

## The p-Block Elements

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**Que 1: Which is the element present in group 15 of periodic table showing oxidation state from -3 to +5?**

**Marks : (1)**

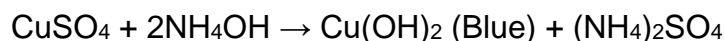
**Ans:** Nitrogen

**Que 2: How ammonia is prepared in laboratory? What is the chemical change happening when ammonium hydroxide solution is added drop wise to excess into a copper sulphate solution? (Give equations wherever necessary.)**

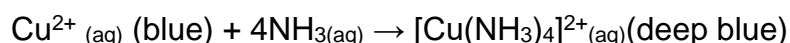
**Marks : (4)**

**Ans:** Ammonia is prepared in laboratory by treating ammonium salts with caustic soda or calcium hydroxide.  $2\text{NH}_4\text{Cl} + \text{Ca}(\text{OH})_2 \rightarrow 2\text{NH}_3 + 2\text{H}_2\text{O} + \text{CaCl}_2$

When ammonium hydroxide is added to copper sulphate solution, initially a blue precipitate is formed due to the formation of copper hydroxide.



When excess is added, the blue color changes to deep blue color due to the formation of tetramine copper ion.



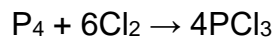
**Que 3: phosphorous is the second element in the 15 th group of the periodic table.**

1. Which are the two important halides of phosphorous?
2. How they are prepared?
3. Explain with equations, their action with moisture.

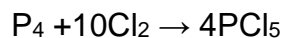
**Marks : (4)**

**Ans:**

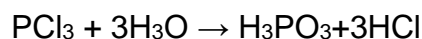
1.  $\text{PCl}_3$  and  $\text{PCl}_5$ .
2.  $\text{PCl}_3$  is obtained by passing dry chlorine over heated white phosphorus.



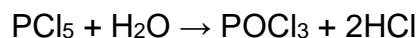
Phosphorus pentachloride is prepared by the reaction of white phosphorus with excess of dry chlorine.

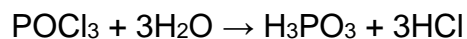


3.  $\text{PCl}_3$  hydrolyses in the presence of moisture



$\text{PCl}_5$  is a yellowish white powder and in moist air, it hydrolyses to  $\text{POCl}_3$  and finally gets converted to phosphoric acid

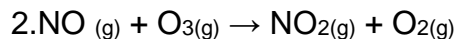
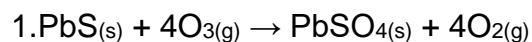
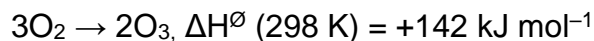




**Que 4: How ozone is prepared? Give any two oxidizing reactions of ozone.**

**Marks :(3)**

**Ans:** Ozone is prepared by passing a slow dry stream of oxygen through a silent electrical discharge.



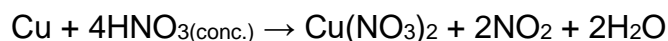
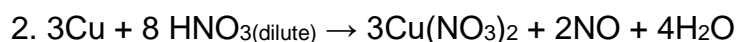
**Que 5: The most important oxoacid of nitrogen is Nitric acid.**

**1. Name the other two oxoacids of nitrogen.**

**2. With the help of balanced chemical equations, explain the reaction of Cu with dilute and concentrated nitric acids.**

**Marks :(3)**

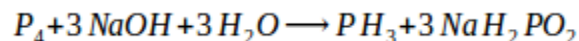
**Ans:** 1. Hyponitrous acid( $\text{H}_2\text{N}_2\text{O}_2$ ) and Nitrous acid ( $\text{HNO}_2$ )



**Que 6: Heating white phosphorous with concentrated NaOH in an inert atmosphere of  $\text{CO}_2$  gives a compound used in Holme's signals. Name the compound. Write the balanced equation showing the reaction.**

**Marks :(2)**

**Ans:** Phosphine.



**Que 7: An oxide of nitrogen which is brown in color and paramagnetic, on cooling becomes another oxide which is diamagnetic liquid or solid. Identify the two oxides and write the equation showing the change.**

**Marks :(2)**

**Ans:** The two oxides are  $\text{NO}_2$  and  $\text{N}_2\text{O}_4$ .

The equation is  $2\text{NO}_2 \rightleftharpoons \text{N}_2\text{O}_4$

**Que 8: Why the first element in groups 15, 16, 17 and 18 of the periodic table show abnormal properties compared to rest of the members?**

**Marks :(1)**

**Ans:** This is due to the small size, high electronegativity, high ionization enthalpy and non-availability of d orbitals.

**Que 9: Which inter halogen compound is used in the production of  $\text{UF}_6$ , a compound that is used in the enrichment of  $\text{U}^{235}$ .**

**Marks :(1)**

**Ans:**  $\text{ClF}_3$

**Que 10: Deacon's process is used for the manufacture of ----- .**

**Marks :(1)**

**Ans:** Chlorine

**Que 11:** Name the process used for the large-scale preparation of Nitric acid.

**Marks :**(1)

**Ans:** Ostwald's process

**Que 12:** Name the compound of phosphorus which is used in Holme's signal.

**Marks :**(1)

**Ans:** Phosphine

**Que 13:** The compound of 15<sup>th</sup> group element which is used as a refrigerant is-----.

**Marks :**(1)

**Ans:** Ammonia

**Que 14:** The strongest hydrohalic acid is ----- . **Marks :**(1)

**Ans:** Hydriodic acid

**Que 15:** Name the important oxoacids of nitrogen and write their chemical formulae. **Marks :**(1)

**Ans:** 1. Nitrous acid :  $\text{HNO}_2$

2. Nitric acid :  $\text{HNO}_3$

3. Hyponitrous acid :  $\text{H}_2\text{N}_2\text{O}_2$

**Que 16:** Nitrogen does not form pentahalides. Why? **Marks :**(1)

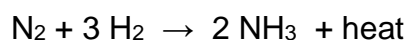
**Ans:** Nitrogen has no vacant d-orbital

**Que 17:** Why dinitrogen ( $\text{N}_2$ ) is inert at room temperature? **Marks :**(2)

**Ans:** Due to high bond dissociation enthalpy of N-N triple bond

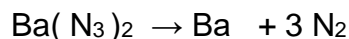
**Que 18:** Explain the manufacture of ammonia? **Marks :**(4)

**Ans:** Ammonia is manufactured by Haber's process. In this nitrogen gas is mixed with hydrogen gas. High Pressure and low temperature favours the formation of ammonia. Hence ammonia is manufactured at a pressure of ~200 atm ( $200 \times 10^5$  Pa) and at an optimum temperature of 700K in presence of catalyst like iron oxide with small amount of  $\text{K}_2\text{O}$  and  $\text{Al}_2\text{O}_3$



**Que 19:** Write a method to prepare very pure nitrogen ( $\text{N}_2$ ) in the laboratory **Marks :**(2)

**Ans:** By the thermal decomposition of Barium azide or sodium azide



**Que 20:** Thermal stability of hydrides of group 15 elements decreases from  $\text{NH}_3$  to  $\text{BiH}_3$ . Why? **Marks :**(2)

**Ans:** Down the group from N to Bi atomic size increases and bond dissociation enthalpy of M-H bond decreases. Hence thermal stability decreases.

**Que 21: Write three anomalous properties of nitrogen compared to other elements of group 15**

**Marks : (3)**

- Ans:** 1. Nitrogen can form stable p pi - p pi multiple bonds  
2. Nitrogen is diatomic gas while others are polyatomic solids  
3. Catenation tendency in nitrogen is weaker than other elements

**Que 22: In group 15 stability of +5 oxidation state decreases down the group. Give reason**

**Marks : (2)**

**Ans:** It is due to Inert pair effect. Inert pair effect increases down the group and +3 oxidation state becomes more stable down the group

**Que 23: In group 15 stability of +5 oxidation state decreases down the group. Give reason**

**Marks : (2)**

**Ans:** It is due to Inert pair effect. Inert pair effect increases down the group and +3 oxidation state becomes more stable down the group

**Que 24: First ionisation enthalpy of Nitrogen is higher than Oxygen. Why?**

**Marks : (2)**

**Ans:** due to the stable outer  $ns^2np^3$  electronic configuration of nitrogen, s level is fully filled and p level is exactly half filled

**Que 25: Which allotropic form of phosphorous is more reactive?**

**Marks : (1)**

**Ans:** White phosphorus

**Que 26: What are the products obtained by the thermal decomposition of sodium azide.**

**Marks : (2)**

**Ans:** Thermal decomposition of sodium azide gives dinitrogen gas and metallic sodium

