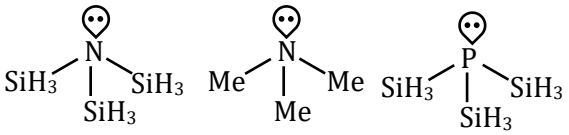
p-Block Elements - Group 13 to 18

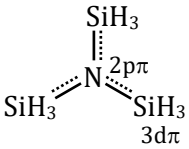
SOLUTIONS

Exercise-I (Conceptual Questions)

1. Ans. (2)

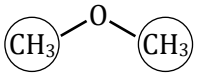


In $N(SiH_3)_3$ Back bonding is possible whereas in $N(Me)_3$ & $P(SiH_3)_3$ No back bonding is there because $N(SiH_3)_3$ $2p\pi$-$3d\pi$ back bonding occurs so shape because trigonal planar.



2. Ans. (2)

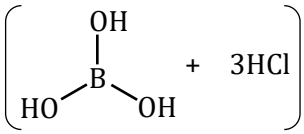
In $N(SiH_3)_3$ back bonding occurs same in $O(SiH_3)_2$ but in $O(CH_3)_2$ No vacant orbital is there so No back bonding and bond angle increases due to large size of side molecule.



Inter Molecular Repulsion

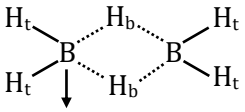
3. Ans. (1)

$BCl_3 + 3H_2O \longrightarrow H_3BO_3 + 3HCl$



4. Ans. (3)

Hybridisation of diborane

$B_2H_6 \rightarrow$ 

$[sp^3]$

5. Ans. (4)

Partial hydrolysis occurs in

$SbCl_3 + H_2O \longrightarrow [SbOCl]$

↓

Ionic character increases as we move down the group so reactivity decreases hence partial hydrolysis occurs.

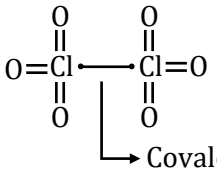
6. Ans. (4)

SF_6 cannot be hydrolysed because of steric repulsion is much more in SF_6.

Whereas in NF_3 No vacant orbital is there.

7. Ans. (4)

In the formation of Cl_2O_6 from ClO_3



Covalent Bond is formed

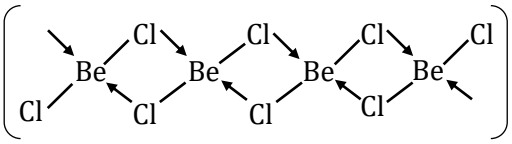
So covalent bond is formed by half-filled orbital no empty atomic orbital in volved.

8. Ans. (4)

$[BeCl_2]_n \rightarrow$ (Solid)

↓

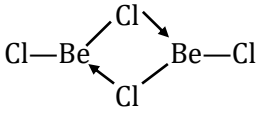
(Polymer)



$\rightarrow 4\sigma + 0$ LP

$\rightarrow sp^3$

$\rightarrow [8e^-]$



$[6e^-]$ $[6e^-]$

$(BeH_2) \rightarrow [3C–2e^-]$

↓

Electron deficient

9. Ans. (1)

$\rightarrow$ HOF $\rightarrow$ As a (Intermidiate)

$\rightarrow$ EN of F $\rightarrow$ Highest $\rightarrow$ (+ve)x

[HOF] [(–1) Oxidising state]

↓

(Highest EN)

$\begin{bmatrix} HFO_3 \\ HFO_2 \end{bmatrix} \rightarrow +ve \rightarrow [x]$

10. Ans. (3)

All Halogens F, Cl, Br, I form oxyacids but not of all type as F only form HOF.

11. Ans. (3)

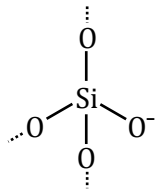
It P is H_3PO_4

$$\underset{ie}{H_3PO_4} \xrightarrow{-1H_2O} \underset{Ous}{HPO_3} \xrightarrow{-O} \underset{Hypo}{HPO_2}$$

In All these oxyacids we have different oxidation state.

12. Ans. (1)

One monovalent corner oxygen atom in each tetrahedron i.e. 3 oxygen atoms are shared.

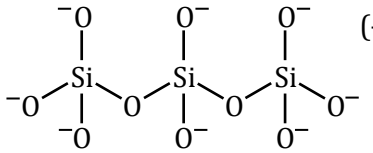


→ At forms sheet silicate $[Si_2O_5^{-2}]$

13. Ans. (2)

In Kinonite $3SiO_4^{-4}$ is attached

$Ca_2Cu_2Si_3O_{10}$



(–8)

14. Ans. (2)

Organo silicon polymer are silicones

15. Ans. (1)

White phosphorous reacts with oxygen at ordinary room temperature.

16. Ans. (1)

Red & Yellow phosphorous are allotropes of phosphorous.

17. Ans. (4)

PbI_4 do not exist due to inert pair effect Pb^{+2} is much more stable than Pb^{+4} and EN of I is very less. So Higher Oxidising state of Pb cannot be achieved.

18. Ans. (2)

Graphite conduct electricity, due to the presence of Delocalisation of π electrons.

19. Ans. (2)

Alane is polymer of $(AlH_3)_n$ chemical name of $(AlH_3)_n$

20. Ans. (3)

Aluminium is protected by a film of Aluminium oxide (Al_2O_3) this layer protect Aluminium from acid attack & water attack.

21. Ans. (3)

In borax based test different coloured meta borates has been formed from which we can identify metal ions.

Ex. → $Cu(BO_2)_2$ → Blue Bead

↓

Copper Meta Borate

22. Ans. (1)

Boric acid $H_3BO_3[B(OH)_3]$ Polymerises due to hydrogen bonding.

23. Ans. (2)

$M_2SO_4.M_2^{'}(SO_4)_3.24H_2O$

$2M:2M^{'}:4(SO_4)$

[1 : 1 : 2] Ratio for M, M', SO_4.

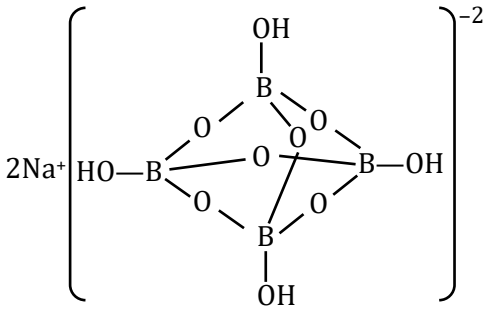
24. Ans. (1)

$[Na_2B_4O_7.10H_2O]$

$Na_2[B_4O_5.(OH)_4].8H_2O$

↓ ↓

Cation Anionic part



25. Ans. (2)

Double salt is made up of 2 salts

(SA + SB) + (SA + WB)

26. Ans. (3)

B_2H_6 all terminal H can be displaced but in $[B_2(CH_3)_6]$ all hydrogen is removed so $B_2(CH_3)_6$ cannot be formed.

27. Ans. (3)

Group 14 element

NH_3, PH_3 ------ Hydrides are covalent in nature.

28. Ans. (1)

Gas responsible for green house is CO_2

29. Ans. (3)
Artificial Gem used for diamond cutting is SiC

30. Ans. (4)
Borax & Boric Acid is used in the manufacture of all of these Pyrex Glass, Fibre, Glass wool.

31. Ans. (1)
Orthoboric acid is used as antiseptic.

32. Ans. (1)
Crucibles is made up of Graphite.

33. Ans. (2)
Alum is used as mordant, purification of water, fanning of leather not as an insecticide.

34. Ans. (3)
B
∨
Al ┐
∧ ├→ Due to contraction Z_{eff} ↑ IP↑
Ga ┘
∨
In ┐
∧ ├→ Lanthanide Contraction
Tl ┘

35. Ans. (3)
$Al + NaOH + H_2O \rightarrow$ In Aq sol
It produces sodium tetra hydroxoaluminate
$Na[Al(OH)_4]$

36. Ans. (2)
With cobalt, Borax Bead test bead of cobalt is
$[CO(BO_2)_2]$
[Blue Bead]

37. Ans. (2)
$B(OH)_3$
$H_3BO_3 \rightarrow$ Lewis acid
Weak mono basic acid.
$2(H_3BO_3) \rightarrow (B_2O_3)$
Protic acid ×

38. Ans. (3)
Correct order of I.E.
C > Si > Ge > Sn < Pb
Sn → Lanthanide contraction → Z_{eff} ↑, IP↑

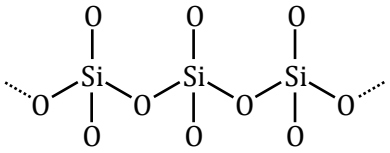
39. Ans. (2)
$Sn^{+2} < Sn^{+4}$ (Is more stable)
Do not posses inert pair effect so Higher Oxidising state is more stable.

40. Ans. (1)
Some of the p block oxides are amphoteric & neutral but maximum are acidic. GeO_2 is acidic by nature.

41. Ans. (3)
Diamond & Graphite have dangling bond but due to closed soccer Bucky ball like structure Buck Minister fullerene do not have dangling bond.

42. Ans. (1)
Dry ice → Refrigerant in ice-cream
CO_2 gas → Soft Drinks
Silicones → Polymer it is so used in water proof Jacket
Zeolite → Used in softening of Hard water with impurity of ($CaCl_2$, $MgCl_2$)

43. Ans. (3)
Basic unit of silicones is $(R_2SiO)_n$

44. Ans. (3)

$SiO_{2+0.5+0.5} \rightarrow \left(SiO_3^{-2}\right)_n$
Linear chain silicate.

45. Ans. (4)
As we move from top to bottom in a group catenation property decreases due to large size self-linking tendency decreases.

46. Ans. (4)
Graphite is thermodynamically more stable than diamond.

47. Ans. (1)
Syn gas & Synthesis gas
$[CO + H_2]$ → formed by $C + H_2O \xrightarrow{\Delta} [CO + H_2]$

48. Ans. (1)
P_4O_{10} is used as Dehydrating agent for many complexes.

49. Ans. (4)
PH_3 Produces smoky ring when it has impurity of P_2H_4.

50. Ans. (1)
PH_3 is less basic than NH_3 as Lone Pair donation tendency is less due to larger size.

51. Ans. (3)
$HNO_3 + I_2 \rightarrow HIO_3$
$\downarrow$
Which can be written were as $\rightarrow HOIO_2$

52. Ans. (3)
Both red & white phosphorous can be oxidised be air.

53. Ans. (3)
N_2O is used in anaesthetic dental surgery.

54. Ans. (4)
Ammonium dichromate & barium azide on heating both of then we get N_2 gas

55. Ans. (4)
NO_2 is formed
Cu + conc. $HNO_3 \rightarrow$ Metal Nitrate + NO_2
Zn + conc. $HNO_3 \rightarrow$ Metal Nitrate + NO_2
$Pb(NO_3)_2 \xrightarrow{\Delta} PbO + NO_2 + O_2$
By all these 3 reaction NO_2 is evolved.

56. Ans. (4)
Au being noble metal directly do not react with conc. HNO_3.

57. Ans. (2)
N_2 is used to create inert atmospheric in steel industry & many industrial process.

58. Ans. (4)
In the preservation of biological material, food items, in cryogenic surgery.

69. Ans. (4)
Ammonium nitrate, urea, ammonium phosphate and many ammonium complex is used in fertilizers.

60. Ans. (2)
Nitric acid is used in the pickling of steel.

61. Ans. (2)
PH_3 is used in Holme's signal for ships.

62. Ans. (1)
Phosphine gas is used in creation of smoke screen.

63. Ans. (3)
Quartz is a crystalline variety of silicates (SiO_2)

64. Ans. (3)
Aluminium vessel should not be washed with washing soda because it reacts with aluminium to form soluble aluminate.

65. Ans. (1)
Haber's Process
$N_2 + 3H_2 \xrightarrow{\text{condition}} \underset{\text{Ammonia}}{2NH_3}$

66. Ans. (2)
NH_3 can act as a Lewis base Lone Pair donor.

67. Ans. (3)
Nitrogen family is used in the formation of fertilizers.

68. Ans. (1)
Nitrogen do not show allotropy.

69. Ans. (4)
Covalency of N is = 4 in all of present oxides N_2O_5, N_2O_4, N_2O_3.
No of Covalent bond 4 is show by Nitrogen.

70. Ans. (3)
PH_3 can be inflammable in the presence of impurity of P_2H_4, P_4 vapours.

71. Ans. (1)
$P_4 + SOCl_2 \rightarrow [PCl_3] + SO_2$

72. Ans. (2)
Pyrophosphorous acid & Phosphinic acid both have 2 P-H links

73. Ans. (1)
Acid can reduce $AgNO_3$ into Metallic silver
Hypophosphorous acid
H_3PO_2

74. Ans. (2)
Ratio of

P-P Bond	:	P-H Bond	:	P-OH Bond
Hypo-phosphoric		Pyro-phosphorous		Cyclotrimeta-phosphoric acid
1	:	2	:	3

75. Ans. (4)
SO_2 can act as Reducing agent & Oxidising agent and as a Bleaching agent for oxidation.

76. Ans. (4)

Ozone after decomposition release oxygen due to which it is used as oxidising agent, disinfectant, Bleaching agent.

77. Ans. (4)

Black sulphide (Galena)

$PbS + O_3 \rightarrow [PbSO_4]$

white

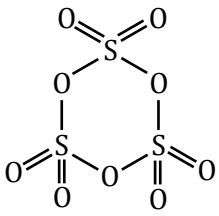
78. Ans. (1)

When H_2S is tested with filter paper moistened with lead acetate paper. It terms silvery black due to the formation of PbS.

$(CH_3COO)_2Pb + H_2S \rightarrow 2CH_3COOH + PbS.$

(Silvery black)

79. Ans. (4)



$S_3O_9 \rightarrow (SO_3)_3 \rightarrow$ S–O–S Links

80. Ans. (3)

Dry bleaching action is done with bleaching powder & O_3 ozone.

81. Ans. (1)

$KBr + \text{conc. } H_2SO_4 \rightarrow KHSO_4 + Br_2 + SO_2$

Bisulphate

Bromine gas is Evolved.

82. Ans. (3)

Conc. H_2SO_4 presence converts or oxidises $HI \longrightarrow I_2$ Due to which its colour comes out that is iodine.

$NaI + H_2SO_4 \longrightarrow Na_2SO_4 + HI$

$$HI \xrightarrow[H_2SO_4]{\text{conc.}} H_2O + SO_2 + \underset{\substack{\text{Voilet}\\ \text{Colour}}}{I_2}$$

83. Ans. (1)

KI $\longrightarrow$ (I_2)

Starch Iodide Reaction — Liberation of Iodine

84. Ans. (4)

Ozone is a good oxidising agent it can act as oxidising agent and also used as bleaching agent in dry state.

85. Ans. (3)

(1) $Zn + \underset{\text{Dil}}{H_2SO_4} \longrightarrow ZnSO_4 + H_2\uparrow$

(2) $Fe_2(SO_4)_3 \xrightarrow{\Delta} Fe_2O_3 + SO_3$

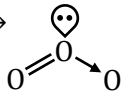
(3) $Cu + H_2SO_4 \longrightarrow CuSO_4 + [SO_2] + H_2O$

$\downarrow$

Sulphur Dioxide

(4) $Cu_5SO_4 \xrightarrow{\Delta}$ Do not Decompose

86. Ans. (3)

$O_3 \rightarrow$ 

(V Bent)

(1) O_2 is paramagnetic proved by MOT & O—O BO in ozone is between 1 & 2

(2) O_3 is Diamagnetic

87. Ans. (4)

(1) SO_2 has bleaching action & temporary bleaching due to its reducing action [S oxidises to higher Oxidising state]

(2) It's used as preservative & Anti oxidation is food industry.

(3) Liquid SO_2 is used to extract aromatics from kerosene pool. So all of above.

88. Ans. (4)

→ Sulphuric acid is used in formation of detergent in Neutralisation process of lauryl alcohol.

→ In storage battery in lead acid batteries.

→ In Nitrocellulose process sulphuric acid act as reaction catalyst. All of above.

89. Ans. (4)

As we move top to bottom in a group only +ve OS as metallic nature increases.

S

Se

Te

Po → + ve → B

T ↓ Metallic nature ↑

90. Ans. (3)

NaH_2PO_2

$\left[Na^{+1}H_2^{+1+1}\overset{+1}{P}/O_2^{-2-2}\right]$

[P = +1]

91. Ans. (4)
Pure ozone colour is Pale Blue in gas as Molecule are less dense & becomes dark blue liq & then become violet black in solid form.

92. Ans. (3)
Ozone absorb UV radiation from solution protect atmosphere by restrain the entry of UV rays but do not stop infra red radiation.
Main reason of ozone depletion is By CFC's & By Nitrogen oxides. Which very fast reacts with ozone.

93. Ans. (3)
$H_2O \rightarrow$ H bond
$\vee$
H_2S
H_2Se } VWFA [VWFA $\propto$ Size $\propto$ SA]
H_2Te

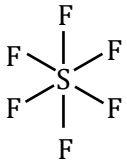
H_2O > $H_2T > H_2Se > H_2S$
↓ ↓
H Bond ↑ VWFA ↑

Bpt ↑

94. Ans. (3)
O_2 Exist as diatomic where as S_8 exist as polyatomic. The Vander Waal of after in S_8 is very much higher than that why difference in m.p & B.pt is much higher.

95. Ans. (4)
H_2O cannot show reducing property due to high bond energy of O-H bond it cannot easily break.
On moving down the group reducing nature increases.

96. Ans. (4)
(1) Hexafluorides are only stable halides due to small size of fluorine less steric repulsion.
(2) Hexafluorides are non toxic, colourless, Odourless gas. (SF_6).
(3) All Hexafluorides (SF_6)



$6\sigma + 0LP \rightarrow$ Octahedral
All of above

97. Ans. (4)
Industrial oxygen (O_2) can be obtained by fractional distillation of air as both N_2 & O_2 have different (B. Pt)
So, from here we get large amount of pure (O_2) at 183°C

98. Ans. (4)
As Pt & Au (Gold) both of them are noble metals where as He is noble gas so all these of them are non-reactive to oxygen.

99. Ans. (1)
There are different allotropes of 's' called monoclinic, plastic and orthorhombic sulphur.

100. Ans. (3)
Oleum → is also known as Pyro sulphuric acid → $[H_2S_2O_7]$
→ $H_2SO_4 + SO_3 \rightarrow [H_2S_2O_7]$
Both 1 & 2

101. Ans. (1)
Oxygen/Acetylene welding or gas welding is a process which relies an combustion of oxygen & acetylene mixed together in a proportion (oxygen).

102. Ans. (2)
In vapour phase sulphurs exist as S_2 molecule & S_2 molecule has 2 unpaired e^- in ABMO 3P orbital & hence exhibits paramagnetism.

103. Ans. (2)
Contacts process is used in the manufacture of $[H_2SO_4]$

104. Ans. (1)
(1) Due to High EN of F it can replace all halogen.
(2) Florine reacts fast with halogens to form interhalogen compounds.
(3) Fluorine reacts readily with H_2O to form Hydrofluoric acid.
(4) Halogens & Oxygen do not combine directly with carbon.

105. Ans. (1)
AgF forms ionic by nature so no ppt, colourless.

106. Ans. (3)

Volatile nature totally depends upon the force of attraction. Between 2 dif. Molecules. As halogens have weak Vander Waal's force of attraction. it because volatile.

107. Ans. (1)

Iodine gas turns starch iodide paper blue/black colour.

As they oxidises iodine to KI & free chlorine gets reduce to chloride ion.

108. Ans. (1)

BrF_5 is Interhalogen

109. Ans. (3)

As iodine do not react with NaCl directly so no reaction takes place so it cannot decolarise iodine.

110. Ans. (4)

$$F_2 + H_2O \longrightarrow H^+_{(aq)} + F^-_{(aq)} + \left(O_2 \uparrow\right)$$

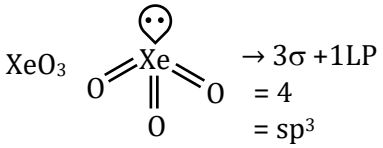
F_2 reacts violently with water to form Hydrogen fluoride $O_2 \uparrow$

111. Ans. (1)

Helium is added to oxygen used be deep sea divers as it is less soluble in blood then nitrogen under high pressure and also maintain the pressure of oxygen in derivers cylinder.

112. Ans. (1)

Which is not correct



113. Ans. (1)

$XeF_2 + SbF_5 \longrightarrow [XeF]^+ + [SbF_6]^-$

Displacement reaction

114. Ans. (3)

$XeCl_4$ can not be formed because Cl has Low EN unable to excite Xe at +4

115. Ans. (2)

$$SbF_5 + XeF_4 \longrightarrow \underset{\text{Anion Octahedral}}{\left[SbF_6^-\right]} + \underset{\text{Cation Tshape}}{\left[XeF_3^+\right]}$$

116. Ans. (2)

Ne due to its small size cannot form clathrate compound.

117. Ans. (2)

Conc. H_2SO_4

118. Ans. (3)

Chlorine gas is not used in refining of sugar

→ Cl is used in Bleaching powder to maintain its quality approx. 33% of dry bleaching powder consist of chlorine.

→ Water chlorination is done with sodium hypochlorite to sterilise water to kill Virus, Bacteria, Microbes.

→ $Au + Cl_2 \xrightarrow{\text{Moisture}} \left[AuCl_3\right]$

Which is soluble in water the pure gold is then precipitated by ferrous sulphate & SO_2

119. Ans. (3)

$CIF_3 + U_3O_8 \longrightarrow [UF_6]$

and further we get pure uranium

U_{238}	U_{235}	
(Major)	0.7%	Before enrichment
	3–5%	After enrichment

120. Ans. (3)

He is non inflammable & light gas it do not support combustion.

121. Ans. (1)

He is used in gas cooled nuclear reactor as a coolant as it condense at very low temperature.

122. Ans. (2)

Ne when used in Discharge tube produces an orange-red glow.

123. Ans. (2)

Ne bulb is used in botanical of green house garden cause it develop orang-red glow helps to reef cool.

124. Ans. (3)

Argon is used to provide inert atmosphere even at high tamp. Metallurgical process to agitate the metal in refining process.

125. Ans. (1)

Ar is used in are welding because it has lowest reactivity with metal.

126. Ans. (3)

Halogen are salt forming or producing family.

127. Ans. (1)
Deacon's process is used in manufacture of NaCl. By electrolysis
$\left[4HCl + O_2 \xrightarrow[400°C]{CuCl_2} 2Cl_2 + H_2O\right]$

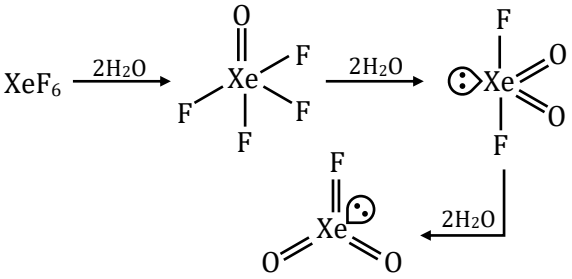
128. Ans. (1)
[HF > HCl > HBr > HI]
[ΔEN↑, BE↑, BDE↑]

129. Ans. (3)
I_2O_5 is used
$I_2O_5 + CO \longrightarrow CO_2 + I_2$
[I_2O_5 reduced to I_2]
[CO is oxidised to CO_2]

130. Ans. (1)
Catalyst used in Deacon's process is $CuCl_2$ it is a type of positive catalyst

131. Ans. (4)
No of O–O bond in perchloric acid is 0

132. Ans. (2)



$XeOF_3$ cannot formed

133. Ans. (3)
RnF_2 it cannot be isolated due its high stability.

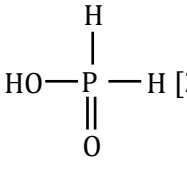
134. Ans. (1)
First inert gas compound was
$Xe[PtF_6]$

135. Ans. (4)
Rn is not found in earth atmosphere.

Exercise-II (Previous Year Questions)

1. Ans. (3)
NO_2 is used for food preservation where as we can't use SO_2 as food preservative.

2. Ans. (3)
Strong reducing behaviour of H_3PO_2 is due to



[2→P-H bond] 1 P–OH bond
High tendency to release proton H^+

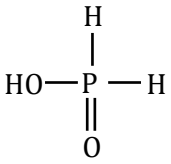
3. Ans. (2)
ONF is iso e^- with O_2N^-
8+7+9 = 8+8+8
= 24 = 24
OF_2 is a fluoride of oxygen not oxide of fluorine.

4. Ans. (4)
+1 is Lower Oxidising state here so Al is more stable in +3 as per Inert pair effect
Al < Ga < In < Tl → Most stable
+1

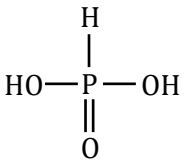
5. Ans. (2)
$HClO < HClO_2 < HClO_3 < HClO_4$
As oxygen atom increases attached to Cl, More e^- pulled away from O–H bonds becomes weak hence acidic strength ↑

6. Ans. (1)
$Cu + Conc.\ HNO_3 \rightarrow Cu(NO_3)_2 + NO_2$
Metal Nitrate + NO_2
every metal

7. Ans. (2)



Phosphinic
Hypo Phosphorous
It is mono protic due to the presence of 1 P–OH Bond



Phosphonic
Diprotic due to the presence of 2 P–OH bond.

8. Ans. (1)
Boric acid is a Lewis acid as it accepts OH^- from water releasing proton.

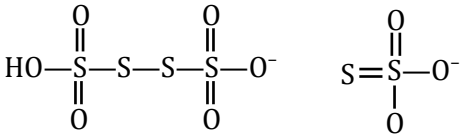
9. Ans. (4)
AlF_3 is soluble in HF only in presence of KF it is due to
$K_3[AlF_6]$
↓
Hexa Dentate

10. Ans. (1)

S–S Bond

$\left[S_4O_6^{-2}, S_2O_3^{-2}\right]$

$[H_2S_4O_6]$ $[H_2S_2O_3]$



Thio Sulphate ion.

11. Ans. (4)

Due to Inert Pair Effect inability of ns^2e^- to participate in valence shell.

$\underline{Sn^{+2}}$ is reducing while $\underline{Pb^{+7}}$ is oxidising

↓ ↓

Gain e^- Loss e^-

12. Ans. (1)

All Halogen oxyacid can be monobasic but HOF is Not as it break giving oxygen.

13. Ans. (1)

HNO_3	NO	N_2	$\overset{+1}{NH_4}/Cl^{-1}$
+5	+2	0	Here nitrogen have -ve OS of –3

14. Ans. (4)

(a) Pure Nitrogen is obtained from heating of barium nitride

$$Ba_3N_2 \xrightarrow{\Delta} 3Ba + \underset{100\%\text{Pure}}{[N_2]}$$

(b) Haber's process

$$N_2 + 3H_2 \xrightarrow{\text{Condition}} 2NH_3$$

(c) Contacts process

For H_2SO_4 $SO_2 + O_2 \rightarrow SO_3$

$SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$

$(2H_2SO_4) \leftarrow \overset{+}{H_2}O$

(d) Deacon's process

$$HCl + O_2 \xrightarrow[723K]{CuCl_2} [Cl_2] + H_2O$$

15. Ans. (1)

PbF_4 is ionic by nature due to law of polarisation as size of anion is small.

$SiCl_4$ can be hydrolysed because it have less steric repulsion and also VO. So H_2O can attack easily.

GeX_4 is way more stable than GeX_2 because In GeX_4 it has Higher Oxidising state

$[Ge^{+4} > Ge^{+2}]$

SnF_4 is ionic

16. Ans. (4)

CO_2 is used in Dry cleaning as super efficient natural solvent to clean textiles particular for oil based stains.

17. Ans. (3)

Silicones are used in cosmetic surgery.

Specially	Siloxane
	Silanol
	Decamethylcyclopentane
	Siloxane

All the polymer of silicones are cyclic

18. Ans. (1)

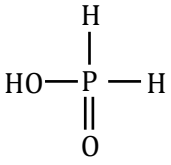
$Ca_3P_2 + H_2O \longrightarrow Ca(OH)_2 + PH_3$

$PH_3 + CuSO_4 \longrightarrow Cu_3P_2 + H_2SO_4$

19. Ans. (3)

The oxyacid which has highest no. of P-H bond

H_3PO_2



(2P-H Bonds)

20. Ans. (1)

Oleum is also known as Pyro-sulphuric acid.

$[H_2S_2O_7]$

21. Ans. (4)

Peroxy-linkage is present is marshals acid $H_2S_2O_8$ Peroxy-disulphuric acid

22. Ans. (1)

(1) CO_2(gas) is not used as refrigerant but CO_2(S) dry ice is used as refrigerant.

(2) C_{60} → Buckminister fullerene

has $\begin{bmatrix} 12 \rightarrow 5\text{Membered ring} \\ 20 \rightarrow 6\text{Membered ring} \end{bmatrix}$

(3) ZSM-5 Zeolite is used as catalyst to convert alcohols to petrol (gasoline)

(4) CO is colorless and odourless gas.

23. Ans. (4)

(CO) carboxy heamoglobin is way more stable than oxy heamoglobin.

24. Ans. (3)

$2F_2 + H_2O \rightarrow HF + O_2 \uparrow$

25. Ans. (2)

Noble gases bound with weak Vander Waal forces of attraction that's why have low melting point & boiling point.

26. Ans. (2)

$H_2O < H_2S < H_2Se < H_2Te$

Acidic strength depends on bond dissociation enthalpy and acidity of hydride increases down the group.

27. Ans. (4)

Electron deficient hydride → Less than $8e^-$ (B_2H_6)

Electron precise hydride → having $8e^-$ without l.p. (GeH_4)

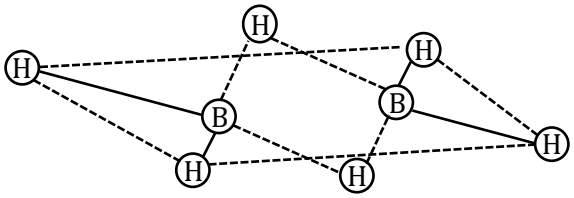
Electron rich hydride → having $8e^-$ with l.p. (HF)

28. Ans. (2)

In diamond each carbon is bonded with four other carbon atoms. So hybridisation of carbon atom is sp^3.

In graphite each carbon is bonded with three other carbon atoms. So hybridisation of carbon atom is sp^2.

29. Ans. (3)

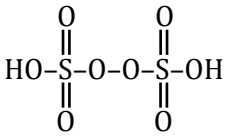


B has sp^3 Hybridisation

Non- planar

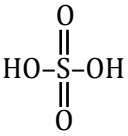
30. Ans. (1)

A → Peroxodisulphuric acid

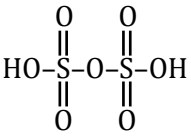


B → Sulphuric acid

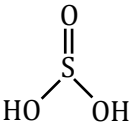
H_2SO_4



C → Pyrosulphuric acid $H_2S_2O_7$



D → Sulphurous acid H_2SO_3



31. Ans. (4)

Po does not show –2 oxidation state due to its metallic nature

32. Ans. (1)

Basic Radicals	**Group Number**
B. Cu^{+2}	II
A. Al^{+3}	III
D. Co^{+2}	IV
C. Ba^{+2}	V
E. Mg^{+2}	VI

Ans. (1) B, A, D, C, E

33. Ans. (4)

Dil. H_2SO_4 do not acts as oxidising agent which prevent oxidation of Fe^{+2} into Fe^{+3}. While concentrated H_2SO_4 will oxidise Fe^{+2} into Fe^{+3}

34. Ans. (1)

Correct order of acidic strength of HF, HCl, HBr, HI is HF < HCl < HBr < HI

35. Ans. (2)

Due to more l_p– l_p repulsion, Bond energy of N-N single bond is lesser than bond energy P-P single bond.

36. Ans. (4)

(A) Lake Test → Al^{+3}

(B) Nessler's Reagent → NH_4^+

(C) Potassium sulphocyanide → Fe^{+3}

(D) Brown ring Test → NO_3^-

Exercise-III (Analytical Questions)

1. Ans. (2)

Statement -I :- BCl_3 is more stable than $TlCl_3$ in Higher Oxidising state Tl is more stable in +1

Statement – II :- Boric acid is Not protic acid it cannot donate or release H^+ it accepts (OH^-) in aq. Solution.

Statement-I is correct but statement-II is wrong.

2. Ans. (1)

PbI_4 does not exist as it reduces to PbI_2 so yes PbI_4 is Not stable.

Al protects itself by protective layer of Al_2O_3 hence it renders passive by nitric acid.

3. Ans. (2)

Aq. solutions of borax is alkaline to litmus paper. Because borax is a salt of sodium hydroxide and boric acid which is SB & WA that why solution is alkaline by nature.

Statement-II

No graphite is more thermodynamics stable than diamond.

4. Ans. (4)

Statement-I :- To stop chain reaction R_3SiCl is used.

Statement-II :- Silica gel is used as drying agent as it adsorb moisture on its surface to stope growth of

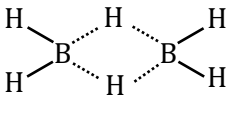
5. Ans. (1)

(1) In Graphite layer there is a Vander wall force of attraction.

(2) In fullerene 6 membering → 5 & 6 both ring.

5 Member ring to fuse with 6 membered ring.

6. Ans. (2)



Only terminal hydrogen lie in same plane

7. Ans. (1)

(1) $Xe[PtF_6]$

(2) XeF_6 are powerful fluorinating agent as they can donate fluorine on large scale.

8. Ans. (2)

2 Type of isotopes are there in which U_{238}, U_{235} we get U_{235} from 0.7% → 3.5% by laser tech.

⇒ Inter halogens are covalent but they are not paramagnetic.

9. Ans. (3)

(1) $Cl_2 + NaOH \xrightarrow{Cold} \underset{\text{chloride}}{NaCl} + \underset{\text{hypochloride}}{NaOCl} + H_2O$

(2) It is a powerful bleaching agent but due to nascent oxygen it can produce in the reaction with H_2O.

10. Ans. (4)

$\ddot{N}H_3$ is basic in nature so it will react with H_2SO_4 to form salt.

$O_2 + O \xrightarrow{Endo} O_3$

$O_3 \xrightarrow{Exo} O_2 + [O]$

11. Ans. (2)

(1) P–H bonds

(2) $H_3PO_4 \xrightarrow{\Delta} P_2O_5 + H_2O$

No disproportionation

12. Ans. (1)

(1) $PCl_3 + H_2O \rightarrow H_3PO_3 + HCl$

(2) White (P_4) has discrete unit of P_4 molecules.

13. Ans. (1)

(A) SF_6 cannot be hydrolysed but SF_4 can be hydrolysed.

(R) 6 F atom in SF_6 are prevent by the attack of H_2O due to steric repulsion.

14. Ans. (2)

(A) HI cannot be prepared by

$KI + H_2SO_4 \rightarrow K_2SO_4 + SO_2 + I_2 + H_2O$

(R) Bond strength $\propto \Delta EN$

15. Ans. (3)

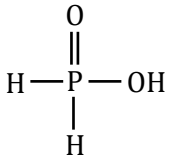
(A) HNO_3 makes iron passive (By making layer of oxides)

(R) HNO_3 forms protective layer of oxide on the surface of iron.

16. Ans. (4)

(A) H_3PO_2 is monobasic, not dibasic as only 1 OH present.

(R) There are 2P–H bonds



17. Ans. (1)

(A) Yes boric acid is a weak acid

(B) It cannot release H^+ ion on its own as it accepts OH^- ion in aq. Solution.

18. Ans. (1)

(A) Al cables are used in transmission cables

(B) As Al has high electrical and thermal conductivity and also of light weight.

19. Ans. (3)

(A) B–F bond length in BF_3 & BF_4^- are different

(R) In both BF_3 & BF_4^- $p\pi$-$p\pi$ bond is not present.

20. Ans. (1)

(A) In N family stability of higher oxidising state ie (+5 Oxidising state) decreases as we move down group an +3 Oxidising state increases down the group 15.

(R) All, due to inert pair effect which is more prone in case of heavier member of p- block.

21. Ans. (4)

(a) $\underset{\text{Borax}}{Na_2B_4O_7} \xrightarrow{\Delta} NaBO_2 + B_2O_3$

(b) $B_2H_6 + H_2O \longrightarrow H_3BO_3$

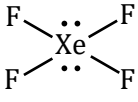
(c) $B_2H_6 + \underset{\text{(excess)}}{NH_3} \xrightarrow{\Delta} (BN)_x$

(d) $BCl_3 + LiAlH_4 \longrightarrow B_2H_6$

22. Ans. (2)

(a) He → It is used in modern diving apparatus.

(b) XeF_6 → Its partial hydrolysis does not change oxidation state of central atom.

(c) XeF_4 →  → 4B.P. + 2LP → sp^3d^2 hybd.

(d) Ar → It is used to provide inert atmosphere for electrical bulbs.

23. Ans. (2)

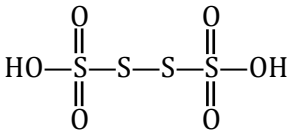
(a) $H_4P_2O_7$ → Pyro Phosphoric acid

(b) $H_2S_4O_6$ → Tetra thionic acid

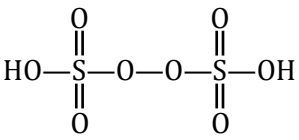
(c) $H_2S_2O_5$ → Pyro sulphurous acid

(d) $H_2S_2O_8$ → Peroxy disulphuric acid

$2(H_3PO_4) = H_6P_2O_8$ & $H_6P_2O_8 - H_2O = H_4P_2O_7$



$2(H_2SO_3) - H_2O \rightarrow H_2S_2O_5$



(Peroxy disulphuric acid)

24. Ans. (2)

(a) Ostwald → HNO_3

$$NH_3 + 5O_2 \xrightarrow[\substack{850^\circ C \\ 5\text{ atom}}]{Pt/Rh} NO + 6H_2O$$

$$NO + \frac{1}{2}O_2 \longrightarrow NO_2$$

$NO_2 + H_2O \rightarrow HNO_3$

(b) Deacon → (Cl_2)

$$4HCl + O_2 \xrightarrow[400^\circ C]{CuCl_2} 2Cl_2 + H_2O$$

(c) Contact → (H_2SO_4)

$$SO_2 + O_2 \xrightarrow[\substack{450^\circ C \\ 1-2\text{atom}}]{V_2O_5} SO_3$$

$SO_3 + H_2SO_4 \rightarrow H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$

(d) Haber → $N_2 + 3H_2 \xrightarrow[\text{Iron catalyst}]{200} (2NH_3)$

25. Ans. (1)

(a) Ortho silicate → SiO_4^{-4} (Basic)

(b) Pyrosilicate → $Si_2O_7^{-6}$

(c) 2D Silicate → $(Si_2O_5^{-2})_n$

(d) 3D Silicate → $(SiO_2)_n$

26. Ans. (3)

(a) Br_2 → Liq. at room temperature

(b) HF → Used in permanent marking on glass surface.

(c) O_3 → Powerful bleaching agents (by giving nascent oxygen)

(d) I_2O_5 → In Estimation of CO

27. Ans. (2)

(a) Anhydride of $HNO_3 \rightarrow H_2N_2O_6 - H_2O \rightarrow N_2O_5$

(b) Anhydride of $HNO_2 \rightarrow H_2N_2O_4 - H_2O \rightarrow N_2O_3$

(c) Anhydride of $4(H_3PO_4) \rightarrow H_{12}P_4O_{16} - 6H_2O \rightarrow P_4O_{10}$

(d) Anhydride of $4(H_3PO_3) \rightarrow 4H_3PO_3 - 6H_2O \rightarrow P_4O_6$

28. Ans. (3)

(a) Red Lead $\rightarrow Pb_3O_4$

(b) Carborandum $\rightarrow$ SiC

(c) Tear gas $\rightarrow Cl_3C.NO_2$

(d) Phosgene $\rightarrow COCl_2$

29. Ans. (4)

(a) Bleaching $\rightarrow CaOCl_2$

(b) Pseudo halogen $\rightarrow (CN)_2$

(c) Inter halogen compound $\rightarrow ICl_3$

(d) Hypo Solution $\rightarrow Na_2S_2O_3.5H_2O$

30. Ans. (3)

(a) Borax $\rightarrow$ Swell's up on heating

(b) Diborane $\rightarrow$ Catches fire spontaneously

(c) CO $\rightarrow$ Form complex with haemoglobin

(d) $CO_2 \rightarrow$ Fire extinguisher

31. Ans. (4)

(a) P_4 in white Phosphorous have angular strain that's why it is more reactive

(c) PCl_5 Solid $\rightarrow$ Ions

$\underset{\text{Tetra}}{\left[PCl_4^+\right]}\ \underset{\text{Octa}}{\left[PCl_6^-\right]}$

32. Ans. (3)

In 3rd option

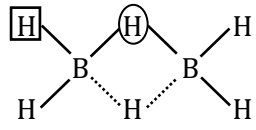
$NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$

Oxidising state remains same

No Reduction & oxidation

Hence cannot act as oxidising agent.

33. Ans. (1)



$\boxed{H}$ & $\textcircled{H}$ are not in same plane.

34. Ans. (4)

(1) $2(H_3PO_3) \xrightarrow{\Delta} PH_3 + H_3PO_4$

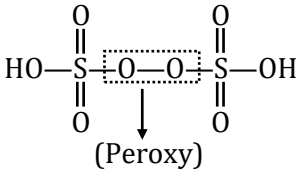
(2) P_4 + con. NaOH $\xrightarrow{\Delta}$ $NaH_2PO_2 + PH_3$

(3) $Ca_3P_2 \rightarrow \xrightarrow{H_2O} Ca(OH)_2 + PH_3$

(4) $H_3PO_4 \xrightarrow{\Delta} P_2O_5 + H_2O\uparrow$

35. Ans. (1)

$H_2S_2O_8 \rightarrow$ Marshal's acid



(Peroxy)

36. Ans. (4)

$NH_4NO_3 \xrightarrow{\Delta} N_2O + H_2O$

No Nitrogen

Azide on heating given purest form of N_2 i.e. 100% Pure.

37. Ans. (4)

$C_2H_2O_4 \xrightarrow[\text{Con. } H_2SO_4]{\Delta} CO + CO_2 + H_2O$

$(COOH)_2$

But Does not evolve SO_2

38. Ans. (3)

SiO_2 is very stable, hence unreactive but still reacts with HF

$\left[\begin{array}{l} SiO_2 + HF \longrightarrow H_2SiF_6 \\ SiO_2 + NaOH \longrightarrow Na_2SiO_3 \end{array}\right]$

39. Ans. (3)

$PCl_5 + H_2O \longrightarrow H_3PO_4 + HCl$

$\downarrow$

Phosphoric acid

40. Ans. (3)

Zn^{+2} cannot give as it is diamagnetic by nature.