

### Phosphorous and its Compounds

- 1 Which one of the following properties of white phosphorous are shared by red phosphorous  
(A) It dissolves in  $\text{CS}_2$  (B) It burns when heated in air  
(C) It reacts with  $\text{NaOH}$  to give  $\text{PH}_3$  (D) It phosphorescence in air
- 2 The P – P – P bond angle in white phosphorus is -  
(A)  $120^\circ$  (B)  $90^\circ$  (C)  $60^\circ$  (D)  $109^\circ, 28'$
3. Which of the following is least reactive ?  
(A) White phosphorus (B) Yellow phosphorus  
(C) Red phosphorus (D) Black phosphorus
- 4 Red phosphorus is less reactive than yellow phosphorus because -  
(A) Its colour is red (B) It is highly polymerised  
(C) It is tetratomic (D) It is hard
5. In modern process, white phosphorus is manufactured by :  
(A) heating a mixture of phosphorite mineral with sand and coke in an electric furnace  
(B) heating calcium phosphate with lime  
(C) heating bone ash with coke  
(D) heating phosphate mineral with sand.
6. Red and white phosphorus will differ but not in :  
(A) smell (B) solubility in  $\text{CHCl}_3$   
(C) exhibiting phosphorescence (D) reaction with concentrated  $\text{HNO}_3$
7. Red phosphorus can be prepared from white phosphorus by :  
(A) adding red colour to white phosphorus  
(B) heating white phosphorus to red heat  
(C) heating white phosphorus in inert atmosphere to  $250^\circ\text{C}$  or at low temperature in the presence of sun light.  
(D) heating white phosphorus at high pressure and 473 k temperature.
8.  $\text{CS}_2$  can separate a mixture of :  
(A)  $\text{P}_4$  (white) and  $\text{S}_8$  (rhombic) (B)  $\text{P}_4$  (red) and  $\text{S}_8$  (monoclinic)  
(C)  $\text{S}_8$  (rhombic) and  $\text{S}_8$  (monoclinic) (D)  $\text{S}_8$  (rhombic) and S (plastic)

9. Of the different allotropes of phosphorus, the one which is most reactive is  
 (A) Violet phosphorus (B) Scarlet phosphorus  
 (C) Red phosphorus (D) White phosphorus
10. Phosphorus is manufactured by heating in an electric furnace a mixture of  
 (A) Bone ash and coke (B) Bone ash and silica  
 (C) Bone ash, silica and coke (D) None of these
11. Which of the following may ignite spontaneously in air ?  
 (A) White phosphorus (B) Red phosphorus (C) Black phosphorus (D) Nitrogen
12. White phosphorus contains -  
 (A)  $P_2$  molecules (B)  $P_6$  molecules (C)  $P_4$  molecules (D)  $P_5$  molecules
13. Red phosphorus is chemically unreactive because -  
 (A) It does not contain P — P bonds  
 (B) It does not contain tetrahedral  $P_4$  molecules  
 (C) It does not catch fire in air even upto  $400^\circ\text{C}$   
 (D) It has a polymeric structure.
14. Phosphorus vapours consists of -  
 (A) P molecule (B)  $P_2$  molecule (C)  $P_3$  molecule (D)  $P_4$  molecule
15. Which of the following order is INCORRECT for allotropes of phosphorus"  
 (A) white-P > red-P > black-P reactivity (B) white-P > red-P: solubility in  $\text{CS}_2$   
 (C) white-P > red-P solubility in water (D) black-P > red-P : stability
16.  $P_4 + \text{NaOH} \xrightarrow{\text{warm}}$  Products  
 Products will be :  
 (A)  $\text{H}_3\text{PO}_4 + \text{PH}_3$  (B)  $\text{PH}_3 + \text{NaH}_2\text{PO}_2$   
 (C)  $\text{NaH}_2\text{PO}_2 + \text{H}_3\text{PO}_4$  (D)  $\text{H}_3\text{PO}_4$
17.  $P_4(s) + 3\text{OH}^-(\text{aq}) + 3\text{H}_2\text{O}(l) \rightarrow \text{PH}_3(g) + 3\text{H}_2\text{PO}_2^-(\text{aq})$   
 In the above equation, the species getting oxidized and reduced respectively are :  
 (A)  $P_4$  and  $\text{OH}^-$  (B)  $\text{OH}^-$  and  $P_4$  (C)  $P_4$  and  $\text{H}_2\text{O}$  (D)  $P_4$  and  $P_4$
18. White phosphorous on reaction with NaOH gives  $\text{PH}_3$  and  
 (A)  $\text{Na}_2\text{HPO}_3$  (B)  $\text{NaH}_2\text{PO}_2$  (C)  $\text{NaH}_2\text{PO}_3$  (D)  $\text{Na}_3\text{PO}_4$
19. The arrangement of oxygen atoms around phosphorus atoms in  $\text{P}_4\text{O}_{10}$  is -  
 (A) Pyramidal (B) Octahedral (C) Square planar (D) Tetrahedral

20. By the action of conc.  $\text{H}_2\text{SO}_4$ , phosphorus changes to  
(A)  $\text{H}_3\text{PO}_3$  (B)  $\text{HPO}_3$  (C)  $\text{H}_3\text{PO}_4$  (D)  $\text{H}_4\text{P}_2\text{O}_7$
21. Which of the following sulphides is used in the manufacture of "Strike anywhere" matches—  
(A)  $\text{P}_2\text{S}_2$  (B)  $\text{P}_2\text{S}_3$  (C)  $\text{P}_4\text{S}_3$  (D) None
22. Pick out the incorrect statement—  
(A) Red phosphorus consists of a complex chain structure and black phosphorus has a 3-D structure  
(B) Nitrogen shows a little tendency for catenation, because N - N single bond is very strong.  
(C) The maximum number of covalent bonds formed by nitrogen is four, since it has no d-orbitals in its valence shell.  
(D) The group 15 elements do not form  $\text{M}^{5+}$  ions, but +5 oxidation state is realized only through covalent bonding
23. Which one of the following statement is wrong ?  
(A) Ammonia is more poisonous than phosphine  
(B) Ammonia is more basic than phosphine  
(C) Ammonia is more stable than phosphine  
(D) Ammonia is more soluble in water than phosphine
24. One mole of calcium phosphide on reaction with excess of water gives —  
(A) One mole of phosphine (B) Two moles of phosphoric acid  
(C) Two moles of phosphine (D) One mole of phosphorus penta-oxide
25. Phosphine is not obtained by the reaction when -  
(A) White P is heated with NaOH (B) Red P is heated with NaOH  
(C)  $\text{Ca}_3\text{P}_2$  reacts with water (D)  $\text{P}_4\text{O}_6$  is boiled with water
26. When white phosphorous is heated with caustic soda, the compounds formed are -  
(A)  $\text{PH}_3 + \text{NaH}_2\text{PO}_3$  (B)  $\text{PH}_3 + \text{NaH}_2\text{PO}_2$   
(C)  $\text{PH}_3 + \text{Na}_2\text{HPO}_3$  (D)  $\text{PH}_3 + \text{NaH}_2\text{PO}_4$
27. Phosphine produces smoky rings when it comes in contact with air because -  
(A) It reacts with water vapour (B) It reacts with nitrogen  
(C) It burns in air (D) It contains impurities of  $\text{P}_2\text{H}_4$

28. Mixture used in Holme's signal is -  
 (A)  $\text{CaC}_2$  and  $\text{CaCl}_2$  (B)  $\text{CaCl}_2$  and  $\text{Ca}_3\text{P}_2$   
 (C)  $\text{CaC}_2$  and  $\text{Ca}_3\text{N}_2$  (D)  $\text{CaC}_2$  and  $\text{Ca}_3\text{P}_2$
29. One mole of calcium phosphide on reaction with excess water gives :  
 (A) one mole of phosphine (B) two moles of phosphoric acid  
 (C) two moles of phosphine (D) one mole of phosphorus pentoxide
30.  $\text{PH}_3$  (anhydrous) +  $\text{HBr}$  (anhydrous)  $\rightarrow$  X. Identify X ?  
 (A)  $\text{H}_3\text{BrO}_3$  (B)  $\text{PH}_4\text{Br}$  (C)  $\text{Br}_2$  (D)  $\text{P}_4$
31. Calcium phosphide reacts with water or dil.  $\text{HCl}$  and gives a compound 'X', which fails to react with  $\text{HCl}$  but produces dense white fumes with  $\text{HI}$  (g) due to formation of 'Y'. Compound X and Y respectively.  
 (A)  $\text{X} = \text{PH}_3$  and  $\text{Y} = \text{PH}_4\text{I}$  (B)  $\text{X} = \text{NaH}_2\text{PO}_2$  and  $\text{Y} = \text{H}_3\text{PO}_2$   
 (C)  $\text{X} = \text{PH}_4^+$  and  $\text{Y} = \text{PH}_4\text{I}$  (D)  $\text{X} = \text{PH}_3$  and  $\text{Y} = \text{H}_3\text{PO}_2$
32. With respect to protonic acids, which of the following statement is correct ?  
 (A)  $\text{PH}_3$  is more basic than  $\text{NH}_3$  (B)  $\text{PH}_3$  is less basic than  $\text{NH}_3$   
 (C)  $\text{PH}_3$  is equally basic as  $\text{NH}_3$  (D)  $\text{PH}_3$  is amphoteric while  $\text{NH}_3$  is basic.
33. Phosphine is generally prepared in the laboratory  
 (A) By heating phosphorus in a current of hydrogen  
 (B) By heating white phosphorus with aqueous solution of caustic potash  
 (C) By decomposition of  $\text{P}_2\text{H}_4$  at  $110^\circ\text{C}$   
 (D) By heating red phosphorus with an aqueous solution of caustic soda.
34.  $\text{PH}_3 + \text{H}_2\text{O} \xrightarrow{h\nu} \text{'X'} + \text{H}_2$   
 Where 'X' is  
 (A) white - P (B) black - P (C) red - P (D) none of these
35. Pick out the incorrect statement—  
 (A)  $\text{PH}_4^+$  ion is tetrahedral like the  $\text{NH}_4^+$  ion and is obtained when  $\text{PH}_3$  is bonded to proton  
 (B)  $\text{PH}_4\text{I}$  is one of the most stable salts containing the phosphonium ion. It is also more stable than ammonium salts.  
 (C)  $\text{PH}_4\text{I}$  is decomposed by water to form  $\text{PH}_3$   
 (D)  $\text{PH}_3$  converts silver salts in solution to silver phosphide, which subsequently reacts to give free metal

36. Phosphine is prepared by the reaction of  
(A) P and  $\text{HNO}_3$  (B) P and  $\text{H}_2\text{SO}_4$  (C) P and NaOH (D) P and  $\text{H}_2\text{S}$
37. Phosphine is not obtained by the reaction :  
(A) White P is heated with NaOH  
(B) Red P is heated with NaOH  
(C)  $\text{Ca}_3\text{P}_2$  reacts with water  
(D) Phosphorus trioxide is boiled with water under pressure.
38. Which of the following is incorrect ?  
(A) Ammonia is prepared in the laboratory by the action of NaOH on Ammonium salt.  
(B) All the hydrides of 15<sup>th</sup> group are colourless, highly volatile and poisonous gases  
(C) Metal phosphides upon hydrolysis give phosphine.  
(D) Metal phosphides upon hydrolysis give phosphoric acid.
39. In warfare smoke screens are prepared from –  
(A)  $\text{PH}_3$  (B)  $\text{CaC}_2$  (C)  $\text{P}_2\text{O}_5$  (D)  $\text{COCl}_2$
40. In a molecule of phosphorus (V) oxide, there are –  
(A) 4P – P, 10P – O and 4P = O bonds (B) 12P – O and 4P = O bonds  
(C) 2P – O and 4P = P bonds (D) 6P – P, 12P – O and 4P = P bonds
41. In  $\text{P}_4\text{O}_6$  the number of oxygen atoms bonded to each phosphorus atom is -  
(A) 1.5 (B) 2 (C) 3 (D) 4
42. Which of the following oxides will be least acidic -  
(A)  $\text{P}_4\text{O}_6$  (B)  $\text{P}_4\text{O}_{10}$  (C)  $\text{As}_4\text{O}_6$  (D)  $\text{As}_4\text{O}_{10}$
43. The number of molecules of water needed to convert one molecule of  $\text{P}_2\text{O}_5$  into orthophosphoric acid is –  
(A) 2 (B) 3 (C) 4 (D) 5
44.  $\text{P}_2\text{O}_5$  is used extensively as a –  
(A) Dehydrating agent (B) Catalytic agent  
(C) Reducing agent (D) Preservative
45. How many P–O bonds and how many lone pairs respectively are present in  $\text{P}_4\text{O}_6$  molecule –  
(A) 12, 4 (B) 8, 8 (C) 12, 16 (D) 12, 12

46. In  $P_4O_{10}$ , the number of oxygen atoms bonded to each phosphorus atom is -  
 (A) 2.5 (B) 3 (C) 4 (D) 5
47. When  $P_4O_{10}$  is dissolved in water, the acid formed finally is :  
 (A)  $H_3PO_2$  (B)  $H_3PO_4$  (C)  $H_3PO_3$  (D)  $H_4P_2O_7$
48. In the reaction,  $\text{conc. } H_2SO_4 + P_2O_5 \xrightarrow{\Delta} (X) + SO_3$  ; the major product (X) is :  
 (A)  $PH_3$  (B)  $H_3PO_4$  (C)  $HPO_3$  (D)  $H_4P_2O_7$
49. In the compounds of the type  $POX_3$ , P atoms show multiple bonding of the type -  
 (A)  $p\pi - p\pi$  (B)  $d\pi - d\pi$  (C)  $p\pi - d\pi$  (D) None of these
50.  $PCl_5$  is kept in well stoppered bottles because -  
 (A) It is highly volatile (B) It reacts with oxygen  
 (C) It reacts readily with moisture (D) It is explosive
51. Choose the incorrect statement -  
 (A) Solid  $PCl_5$  exists as tetrahedral  $[PCl_4]^+$  and octahedral  $[PCl_6]^-$  ions  
 (B) Solid  $PBr_5$  exists as  $[PBr_4]^+ Br^-$   
 (C) Solid  $N_2O_5$  exists as  $NO_2^+ NO_3^-$   
 (D) Oxides of phosphorus  $P_2O_3$  and  $P_2O_5$  exist as monomers
52.  $PCl_3$  reacts with water to form -  
 (A)  $PH_3$  (B)  $H_3PO_3$  and  $HCl$  (C)  $POCl_3$  (D)  $H_3PO_4$
53. The final product obtained on hydrolysis of  $PCl_5$  is :  
 (A)  $H_3PO_4$  (B)  $H_3PO_3$  (C)  $POCl_3$  (D)  $PH_3$
54. Which of the following phosphorus halide is the best reducing agent?  
 (A)  $PCl_3$  (B)  $PF_3$  (C)  $PBr_3$  (D)  $PI_3$
55. The compound which has ionic nature in solid state is :  
 (A)  $PCl_5$  (B)  $POCl_3$  (C)  $P_4O_{10}$  (D)  $PCl_3$
56. Phosphorus trichloride,  $PCl_3$  undergoes, hydrolysis at room temperature to produce an oxoacid. It has the formula :  
 (A)  $HPO_3$  (B)  $H_3PO_3$  (C)  $H_3PO_4$  (D)  $H_3PO_2$

57.  $\text{SbCl}_3$  and  $\text{BiCl}_3$  on hydrolysis gives –  
 (A)  $\text{Sb}^{+3}$  and  $\text{Bi}^{+3}$  (B)  $\text{Sb(OH)}_3$  and  $\text{Bi(OH)}_3$   
 (C)  $\text{SbOCl}$  and  $\text{BiOCl}$  (D) None
58.  $\text{PCl}_5$  reacts with compounds containing .... group–  
 (A)  $-\text{SO}_3$  (B)  $-\text{OH}$  (C)  $-\text{NO}_3$  (D)  $-\text{NO}$
59. Which of the following statement is/are CORRECT for  $\text{PCl}_5$ ?  
 (A) In the solid state it exists as an ionic solid. In which cationic part is octahedral and anionic part is tetrahedral.  
 (B) It prepared by the reaction of white-P with excess of dry chlorine.  
 (C) In gaseous & liquid phase it has T.B.P. structure.  
 (D) In gaseous & liquid phase it has same type of bond & bond angles.
60. A white ppt is obtained on hydrolysis of  
 (A)  $\text{PCl}_5$  (B)  $\text{NCl}_3$  (C)  $\text{BiCl}_3$  (D)  $\text{AsCl}_3$
61. Which of the following phosphorus oxyacids can act as a reducing agent ?  
 (A)  $\text{H}_3\text{PO}_3$  (B)  $\text{H}_3\text{PO}_4$  (C)  $\text{H}_4\text{P}_2\text{O}_8$  (D)  $\text{H}_4\text{P}_2\text{O}_7$
62. Which of the following oxy acids of Phosphorus is a reducing agent and monobasic -  
 (A)  $\text{H}_3\text{PO}_2$  (B)  $\text{H}_3\text{PO}_3$  (C)  $\text{H}_3\text{PO}_4$  (D)  $\text{H}_4\text{P}_2\text{O}_6$
63. The strongest acid is–  
 (A)  $\text{H}_3\text{PO}_2$  (B)  $\text{H}_3\text{PO}_3$  (C)  $\text{HPO}_3$  (D)  $\text{H}_3\text{PO}_4$
64. The final product of hydrolysis of  $\text{P}_4\text{O}_6$  is -  
 (A)  $\text{H}_3\text{PO}_3$  (B)  $(\text{HPO}_3)_n$  (C)  $\text{H}_4\text{P}_2\text{O}_7$  (D)  $\text{H}_3\text{P}_4\text{O}_{13}$
65. Which of the following oxyacids acts as most reducing agent–  
 (A)  $\text{H}_3\text{PO}_3$  (B)  $\text{H}_3\text{PO}_4$  (C)  $\text{H}_4\text{P}_2\text{O}_6$  (D)  $\text{H}_4\text{P}_2\text{O}_7$
66. Oxyacid of phosphorus that can reduce  $\text{AgNO}_3$  to silver is–  
 (A)  $\text{H}_3\text{PO}_4$  (B)  $\text{H}_4\text{P}_2\text{O}_7$  (C)  $\text{H}_3\text{PO}_3$  (D)  $\text{HPO}_3$
67.  $\text{P}_4\text{O}_{10}$  has short and long P–O bonds. The number of short P–O bonds in this compounds is–  
 (A) 1 (B) 2 (C) 3 (D) 4

68. A monobasic acid of phosphorus, which reduces  $\text{HgCl}_2$  to black Hg is—  
 (A) Hypophosphorus acid (B) Phosphoric acid  
 (C) Metaphosphoric acid (D) Pyrophosphoric acid
69. White  $\text{P}_4 + \text{alkali} \rightarrow \text{'X'}$   
 which of the following statement is CORRECT for 'X'  
 (A) X is  $\text{H}_3\text{PO}_3$  (B) It has one  $\text{P}=\text{O}$  and two  $\text{P}-\text{OH}$  bonds  
 (C) Its basicity is one (D) It is hypo phosphoric acid
70. Which of the following statement is CORRECT for  $\text{H}_3\text{PO}_3$ ?  
 (A) It is formed by reaction of  $\text{P}_2\text{O}_3 + \text{H}_2\text{O}$   
 (B) It is formed by reaction of  $\text{PCl}_5 + \text{H}_2\text{O}$   
 (C) It contain one  $\text{P}-\text{H}$  & one  $\text{P}-\text{O}-\text{H}$  bond  
 (D) Its basicity is 3
71.  $\text{H}_3\text{PO}_3 \xrightarrow{\Delta} \text{H}_3\text{PO}_4 + \text{X}_{(\text{g})}$   
 where 'X' contain.  
 (A) pungent smell (B) rotten egg smell  
 (C) rotten fish smell (D) greenish yellow colour
72.  $\text{AgNO}_3 + \text{H}_3\text{PO}_2 \xrightarrow{\text{H}_2\text{O}} \text{'oxy acid of P'}$   
 which of the following statement is/are CORRECT for 'oxyacid'  
 (A) Its basicity is 2. (D) It is  $\text{H}_3\text{PO}_4$ .  
 (B) It is formed by reaction of  $\text{P}_4\text{O}_{10} + \text{H}_2\text{O}$ .  
 (C) Oxidation state of central atom is +3.
73. Sodium hexametaphosphate is known as -  
 (A) Calgon (B) Permutit (C) Natalite (D) Nitrolim
74. How many  $\text{P}=\text{O}$  bonds are present in  $(\text{HPO}_3)_3$  ?  
 (A) 0 (B) 6 (C) 3 (D) 9
75. The true statement for the acids of phosphorus  $\text{H}_3\text{PO}_2$ ,  $\text{H}_3\text{PO}_3$  and  $\text{H}_3\text{PO}_4$  is.  
 (A)  $\text{H}_3\text{PO}_3$  on heating does not disproportionate  
 (B) all of them are reducing in nature  
 (C) all of them are tribasic acids  
 (D)  $\text{H}_3\text{PO}_2$  is obtained by alkaline hydrolysis of  $\text{P}_4$  (white)



76. The true statement for the acids of phosphorus  $\text{H}_3\text{PO}_2$ ,  $\text{H}_3\text{PO}_3$  and  $\text{H}_3\text{PO}_4$  is :  
(A) the order of their reducing strength is  $\text{H}_3\text{PO}_2 > \text{H}_3\text{PO}_3 > \text{H}_3\text{PO}_4$ .  
(B) the hybridisation of phosphorus is  $\text{sp}^2$  in all these.  
(C) The acidic strength order is  $\text{H}_3\text{PO}_2 > \text{H}_3\text{PO}_3 > \text{H}_3\text{PO}_4$ .  
(D) all of these.
77. Ortho phosphoric acid on heating above  $300^\circ\text{C}$  gives :  
(A) hypophosphorus acid (B) hypophosphoric acid  
(C) metaphosphoric acid (D) phosphorous acid
78. 1 mol each of  $\text{H}_3\text{PO}_2$ ,  $\text{H}_3\text{PO}_3$  and  $\text{H}_3\text{PO}_4$  will neutralise x mole of  $\text{NaOH}$ , y mol of  $\text{Ca}(\text{OH})_2$  and z mol of  $\text{Al}(\text{OH})_3$  (assuming all as strong electrolytes) respectively. x, y, z are in the ratio of :  
(A) 3 : 1.5 : 1 (B) 1 : 2 : 3 (C) 3 : 2 : 1 (D) 1 : 1 : 1
79. Which of the following salt/s of  $\text{H}_3\text{PO}_3$  exists ?  
(I)  $\text{NaH}_2\text{PO}_3$  (II)  $\text{Na}_2\text{HPO}_3$  (III)  $\text{Na}_3\text{PO}_3$   
(A) I and II only (B) I, II and III (C) II and III only (D) III only