

Elements and Compounds of Group 15 and 16

1. The order of the oxidation state of the phosphorus atom in H_3PO_2 , H_3PO_4 , H_3PO_3 and $\text{H}_4\text{P}_2\text{O}_6$ is

(2017)

(a) $\text{H}_3\text{PO}_4 > \text{H}_3\text{PO}_2 > \text{H}_3\text{PO}_3 > \text{H}_4\text{P}_2\text{O}_6$

(b) $\text{H}_3\text{PO}_4 > \text{H}_4\text{P}_2\text{O}_6 > \text{H}_3\text{PO}_3 > \text{H}_3\text{PO}_2$

(c) $\text{H}_3\text{PO}_2 > \text{H}_3\text{PO}_3 > \text{H}_4\text{P}_2\text{O}_6 > \text{H}_3\text{PO}_4$

(d) $\text{H}_3\text{PO}_3 > \text{H}_3\text{PO}_2 > \text{H}_3\text{PO}_4 > \text{H}_4\text{P}_2\text{O}_6$

2. The species in which the N-atom is in a state of sp hybridisation is

(2016)

(a) NO_2^-

(b) NO_3^-

(c) NO_2

(d) NO_2^+

3. The pair in which phosphorus atoms have a formal oxidation state of +3 is

(2016)

(a) pyrophosphorous and hypophosphoric acids

(b) orthophosphorous and hypophosphoric acids

(c) pyrophosphorous and pyrophosphoric acids

(d) orthophosphorous and pyrophosphorous acids

4. The product formed in the reaction of SOCl_2 with white phosphorus is

(2014)

(a) PCl_3

(b) SO_2Cl_2

(c) SCl_2

(d) POCl_3

5. Which of the following properties is not shown by NO?

(2014)

- (a) It is paramagnetic in liquid state
- (b) It is a neutral oxide
- (c) It combines with oxygen to form nitrogen dioxide
- (d) Its bond order is 2.5

6. Concentrated nitric acid upon long standing, turns yellow-brown due to the formation of

- (a) NO
- (b) NO₂
- (c) N₂O
- (d) N₂O₄

7. Which of the following is the wrong statement ?

(2013)

- (a) ONCl and ONO⁻ are not isoelectric
- (b) O₃ molecule is bent
- (c) Ozone is violet-black in solid state
- (d) Ozone is diamagnetic gas

8. The reaction of white phosphorus with aqueous NaOH gives phosphine along with another phosphorus containing compound. The reaction type, the oxidation states of phosphorus in phosphine and the other product respectively are

(2012)

- (a) redox reaction, - 3 and - 5
- (b) redox reaction, 3 and + 5
- (c) disproportionation reaction, - 3 and + 5
- (d) disproportionation reaction, - 3 and + 3

9. Which ordering of compounds is according to the decreasing order of the oxidation state of nitrogen?

(2012)

(a) HNO_3 , NO , NH_4Cl , N_2

(b) HNO_3 , NO , N_2 , NH_4Cl

(c) HNO_3 , NH_4Cl , NO , N_2

(d) NO , HNO_3 , NH_4Cl , N_2

10. Extra pure N_2 can be obtained by heating

(2011)

(a) NH_3 with CuO

(b) NH_4NO_3

(c) $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$

(d) $\text{Ba}(\text{N}_3)_2$

11. The reaction of P_4 with X leads selectively to P_4O_6 . The X is

(2009)

(a) dry O_2

(b) a mixture of O_2 and N_2

(c) moist O_2

(d) O_2 in the presence of aqueous NaOH

12. The percentage of p-character in the orbitals forming P_4

(2007)

(a) 25

(b) 33

(c) 50

(d) 75

13. Which of the following is not oxidised by O_3 ?

(2005)

(a) KI

(b) FeSO_4

(c) KMnO_4

(d) K_2MnO_4

14. Which gas is evolved when PbO_2 is treated with concentrated HNO_3 ? **(2005)**

(a) NO_2

(b) O_2

(c) N_2

(d) N_2O

15. A pale blue liquid obtained by equimolar mixture of two gases at -30°C is **(2005)**

(a) N_2O

(b) N_2O_3

(c) N_2O_4

(d) N_2O_5

16. Which of the following isomers of phosphorus is thermodynamically most stable? **(2005)**

(a) Red

(b) White

(c) Black

(d) Yellow

17. Which of the following has —O—O— linkage? **(2004)**

(a) $\text{H}_2\text{S}_2\text{O}_6$

(b) $\text{H}_2\text{S}_2\text{O}_8$

(c) $\text{H}_2\text{S}_2\text{O}_3$

(d) $\text{H}_2\text{S}_4\text{O}_6$

18. For H_3PO_3 and H_3PO_4 , the correct choice is **(2003)**

(a) H_3PO_3 is dibasic and reducing

(b) H_3PO_3 is dibasic and non-reducing

(c) H_3PO_4 is tribasic and reducing

(d) H_3PO_3 is tribasic and non-reducing

19. Polyphosphates are used as water softening agents because they

(2002)

(a) form soluble complexes with anionic species

(b) precipitate anionic species

(c) form soluble complexes with cationic species

(d) precipitate cationic species

20. The number of S—S bonds in sulphur trioxide trimer, (S_3O_9) is

(2001)

(a) three

(b) two

(c) one

(d) zero

21. Ammonia can be dried by

(2000)

(a) conc. H_2SO_4

(b) P_4O_{10}

(c) CaO

(d) anhydrous CaCl_2

22. Amongst H_2O , H_2S , H_2Se and H_2Te , the one with the highest boiling point is

(2000)

(a) H_2O because of hydrogen bonding

(b) H_2Te because of higher molecular weight

(c) H_2S because of hydrogen bonding

(d) H_2Se because of lower molecular weight

23. The correct order of acidic strength is **(2000)**

- (a) $\text{Cl}_2\text{O}_7 > \text{SO}_2 > \text{P}_4\text{O}_{10}$
- (b) $\text{CO}_2 > \text{N}_2\text{O}_5 > \text{SO}_3$
- (c) $\text{Na}_2\text{O} > \text{MgO} > \text{Al}_2\text{O}_3$
- (d) $\text{K}_2\text{O} > \text{CaO} > \text{MgO}$

24. The number of P—O—P bonds in cyclic metaphosphoric acid is **(2000)**

- (a) Zero
- (b) two
- (c) three
- (d) four

25. One mole of calcium phosphide on reaction with excess water gives **(1999)**

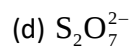
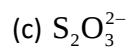
- (a) one mole of phosphine
- (b) two moles of phosphoric acid
- (c) two moles of phosphine
- (d) one mole of phosphorus penta oxide

26. Sodium thiosulphate is prepared by **(1996)**

- (a) reducing Na_2SO_4 solution with H_2S
- (b) boiling Na_2SO_3 solution with S in alkaline medium
- (c) neutralising $\text{H}_2\text{S}_2\text{O}_3$ solution with NaOH
- (d) boiling Na_2SO_3 solution with S in acidic medium

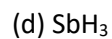
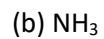
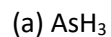
27. There is no S—S bond in **(1991)**

- (a) $\text{S}_2\text{O}_2^{2-}$
- (b) $\text{S}_2\text{O}_5^{2-}$



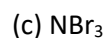
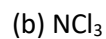
28. Which one of the following is the strongest base?

(1989)



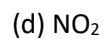
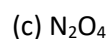
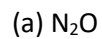
29. Amongst the trihalides of nitrogen, which one is least basic?

(1987)



30. Which of the following oxides of nitrogen is a coloured gas?

(1987)



31. The bonds present in N_2O_5 are

(1986)

(a) only ionic

(b) covalent and coordinate

(c) only covalent

(d) covalent and ionic

32. A gas that cannot be collected over water is **(1985)**

- (a) N_2
- (b) O_2
- (c) SO_2
- (d) PH_3

33. HNO_3 on dehydration with phosphorus pentoxide yields **(1978)**

- (a) N_2O
- (b) N_2O_5
- (c) NO_2
- (d) N_2O_3

34. Which of the following is incorrect statement? **(1978)**

- (a) NO is heavier than O_2
- (b) The formula of heavy water is D_2O
- (c) N_2 diffuses faster than oxygen through an orifice
- (d) NH_3 can be used as a refrigerant

35. The nitrogen containing compound produced in the reaction of HNO_3 with P_4O_{10} **(2016)**

- (a) can also be prepared by reaction of P_4 and HNO_3
- (b) is diamagnetic
- (c) contains one N—O bond
- (d) reacts with Hg metal producing a yellow coloured gas

36. The incorrect statement about O_3 is/are **(2013)**

- (a) O—O bond lengths are equal
- (b) thermal decomposition of O_3 is endothermic

(c) O_2 is diamagnetic in nature

(d) O_2 has a bent structure

37. The nitrogen oxides that do not contain(s) N—N bond(s) is (2009)

(a) N_2O

(b) N_2O_4

(c) N_4O_4

(d) N_2O_5

38. Ammonia on reaction with hypochlorite anion, can form (1999)

(a) NO

(b) NH_4Cl

(c) N_2H_4

(d) HNO_2

39. White phosphorus (P_4) has (1998)

(a) six P—P single bonds

(b) four P—P single bonds

(c) five lone pairs of electrons

(d) P—P—P angle of 90°

40. Nitrogen (I) oxide is produced by (1989)

(a) thermal decomposition of $NaNO_3$

(b) disproportionation of N_2O_4

(c) thermal decomposition of NH_4NO_2

(d) interaction of hydroxylamine and nitrous acid

Assertion and Reason

Read the following questions and answer as per the direction given below:

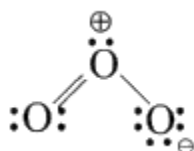
- (a) Statement I is correct. Statement II is correct. Statement II is the correct explanation of Statement I
- (b) Statement I is correct, Statement II is correct, Statement II is not the correct explanation of Statement I
- (c) Statement I is correct, Statement II is incorrect
- (d) Statement I is incorrect, Statement II is correct

41. **Statement I** Nitrogen and oxygen are the main components in the atmosphere but these do not react to form oxides of nitrogen.

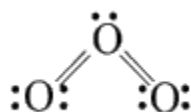
Statement II The reaction between nitrogen and oxygen requires high temperature. (1998)

Solution: a) Both Statement I and Statement II are true and Statement II is correct explanation of Statement I.

42. **Statement I** The electronic structure of O_3 is



Statement II The following structure is not allowed because octet around O cannot be expanded. (1998)

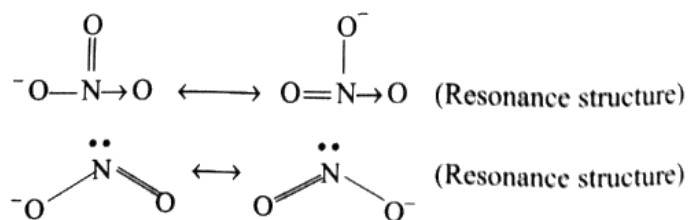


Solution: a) Both Statement I and Statement II are true and Statement II is correct explanation of Statement I.

43. **Statement I** HNO_3 is a stronger acid than HNO_2 .

Statement II In HNO_3 , there are two nitrogen to oxygen bonds whereas in HNO_2 there is only one. (1998)

Solution: a) Both Statement I and Statement II are true and Statement II explains the Statement I appropriately. Nitrate ion (NO_3^-) is more stable than nitrite ion :



44. The lead chamber process involves oxidation of SO_2 by atomic oxygen under the influence of which catalyst? **(1992)**

- (a) CO_2
- (b) NO_2
- (c) NO_4
- (d) CO_4

45. In P_4O_{10} the number of oxygen atoms bonded to each phosphorus atom is **(1992)**

- (a) 1
- (b) 6
- (c) 4
- (d) 2

46. The basicity of phosphorus acid (H_3PO_3) is **(1990)**

- (a) Two
- (b) Three
- (c) Four
- (d) Five

47. Which phosphorus is reactive because of its highly strained tetrahedral structure? **(1987)**

- (a) Green
- (b) Blue

(c) Red

(d) White

48. Of the following the most acidic is

(a) H_3PO_4

(b) H_3AsO_4

(c) H_3SbO_4

(d) H_3BiO_4

49. The mixed anhydride of nitrous and nitric acid is

(a) N_2O

(b) NO_2

(c) NO

(d) N_2O_5

50. Copper reacts with dil. HNO_3 to form a nitrate and

(a) NO_2

(b) NO

(c) N_2O_3

(d) N_2O_5

51. When silver nitrate is heated, the products are

(a) Oxygen and metal nitrate

(b) Nitrogen dioxide, O_2 and metallic oxide

(c) Nitrogen dioxide, O_2 and metal

(d) Nitrogen dioxide and metal oxide

52. The strongest acid is

(a) HNO_2

(b) HNO_3

(c) $\text{H}_2\text{N}_2\text{O}_2$

(d) $\text{H}_4\text{N}_2\text{O}_4$

53. In which of the following states nitric oxide is paramagnetic?

(a) Solid

(b) Liquid

(c) Gaseous

(d) It is diamagnetic in all the three states

54. Nitrogen reacts with calcium and carbon or when N_2 gas is passed over heated calcium carbide (at 1070 K) it gives _____ which is an important fertiliser marketed under the name Nitrolim

(a) Calcium nitrate

(b) Calcium cyanide

(c) Calcium cyanamide

(d) Calcium nitride

55. Catalytic oxidation of NH_3 (passing a mixture of NH_3 and air over heated Pt gauze) gives

(a) NO

(b) N_2O

(c) N_2O_3

(d) N_2O_5

56. Ordinary strong solution of HCl , HNO_3 and H_2SO_4 contains roughly

(a) 1/5, 2/3 and 3/3 fractions of pure acid and water respectively

(b) 2/3, 1/5 and 3/3 fractions of pure acid and water respectively

(c) 2/3, 3/3 and 1/5 fractions. of pure acid and water respectively

(d) none

57. Hypophosphorous acid is

(a) A tribasic acid

(b) A dibasic acid

(c) A monobasic acid

(d) Neutral

58. Which of the following halide does not hydrolyse?

(a) SbCl_3

(b) AsCl_3

(c) PCl_3

(d) NF_3

59. The structure of phosphide ion is similar to that of

(a) Nitride ion

(b) Chloride ion

(c) Fluoride ion

(d) Sodium ion

60. Basicity of H_3PO_4 and H_3PO_3 are

(a) 3, 3

(b) 3, 2

(c) 2, 3

(d) 2, 2

61. The crown structure is possessed by

- (a) Phosphorous
- (b) Cyclo-octa ring of Sulphur
- (c) Cyclic trimer of SO_3
- (d) Cyclic tetrameric form of SeO_3

62. Which one of the following is strongest acid?

- (a) H_2S
- (b) H_2Se
- (c) H_2O
- (d) H_2Te

63. Which of the following is chalcogen?

- (a) O
- (b) S
- (c) Se
- (d) All

64. Which of the following compounds does not evolve oxygen when heated alone ?

- (a) KClO_3
- (b) KMnO_4
- (c) NH_4NO_2
- (d) KNO_3

65. Basicity of sulphurous acid and sulphuric acid are

- (a) 2, 2
- (b) 1, 2
- (c) 2, 1
- (d) 1, 1

66. When oxygen is passed through a solution of Na_2SO_3 , we get

- (a) Na_2S
- (b) Na_2SO_4
- (c) NaHSO_4
- (d) NaH

67. Structure of TeCl_4 is

- (a) Octahedral
- (b) Square planar
- (c) Trigonal bipyramid
- (d) Tetrahedral

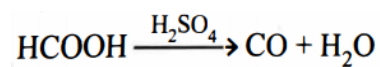
68. Which of the following is not known?

- (a) SF_6
- (b) SCl_6
- (c) SF_4
- (d) SCl_4

69. High density and low volatility H_2SO_4 is due to

- (a) Strong bonds
- (b) van der Waals force
- (c) Hydrogen bonding
- (d) None

70. In the following reaction, H_2SO_4 acts as



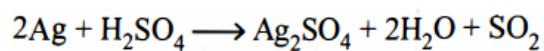
- (a) Dehydrating agent

- (b) Oxidising agent
- (c) Reducing agent
- (d) All

71. Oxalic acid when heated with cone. H_2SO_4 it gives out

- (a) H_2O and CO_2
- (b) Oxalic sulphate
- (c) CO_2 and H_2S
- (d) CO and CO_2

72. In the following reaction, H_2SO_4 acts as



- (a) Reducing agent
- (b) Oxidising agent
- (c) Catalytic agent
- (d) Dehydration agent

73. A boy accidentally splashes a few drops of cone. H_2SO_4 on his cotton shirt and splashed part blackens and holes appears. This is because the sulphuric acid

- (a) Heats up the cotton so that it burns
- (b) Dehydrates the cotton
- (c) Causes the cotton to react with oxygen in air
- (d) Removes the elements of water from cotton

74. Hypo is used in photography because of its

- (a) Complexing ability
- (b) Solubility in water
- (c) Reducing behaviour
- (d) Sensitivity to light

75. Caro's and Marshall's acid does not react with

- (a) S
- (b) KMnO_4
- (c) KI
- (d) H_2O

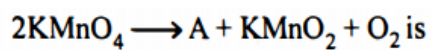
76. Sulphur dioxide is obtained by the action of dilute H_2SO_4 on:

- (a) Copper turning
- (b) Sodium sulphate
- (c) Sodium sulphite
- (d) Sodium sulphide

77. The ratio of the gases obtained on dehydration of HCOOH and $\text{H}_2\text{C}_2\text{O}_4$ by cone. H_2SO_4 is

- (a) 2 : 1
- (b) 1 : 2
- (c) 3 : 1
- (d) 1: 3

78. The product A in the following reaction:



- (a) $\text{K}_2\text{Mn}_2\text{O}_7$
- (b) K_2MnO_4
- (c) K_2O
- (d) K_2O_2

79. Anhydride of sulphuric acid is

- (a) SO_2

- (b) SO_3
- (c) $\text{H}_2\text{S}_2\text{O}_3$
- (d) H_2SO_3

80. When SO_2 is passed through a solution of H_2S in water:

- (a) Sulphuric acid is formed
- (b) A clear solution is formed
- (c) Sulphur is precipitated
- (d) No change is observed

81. Silver chloride dissolves in excess of NH_4OH . The cation present in solution is

- (a) $[\text{Ag}(\text{NH}_3)]^\oplus$
- (b) $[\text{Ag}(\text{NH}_3)_4]^\oplus$
- (c) $[\text{Ag}(\text{NH}_3)_2]^\oplus$
- (d) $[\text{Ag}(\text{NH}_3)_6]^\oplus$

82. When NH_4OH is added to copper sulphate solution, blue colour is obtained due to formation of

- (a) $\text{Cu}(\text{NH}_3)_4\text{SO}_4$
- (b) $\text{Cu}(\text{NH}_3\text{SO}_4)_2$
- (c) $\text{Cu}(\text{OH})_2$
- (d) CuO

83. A certain element forms a solid oxide which dissolves in water to form an acidic solution. The element is

- (a) Na
- (b) Mg
- (c) S

(d) P

84. A colourless gas X forms a brown coloured gas when mixed with air. The gas X is

(a) N_2O

(b) NO

(c) NH_3

(d) NO_2

85. The number of P- O-P and P-OH bonds present respectively in pyrophosphoric acid molecule are

(a) 2, 3

(b) 1, 8

(c) 1, 4

(d) 1, 2

86. When ammonia is heated with CO_2 under pressure, the product is

(a) $(\text{NH}_4)_2\text{CO}_3$

(b) NH_2CONH_2

(c) $\text{NH}_2\text{COONH}_4$

(d) NH_4HCO_3

87. Phosphorus is used in

(a) Rubber industry

(b) Cement industry

(c) Photography

(d) Match industry

88. When phosphine is bubbled through a solution of nitrate, _____ is precipitated.

(a) Silver

(b) Silver phosphide

(c) Silver oxide

(d) None of these

89. When orthophosphoric acid is heated at 240°C , the main product formed is

(a) H_3PO_3

(b) H_3PO_2

(c) HPO_3

(d) $\text{H}_4\text{P}_2\text{O}_7$

90. When treated with nitric acid which of the following liberates hydrogen?

(a) Zinc

(b) Copper

(c) Magnesium

(d) Mercury

91. White phosphorus reacts with caustic soda. The products are PH_3 and NaH_2PO_2 . This reaction is an example of

(a) Oxidation

(b) Reduction

(c) Neutralisation

(d) Disproportionation

92. Which one of the acids is a di basic acid?

(a) H_3PO_3

(b) H_3PO_2

(c) HPO_3

(d) H_3PO_4

93. Which of the following solutions does not change its colour on passing ozone through it?

- (a) starch iodine solution
- (b) alcoholic solution of benzidine
- (c) acidic solution of $\text{K}_2\text{Cr}_2\text{O}_7$
- (d) Acidified solution of FeSO_4

94. Hydrolysis of one mole of peroxydisulphuric acid produces

- (a) Two moles of sulphuric acid
- (b) Two moles of peroxymonosulphuric acid
- (c) One mole of sulphuric acid and one mole of peroxymonosulphuric acid
- (d) One mole of sulphuric acid, one mole of peroxymonosulphuric acid and one mole of hydrogen peroxide

95. When an inorganic compound reacts with SO_2 in aqueous medium produces (A). (A) on reaction with Na_2CO_3 gives the compound (B) which with sulphur gives a substance (C) used in photography. The compound (C) is

- (a) $\text{Na}_2\text{S}_2\text{O}_3$
- (b) Na_2SO_4
- (c) Na_2S
- (d) $\text{Na}_2\text{S}_2\text{O}_7$

96. Identify the correct sequence of increasing number of π -bonds in structures of the following molecules.

(I) $\text{H}_2\text{S}_2\text{O}_6$ (II) H_2SO_3 (III) $\text{H}_2\text{S}_2\text{O}_5$

- (a) I, II, III
- (b) II, III, I
- (c) II, I, III
- (d) I, III, II

97. Sulphur reacts with chlorine in 1: 2 ratio and forms (X). (X) on hydrolysis gives a sulphur compound (Y). What is the hybridised state of central atom in the anion of (Y)?

- (a) sp
- (b) sp^3
- (c) sp^2
- (d) sp^3d

98. Which gas is used to improve the atmosphere of the crowded places?

- (a) H_2
- (b) O_2
- (c) O_3
- (d) N_2O

99. In NO_3^- ion, the number of bond pair and lone pair of electrons on nitrogen atoms are

- (a) 2, 2
- (b) 3, 1
- (c) 1, 3
- (d) 4, 0

100. H_3BO_3 is

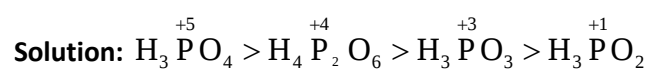
- (a) monobasic and weak Lewis acid
- (b) monobasic and weak Bronsted acid
- (c) monobasic and strong Lewis acid
- (d) tribasic and weak Bronsted acid

Answer Keys:

1. b	2. d	3. b	4. a	5. a	6. b	7. c	8. c	9. b	10. d
11. d	12. b	13. d	14. c	15. b	16. b	17. c	18. b	19. a	20. c
21. d	22. c	23. a	24. c	25. c	26. b	27. d	28. b	29. a	30. d
31. b	32. c	33. b	34. a	35. b	36. b	37. d	38. c	39. a	40. d
41. b	42. c	43. a	44. d	45. a	46. b	47. b	48. c	49. b	50. c
51. c	52. a	53. a	54. c	55. d	56. a	57. b	58. b	59. d	60. d
61. c	62. a	63. b	64. c	65. b	66. b	67. c	68. a	69. d	70. b
71. d	72. a	73. b	74. c	75. b	76. b	77. b	78. c	79. a	80. d
81. b	82. c	83. b	84. d	85. b	86. d	87. c	88. d	89. a	90. c
91. c	92. a	93. b	94. b	95. c	96. d	97. a	98. c	99. d	100. a

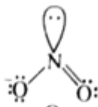
Solutions:

1.



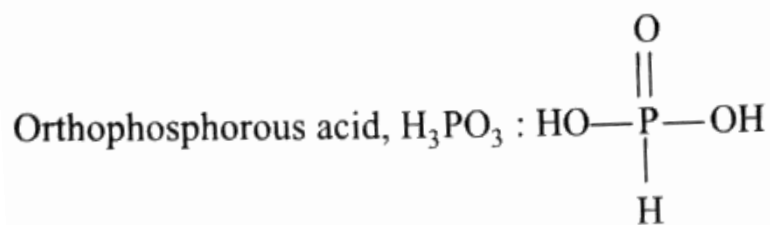
2.

Solution:

Species	Hybridisation
	sp^2
	sp^2
	sp^2
$O=N^+=O$	sp

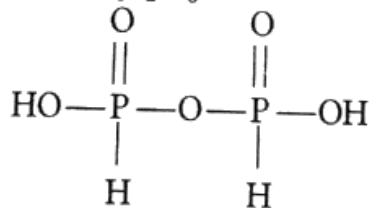
3.

Solution:



$$H_3\overset{x}{P}O_3 = 3 + x + 3(-2) = 0 \text{ or } x = +3$$

Pyrophosphorous acid, $H_4P_2O_5$:



$$H_4\overset{x}{P}_2O_5 = 4 + 2x + 5(-2) = 0$$

$$4 + 2x - 10 = 0, x = +3$$

4.

Solution:

PLAN This problem is based on chemical properties of phosphorus.

White phosphorus on reaction with thionyl chloride (SOCl_2) produces phosphorus trichloride.



But if amount of thionyl chloride (SOCl_2) is in excess then it produces phosphorus pentachloride.



5.

Solution:

NO is paramagnetic in gaseous state because in gaseous state, it has one unpaired electron.

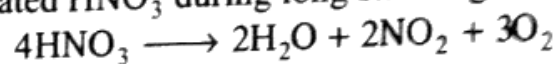
Total number of electrons = $7 + 8 = 15\text{ e}^-$

Hence, there must be the presence of unpaired electron in gaseous state while in liquid state, it dimerises due to unpaired electron.

6.

Solution:

NO_2 is a brown coloured gas and imparts this colour to concentrated HNO_3 during long standing.

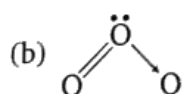


7.

Solution:

(a) $\text{ONCl} = 8 + 7 + 17 = 32e^-$

$\text{ONO}^- = 8 + 7 + 8 + 1 = 24e^-$ (correct)



Central O-atom is sp^2 -hybridised with 1 lone pair, so bent shape (correct).

(c) In solid state, ozone is violet-black. Ozone does not exist in solid state, thus incorrect.

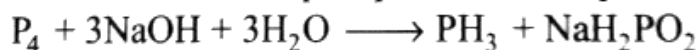
(d) O_3 has no unpaired electrons, so diamagnetic (correct).

Hence, (c) is the correct.

8.

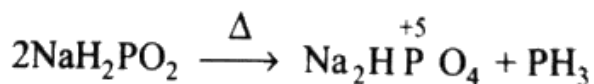
Solution:

The reaction of white phosphorus with aqueous alkali is



In the above reaction, phosphorus is simultaneously oxidised [$\text{P}_4(0) \longrightarrow \text{NaH}_2\overset{+1}{\text{P}}\text{O}_2$] as well as reduced

[$\text{P}_4(0) \longrightarrow \overset{-3}{\text{P}}\text{H}_3$]. Therefore, this is an example of disproportionation reaction. Oxidation number of phosphorus in PH_3 is -3 and in NaH_2PO_2 is $+1$. However, $+1$ oxidation number is not given in any option, one might think that NaH_2PO_2 has gone to further decomposition on heating.



9.

Solution:

Let oxidation number of N be x .

$$\text{In HNO}_3, +1 + x + 3(-2) = 0 \Rightarrow x = +5$$

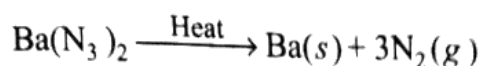
$$\text{In NO}, x - 2 = 0 \Rightarrow x = +2$$

$$\text{In N}_2, x = 0$$

$$\text{In NH}_4\text{Cl}, x + 4 - 1 = 0 \Rightarrow x = -3$$

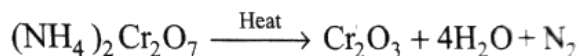
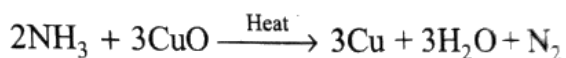
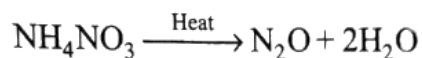
10.

Solution:



Azide salt of barium can be obtained in purest form as well as the decomposition product contain solid Ba as by product alongwith gaseous nitrogen, hence no additional step of separation is required.

Other reactions are



11.

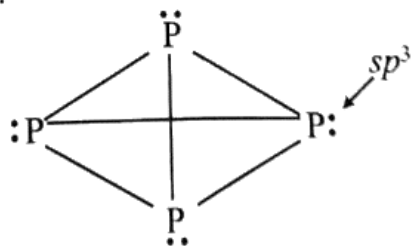
Solution:

In limited supply of oxygen, phosphorus is oxidised to its lower oxide P_4O_6 while excess of oxygen gives P_4O_{10} . A mixture of O_2 and N_2 is used for controlled oxidation of phosphorus into P_4O_6 .

12.

Solution:

In P_4 , all phosphorus are sp^3 -hybridised and has 75% p -character.



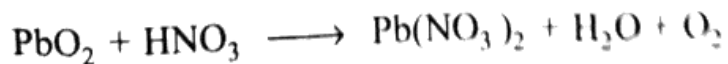
13.

Solution:

In $KMnO_4$, Mn is already in its highest oxidation state (+7), cannot be oxidised by any oxidising agent.

14.

Solution:



15.

Solution:

Equimolar amounts of NO and NO_2 at $-30^\circ C$ gives $N_2O_3(l)$ which is a blue liquid.

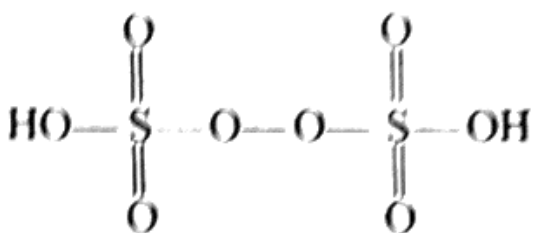
16.

Solution: Black phosphorus is thermodynamically most stable allotrope of phosphorus.

It is due to three dimensional, network structure of polymeric black phosphorus.

17.

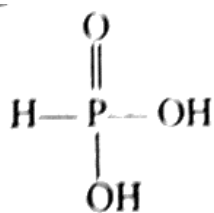
Solution: $\text{H}_2\text{S}_2\text{O}_8$ is a peroxy acid, has —O—O— linkage



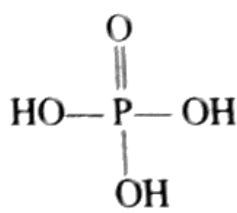
Peroxodisulphuric acid

18.

Solution: H_3PO_3 is a dibasic, reducing acid. H_3PO_4 is tribasic, non-reducing acid.



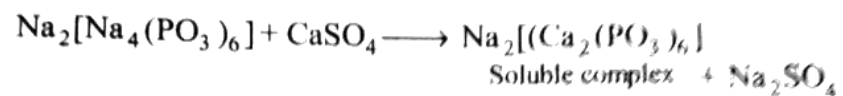
Dibasic, reducing



Tribasic, non-reducing

19.

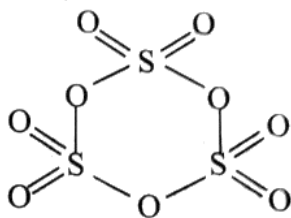
Solution: Polyphosphates are used as water softening agents because they form soluble complexes with cationic species of hard water.



20.

Solution:

The structure of S_3O_9 is



It has no S—S linkage.

21.

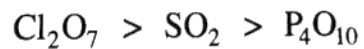
Solution: CaO, a basic oxide, is most suitable for drying of basic ammonia.

22.

Solution: H_2O , due to its ability to form intermolecular H-bonds.

23.

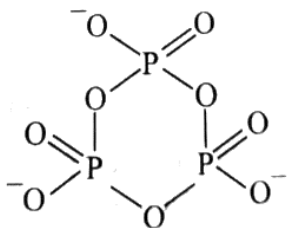
Solution: Corresponding acids are $HClO_4$, H_2SO_3 and H_3PO_4 . Hence the order of acidic strength is



24.

Solution:

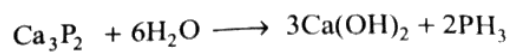
The structure of cyclic metaphosphate is



There is three P—O—P bonds.

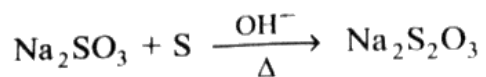
25.

Solution:



26.

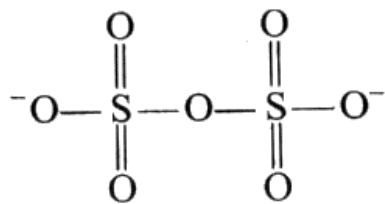
Solution:



27.

Solution:

$\text{S}_2\text{O}_7^{2-}$ has no S—S linkage.



All others have atleast one S—S linkage.

28.

Solution: Amongst XH_3 where 'X' is group-15 elements, basic strength decreases from top to bottom. Hence, NH_3 is strongest base.

29.

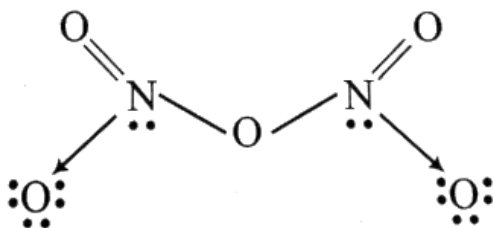
Solution: The electron withdrawing inductive effect of halogen decreases electron density on nitrogen, leads to lowers basic strength. Since, fluorine is most electronegative, NF_3 is least basic.

30.

Solution: $\text{NO}_2(\text{g})$ is deep brown coloured.

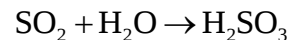
31.

Solution: In N_2O_5 , there are σ (sigma) covalent bonds, π (pi) bonds and coordinate covalent bonds as



32.

Solution: SO_2 cannot be collected over water because it reacts with water forming H_2SO_3 .



33.

Solution: $4\text{HNO}_3 + \text{P}_4\text{O}_{10} \rightarrow 4\text{HPO}_3 + 2\text{N}_2\text{O}_5$

34.

Solution: NO₂ is lighter than O₂.

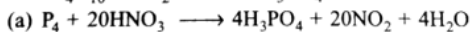
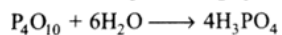
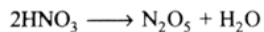
D₂O is commonly known as heavy water.

N₂ is lighter than O₂, effuse at faster rate under identical experimental conditions. NH₃ liquefies at very low temperature. Therefore, liquid NH₃ is used as a refrigerant.

35.

Solution:

P₄O₁₀ is a dehydrating agent and converts HNO₃ into N₂O₅

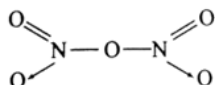


Thus, (a) is incorrect.

(b) N₂O₅ has no unpaired electron and is thus, diamagnetic thus,

(b) is correct.

(c)



There is no N—N bond, thus, (c) is incorrect.



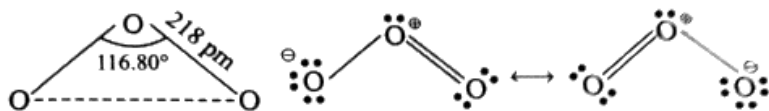
N₂O₅ vapours are of brownish colour. Thus, (d) is incorrect.

36.

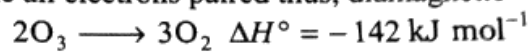
Solution:

Plan Due to resonance, bond lengths between two atoms are equal
Species is said to be diamagnetic if all electrons are paired

Process is endothermic if it takes place with absorption of heat.



bent molecule all electrons paired thus, diamagnetic



Exothermic

Thus, (b) is incorrect. (a, c, d) are correct.

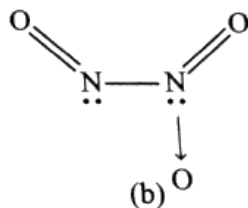
37.

Solution:

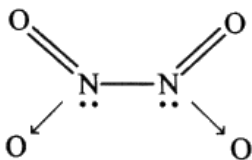
The structures of these oxides are



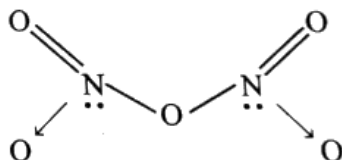
(a)



(b)



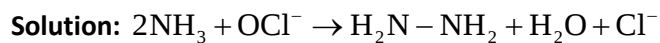
(c)



(d)

(a), (b), (c) have N—N bonds.

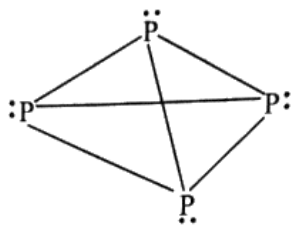
38.



39.

Solution:

The structure of P_4 is

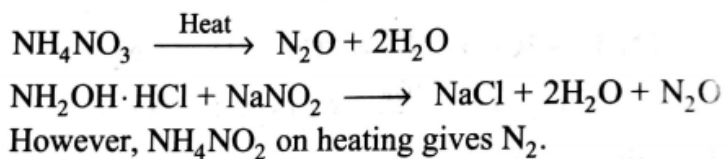


It has six P—P single bonds.

There are four lone pairs on four phosphorus. P—P—P bond angles are of 60° .

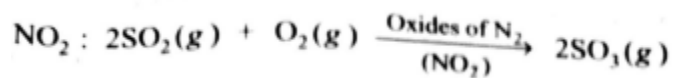
40.

Solution:



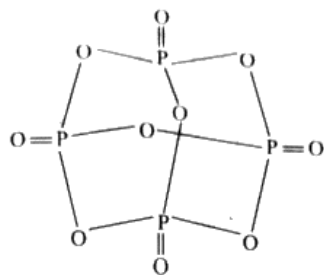
41.

Solution:



42.

Solution:



Here four oxygen atoms are bonded to each phosphorus atom.

43.

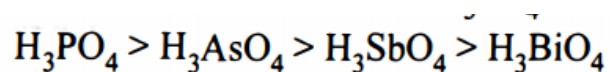
Solution: H_3PO_3 [$\text{O} = \text{PH}(\text{OH})_2$] is a dibasic acid.

44.

Solution: White phosphorus has highly strained, tetrahedral structure, therefore highly reactive.

45.

Solution: When oxidation state of central atom is same, with the decrease in electronegativity of central atom, acidic character decreases. Hence H_3PO_4 is most acidic.



46.

Solution: $\text{HNO}_2 + \text{HNO}_3 \rightarrow \text{NO}_2 + \text{H}_2\text{O}$

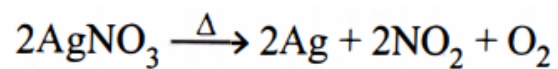
Hence NO_2 is mixed anhydride of HNO_2 and HNO_3 .

47.

Solution: $3\text{Cu} + 8\text{HNO}_3(\text{dil}) \rightarrow 3\text{Cu}(\text{NO}_3)_2 + 2\text{NO} + 4\text{H}_2\text{O}$

48.

Solution:



49.

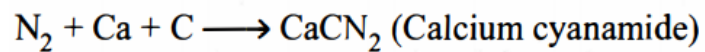
Solution: Greater the positive oxidation of the central atom of the oxyacid, greater is the acidic strength. Hence HNO_3 is the strongest acid.

50.

Solution: In gaseous state, nitric oxide exist as NO, an odd electron molecule, hence paramagnetic.

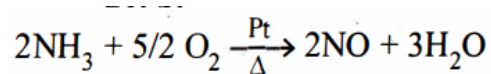
51.

Solution:



52.

Solution:



53.

Solution:

HCl, HNO₃ and H₂SO₄ form azeotrope at 20%, 68% and 98% respectively by mass of acid.

Therefore, HCl contains $\approx 20/100 = 1/5$

HNO₃ contains $\approx 68/100 \approx 2/3$

H₂SO₄ contains $\approx 98/100 \approx 3/3$

Thus, ordinary strong solution of HCl, HNO₃ and H₂SO₄ contains roughly 1/5, 2/3 and 3/3 fractions of pure acid and water respectively.

54.

Solution: In H₃PO₂; since only one P—OH group is present it acts as monobasic acid.

55.

Solution: Due to high N—F bond strength, NF₃ is highly stable and hence inert towards hydrolysis.

56.

Solution: Phosphide ion is P³⁻. Hence, similar structure with nitride ion (N³⁻).

57.

Solution: H₃PO₄ has 3 P—OH groups whereas H₃PO₃ has 2 P—OH groups, hence they are tribasic and dibasic respectively.

58.

Solution: Sulphur exists as S_8 molecule.

59.

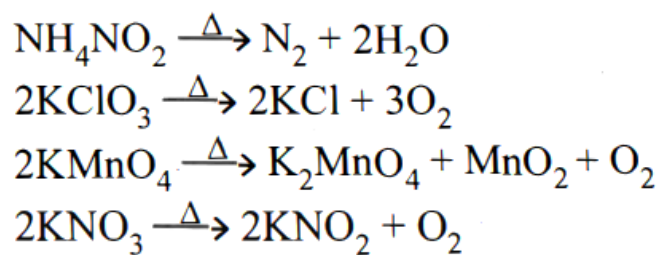
Solution: H_2Te due to the weakest $Te-H$ bond strength, acts as the strongest acid.

60.

Solution: Chalcogens are ore-forming elements, i.e. O, S and Se.

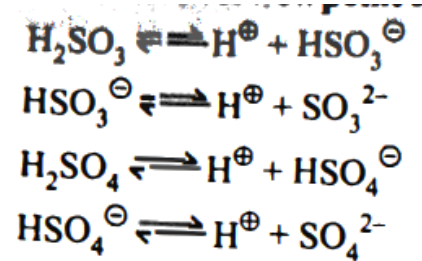
61.

Solution:



62.

Solution:



63.

Solution: $2\text{Na}_2\text{SO}_3 + \text{O}_2 \rightarrow 2\text{Na}_2\text{SO}_4$

64.

Solution: Geometry-Trigonal bipyramid Shape-(See-saw)

65.

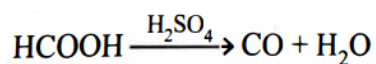
Solution: Due to (i) less electronegativity of Cl, oxidation state +6 cannot be achieved in S and (ii) Steric hindrance.

66.

Solution: H_2SO_4 molecules are associated with intermolecular H-bonding, which results in its high density and low volatility.

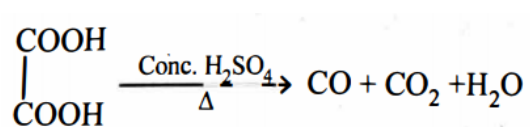
67.

Solution: Since H_2O is lost, H_2SO_4 is acting as a dehydrating agent.



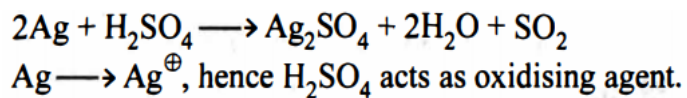
68.

Solution:



69.

Solution:

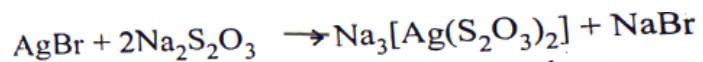


70.

Solution: Charring occurs

71.

Solution:



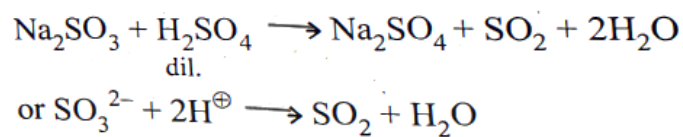
This reaction is used in photography to remove undecomposed silver halide on photographic plate.

72.

Solution: KMnO_4 is stronger oxidising agent.

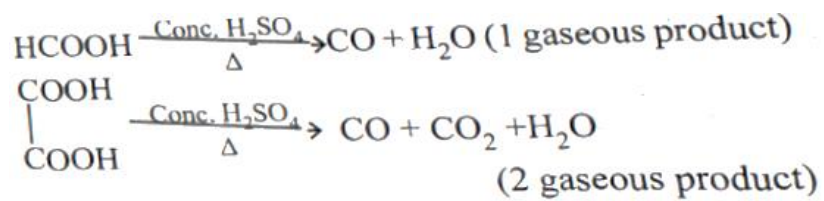
73.

Solution:



74.

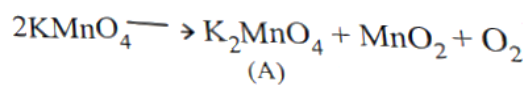
Solution:



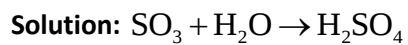
The ratio of two gases obtained is 1 : 2.

75.

Solution:

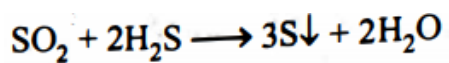


76.



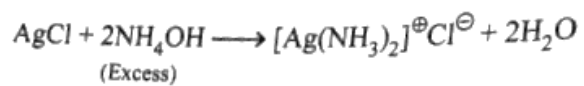
77.

Solution:



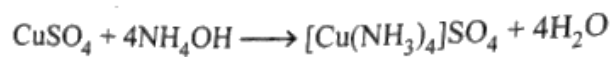
81.

Solution:



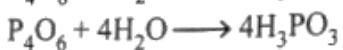
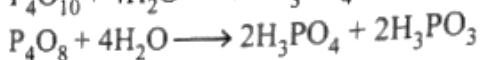
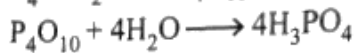
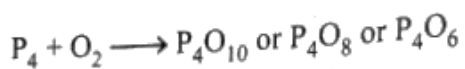
82.

Solution:



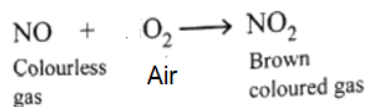
83.

Solution:



84.

Solution:



85.

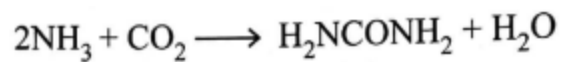
Solution:

H₄P₂O₇ Number of bonds are:

P–O–P bonds = 1; P–OH bonds = 4

86.

Solution:



87.

Solution: The chemical present in matchstick is potassium chlorate, sulfur, starch and glue. These chemicals present on the tip of the matchstick. Matchbox striking surface contains **red phosphorus**, powdered glass and glue.

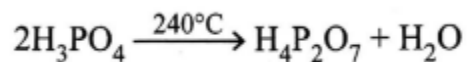
88.

Solution:



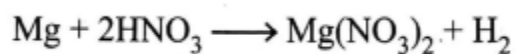
89.

Solution:



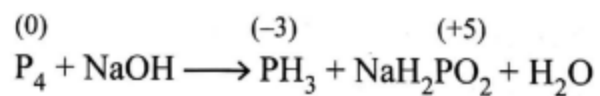
90.

Solution:



91.

Solution:



92.

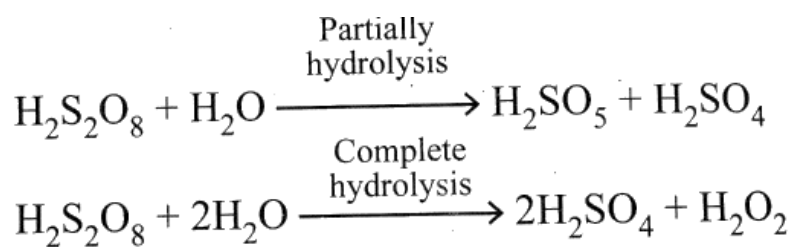
Solution: H_3PO_3 contains 2P–OH groups.

93.

Solution: Ozone does not react with acidified solution of $\text{K}_2\text{Cr}_2\text{O}_7$.

94.

Solution:



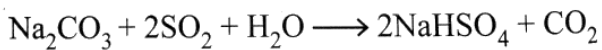
95.

Solution:

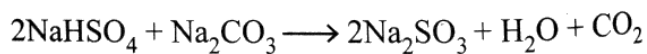
Inorganic compound + SO_2 in aq. medium $\longrightarrow$ (A)

(A) + $\text{Na}_2\text{CO}_3 \longrightarrow$ (B)

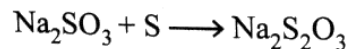
(B) + S $\longrightarrow$ (C) (Used in photography)



(A)



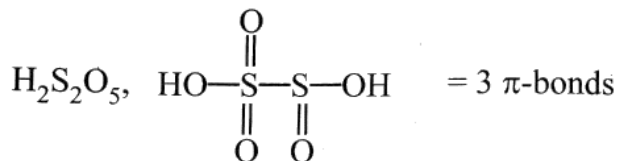
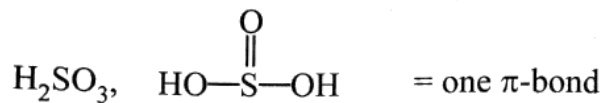
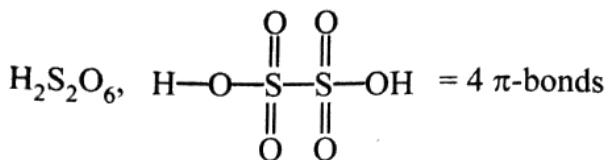
(B)



(C)

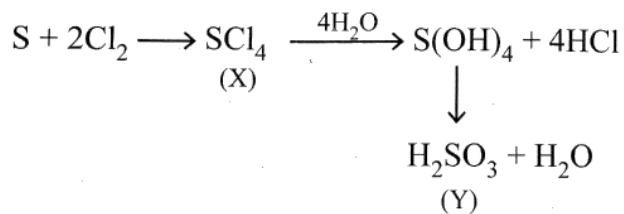
96.

Solution:



97.

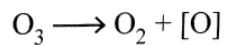
Solution:



The hybridised state of S in (Y) is sp^3 .

98.

Solution:



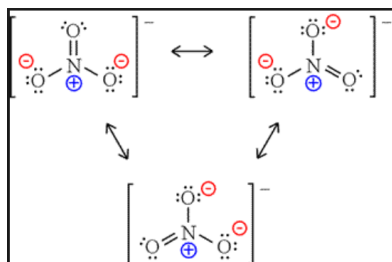
O_3 decomposes to produce O_2 , thus improves the air of crowded places.

99.

Solution:

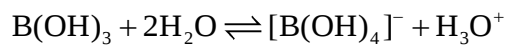
Number of bond pairs = 4

Number of lone pairs = 0



100.

Solution:



Boron completes its octet by accepting the OH^- from water molecule. So it is monobasic and weak Lewis acid and not proton donor (as it does not give proton).