Hybridisation

61. (b) PF_5 involves sp^3d hybridization and hence has trigonal bipyramidal structure.

62. (c) *s*-character in $sp = \frac{1}{2} \times 100 = 50\%$

s-character in $sp^2 = \frac{1}{3} \times 100 = 33.3\%$

s-character in $sp^3 = \frac{1}{4} \times 100 = 25\%$

Hence, maximum *s*-character is found in *sp*-hybridisation.

63. (b) The molecule of PCl_5 has sp^3d hybridisation, structure is trigonal bipyramidal.

64. (b) Merging (mixing) of dissimilar orbitals of different energies to form new orbitals is known as hybridisation and the new orbital formed are known as hybrid oribitals. They have similar energy.

65. (b) In SO_3 sulphur is sp^2 hybridized so its shape will be trigonal planar.

66. (a) These all are triangular with sp^2 hybridization.

67. (c) Bond length depends upon bond order and in benzene all $C-C$ bonds have same bond order.

68. (b) In C_2H_2 each carbon has sp -hybridization $H-\underset{sp}{C} \equiv \underset{sp}{C}-H$

69. (c) sp^2

Explanation:

The **sp^2 hybrid orbitals** arrange themselves in a **trigonal planar** geometry to minimize repulsion, resulting in **bond angles of 120°**

70. (a) As *p*-character increases the bond angle decreases.

In sp - p-character $\frac{1}{2}$, bond angle - 180^{o}

In sp^{2} - p-character $\frac{2}{3}$, bond angle - 120^{o}

In sp^{3} - p-character $\frac{3}{4}$, bond angle - 109^{o}

71. (a) sp^{3}-hybridization called tetrahedral because it provides tetrahedral shape to the molecule.

72. (a) S-atom in SF_6 has sp^3d^2 hybridisation. So, the structure of SF_6 will be octahedral.

73. (b) sp, sp^2 and sp^3

Explanation:

- In **$BeCl_2$**, beryllium forms two sigma bonds → **sp hybridization** (linear shape).
- In **BCl_3**, boron forms three sigma bonds → **sp^2 hybridization** (trigonal planar).
- In **CCl_4**, carbon forms four sigma bonds → **sp^3 hybridization** (tetrahedral).

74. (b) Structure of H_2O_2 is non-planar. It has open book structure.

75. (d) Structure of N_2O is similar to CO_2 both have linear structure.

76. (d) sp^3

Explanation:

In **carbon tetrachloride (CCl_4)**, the central carbon atom forms **four sigma (σ) bonds** with chlorine atoms.

To form four equivalent bonds, the carbon atom undergoes **sp^3 hybridisation**, resulting in a **tetrahedral shape** with bond angles of approximately **109.5°**.

77. (c) HNO_3

Explanation:

In **nitric acid (HNO_3)**, all atoms lie approximately in the same plane due to **sp^2 hybridisation** of the central nitrogen atom, giving the molecule **planar symmetry**.

In contrast, **CCl_4** is tetrahedral and **H_2O** and **H_2SO_4** are non-planar

78. (a) $SnCl_2$ is V – shaped.

79. (d) In NH_4^+ nitrogen is sp^3 hybridised so 4 hydrogen situated at the corners of a tetrahedron.

80. (b) 120°

Explanation:

In **sp^2 hybridisation**, one s orbital and two p orbitals mix to form **three equivalent sp^2 hybrid orbitals** arranged in a **trigonal planar** geometry.

The orbitals are oriented **120° apart** to minimize repulsion, giving a **planar triangular structure**.