

9.7 PHOSPHORUS

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Learning outcomes

By the end of this chapter, Students should be able to:

- Name allotropes of phosphorus.
- Write balanced chemical equations for the preparation of phosphine.
- Write balanced chemical equations for the properties (basic nature, reducing nature, action with halogens and oxygen) of phosphine
- State the uses of phosphine.

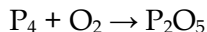
 To help reinforce your skills, most chemical equations are intentionally left unbalanced—test yourself by balancing them as you study!

Allotropes of phosphorus

1. White phosphorus(P₄)
2. Red phosphorus
3. Black phosphorus
4. Violet phosphorus
5. Scarlet phosphorus

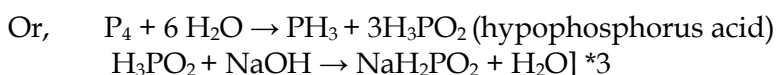
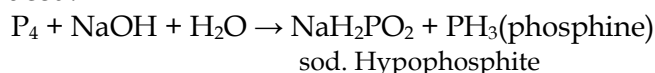
1. Name any two allotropes of phosphorus.

 **Fun Fact — Phosphorescence ("Ghost Light"):** When white phosphorus is exposed to moist air, it slowly oxidises and glows in the dark without producing significant heat. This phenomenon is called **phosphorescence, cold light or ghost light**.



Lab preparation of phosphine (PH₃)

When white phosphorus is heated with concentrated aqueous caustic soda (NaOH), phosphine gas is produced.



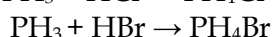
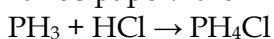
2. Give a balanced chemical equation for the preparation of phosphine gas.
3. What happens when white phosphorus is heated with aqueous caustic soda?

Chemical properties of Phosphine

You can do it!

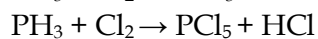
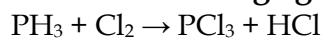
Write the Lewis structure of PH₃ and predict if it would behave as a base or acid.

1. **Weakly Basic nature:** Phosphine is less basic than NH₃; it's too weak to change the colour of red litmus paper. It forms phosphonium compounds with hydrohalic acids.

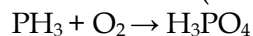
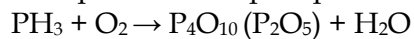




2. **Phosphine as a reducing agent:** action with Cl_2 or Br_2 gas



3. Action of air (oxygen): non-supporter of combustion. But when heated with oxygen, phosphorus pentoxide or phosphoric acid is formed



Uses of phosphine gas

1. As a reducing agent
 2. to prepare PCl_3 , PCl_5 , P_2O_5
 3. In Holme's signal for sea navigation
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1. Which statement regarding PH_3 is incorrect?
 - a. With HCl , it forms phosphonium chloride
 - b. PH_3 can be used as an oxidising agent
 - c. PH_3 is less basic than NH_3
 - d. P contains a lone pair of electrons

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