CBSE Test Paper-05

Class - 12 Chemistry (The p - Block Elements)

1. How many moles of oxygen are obtained by heating 8 mol of potassium chlorate?
   a. 28
   b. 8
   c. 16
   d. 12
2. Name the gas whose formula was established by Sorret.
   a. Nitrous oxide
   b. Oxygen
   c. Ozone
   d. Nitric oxide
3. When sugar is treated with conc. Sulphuric acid, the sugar is charred. In this process, sugar is
   a. Oxidised
   b. Reduced
   c. Dehydrated
   d. Sulphonated
4. Elements having +5 oxidation state is
   a. Phosphorous
   b. Arsenic
   c. Bismuth
   d. Antimony
5. First compound of inert gas was prepared by Bartlett in 1962. The compound is
   a. $XeOF_4$
   b. XeO_3
   c. XeF_6
   d. $Xe[PtF_6]$
6. Which one of the following does not exist?
   i. $XeOF_4$

ii. NeF_2

iii. XeF_2

iv. XeF_6

7. Enlist some uses of dioxygen.
8. What inspired N. Bartlett for carrying out the reaction between Xe and PtF_6?
9. Draw the resonating structures of ozone.
10. How is O_3 estimated quantitatively?
11. Why do noble gases exist as monoatomic?
12. Oxygen molecule has the formula O_2 while sulphur is S_8. (Give reason)
13. What are allotropes of sulphur? Draw structures of S_8 and S_6.
14. How are the following compounds prepared from XeF_6?
    i. $XeOF_4$
    ii. XeO_3
15. Give the formula and describe the structure of a noble gas species which is isostructural with:
    i. ICl_4^-
    ii. IBr_2^-
    iii. BrO_3^-

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Solutions

1. d. 12

   Explanation: $2KClO_3 \rightarrow 2KCl + 3O_2$

   2mol of $KClO_3$ gives 3 mol of O_3.

   So 8 mol of potassium chlorate will yield = $\frac{8 \times 3}{2}$ = 12 mol of O_2.

2. c. Ozone

   Explanation: Sorret established formula of ozone and pointed out that ozone is an allotrope of oxygen.

3. c. Dehydrated

   Explanation: Concentrated H_2SO_4 is a dehydrating agent and is hygroscopic in nature. So it absorbs water to form black charry mass of carbon.

4. a. Phosphorous

   Explanation: The maximum oxidation state shown by a p-block element is equal to the total number of valence electrons (i.e., the sum of the s and p-electrons).

   P :[Ne]$3s^2 3p^3$. Total valence electrons =5 so it will show +5 oxidation state. The stability of +5 oxidation state decreases down the group due to inert pair effect.

5. d. $Xe[PtF_6]$

   Explanation: Bartlett in 1962 prepared $Xe[PtF_6]$. He passed orange red vapours platinum hexa fluoride over xenon to form yellow solid of xenon platinum hexa fluoride.

   PtF_6 + Xe $\rightarrow$ $Xe[PtF_6]$ xenon hexafluoroplatinate(V)

6. Although both Xe and Ne belong to noble gases, due to smaller size, non- availability of d-orbitals and high ionization enthalpy of Ne than Xe. Therefore Neon does not combine with other elements, Whereas, Xe forms compounds with electronegative elements like F and O. Hence, NeF_2 does not exist.

7. Oxygen is used-
   a. In oxyacetylene welding.
   b. In manufacture of steel.

c. In hospitals and mountaineering as oxygen cylinders.

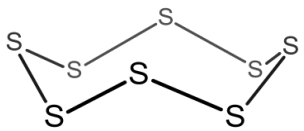
8. Neil Bartlett initially carried out a reaction between oxygen and Pt. This resulted in the formation of a red compound, $O_2^+[PtF_6]^-$ Later, he realized that the first ionization energy of oxygen (1175 kJ/mol) and Xe (1170 kJ/mol) is almost the same. Thus, he tried to prepare a compound with Xe and. He was successful and a red-coloured compound, $Xe^+[PtF_6]^-$ was formed.
9. The resonating structures of O_3 are shown below:

10. Quantitatively, ozone can be estimated with the help of potassium iodide. When ozone is made to react with potassium iodide solution buffered with a borate buffer (pH 9.2), iodine is liberated. This liberated iodine can be titrated against a standard solution of sodium thiosulphate using starch as an indicator. The reactions involved in the process are given below.

$$\underset{Iodine}{2I^-} + H_2O + \underset{Ozone}{O_3} \rightarrow 2OH^- + \underset{Iodine}{I_2} + O_2$$

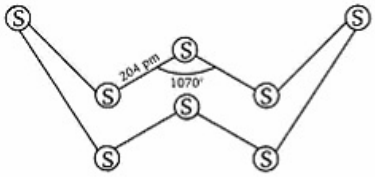
$$I_2 + 2\underset{\substack{Sodium\\thiosulphate}}{Na_2S_2O_3} \rightarrow \underset{\substack{Sodium\\tetrathionate}}{Na_2S_4O_6} + 2NaI$$

11. Noble gases have a stable electronic configuration (ns^2np^6). Therefore, they have no tendency to lose or gain the electron. Hence they exist as monoatomic gases.
12. Due to the small size and high electronegativity oxygen forms $p\pi - p\pi$ multiple bonds. As a result, oxygen exists as diatomic (O_2) molecule. Due to its bigger size and lower electronegativity sulphur does not form $p\pi - p\pi$ multiple bonds. Consequently, sulphur because of its high tendency of catenation and a lower tendency of $p\pi - p\pi$ multiple bonds forms octa atomic (S8) molecules having an eight-membered puckered ring structure.

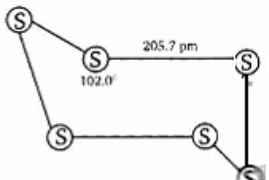


13. **Allotropy of sulphur:**
    i. The stable form of sulphur at room temperature is orthorhombic sulphur, which transforms to monoclinic sulphur when heated above 369 K.

ii. Both orthorhombic and monoclinic sulphur are molecular solids. The S_8 ring in both, the form is puckered and has a crown shape.



Structure of S_8



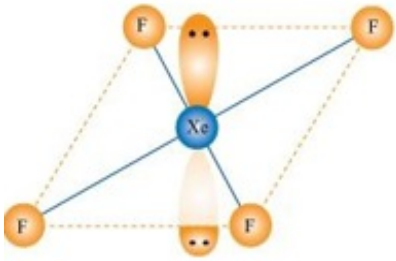
Structure of S_6

14. Hydrolysis of XeF_6 with water gives $XeOF_4$ and XeO_3

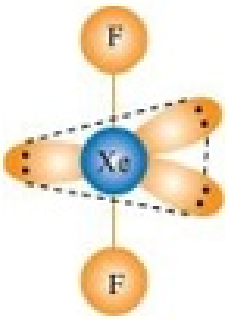
i. Partial hydrolysis of XeF_6 gives $XeOF_4$: $XeF_6 + H_2O \rightarrow XeOF_4 + 2HF$

ii. Complete hydrolysis of XeF_6 gives XeO_3 : $XeF_6 + 3H_2O \rightarrow XeO_3 + 6HF$

15. i. XeF_4 is isoelectronic with ICl_4^- and has square planar geometry.



ii. XeF_2 is isoelectronic to IBr_2^- and has a linear structure.



iii. XeO_3 is isostructural to BrO_3^- and has a pyramidal molecular structure.