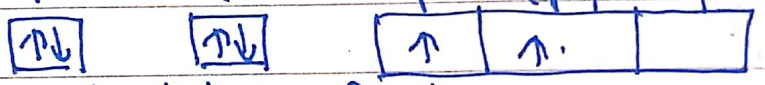
The electronic configuration of carbon in ground state is

$_{6}C^{12}$ $1s^2$ $2s^2$ $2p^1$ $2p^1$ $2p^2$.



In ground state electronic configuration of carbon has only two electrons are unpaired and hence carbon must form compounds in valency two. But it is established fact that carbon form all organic compounds in its tetravalence state. Tetravalency of carbon is explained on the suggestation that the paired electrons of 2s orbital becomes unpaired before reaction and its electron is promoted to vacand 2pz orbital. This situation.

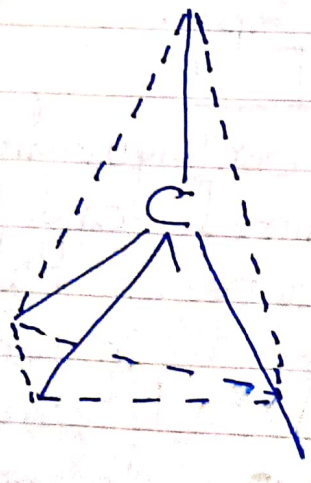
is possible. When carbon will be excited. The electronic configuration of carbon in excited state.

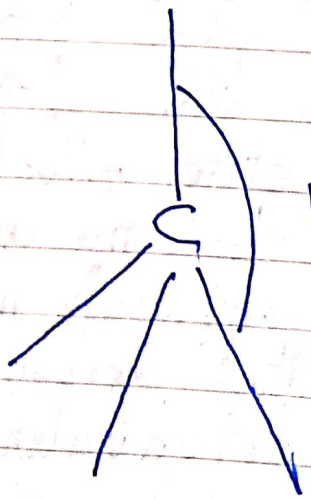
$_6C^{12}$.

$1s^2$	$2s^1$	$2p_x^1$	$2p_y^1$	$2p_z^1$
↑↓	↑	↑	↑	↑

In excited state carbon has four unpaired electrons and so formed four bonds.

According to Le Bel and Vant Hoff (1876) "the four covalent bond of carbon are not situated in the plan but are symmetrically distributed in space. The four bonds of carbon are directed towards the four corners of a regular tetrahedron constructed around the carbon atom as the centre. The bond angle of any two bonds of carbon is 109°28'.

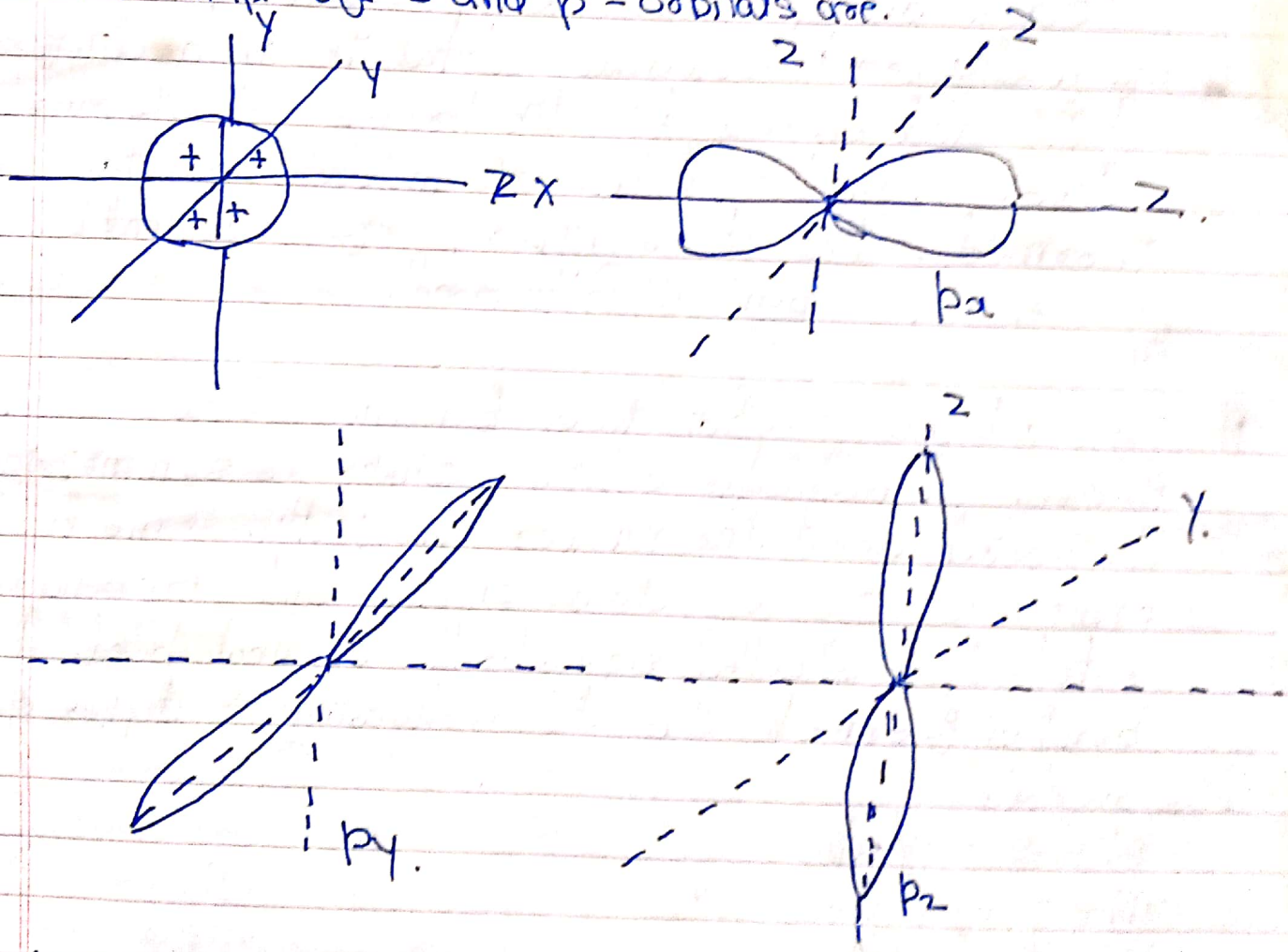




Normal direction of carbon bond.

Atomic orbitals: The maximum probability of finding

an electron in a three dimensional space around the nucleus of an atom is called atomic orbitals or simply orbitals. s, p, d and f are called atomic orbitals in which the maximum number of 2, 6, 10 and 14 electrons can be accumulated and have 1, 3, 5 and sub-orbitals.
The shape of s and p-orbitals are.



(The orientation of s and p orbitals).

A covalent bond is formed as a result of overlapping of atomic orbitals of the combining

atoms. giving a molecular orbitals. Thus a covalent bond formation may involve the following types of overlap:-

(i) s-s and overlap. (s and s overlap)
(ii) s-p and overlap. (s and p overlap)
(iii) p-p and overlap (linear or sid ewise)

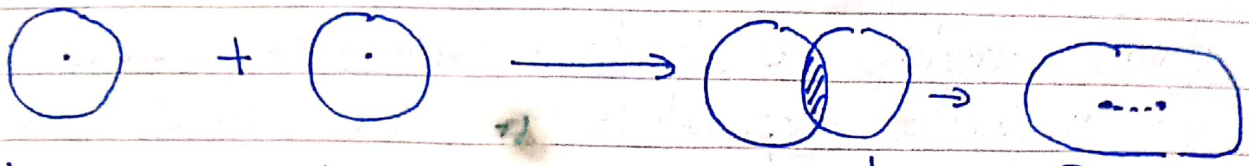
Each one of these overlap result in the formation of a different molecular orbital having a different shape and energy. In the process of overlap. two main types of molecular orbitals are formed. Thus two types of covalent bond. (i) sigma σ bond (ii) Pi π bond.

(1) Sigma bond. When two bonding orbitals overlap to form a molecular orbital which is symmetrical distributed about the nuclear axis; the molecular orbital is referred to as sigma and the bond thus established is called sigma bond or single bond. A sigma bond is formed due to following types of overlap.

(a) s-s overlap.
(b) s-p overlap.
(c) p-p overlap.

(a) s-s overlapping When s-orbital of two atoms overlap each other, a new orbital is formed.

which is known as s-s molecular orbital. It can be understood by taking the example of formation of hydrogen molecule.



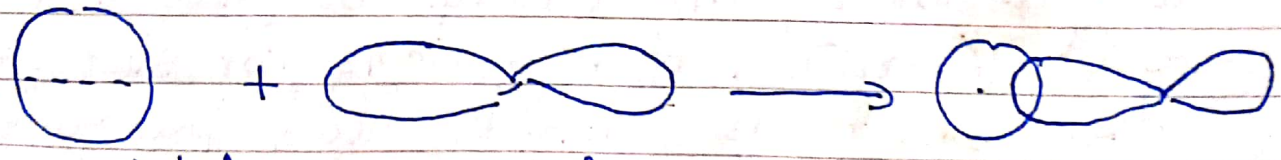
1s 1s s-s overlap. Bond axis.

The s-s molecular orbital is also called σ-orbital and the bond formed between the atoms is called σ-bond. which is non-directional.

(b). s-p overlapping:- When one s-orbital and one p orbital overlap each other. s-p molecular orbital is formed. This type of overlapping can be understood by taking the example of formation of H-F molecule.

F atom $1s^2$ $2s^2$ $2p_x^1$ $2p_y^1$ $2p_z^1$

H atom $1s^1$

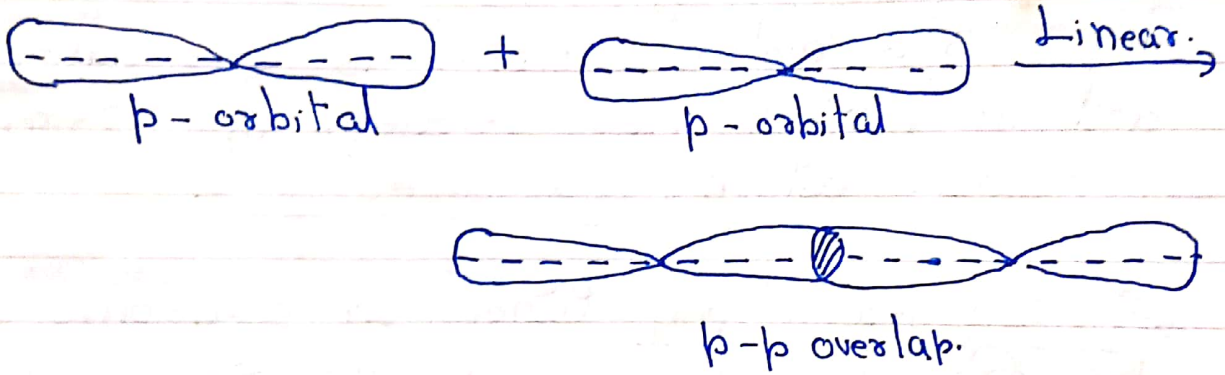


s-orbital p-orbital s-p overlap.

sp. molecular orbital.

As a result of s-p overlapping σ bond is formed.

(c) p-p overlapping:- When p-orbitals of two atoms overlap each other linear i.e. axially σ molecule. σ molecular orbital is formed and the bond is called σ bond.



(2) Pi-bond. This type of a covalent bond is formed as a result of the lateral or side wise overlap of the p-orbitals of two atoms. For such overlap, the two p-orbitals must be held parralled and should approach of each other as shown:-