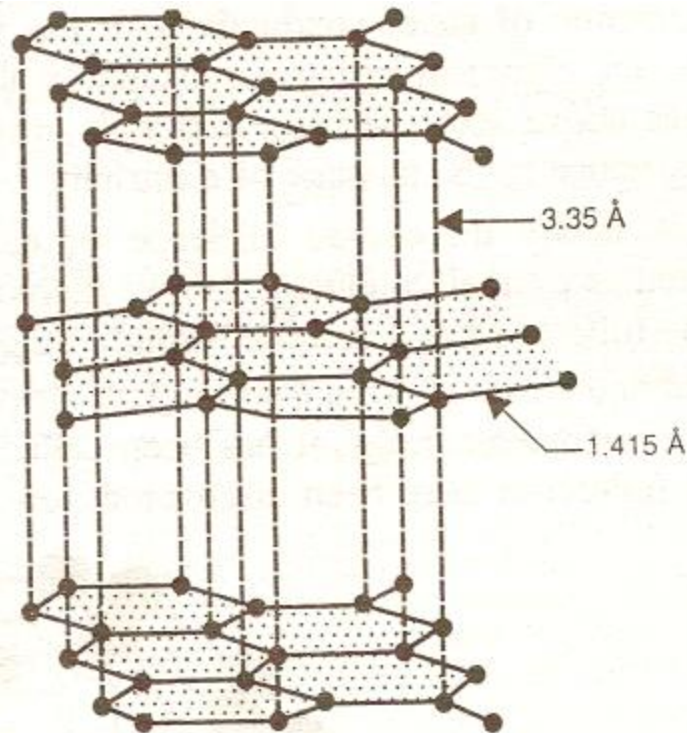


# Graphite

**Structure :** Each carbon atom is covalently bonded to three others involving  $sp^2$  hybrid orbitals instead of four as in diamond. Thus, all atoms in a single plane are linked to give flat hexagons as in benzene. The hexagons are held together in sheet like structures, parallel to one another. The C - C covalent bond distance is 1.42 Å. The distance between the sheets or layers, however is comparatively large being about 3.35 Å. This rules out the possibility of covalent bonding between the layers. Such crystals in which the various sheets of atoms are separated from one another by a distance larger than the maximum permissible for the formation of chemical bond are said to have layer lattices.

# Graphite



**Graphite is a good conductor :** In graphite, each carbon atom is connected only to three other carbon atoms ; while the fourth valency is unsatisfied. In other words, these delocalised electrons are free to move within the layer itself. This accounts for the fact that graphite is good conductor of electricity.

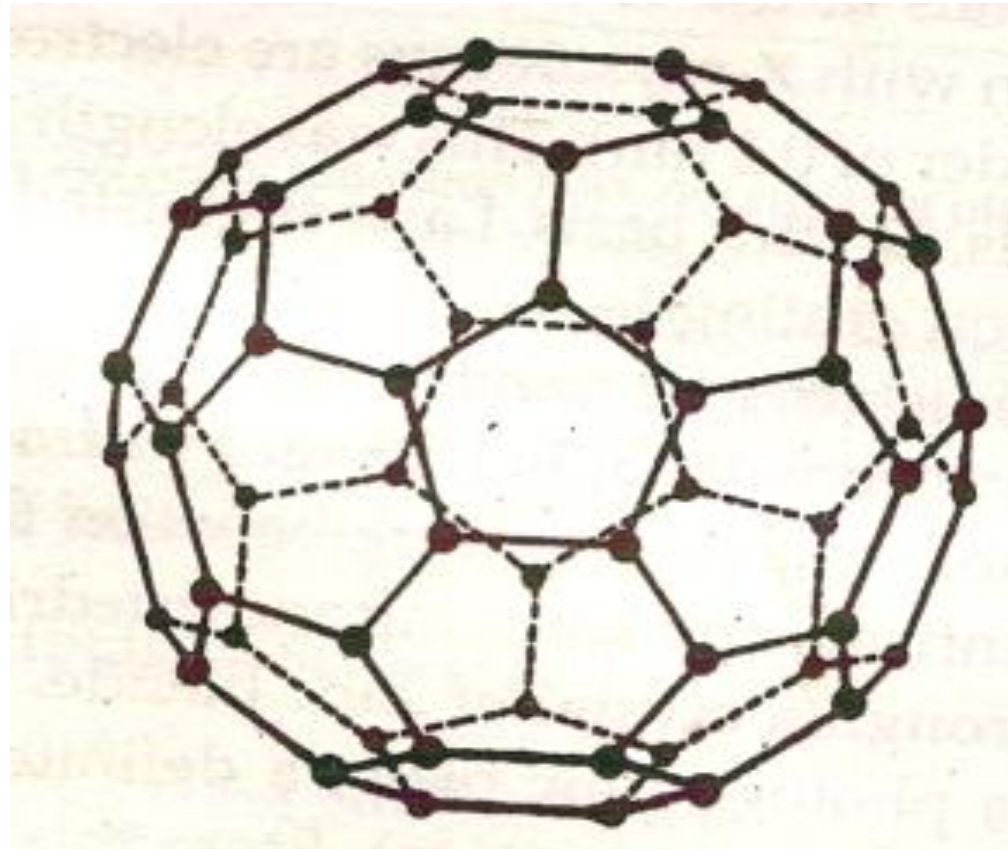
# FULLERENES

**Introduction** : Fullerene is an allotrope of carbon. It is a molecule of formula  $C_{60}$ . It is popularly known as Buckminster fullerene in honour of the american architect Buckminster Fuller, who designed dome structures based on hexagons & pentagons.

**Preparation** : Fullerenes are prepared by vaporizing a graphite rod in a helium atmosphere. Mixture of fullerenes like  $C_{60}$ ,  $C_{70}$  etc., are formed which are separated by solvent extraction. Pure  $C_{60}$  is isolated from this mixture by column chromatography.

**Structure** : The  $C_{60}$  molecule has a truncated icosahedron structure. An icosahedron is a polygon with 60 vertices and 32 faces, 12 of which are pentagonal and 20 hexagonal. A carbon atom is present at each vertex of this structure. The molecule is aromatic and has several resonance structures. The valencies of each carbon atom are satisfied by two single and one double bond.  $C_{60}$  is also known as buckyball as it is a spherical cluster of carbon atoms arranged in series of 5 and 6, membered rings to form a soccer ball shape.

# FULLERENES



# FULLERENES

## **Properties of Fullerenes :**

1. Fullerene is a black powdery material.
2. It forms deep magenta solution, when dissolved in benzene.
3. It is very tough and thermally stable.
4. It exists as a discrete molecule, unlike the other two allotropes of carbon (viz. diamond and graphite).
5. It can be compressed to lose 30% of its volume without destroying its carbon cage structure.

## **Applications of fullerenes :**

1. It is suitable for use as a lubricant due to its spherical structure. The bucky balls would act as molecular ball bearings.

# FULLERENES

2. It can be used as a superconductor when mixed with alkali metals.
3. It can also be used as soft ferromagnet.
4. Other possible areas of uses are:
  - (i) Electronic and Microelectronic devices.
  - (ii) Non-linear optical devices.