XeO_2F_2 + 4HF$

7. Higher the value of reduction potentials, stronger is the oxidising behaviour. Therefore, BrO_4^- is the strongest oxidizing agent.

8. H_3PO_3 on heating undergoes self-oxidation-reduction

$$\underset{\substack{phosphorons\\acid}}{4\overset{+3}{H_3}PO_3} \rightarrow \underset{phosphine}{\overset{-3}{P}H_3} + \underset{\substack{Ortho-phosphorie\\acid}}{3\overset{+5}{H_3}PO_4}$$

9. Halogens have the smallest size in their respective periods and therefore high effective nuclear charge. As a consequence, they readily accept one electron to an acquine noble gas electronic configuration.

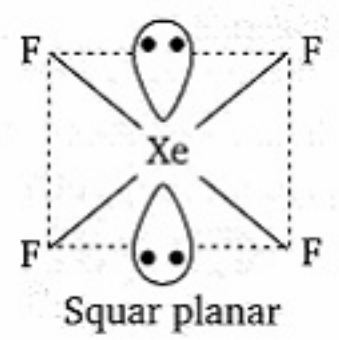
10. i. $\underset{Ethane}{C_2H_4} + \underset{Oxygen}{3O_2} \rightarrow \underset{Carbondioxide}{2CO_2} + \underset{Water}{2H_2O}$

    ii. $\underset{\text{Aluminium}}{4Al} + \underset{Oxygen}{3O_2} \rightarrow \underset{\text{Alumina}}{2Al_2O_3}$

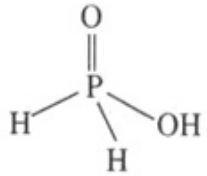
11. It reduces Fe (III)salt to Fe (II) salt.

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

12. The square planar structure of XeF_4 is shown below:



13. The phosphorus acid is a dibasic acid having an oxidation state of P = + 3 as shown below;



14. $H_2SO_{4(aq)} + H_2O_{(l)} \rightarrow H_3O^+_{(aq)} + HSO^-_{4(aq)};\ K_{a_1} > 10$

    $HSO_4^- + H_2O \rightarrow H_3O^+ + SO_4^{2-},\ K_{a_2} = 1.2 \times 10^2$

    It can be noticed that $K_{a1} >> K_{a2}$.

    This is because a neutral H_2SO_4 has a much higher tendency to lose a proton than the negatively charged HSO_4^- . Thus, the former is a much stronger acid than the latter.

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.