Hybridisation

81. (c) Increasing order of bond angle is $\underset{109^\circ}{sp^3} < \underset{120^\circ}{sp^2} < \underset{180^\circ}{sp}$.

82. (b) Trigonal planar, sp^2

Explanation:

In **boron trifluoride (BF_3)**, the central boron atom forms **three sigma (σ) bonds** with fluorine atoms and no lone pairs.

The boron atom undergoes **sp^2 hybridisation**, resulting in a **trigonal planar geometry** with **bond angles of 120°**.

83. (d) Spread out between the structure

Explanation:

In **graphite**, each carbon atom is **sp^2 hybridised** and forms **three sigma bonds** with neighbouring carbon atoms, leaving one **unhybridised p-orbital**.

These p-orbitals overlap sidewise to form a **delocalised π-electron cloud** spread throughout the layers, allowing **electrical conductivity** and **lubricating properties**.

84. (a) NH_4^+ has sp^3 − hybridized nitrogen so its shape is tetrahedral.

85. (d) Linear

Explanation:

In **sp hybridisation**, one s orbital and one p orbital mix to form **two equivalent sp hybrid orbitals** oriented **180° apart**.

This gives a **linear geometry**, as seen in molecules like **$BeCl_2$** and **CO_2**, where the central atom has **sp hybridisation**.

86. (b) Bond angle increases with change in hybridisation in following order $sp^3 < sp^2 < sp$.

87. (d) Tetrahedral, sp^3

Explanation:

In **tetramethylsilane ($Si(CH_3)_4$)**, the central silicon atom forms **four sigma (σ) bonds** with four methyl groups ($–CH_3$).

Silicon undergoes **sp^3 hybridisation**, giving a **tetrahedral geometry** with bond angles of approximately **109.5°**.

88. (c) In Diborane boron shows sp^3 – hybridization.

89. (a) Alkene does not show linear structure but it has planar structure due to sp^2 – hybridisation.

90. (c) Generally SF_4 consist of 10 electrons, 4 bonding electron pair and one lone pair of electron, hence it shows sp^3d hybridization.

91. (c) H_3O^+

Explanation:

The **hydronium ion (H_3O^+)** has the central oxygen atom **sp^3 hybridised** with **one lone pair** of electrons.

This lone pair repels the bonding pairs, giving the molecule a **trigonal pyramidal shape**, similar to **NH_3**.

92. (c)

Atom/Ion	Hybridisation
NO_2^+	sp
SF_4	sp^3d with one lone pair of electron
PF_6^-	sp^3d^2

93. (a) PF_3 consist of three bonding pair electrons and one lone pair of electron hence it shows sp^3 – hybridization.

94. (b) NO_2^+ shows sp – hybridization. So its shape is linear.

95. (c) Generally octahedral compound show sp^3d^2 – hybridization.

96. (a) In fifth group hydride bond angle decreases from top to bottom

$NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$.

97. (b) Generally NH_4^+ shows sp^3 hybridization.

98. (b) We know that single, double and triple bond lengths of carbon in carbon dioxide are 1.22 Å, 1.15 Å and 1.10Å respectively.

99. (b) It shows sp^2 – hybridization so it is planar.

100. (b) Square pyramidal

Explanation (Word-friendly format):
In [SbF5]2−[SbF_5]^{2−}[SbF5]2−, the central atom antimony (Sb) has the outer electronic configuration 5s2 5p35s^2¥,5p^35s25p3.
It forms five sigma bonds with fluorine atoms and has one lone pair due to the extra two negative charges.

Thus, there are a total of six electron pairs (5 bond pairs + 1 lone pair) around Sb.
For six electron pairs, the hybridization is **sp³d²**, which corresponds to an **octahedral** arrangement of orbitals.
However, the presence of one lone pair distorts the shape from octahedral to **square pyramidal**.

Therefore, the geometry of [SbF5]2−[SbF_5]^{2−}[SbF5]2− is **square pyramidal**, not trigonal bipyramidal.