

## P-BLOCK ELEMENTS

### VA GROUP ELEMENTS

2011

1. The oxidation state of phosphorus in cyclotrimetaphoric acid is

1. +3                      2. +5                      3. -3                      4. +2                      5. -2

2. The basicity of pyrophosphorus acid is

[Kerala CEE]

1. 2                      2. 4                      3. 1                      4. 5                      5. 3

2010

3. Which of one of the following compounds is a peroxide?

[CBSE AIPMT]

1.  $NO_2$               2.  $KO_2$               3.  $BaO_2$               4.  $MnO_2$

4. The maximum number of P – H bonds are contained in which of the following molecules?

[AMU]

1.  $H_3PO_2$               2.  $H_3PO_3$               3.  $H_3PO_4$               4.  $H_4P_2O_7$

5. The hydrolysis of  $NCl_3$  by water produces

[AMU]

1.  $NH_2OH$  and  $HOCl$                       2.  $NH_2NH_2$  and  $HCl$   
3.  $NH_4OH$  and  $HOCl$                       4.  $NH_2Cl$  and  $HOCl$

6. Ammonia, on reaction with excess of chlorine, gives

[AFMC]

1.  $NCl_3$  and  $HCl$               2.  $N_4$  and  $NH_4Cl$               3.  $NCl_3$  and  $NH_4Cl$               4.  $N_2$  and  $HCl$

7. The number of P – O bonds in  $P_4O_{10}$  is

(CPMT)

1. 16                      2. 12                      3. 8                      4. 4

8. On the heating  $NH_4NO_3$  strongly which is obtained?

[MP PMT]

1.  $NO_2$               2.  $NH_3$                       3.  $N_2$                       4.  $N_2O$

9. Nitrous oxide is

1. acidic                      2. Basic                      3. Amphoteric                      4. neutral

10. The nitrogen atom has 7 protons and 7 electrons. The nitride ion will have. [RPMT]

1. 7 protons and 10 electrons.                      2. 4 protons and 7 electrons  
3. 4 protons and 10 electrons                      4. 10 protons and 7 electrons

11. The laughing gas is [RPMT]

1. nitrogen oxide                      2. Nitric oxide                      3. Nitrogen trioxide                      4. Nitrogen pentoxide

12. Sulphuric acid reacts with  $PCl_5$  to give [Manipal]

1. thionyl chloride                      2. Sulphur monochloride  
3. sulphur chloride                      4. Sulphur tetrachloride

13. Phosphorus pentoxide is widely used as [Guj. CET]

1. bleaching agent                      2. Dehydrating agent                      3. Oxidising agent                      4. Reducing agent

14. Given are  $H_3PO_2$ ,  $H_3PO_3$ ,  $H_3PO_4$  and  $H_4P_2O_7$  Which of the above oxoacids results into two series salts? [Guj. CET]

1.  $H_3PO_2$                       2.  $H_3PO_3$                       3.  $H_3PO_4$                       4.  $H_3P_2O_7$

15. The number of  $\sigma$ -bonds in  $P_4O_{10}$  is [Harayana PMT]

1. 6                      2. 16                      3. 20                      4. 7

16. Which of the following is not correct? White phosphorus ( $P_4$ ) has. [Harayana PMT]

1. six P – P single bond                      2. four P – P single bonds.  
3. four lone pair of electrons                      4. PPP angle is  $60^\circ$

17. Gaseous product obtained on thermal decomposition of  $(NH_4)_2Cr_2O_7$  is [OJEE]

1.  $NH_3$                       2.  $N_2$                       3.  $O_2$                       4. NO



26. Products formed on heating  $Pb(NO_3)_2$  are [OJEE]

1.  $PbO, N_2, O_3$       2.  $PbO(NO_2)_2, O_2$       3.  $PbONO_2, O_2$       4.  $PbN_2, O_2$

27. The reaction of elemental  $P_4$  in aqueous NaOH gives [OJEE]

1.  $PH_3, NaH_2PO_2$       2.  $PH_3, Na_2PO_4$       3.  $NaHPO_4, Na_2PO_4$       4.  $Na_3P, Na_3PO_4$

28. One of the product of the following reaction is  $KNCO + (NH_4)_2SO_4 \xrightarrow{\Delta}$  [OJEE]

1.  $NH_4NO_3$       2.  $NH_2CONH_2$       3.  $N_2$       4.  $NO_2$

29. Atoms in  $P_4$  molecule of white phosphorus are arranged regularly in the following way

[WB JEE]

1. at the corners of a cube      2. at the corners of an octahedron  
3. at the corners of a tetrahedron      4. at the centre and corners of a tetrahedron

30. Of the following compounds the most acidic is [WB JEE]

1.  $As_2O_3$       2.  $P_2O_5$       3.  $Sb_2O_3$       4.  $Bi_2O_3$

31. Pick out the stronger reducing agent among the following oxyacids of phosphorus

[Kerala CEE]

1. hypophosphorus acid      2. phosphorus acid      3. hypophosphoric acid  
4. pyrophosphorus acid      5. phosphoric acid

32. Ammonia forms the complex ion  $[Cu(NH_3)_4]^{2+}$  with copper ions in the alkaline solutions but not in acidic solutions. What is the reason for it? [RPMT]

1. In acidic solutions hydration protects copper ions.
2. In acidic solutions protons coordinate with ammonia molecules forming  $NH_4^+$  ions and  $NH_3$  molecules are not available.
3. In alkaline solutions insoluble  $Cu(OH)_2$  is precipitated which is soluble in excess of any alkali.
4. Copper hydroxide is an amphoteric substance.

33. Which of the following oxides of nitrogen is the anhydride of nitrous acid? [AFMC]

1. NO
2.  $N_2O_3$
3.  $N_2O_4$
4.  $N_2O_5$

34. Assertion  $H_3PO_3$  is a dibasic acid. Reason There are two H-atoms directly attached to P.

[AIIMS]

1. Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
2. Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
3. Assertion is true but Reason is false.
4. Both Assertion and Reason are false.

35. Which of the following is the correct order of increasing enthalpy of vaporization?

[Kerala CEE]

1.  $NH_3 < PH_3 < AsH_3$
2.  $AsH_3 < PH_3 < NH_3$
3.  $PH_3 < AsH_3 < NH_3$
4.  $NH_3 < AsH_3 < PH_3$
5.  $AsH_3 < NH_3 < PH_3$

36. Sodium pyrophosphate is represented by which of the following formula? [Manipal]

1.  $Na_2P_2O_4$
2.  $Na_4P_2O_5$
3.  $Na_4P_2O_7$
4.  $Na_4P_2O_5$

37. Which of the following oxide of nitrogen is most thermally stable?

1.  $N_2O_5$
2.  $N_2O$
3. NO
4.  $N_2O_3$

38. The correct formula of salt formed by the neutralization of hypophosphorus acid with NaOH is [Guj.CET]
1.  $Na_3PO_3$       2.  $Na_3PO_2$       3.  $Na_3HPO_2$       4.  $NaH_2PO_2$
39. Which of the following has the highest proton affinity? [Guj. CET]
1. Arsine ( $AsH_3$ )      2. Stibine ( $SbH_3$ )      3. Ammonia ( $NH_3$ )      4. Phosphine ( $PH_3$ )
40. Which of the following acts as a pickling agent? [CPMT]
1.  $HNO_3$       2. HCl      3.  $H_2SO_4$       4.  $HNO_2$
41. Iron is dropped in dil.  $HNO_3$ , it gives
1. ferric nitrate      2. ferric nitrate and  $NO_2$   
3. ferrous nitrate and ammonium nitrate      4. ferrous nitrate and nitric oxide
42. When tin is treated with concentrated acid [AMU]
1. it is converted into stannous nitrate      2. it is converted into stannic nitrate  
3. it is converted into metastannic acid      4. it becomes passive
43.  $CaCN_2 + C$  is called as
1. urea      2. Thomas slag      3. nitrolim      4. triple superphosphate
44. Which of the following metals, Fe, Zn, Pb, Ag and Pt, do not give a metal nitrate on treatment with concentrated  $HNO_3$ ?
1. Fe and Zn      2. Fe and Pt      3. Pb, Ag and Pt      4. Fe, Ag and Pt      5. Fe, Zn and
45. The decreasing order of boiling points of the following hydrides. [Kerala CEE]
- A)  $NH_3$       B)  $PH_3$       C)  $AsH_3$       D)  $SbH_3$       E)  $H_2O$
1. (E) > (D) > (A) > (C) > (B)      2. (E) > (A) > (B) > (C) > (D)  
3. (B) > (D) > (C) > (A) > (E)      4. (D) > (C) > (A) > (B) > (E)  
5. (E) > (D) > (C) > (B) > (A)

46. Pnictogens are the elements of group [MHT CET]  
1. 15                      2. 13                      3. VIII                      4. zero
47. As the number of – OH groups increases in hypophosphorus acid, phosphorus acid and phosphoric acid, the acidic strength [MHT CET]  
1. increases                      2. decreases  
3. remain nearly same                      4. remain appropriately same
48. Thomas slag is  
1.  $Ca_3(PO_4)_2 \cdot 2H_2O$                       2.  $Ca_3(PO_4)_2 \cdot CaSiO_3$   
3.  $MgSiO_3$                       4.  $CaSiO_3$

## 2005

49. What is the correct relationship between the  $pH_s$  of isomolar solutions of sodium oxide ( $pH_1$ ), sodium sulphide ( $pH_2$ ), sodium selenide ( $pH_3$ ) and sodium telluride ( $pH_4$ )? [CBSE AIME]  
1.  $pH_1 > pH_2 \approx pH_3 > pH_4$                       2.  $pH_1 < pH_2 < pH_3 < pH_4$   
3.  $pH_1 < pH_2 < pH_3 \approx pH_4$                       4.  $pH_1 > pH_2 > pH_3 > pH_4$
50. A colourless gas with the smell of rotten fish is [AFMC]  
1.  $H_2S$                       2.  $PH_4$                       3.  $SO_2$                       4. None of these
51. Nausadsr is  
1.  $NH_4NO_3$                       2.  $NH_4Cl$                       3.  $(NH_4)_2SO_4$                       4.  $NH_4OH$
52. When plants and animals decay, the organic nitrogen is converted into inorganic nitrogen. The inorganic nitrogen is in the form of  
1. ammonia                      2. elements of nitrogen  
3. nitrates                      4. nitrides

53. Carbogen is a mixture of

1.  $CO_2 + N_2$       2.  $CO + O_2$       3.  $CO_2 + O_2$       4.  $C + H_2 + N_2$

54. Which of the following oxides of nitrogen is solid?

1.  $NO_2$       2.  $N_2O$       3.  $N_2O_3$       4.  $N_2O_5$

55. The statement true for  $N_3^-$  is

1. it has non linear structure      2. it is called pseudohalgen  
3. the formal oxidation state of nitrogen in this anion is +1.  
4. it is isoelectronic with  $N_2O$

56. The maximum concentration of nitrogen is present in [AFMC]

1. nitrolim      2. calcium ammonium nitrate  
3. ammonium sulphate      4. urea

57. The true statement for the acids of phosphorus.  $H_3PO_2$ ,  $H_3PO_3$  and  $H_3PO_4$  is [AIIMS]

1. the order of their acidity is  $H_3PO_4 > H_3PO_2 > H_3PO_3$   
2. all of them are reducing in nature.      3. all of them are tribasic acids  
4. the geometry of phosphorus is tetrahedral in all the three.

58. Assertion  $NF_3$  is a weaker ligand than  $N(CH_3)_3$ . Reason  $NF_3$  ionizes to give  $F^-$  ions in aqueous solution. [AIIMS]

1. Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
2. Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
3. Assertion is true but Reason is false.  
4. Both Assertion and Reason are false.



59. Mg on heating to redness in an atmosphere of  $N_2$  and then on treating with  $H_2O$  gives

[AMU]

1.  $NH_3$                       2.  $N_2$                       3.  $PH_3$                       4. Mgo

60.  $PI_3$  upon hydrolysis gives

1. monobasic acid and dibasic acid                      2. monobasic and tribasic acid  
3. monobasic and and a salt                      4. diabasic acid and tribasic acid

61. Which of the following pentafluorides can't be formed?

[J & K CET]

1.  $PF_5$                       2.  $AsF_5$                       3.  $SbF_5$                       4.  $BiF_5$

### VA GROUP ELEMENTS

#### KEY

1) 2	2) 1	3) 3	4) 1	5) 3	6) 1	7) 1	8) 4	9) 4	10) 1
11) 1	12) 3	13) 2	14) 2	15) 2	16) 2	17) 2	18) 3	19) 3	20) 1
21) 2	22) 2	23) 3	24) 4	25) 2	26) 3	27) 1	28) 2	29) 3	30) 2
31) 1	32) 2	33) 2	34) 3	35) 3	36) 3	37) 3	38) 4	39) 3	40) 3
41) 3	42) 3	43) 3	44) 2	45) 1	46) 1	47) 3	48) 2	49) 4	50) 2
51) 2	52) 1	53) 3	54) 3	55) 4	56) 4	57) 4	58) 3	59) 1	60) 1
61) 4									

## VA GROUP ELEMENTS

### SOLUTIONS

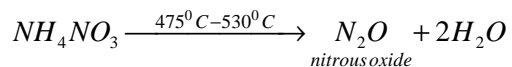
1. Phosphorus is + 5 oxidation state

2. Pyrophosphorus acid  $H_4P_2O_5$

5.  $2NCl_3 + 8H_2O \rightarrow 2NH_4OH + 6HOCl$

6.  $NH_3 + 3Cl_2 \rightarrow NCl_3 + 3HCl$   
excess (explosive)

8. On heating ammonium nitrate, nitrous oxide or nitrogen (I) oxide is formed.



9. Nitrous oxide is a neutral gas.

10. In  $N^{3-}$  (nitride) ion,

No. of proton = atomic number = 7

and no. of electron = atomic number  $\pm$  charge on the ion.

$\therefore$  No. of electron =  $7 + 3 = 10$

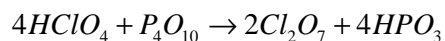
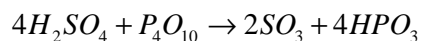
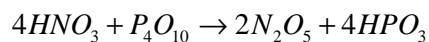
Hence,  $N^{3-}$  ion have 7 protons and 10 electrons.

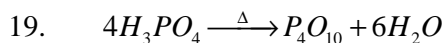
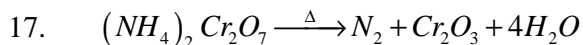
11. Nitrogen oxide (nitrous oxide,  $N_2O$ ) is known as laughing gas

12.  $H_2SO_4 + 2PCl_5 \rightarrow SO_2Cl_2 + 2POCl_3 + 2HCl$   
sulphuryl chloride

13. Phosphorus pentoxide acts as a powerful dehydrating agent. It dehydrates to

$HNO_3$  to  $N_2O_5$ ,  $H_2SO_4$  to  $SO_3$ ,  $HClO_4$  to  $Cl_2O_7$  etc.

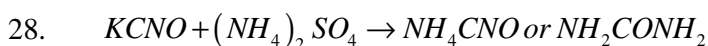
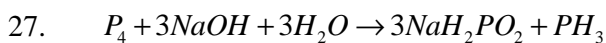
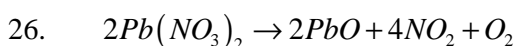




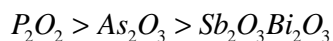
22. Black phosphorus has a highly polymeric layer type structure. Hence thermodynamically, it is the most stable form of phosphorus.

24.  $PCl_5$ , on hydrolysis, with insufficient quantity of water, gives  $POCl_3$  while with excess of water gives phosphoric acid,  $(H_3PO_4)$ .

25.  $PbO_2$  being a powerful oxidising agent, liberates  $O_2$ , when treated with conc.  $HNO_3$ .



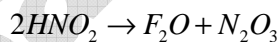
30. Acidic strength of oxides decreases along a group from upward to downward. Thus, the order of acidic strength is



31. Among the given oxyacids of phosphorus, hypophosphorus acid is the strongest reducing agent because in it oxidation state of phosphorus is least (i.e., + 1) and it contains two hydrogen atoms linked directly to the phosphorus.

32. In acidic solutions, the pair of electron present with nitrogen will not be available to be denoted as  $H^+$  will consume that one.

33. Nitrous acids gives dinitrogen trioxide on dehydration.



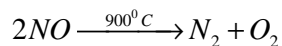
35. Order of increasing enthalpy of vaporization is



The enthalpy  $NH_3$  is higher due to the H-bonding.

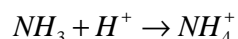
36. Sodium pyrophosphate is represented by  $Na_4P_2O_7$ . It is sodium salt of pyrophosphoric acid ( $H_4P_2O_7$ ), which may be phosphoric acid ( $H_3PO_4$ ), eliminating one molecule of  $H_2O$

37. Nitric oxide (NO) is decomposed at  $900^{\circ}C$ . So it is the most thermally stable oxide of nitrogen.



38.  $NaOH + H_3PO_2 \rightarrow NaH_2PO_2 + H_2O$   
sodium hydroxide      hypophosphorus acid

39. Ammonia has the highest proton affinity.

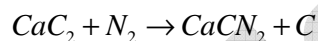


40.  $H_2SO_4$  acts as a pickling agent. Pickling is an industrial process for removing layers of basic oxides from metals like Fe and Cu before electropolating, enamelling galvanizing and soldering.

41.  $4Fe + 10HNO_3 \rightarrow 4Fe(NO_3)_2 + NH_4NO_3 + 3H_2O$   
dil.

42.  $Sn + 4HNO_3 \rightarrow H_2SnO_3 + 4NO_2 + H_2O$   
metastannic acid

43. The mixture of calcium cyanamide and carbon is called nitrolim. It is a fertilizer.



44. Fe and Pt metals do not give a metal nitrate on treatment with concentrated  $HNO_3$  because Pt has no action with  $HNO_3$  of any concentration and Fe becomes passive on treatment with oxide layer on the metal surface.

45. The decreasing order of boiling points of  $NH_3$ ,  $PH_3$ ,  $AsH_3$ ,  $SbH_3$  and  $H_2O$  is as:



The boiling point generally increases as the molecular mass increases, but in  $NH_3$  and  $H_2O$  the boiling point increases also due to the presence of hydrogen bonding, hence they have higher boiling points.

46. Nitrogen ( ${}_7N$ ), phosphorus ( ${}_{15}P$ ), arsenic ( ${}_{33}As$ ), antimony ( ${}_{51}Sb$ ) and bismuth ( ${}_{83}Bi$ ) constitute group 15 or VA of the Periodic Table. Collectively, these elements are called pnictogens and their compounds are pnictides.
47.  $H_3PO_2$  has 1 – OH group,  $H_3PO_3$  has 2 – OH groups and  $H_3PO_4$  has 3 – OH groups. In these acids although the number of acidic hydrogens does not increase very much. This is due to the fact that the number of unprotonated oxygen, responsible for the enhancement of acidity due to inductive effect, remains the same with the result that dissociation constants also remain nearly same.
48. Thomas slag or phosphatic slag is a mixture of calcium phosphate and calcium silicate  $[Ca_3(PO_4)_2 \cdot CaSiO_3]$ . It is used as manure.
50.  $H_2S$  has smell of rotten eggs and is produced during decay of organic matter.  $SO_2$  has pungent odour of burning sulphur while phosphine ( $PH_3$ ) has an odour of rotten fish.
51.  $NH_4Cl$  is called nessler. It is used in dry cell.
52. The inorganic nitrogen exists in the form of ammonia, which may be lost as gas to atmosphere, be acted upon by nitrifying bacteria, or may be taken up directly by plants.
53. Carbogen is a mixture of 90% oxygen and 10% carbon dioxide.
58. It is a correct statement that  $NF_3$  is a weaker ligand than  $N(CH_3)_3$ . The reason is that fluorine is highly electronegative, hence, it withdraws electrons from N atom. Hence, the lone pair of N atom cannot be ligated, while  $N(CH_3)_3$  is a strong ligand because  $CH_3$  is an electron-releasing group which increases electron density on N atom.
59.  $3Mg + N_2 \rightarrow Mg_3N_2$   
 $Mg_3N_2 + 6H_2O \rightarrow 3Mg(OH)_2 + 2NH_3 \uparrow$
60.  $PI_3 + 3H_2O \rightarrow H_3PO_3 + 3HI$   
(dibasic) (monobasic)
61. Bismuth (Bi) does not form pentafluorides due to inert pair effect, i.e., reluctance of the 6s-electrons of bismuth to participate in bond formation.