THE P BLOCK ELEMENTS - A

Single Correct Answer Type

1. Boron was isolated by:
   a) Moseley b) Davy c) Rutherford d) Moisson
2. The type of glass used in making lenses and prism is
   a) Pyrex glass b) Quartz glass c) Jena glass d) Flint glass
3. Graphite is used in nuclear reactors:
   a) As a lubricant b) As a fuel c) As moderator d) None of these
4. Purification of alumina is essential because:
   a) Impure alumina is a very poor conductor of electricity
   b) Impure alumina has a very high melting point
   c) Impure alumina cannot react with the oxidizing agent
   d) It is difficult to purify aluminium metal
5. An element A dissolves both in acid and alkali. It is an example of
   a) Amorphous nature of A b) Allotropic nature of A
   c) Amphoteric nature of A d) Dimorphic nature of A
6. The hybridization of boron atom in orthoboric acid is:
   a) sp b) sp^2 c) sp^3 d) sp^3d
7. Molecular weight of anhydrous aluminium chloride is:
   a) 133.5 b) 267.0 c) 241.5 d) 483.0
8. Which of the following is only acidic in nature?
   a) $Mg(OH)_2$ b) $Be(OH)_2$ c) $Al(OH)_3$ d) $B(OH)_3$
9. Solid CO_2 is known as dry ice, because
   a) It evaporates at 40°C b) It melts at 0°C
   c) Its boiling points is more than 199°C d) It evaporates at '-' 78°C without melting
10. Which of the following is a gas?
    a) BF_3 b) BCl_3 c) BBr_3 d) BI_3
11. The most abundant gas in ordinary air among the following is:
    a) Argon b) Helium c) Carbon dioxide d) Carbon monoxide
12. The correct Lewis acid order for boron halides is:
    a) $BF_3 > BCl_3 > BBr_3 > BI_3$
    b) $BCl_3 > BF_3 > BBr_3 > BI_3$
    c) $BI_3 > BBr_3 > BCl_3 > BF_3$
    d) $BBr_3 > BCl_3 > BI_3 > BF_3$
13. Which one of the following orders presents the correct sequence of the increasing basic nature of the given oxides?
    a) $Al_2O_3 < MgO < Na_2O < K_2O$
    b) $MgO < K_2O < Al_2O_3 < Na_2O$
    c) $Na_2O < K_2O < MgO < Al_2O_3$
    d) $K_2O < Na_2O < Al_2O_3 < MgO$
14. Aluminium oxide is not reduced by chemical reactions since
    a) Aluminium oxide is reactive b) Reducing agents contaminate
    c) Aluminium oxide is highly stable d) The process pollutes the environment

15. Thermite is a mixture of
a) $Cr_2O_3 + Al_2O_3$ b) $Fe_2O_3 + Al$ c) $Fe_2O_3 + Al_2O_3$ d) $Al_2O_3 + 2Cr$
16. Carbon cannot be used in the reduction of Al_2O_3 because
a) It is an expensive proposition
b) The enthalpy of formation of CO_2 is more than that of Al_2O_3
c) Pure carbon is not easily available
d) The enthalpy of formation of Al_2O_3 is too high
17. Red lead is:
a) PbO b) Pb_3O_4 c) PbO_2 d) HgS
18. Graphite is a soft solid lubricant extremely difficult to melt. The reason for this anomalous behaviour is that, graphite
a) Is a non-crystalline substance
b) Is an allotropic from of diamond
c) Has molecules of variable molecular masses like polymers
d) Has carbon atoms arranged in large plates of rings of strongly bound carbon atoms with weak interplate bonds
19. An oxide of an element is a gas and dissolves in water to give an acidic solution. The element belongs to
a) II group b) IV group c) VIII group d) Zero group
20. An insulator is:
a) Silicon b) Graphite c) Aluminium d) Diamond
21. In the sale of diamonds the unit of weight is carat. One carat is equal to:
a) 100 mg b) 300 mg c) 400 mg d) 200 mg
22. An alumina-silica clay, called bentonite is dropped from aeroplanes in the slurry form for:
a) Fertilizing the soil
b) Spreading water over fires
c) Cooling the soil
d) Fumigation
23. R_3SiCl on hydrolysis forms:
a) R_3SiOH b) $R_3Si - O - SiR_3$ c) $R_2Si = O$ d) None of these
24. Carbon dioxide is used for extinguishing fire because:
a) It has a relatively high critical temperature
b) In solid state, it is called dry ice
c) It is neither combustible nor a supporter of combustion
d) It is a colourless gas
25. CO_2 is called dry ice or drikold because:
a) It wets the surface
b) It does not melt
c) At atmospheric pressure solid CO_2 changes directly into the gas and the liquid phase is not formed and does not wet the surface
d) It is gaseous in nature
26. In Gold Schmidt reaction, certain metallic oxides are reduced to the metallic state by-heating with:
a) Metallic magnesium b) Metallic aluminium c) Metallic iron d) Sodium metal
27. Which element has a limited coordination number of four?
a) Sn b) C c) Si d) Ge
28. The dissolution of $Al(OH)_3$ by a solution of NaOH results in the formation of:
a) $[Al(H_20)_4(OH)]^{2+}$ b) $[Al(H_2O)_2(OH)_4]^-$ c) $[Al(H_2O)_3(OH)_3]$ d) $[Al(H_2O)_6(OH)_3]$
29. Inorganic benzene is:

a) BN b) BF_4 c) B_2H_6 d) $B_3N_3H_6$

30. Carbon reacts with conc. H_2SO_4 to give :
a) CO_2, SO_2, H_2O b) SO_2, H_2O, CO c) CO, H_2O d) CO_2, H_2O

31. The coal form containing maximum percentage of carbon is:
a) Lignite b) Anthracite c) Bituminous d) Peat

32. White lead is
a) $PbCO_3PbO$ b) $PbCO_3$ c) $Pb(OH)_2.2PbCO_3$ d) $PbSO_4.PbO$

33. Which of the following is used for making optical instruments?
a) SiO_2 b) Si c) SiH_4 d) SiC

34. Which is the least pure form of carbon?
a) Graphite b) Lamp black c) Wood charcoal d) Animal charcoal

35. The incorrect statement/s among the following is/are
I. NCl_5 does not exist while PCl_5 does.
II. Lead prefers to form tetravalent compounds.
III. The three $C-O$ bonds are not equal in the carbonate ion.
IV. Both O_2^+ and NO are paramagnetic.
a) I, III and IV
b) I and IV
c) II and III
d) I and III

36. When carbon monoxide is passed over solid caustic soda heated to 200°C, it forms
a) Na_2CO_3 b) CH_3COONa c) $NaHCO_3$ d) HCOONa

37. Boron nitride has the structure of the type
a) Graphite type b) Diamond type
c) Both diamond and graphite type d) NaCl type

38. The acid used for etching the glass is:
a) Sulphuric acid b) Perchloric acid c) Hydrofluoric acid d) Aqua-regia

39. Which is true for an element R present in III group of the periodic table?
a) It has oxidation state of $+4$ b) It is gas at room temperature
c) It forms R_2O_3 d) It forms RX_2

40. Red lead in an example of a/an...oxide
a) Basic b) Mixed c) Super d) Amphoteric

41. The relative Lewis acid character of boron trihalides is in the order
a) $BI_3 > BBr_3 > BF_3 > BCl_3$ b) $BI_3 > BBr_3 > BCl_3 > BF_3$
c) $BF_3 > BCl_3 > BBr_3 > BI_3$ d) $BCl_3 > BF_3 > BI_3 > BBr_3$

42. Pb reacts with dilute HNO_3 produces
a) NO b) NH_4NO_3 c) N_2O_5 d) NO_2

43. In the alumino-thermic process, aluminium acts as:
a) An oxidizing agent b) A flux c) A reduction agent d) A solder

44. A fibrous mineral which can withstand red hot flames without any damage is
a) Talc b) Glass wool c) Soap stone d) Asbestos

45. The two type of bonds present in B_2H_6 are covalent and.....
a) Ionic b) Coordinate c) Hydrogen bridge d) None of these

46. Which of the following has structure similar to graphite?
a) BN b) B c) B_4C d) B_2H_6

47. Mica is chemically:
a) Potassium alumino silicate having sheet structure

b) Calcium alumino silicate having fibrous structure
c) Calcium magnesium silicate having three dimensional network
d) Hydrated sodium alumino silicate having three dimensional network

48. The borax bead is chemically:
a) B_2O_3 b) $Na_2B_4O_7$ c) Na_3BO_3 d) $B_2O_3 + NaBO_2$

49. Least stable hydride is :
a) Methane b) Plumbane c) Silane d) Stibine

50. Each $B - H - B$ bridge in B_2H_6 is formed by the sharing of
a) 2 electrons b) 4 electrons c) 1 electrons d) 3 electrons

51. Coal gas:
a) Burns with a smoky flame
b) Burns with non-smoky flame
c) Is not used for lighting purpose
d) Is not a good fuel

52. All alums contain:
a) One monovalent and one trivalent metal
b) Both monovalent metal
c) One divalent and one monovalent metal
d) Both divalent metal

53. Which of the following is not an ionic trihalide?
a) AlF_3 b) BF_3 c) InF_3 d) GaF_3

54. Moissan boron is
a) Amorphous boron of ultra purity b) Crystalline boron of ultra purity
c) Amorphous boron of low purity d) Crystalline boron of low purity

55. Boric acid is used in carom boards for smooth gliding of pawns because
a) H_3BO_3 molecules are loosely chemically bonded and hence soft
b) Its low density makes it fluffy
c) It can be powered to a very small grain size
d) H-bonding in H_3BO_3 gives it a layered structure

56. The inert form of carbon is:
a) Diamond b) Graphite c) Coal d) Charcoal

57. Which of the following compounds has peroxide linkage?
a) Pb_2O_3 b) CO_2 c) PbO_2 d) SiO_2

58. The structure of BF_3 is
a) Planar triangular b) Pyramidal c) Tetrahedral d) T-shaped

59. Ammonical CuCl absorbs:
a) CO_2 b) SO_2 c) H_2SO_4 d) CO

60. Highest electronegativity among the following is for:
a) C b) Si c) Sn d) Pb

61. Asbestos is chemically:
a) Silicate of calcium and magnesium
b) Calcium alumino silicate
c) Magnesium alumino silicates
d) Calcium silicate + calcium aluminates

62. Hoope's process is used for the purification of the metal
a) Cu b) Al c) Zn d) Ag

63. Carbon burns in air and forms two oxides CO and CO_2. This shows that carbon has:

a) Two allotropic forms
b) Two oxidation states
c) Two isotopes
d) 4 electrons in valency shell

64. Fluorine is more electronegative than either boron or phosphorus. What conclusion can be drawn from the fact that BF_3 has no dipole moment but PF_3 has?
a) BF_3 is spherically symmetrical, PF_3 is not
b) BF_3 molecule must be linear
c) The atomic radius of P is larger than the atomic radius of B
d) The BF_3 molecule must be planar triangular

65. Which of the following does not exist in free form?
a) BF_3 b) BH_3 c) BCl_3 d) BBr_3

66. Silicon react with hot solution of NaOH forming
a) $Si(OH)_4$ b) $Si(OH)_2$ c) SiO_2 d) Na_2SiO_4

67. Diborane does not undergo cleavage reaction with:
a) Trimethyl amine b) Ammonia c) CO d) CO_2

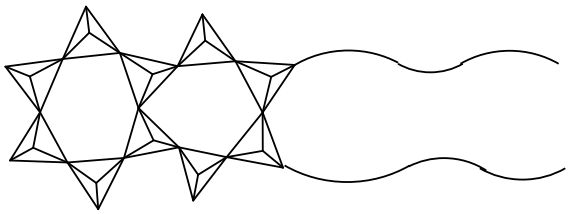
68. Carbon dioxide dissolves under pressure in water to give:
a) An alkaline solution
b) An acidic solution
c) A neutral solution
d) A highly alkaline solution

69. Which is not a characteristic property of carbon?
a) Catenation
b) Multiple bond formation
c) Availability of d-orbitals for bonding
d) Highest electronegativity in the group

70. Which metal is protected by a layer of its own oxide?
a) Fe b) Au c) Ag d) Al

71. BF_3 acts as acid according to:
a) Lewis b) Bronsted c) Arrhenius d) None of these

72. By chlorinating carbon disulphide with chlorine in presence of aluminium chloride, we get:
a) Carbon tetrachloride b) Chloroform c) Chloral d) Methylene chloride

73. 

Silicate structure unit of
a) $(Si_4O_{11})_n^{-6n}$ b) $(Si_2O_{11})_n^{-2n}$ c) (Si_2O_3) d) $(SiO_4)^{-4}$

74. On the addition of mineral acid to an aqueous solution of borax, the compound formed is:
a) Borodihydride b) Orthoboric acid c) Metaboric acid d) Pyroboric acid

75. Pyrosilicate ion is:
a) SiO_2^{2-} b) SiO_4^{2-} c) $Si_2O_7^{6-}$ d) $Si_2O_6^{7-}$

76. CO_2 and N_2 are non-supporters of combustion. However, for putting out fires CO_2 is preferred over N_2 because CO_2 :
a) Does not burn
b) Forms non-combustible products with burning substances

c) Is denser than nitrogen
d) Is a more reactive gas

77. Aluminium chloride exists as dimer, Al_2Cl_6, in solid state as well as in solution of non-polar solvents such as benzene. When dissolved in water, it gives
a) $Al^{3+} + 3Cl^-$ b) $[Al(H_2O)_6]^{3+} + 3Cl^-$ c) $[Al(OH)_6]^{3-} + 3HCl$ d) $Al_2O_3 + 6HCl$

78. Feldspar is:
a) Potassium sodium alumino silicate
b) A mixture of potassium, aluminium and silicon oxides
c) Hydrated calcium silicate
d) None of the above

79. One that marks the paper like lead is:
a) Ga b) Ti c) B d) Tl

80. Orthoboric acid when heated to red hot gives:
a) Metaboric acid b) Pyroboric acid c) Boron and water d) Boric anhydride

81. Al reduces most of the metallic oxides due to its greater affinity for:
a) Oxygen b) Metals c) Electrons d) Protons

82. In laboratory silicon can be prepared by the reaction
a) Silica with magnesium
b) By heating carbon in electric furnace
c) By heating potassium fluosilicate with potassium
d) None of the above

83. Carbon is soluble in :
a) Conc. HCl b) dil. HNO_3 c) H_2SO_4 d) dil. HCl

84. Which is not an alloy of aluminium?
a) Magnalism b) Duralumin c) German silver d) Aluminium bronze

85. Good conductor of heat and current is:
a) Anthracite b) Diamond c) Charcoal d) Graphite

86. Ultra violet rays are not allowed to pass through:
a) Flint glass b) Crown glass c) Crookes glass d) Safety glass

87. Which gas is essential constituent of almost all fuel gases?
a) CO_2 b) N_2 c) Co d) H_2O

88. Silicon is
a) Semiconductor b) Insulator c) Conductor d) None of these

89. When CO is heated with NaOH under pressure, we get:
a) Sodium benzoate b) Sodium acetate c) Sodium formate d) Sodium oxalate

90. Aluminium reacts with nitrogen to form:
a) AlN b) Al_2N_3 c) Al_2N d) Al_4N_6

91. Which is a true acid anhydride?
a) Al_2O_3 b) CO c) CaO d) CO_2

92. In graphite, the sheets are held by :
a) Ionic forces b) Covalent forces c) Van der Waals' forces d) Metallic forces

93. Which glass has the highest percentage of lead?
a) Soda glass b) Flint glass c) Jena glass d) Pyrex glass

94. Density is highest for :
a) Si b) Ge c) Sn d) Pb

95. CO_2 in water behaves as
a) Weak dibasic acid H_2CO_3 b) Weak monobasic acid HO−COOH

c) Weak diacid base $CO(OH)_2$ d) Weak monoacid base $HO-COOH$

96. Monosilane on coming in contact with air burns with a luminous flame producing vortex rings. These rings are of
a) SiO_2 b) SiO c) Si d) H_2SiO_3

97. PbO is ……..oxide.
a) Basic b) Acidic c) Amphoteric d) Neutral

98. During day time plants absorb:
a) Carbon dioxide b) Carbon monoxide c) Nitrogen d) Oxygen

99. A metal, M forms chlorides in its +2 and +4 oxidation states. Which of the following statements about these chlorides is correct?
a) MCl_2 is more volatile than MCl_4
b) MCl_2 is more soluble in the anhydrous ethanol than MCl_4
c) MCl_2 is more ionic than MCl_4
d) MCl_2 is more easily hydrolysed than MCl_4

100. The bonds present in borazole are:
a) $12\sigma, 3\pi$ b) $9\sigma, 6\pi$ c) $6\sigma, 6\pi$ d) $9\sigma, 9\pi$

101. Which is formed when $SiCl_4$ vapours are passed over hot Mg?
a) $SiCl_2 + MgCl_2$ b) $Si + MgCl_2$ c) $Mg_2Si + Cl_2$ d) $MgSiCl_6$

102. Which mixed sulphate is not an alum?
a) $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$
b) $K_2SO_4 \cdot Cr_2(SO_4)_3 \cdot 24H_2O$
c) $Na_2SO_4 \cdot Fe_2(SO_4)_3 \cdot 24H_2O$
d) $CuSO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$

103. Which is covalent compound?
a) Aluminium oxide b) Aluminium fluoride c) Aluminium chloride d) Aluminium sulphate

104. Which of the following organo-silicon compound on hydrolysis will give a three dimensional silicone?
a) R_3SiCl b) $RSiCl_3$ c) $SiCl_4$ d) R_2SiCl_2

105. Lead pipes are not suitable for drinking water because
a) A layer of lead dioxide is deposited over pipes
b) Lead forms basic lead carbonate
c) Lead reacts with water containing air to form $Pb(OH)_2$
d) Lead reacts with air to form litharge

106. The alloy used in preparation of balance beam:
a) Magnalium b) Duralumin c) Aluminium bronze d) Nickeloy

107. Aluminium is more reactive than iron but aluminium is less easily corroded than iron because:
a) Aluminium is a noble metal
b) Oxygen forms a protective oxide layer
c) Iron undergoes reaction easily with water
d) Iron forms both mono and divalent ions

108. B—F bond order in BF_3 is:
a) 1 b) 2 c) 3 d) 4/3

109. When sugar is treated with conc. H_2SO_4, we get a pure form of :
a) Carbon b) Hydrogen c) Oxygen d) None of these

110. Covalency and hybridization of B in BF_4^- is:
a) $5, sp$ b) $4, sp^3$ c) $3, sp^3$ d) $2, sp^2$

111. Al_2O_3 formation involves large quantity of heat evolution which makes its use in:
a) Deoxidizer b) Confectionary c) Indoor photography d) Thermite welding

112. Which gas is responsible for green house effect?
a) CO_2 b) SO_2 c) CO d) SO_3
113. Borax is prepared by treating colemanite with:
a) $NaNO_3$ b) NaCl c) Na_2CO_3 d) $NaHCO_3$
114. Purest form of silica is :
a) Quartz b) Flint c) Sandstone d) Keiselguhr
115. Alumina may be converted into anhydrous aluminium chloride by:
a) Heating it with conc. HCl
b) Heating in a current of dry chlorine
c) Heating it with rock salt
d) Mixing it with carbon and heating the mixture in a current of dry chlorine
116. Which is used in high temperature thermometry?
a) Na b) Tl c) Ga d) Hg
117. The state of hybridization of boron and oxygen atoms in boric acid (H_3BO_3)are respectively:
a) sp^3 and sp^3 b) sp^2 and sp^3 c) sp^3 and sp^2 d) sp^2 and sp^2
118. Boron when heated with carbon forms
a) B_4C b) BC_4 c) B_4C_3 d) B_2C_3
119. Which element occurs in free state?
a) C b) Si c) Ge d) Sn
120. The hardest substance amongst the following
a) Be_2C b) Tritonium c) B_4C d) Graphite
121. The correct order of decreasing hardness of the following compounds is:
a) Diamond > Borazon > Carborundum > Corundum
b) Borazon > Diamond > Carborundum > Corundum
c) Corundum > Carborundum > Borazon > Diamond
d) None of the above
122. Sesquioxide of lead is:
a) PbO b) PbO_2 c) Pb_2O d) Pb_2O_3
123. Destructive distillation of coal does not gives:
a) C_2H_2 b) C_2H_4 c) Carbides d) Coal gas
124. B_2O_3 is:
a) Ionic b) Basic c) Acidic d) Amphoteric
125. Boron halides behave as Lewis acids because of their …… nature.
a) Proton donor b) Covalent c) Electron deficient d) Ionising
126. Mineral of aluminium that does not contain oxygen is:
a) Corundum b) Diaspore c) Bauxite d) Cryolite
127. The role of fluorspar (CaF_2) which is added in small quantities in the electrolytic reduction of alumina dissolved in fused cryolite (Na_3AlF6) is:
a) As a catalyst
b) To make the fused mixture very conducting
c) To increase the temperature of the melt
d) To decrease the rate of oxidation of carbon at the anode
128. Which is not correct?
a) Al acts as a reducing agent.
b) Al does not react with steam even at higher temperature
c) Al forms a number of alloys with other metals
d) Al is ionic in all its compounds

129. Boric acid is not used:
   a) As an antiseptic
   b) As a flux in soldering
   c) In making optical glasses
   d) In making enamels and pottery glazes
130. The metal which does not form a polynuclear carbonyl is :
   a) Sodium b) Manganese c) Iron d) Cobalt
131. The chemical formula of phosgene or carbonyl chloride is:
   a) PH_3 b) $COCl_2$ c) $POCl_3$ d) PCl_3
132. Which does not react with water?
   a) B_2S_3 b) B_4C c) Al_4C_3 d) Al_2S_3
133. Flux is used to
   a) Remove silica b) Remove silica undesirable metal oxide
   c) Remove all impurities from ores d) Reduce metal oxide
134. The correct order of increasing C—O bond length in CO, CO_3^{2-} and CO_2 is:
   a) $CO_3^{2-} < CO_2 < CO$ b) $CO < CO_3^{2-} < CO_2$ c) $CO_2 < CO_3^{2-} < CO$ d) $CO < CO_2 < CO_3^{2-}$
135. Which of the following is formed when aluminium oxide and carbon is strongly heated in dry chlorine gas?
   a) Aluminium chloride b) Hydrate Aluminium chloride
   c) Anhydrous Aluminium chloride d) None of the above
136. Alumina on heating with carbon in nitrogen atmosphere gives:
   a) $Al + CO$ b) $Al + CO_2$ c) $AlN + CO$ d) $Al + CO + N_2$
137. Water glass is
   a) Glass made of water b) Sodium silicate c) Calcium formate d) Pyrex glass
138. When Sn (IV) chloride is treated with excess of conc. HCl, the complex $[SnCl_6]^{2-}$ is formed. The oxidation state of Sn in this complex is:
   a) +6 b) +4 c) -2 d) +2

: ANSWER KEY :

1)	b	2)	d	3)	c	4)	d	5)	c	6)	b	7)	b	8)	d
9)	d	10)	a	11)	a	12)	c	13)	a	14)	c	15)	b	16)	d
17)	b	18)	d	19)	b	20)	d	21)	d	22)	d	23)	b	24)	c
25)	c	26)	b	27)	b	28)	b	29)	d	30)	a	31)	b	32)	c
33)	a	34)	d	35)	c	36)	d	37)	a	38)	c	39)	c	40)	b
41)	b	42)	a	43)	c	44)	d	45)	c	46)	a	47)	a	48)	d
49)	b	50)	a	51)	b	52)	a	53)	b	54)	c	55)	d	56)	a
57)	c	58)	a	59)	d	60)	a	61)	a	62)	b	63)	b	64)	d
65)	b	66)	d	67)	d	68)	b	69)	c	70)	d	71)	a	72)	a
73)	a	74)	b	75)	c	76)	a	77)	b	78)	a	79)	d	80)	d
81)	a	82)	a	83)	c	84)	c	85)	d	86)	c	87)	c	88)	a
89)	c	90)	a	91)	d	92)	c	93)	b	94)	d	95)	a	96)	a
97)	c	98)	a	99)	c	100)	a	101)	b	102)	d	103)	c	104)	b
105)	c	106)	a	107)	b	108)	d	109)	a	110)	b	111)	d	112)	a
113)	c	114)	a	115)	d	116)	c	117)	b	118)	a	119)	a	120)	c
121)	a	122)	d	123)	c	124)	c	125)	c	126)	d	127)	b	128)	d
129)	b	130)	a	131)	b	132)	a	133)	b	134)	d	135)	c	136)	c
137)	b	138)	b												

: HINTS AND SOLUTIONS :

1 **(b)**
Davy isolated boron

3 **(c)**
To slow down the speed of neutrons.

4 **(d)**
It is a fact.

5 **(c)**
Amphoteric substance can react with both acid and base

6 **(b)**
In H_3BO_3 boron atom is sp^2-hybridised.

7 **(b)**
$AlCl_3$ exists as Al_2Cl_6.

8 **(d)**
Expect $B(OH)_3$ all other hydroxide are of metallic hydroxide having the basic nature, $B(OH)_3$ are the hydroxide of non-metal showing the acidic nature

9 **(d)**
Solid CO_2 is known as dry ice because it evaporates at $-78°C$ without changing in the liquid state

10 **(a)**
BF_3 is gas.

11 **(a)**
The composition of dry air is: $N_2 = 78.08\%$; $O_2 = 20.95\%$; $Ar = 0.93\%$; $CO_2 = 0.03\%$; $Ne = 0.0018\%$; $He = 0.0005\%$; $Kr = 0.0001\%$ and $Xe = 0.00001\%$. In addition to these it also contains water vapours hydrocarbons,H_2O_2, sulphur compounds.

12 **(c)**
The Lewis acid order for boron halides are explained in terms of back-bonding.

13 **(a)**
As metallic character of element attached to oxygen atom increases, the difference between the electronegativity values of element and oxygen increases and thus basic character of oxides increases and *vice-versa*. Hence the increasing correct order of basic nature is $Al_2O_3 < Mgo < Na_2O < K_2O$.

14 **(c)**
Aluminium oxide is highly stable therefore, it is not reduced by chemical reaction

15 **(b)**
Thermite is a mixture of $Fe_2O_3 + Al$.

16 **(d)**
The enthalpy of formation of Al_2O_3 is very high and hence, it is not possible to reduce it by carbon.

17 **(b)**
It is also known as minium or sindhur.

18 **(d)**
C-atoms form covalently bonded plates (layers). Layers are bonded weakly together, that's why one layer can slide over other cause lubricacy. Cannot be melted easily as large number of atoms being bonded strongly in the layer form big entity.

19 **(b)**
Carbon element belongs to IV A group.

$$C + O_2 \rightarrow CO_2$$
$$CO_2 + H_2O \rightarrow H_2CO_3$$

carbonic acid

20 **(d)**

Diamond is bad conductor of current.

21 **(d)**

It is a fact.

22 **(d)**

Bentonite is spread to destroy the bacteria, insects and other pests by exposure to poisonous gas or smoke. This is called fumigation.

23 **(b)**

$R_3SiCl + HOH \longrightarrow R_3SiOH + HCl$

$R_3SiOH + HOSiR_3 \longrightarrow R_3Si—O—SiR_3$

25 **(c)**

It is a reason for given fact.

26 **(b)**

$2Al + Fe_2O_3 \longrightarrow Al_2O_3 + 2Fe\,;\Delta H = -ve;$

The heat given out is used in welding. This is also called Gold Schmidt alumino thermic process.

27 **(b)**

Carbon cannot expand its octet due to inavailability of d-subshell in 2nd shell.

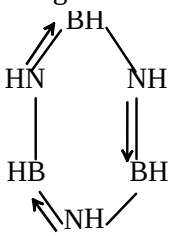
28 **(b)**

$Al(OH)_3 + OH^- \longrightarrow [Al(OH)_4^-]$.

Coordination no. is six thus, it exists as $[Al(H_2O)_2(OH)_4]^-$.

29 **(d)**

Inorganic benzene is borazole or $B_3N_3H_6$ having structure similar to C_6H_6, *i.e.*,



30 **(a)**

$C + \underset{(Conc.)}{2H_2SO_4} \longrightarrow CO_2 + 2SO_2 + 2H_2O$

31 **(b)**

The purest variety of coal is anthracite.

32 **(c)**

Basic lead carbonate is generally known as white lead.

Formula of compound	**Name of the compound**
$PbCO_3.PbOPbCO_3$	Cerussite
$Pb(OH)_2.2PbCO_3$	White lead
$PbSO_4.PbO$	Lanarkite

33 **(a)**

Silica (SiO_2) is used for making optical instruments.

34 **(d)**

It is a fact.

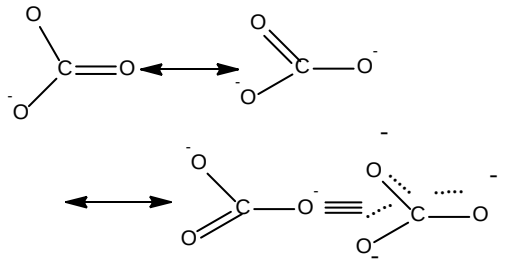
35 **(c)**

1.In nitrogen d-orbitals are absent, so it does not form NCl_5. Thus,NCl_5 does not exist but PCl_5 does.

2. Pb^{2+} is more stable than Pb^{4+}, due to inert pair effect.

3.In carbonate ion (CO_3^{2-}) all the three $C-O$ bonds are identical due to resonance.

4.



5. O_2^+(8+8-1=15)=$\sigma 1s^2, \sigma * 1s^2, \sigma 2s^2, \sigma * 2s^2, \sigma 2p_s^2, \pi 2p_y^2 \approx \pi 2p_z^2, \overset{*}{\pi} 2p_y^1$

NO (7+8=15)

Hence, bo0th O_2^+ and NO contains one unpaired electrons, so paramagnetic.

36 **(d)**

$CO + NaOH \xrightarrow{200°C} HCOONa$

sodium formate

38 **(c)**

HF reacts with silica present in glass and dissolves it to give marking on surface.

39 **(c)**

$Al + III$ group $\longrightarrow$ forms Al_2O_3

41 **(b)**

$BI_3 > BBr_3 > BCl_3 > BF_3$

This order can be easily explained on the basis of the tendency of the halogen atom to back donate its lone pair of electrons to the empty p-orbital of the boron atom through $p\pi - p\pi$ bonding.

42 **(a)**

Pb reacts with dilute HNO_3 and produces NO.

$3Pb + 8HNO_3 \rightarrow 3Pb(NO_3)_2 + 2NO + 4H_2O$

dil.

43 **(c)**

$2Al + Cr_2O_3 \longrightarrow Al_2O_3 + 2Cr\,;\,\Delta H = -ve$

Reductant Oxidant

44 **(d)**

Asbestos can withstand red hot flames without any damage.

45 **(c)**

Diborane possesses four B−H covalent bonds and two three centred (two electrons) B−H−B or hydrogen bridge bonds. These bonds are also known as **banana bonds.**

46 **(a)**

Boron nitride has similar structure to graphite.

47 **(a)**

Mica is a group of minerals, the most important of which are muscotive $H_2KAl_3(SiO_4)_3$ and phlogopite $H_2KMg_3Al(SiO_4)_3$ having sheet structure.

48 **(d)**

Borax on heating forms a glassy mass called borax bead.

$$Na_2B_4O_7 . 10H_2O \xrightarrow{\Delta} Na_2B_4O_7 \xrightarrow{740^oC} \underbrace{NaBO_2 + B_2O_3}_{Bead}$$

49 **(b)**
The stability and basic character of hydrides decreases down the group.

51 **(b)**
It is a fact.

52 **(a)**
General formula of alum is, $M_2'SO_4 \cdot M_2'''(SO_4)_3 \cdot 24H_2O$

53 **(b)**
BF_3 is covalent molecule.

54 **(c)**
Moissan boron is amorphous boron. It has 95-98% boron and is black in colour. It is prepared by reduction of B_2O_3 with Na or Mg.

55 **(d)**
Boric acid is used in carom boards for smooth gliding of pawns because H-bonding in H_3BO_3 gives it a layered structure.

56 **(a)**
Diamond is most inert form of carbon.

59 **(d)**
$\underset{\text{(Amm.sol.)}}{CuCl} + CO \longrightarrow CuCl \cdot CO$

60 **(a)**
Electronegativity decreases down the group.

61 **(a)**
It is a variety of fibrous silicate minerals mainly calcium, magnesium silicates.

62 **(b)**
Hoope's process ⇒ Purification of Al
Hall and Heroult process ⇒ reduction of Al_2O_3
Baeyer's and Serpeck's process ⇒ concentration of bauxite ore

63 **(b)**
In CO and CO_2, carbon has +2 and +4 oxidation states respectively.

64 **(d)**
This give rise to net dipole moment zero in BF_3. BF_3 (sp^2 – hybridization) PF_3 (sp^3).

65 **(b)**
Boron from different hydride of general formula B_nH_{n+4} and B_nH_{n+6} but BH_3 is unknown

67 **(d)**
B_2H_6 form addition product with $(CH_3)_3N$, NH_3 and CO as:

$$B_2H_6 + 2N(CH_3)_3 \longrightarrow [2H_3B \leftarrow N(CH_3)_3]$$
$$B_2H_6 + 2NH_3 \longrightarrow [BH_2(NH_3)_2]^+[BH_4]^-$$
$$B_2H_6 + 2CO \longrightarrow 2[BH_3 \cdot CO]$$

68 **(b)**
$CO_2 + H_2O \longrightarrow H_2CO_3$ (An acid)

69 **(c)**
2nd-orbital has no d-subshell.

70 **(d)**
The thin protective layer of oxide, Al_2O_3 is formed which protects the metal form further attack if air and water and thus stable in air

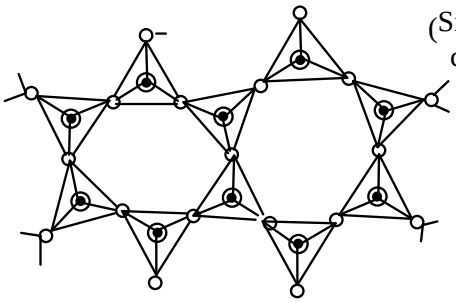
71 **(a)**
It can accept lone pair of electron.

72 **(a)**

$CS_2 + 3Cl_2 \xrightarrow{AlCl_3} CCl_4 + S_2Cl_2$

73 **(a)**

Chain silicates Double chain silicates can be formed when two simple chains are joined together by shared oxygens. These minerals are called amphiboles, and they are well known. The most numerous and best known amphiboles are the asbestos minerals. These are based on the structural unit $(Si_4O_{11})_n^{6n-}$. The structure of amphiboles is



$(Si_4O_{11})_n^{6n^-}$ chain

Structure of amphiboles $(Si_4O_{11})_n^{6n^-}$

74 **(b)**

$Na_2B_4O_7 + H_2SO_4 + 5H_2O \longrightarrow Na_2SO_4 + 4H_3BO_3$

75 **(c)**

It is a fact.

76 **(a)**

CO_2 is more denser than air and N_2 and thus, covers igniting materials more.

77 **(b)**

$AlCl_3$ is covalent but in water, it becomes ionic due to large hydration energy of Al^{3+}.

$AlCl_3 + 6H_2O \rightleftharpoons [Al(H_2O)_6]^{3+} + 3Cl^-$

78 **(a)**

Feldspar is pot. sod. alumino silicate.

79 **(d)**

Tl has marking nature.

81 **(a)**

$2Al + Cr_2O_3 \longrightarrow Al_2O_3 + 2Cr\ ;\ \Delta H = -ve$

82 **(a)**

$SiO_2 + 2Mg \longrightarrow Si + 2MgO$

83 **(c)**

$C + 2H_2SO_4(Conc.) \longrightarrow 2H_2O + 2SO_2 + CO_2$

$C + 4HNO_3(Conc.) \longrightarrow 2H_2O + 4NO_2 + CO_2$

84 **(c)**

German silver contains Cu, Zn and Ni.

85 **(d)**

Graphite is good conductor of current due to the presence of mobile π-electron left on carbon after sp^2-hybridization.

86 **(c)**

Crookes glass contains CeO_2 which cuts off radiations.

87 **(c)**

Most of the fuel gases contain CO as one of the component.

88 **(a)**

Semiconductors are bad conductors of electricity at room temperature but become conductor of electricity at high temperature or when some impurities are added to them.

∴ Si and Ge are semiconductors.

90 **(a)**

$2Al + N_2 \longrightarrow 2AlN$

91 **(d)**

CO_2 is acid anhydride of H_2CO_3.

92 **(c)**

It is a fact.

93 **(b)**

Flint glass or lead glass has composition of

$K_2O.PbO.6SiO_2$.

It is used in making electric bulb and optical instruments.

94 **(d)**

Density of gp. 14 elements are: C (3.51); Si(2.34); Ge (5.32); Sn (7.26) and Pb (11.34) in g/cm^3.

95 **(a)**

$CO_2 + H_2O \longrightarrow H_2CO_3$

96 **(a)**

Monosilane ($e.g.$, SiH_4) on coming in contact with air burns with a luminous flame producing vortex ring. These rings are of silica.

$SiH_4 + 2O_2 \rightarrow SiO_2 + 2H_2O$

97 **(c)**

PbO reacts with acids and alkalies both.

98 **(a)**

Photosynthesis.

99 **(c)**

MCl_2 oxidation state of M=+2

MCl_4 oxidation state of M=+4

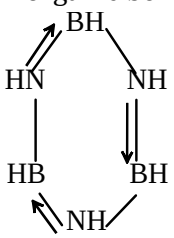
Higher the oxidation state, smaller the size.

Greater the polarizing power, greater the covalent characteristics.

Hence, MCl_4 is more covalent and MCl_2 is more ionic.

100 **(a)**

Inorganic benzene is borazole or $B_3N_3H_6$ having structure similar to C_6H_6, i.e.,



101 **(b)**

$SiCl_4 + 2Mg \longrightarrow Si + 2MgCl_2$

102 **(d)**

General formula of alum is, $M_2'SO_4 \cdot M_2'''(SO_4)_3 \cdot 24H_2O$, Cu is bivalent.

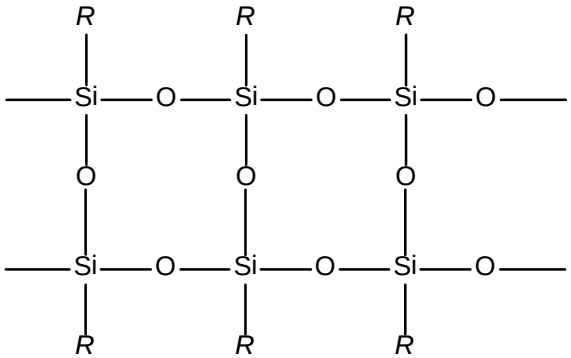
103 **(c)**

$AlCl_3$ is covalent and exists as Al_2Cl_6.

104 **(b)**

$$RSiCl_3 \xrightarrow{3H_2O} RSi(OH)_3 + 3HCl$$

$$RSi(OH)_3 \xrightarrow{\text{Polymerization}}$$



Three dimensional structure of silicon.

105 **(c)**

Lead react with water to form lead hydroxide $Pb(OH)_2$ hence, lead pipes are not suitable for drinking purpose

106 **(a)**

Magnalium is Al +Mg + Cu.

107 **(b)**

The formation of oxide film on Al surface prevents it from further corrosion.

108 **(d)**

Due to back bonding $(p\pi - p\pi)$ giving resonance, bond order in BF_3 is 1.33.

109 **(a)**

$$C_{12}H_{22}O_{11} \xrightarrow{H_2SO_4} 12C + 11H_2O$$

110 **(b)**

B in BF_4^- is sp^3-hybridised having four hybrid orbitals.

112 **(a)**

CO_2 is major contributor to green house effect. This controls the earth's climate.

113 **(c)**

$$Ca_2B_6O_{11} + 2Na_2CO_3 \longrightarrow 2CaCO_3 \downarrow + Na_2B_4O_7 + 2NaBO_2$$

114 **(a)**

Quartz is purest form of silica.

115 **(d)**

$$Al_2O_3 + 3C + 3Cl_2 \longrightarrow 2AlCl_3 + 3CO$$

116 **(c)**

It is a fact.

117 **(b)**

In H_3BO_3, B is sp^2-hybridized and oxygen is sp^2-hybridized having two lone pair on it.

118 **(a)**

It Form boron carbide. The molecular formula of boron carbide is $B_{12}C_3$

$$4B + C \xrightarrow{\Delta} B_4C$$

119 **(a)**

Coal deposits are found very commonly.

120 **(c)**

B_4C is the hardest substance along with diamond

121 **(a)**

Diamond is an allotropic form of carbon, carborundum is SiC, corundum is Al_2O_3, borazon is BN.

122 **(d)**

It is plumbus plumbate, *i. e.*, $PbO \cdot PbO_2$.

123 **(c)**

Destructive distillation of coal (heated to nearly 1270 K) gives coke (solid residue 70%) and hot vapours and gases.

124 **(c)**

B is non-metal and oxide of non-metals are acidic.

125 **(c)**

According to Lewis, the compound which can accept a lone pair of electron, are called acids. Boron halides, being electron deficient compounds, can accept a lone pair of electrons, so termed as Lewis acid.

126 **(d)**

Cryolite is Na_3AlF_6.

127 **(b)**

Addition of CaF_2 to alumina dissolved in Na_3AlF_6 makes it more conducting.

128 **(d)**

Al too forms covalent compounds, *e*. g., $AlCl_3$.

129 **(b)**

Rest all are uses of boric acid.

130 **(a)**

Alkali metals do not form carbonyls.

131 **(b)**

Phosgene is carbonyl chloride, , *e*., $COCl_2$.

132 **(a)**

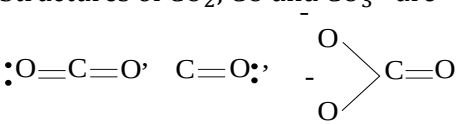
Rest all react with water.

133 **(b)**

Flux is mostly used in removal of silica and undesirable metal oxide.

134 **(d)**

Structures of CO_2, CO and CO_3^{2-} are



Bond multiplicity decreases the bond length. Thus, CO with a triple bond will have shortest C—O bond length. CO_2 with a double bond will have a larger C—O band length. CO_3^{2-} is a resonance hybrid of three structure with a C—O length of more than a C—O double bond but less than a C—O single bond. Thus, C—O bond length is maximum in CO_3^{2-}.

136 **(c)**

$Al_2O_3 + 3C + N_2 \longrightarrow 2AlN + 3CO$

137 **(b)**

Water gas is sodium silicate Na_2SiO_3.

138 **(b)**

$a + 6 \times (-1) = -2; \quad \therefore a = +4$

Assertion - Reasoning Type

This section contain(s) 11 questions numbered 1 to 11. Each question contains STATEMENT 1(Assertion) and STATEMENT 2(Reason). Each question has the 4 choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

a) Statement 1 is True, Statement 2 is True; Statement 2 **is** correct explanation for Statement 1
b) Statement 1 is True, Statement 2 is True; Statement 2 **is not** correct explanation for Statement 1
c) Statement 1 is True, Statement 2 is False
d) Statement 1 is False, Statement 2 is True

1 **Statement 1:** Liquid NH_3 is used for refrigeration.
Statement 2: Liquid NH_3 does not vaporize quickly.

2 **Statement 1:** White phosphorus is stored under water.
Statement 2: White phosphorus is highly reactive and catches fire spontaneously in air.

3 **Statement 1:** OF_2 is named as oxygen difluoride.
Statement 2: OF_2 is oxygen is less electronegative than fluorine.

4 **Statement 1:** Boranes are volatile and decompose to boron, and hydrogen at red heat
Statement 2: All the boranes react with ammonia depending on the conditions

5 **Statement 1:** GeO, SnO and PbO are more basic and ionic than the corresponding GeO_2, SnO_2 and PbO_2
Statement 2: GeO is acidic while SnO And PbO are amphoteric

6 **Statement 1:** White phosphorus is more reactive than red phosphorus.
Statement 2: red phosphorus consists of P_4 tetrahedral units linked to one another to form linear chains.

7 **Statement 1:** Among chalcogens, tendency of catenation is maximum for sulphur.
Statement 2: S-S bond dissociation energy is higher then O-O bond dissociation energy.

8 **Statement 1:** Si−Si bonds are weaker than Si−O bonds
Statement 2: Silicon forms double bonds with itself

9 **Statement 1:** Calcium carbide on hydrolysis gives acetylene
Statement 2: Calcium carbide contains C^{4-} anions

10 **Statement 1:** BF_3 is a useful organic catalyst for Friedel crafts reactions
Statement 2: It is covalent, gaseous and hydrolysed by water

11 **Statement 1:** The ionization energy of gallium remains nearly same as that of aluminium.
Statement 2: This is due to shielding of outer shell electrons form the nucleus by the d electrons of gallium.

: ANSWER KEY :

1)	a	2)	a	3)	a	4)	b
5)	d	6)	b	7)	a	8)	c
9)	c	10)	b	11)	a		

: HINTS AND SOLUTIONS :

1 **(a)**
Liquid ammonia has a large heat of vaporization (0.327 cal/g). It is therefore used in ice plants.

2 **(a)**
The ignition temperature of white P is low (about 30° C) in air. It readily catches fire giving dense fumes of phosphrous pentoxide. It is therefore kept in water.

3 **(a)**
The compound of oxygen and fluorine is more electronegative than oxygen fluorides as fluorine is more electronegative than oxygen

4 **(b)**
$B_2H_6 + 6H_2O \longrightarrow 2H_3BO_3 + 6H_2$
$B_2H_6 + NH_3$ (excess) $\longrightarrow B_2H_6 \cdot 2NH_3$
$B_2H_6 + NH_3$ (excess) $\longrightarrow$ Boron nitride

5 **(d)**
Increased stability of lower valent states on descending a group is illustrated by the facts that $Ge^{2+}$and Sn^{2+} are strong reducing agent

6 **(b)**
White P exists as discrete P_4 tetrahedral molecule having P-P-P bound angle 60°.Hence, molecule is under strain and more reactive while red P exits as P_4 tetrahedral joined together through covalent bounds giving polymeric structure.

7 **(a)**
Catenation means the tendency of an element to from chains of identical atoms which is pronounced in sulphur among chalcogens.

8 **(c)**
Si−Si bonds ar weaker than Si − O bonds and Si has no tendency to form double bonds with itself

9 **(c)**
Calcium carbide on hydrolysis gives acetylene. Calcium carbide contains C_2^{2-} anion

10 **(b)**
$BF_3 + H_2O \longrightarrow H[BF_3OH]$
$BF_3 + 3H_2O \longrightarrow H_3PO_3 + 3HF$
Since B has 6 electrons in the outer shell in BF_3 molecules, it can readily accept a lone pair of electrons from a donor atoms

11 **(a)**
In Ga, 10-d electrons in penultimate shell shiled the nucleus change less effectively, the outer electrons is held frimly by the nucleus. As result, the ionisation energy remains nearly the same as that of aluminium in spite of the fact that atomic size increase.