CHEMICAL BONDING

Dr. G. VIGNESH

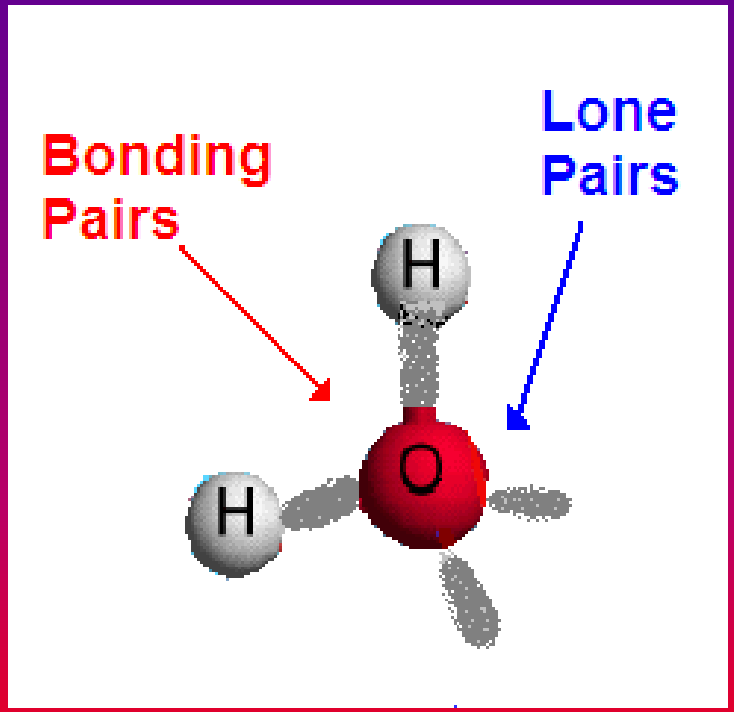
Assistant Professor

St.Xavier's College(Autonomous)

PalayamKottai

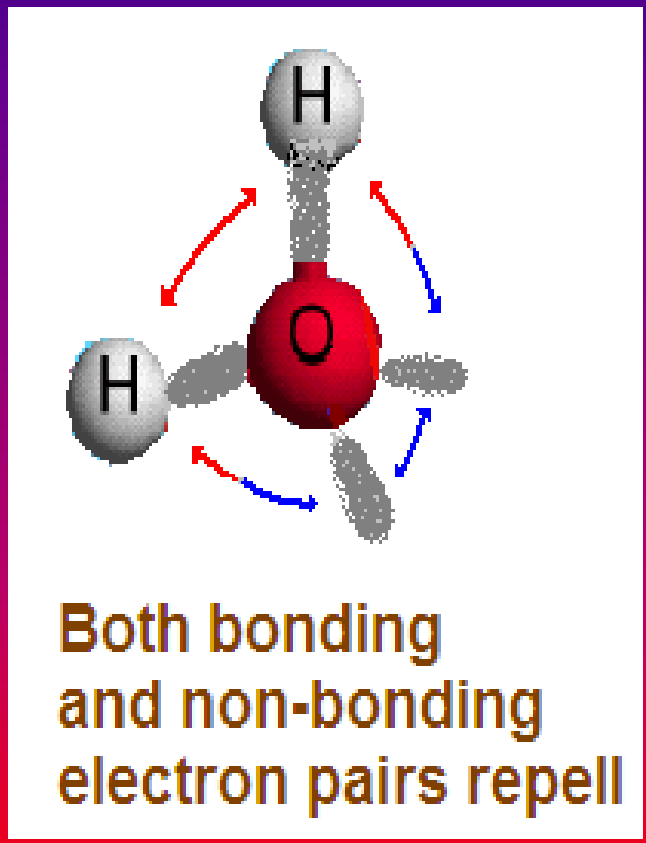
Bonding Electrons and Lone Pairs

- In a molecule some of the valence electrons are shared between atoms to form covalent bonds. These are called **bonding electrons.**
- Other valence electrons may not be shared with other atoms. These are called **non-bonding electrons** or they are often referred to as **lone pairs.**



VSEPR

- In all covalent molecules electrons will tend to stay as far away from each other as possible
- The shape of a molecule therefore depends on:
  1. the number of regions of electron density it has on its central atom,
  2. whether these are bonding or non-bonding electrons.



VSEPR: Predicting the shape

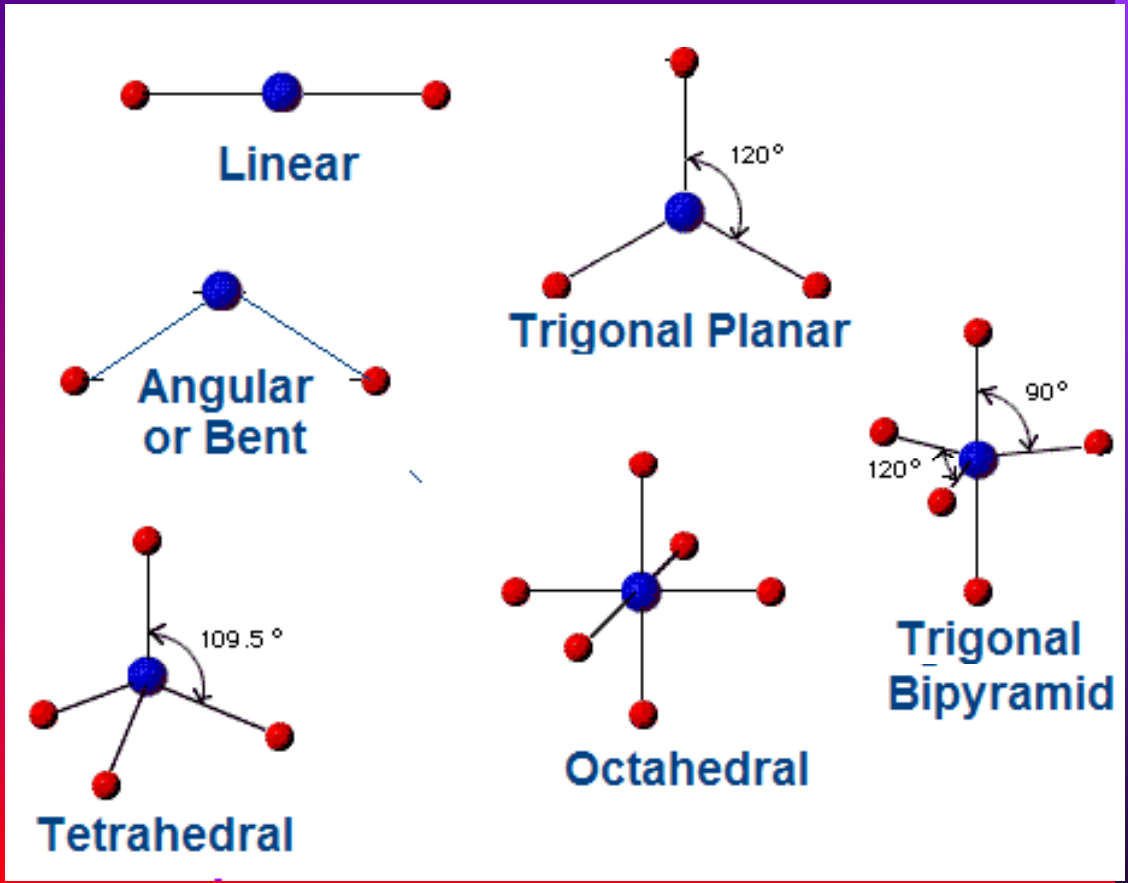
- Once the dot structure has been established, the shape of the molecule will follow one of basic shapes depending on:
  1. The number of regions of electron density around the central atom
  2. The number of regions of electron density that are occupied by bonding electrons

VSEPR: Predicting the shape

- The number of regions of electron density around the central atom determines the electron skeleton
- The number of regions of electron density that are occupied by bonding electrons and hence other atoms determines the actual shape

Basic Molecular shapes

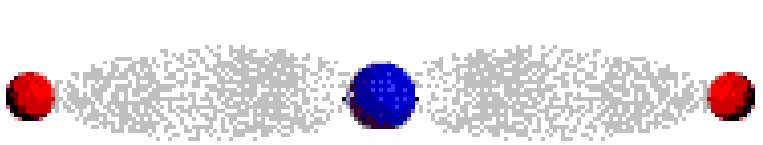
The most common shapes of molecules are shown at the right



Linear Molecules

Linear molecules have only two regions of electron density.

Linear



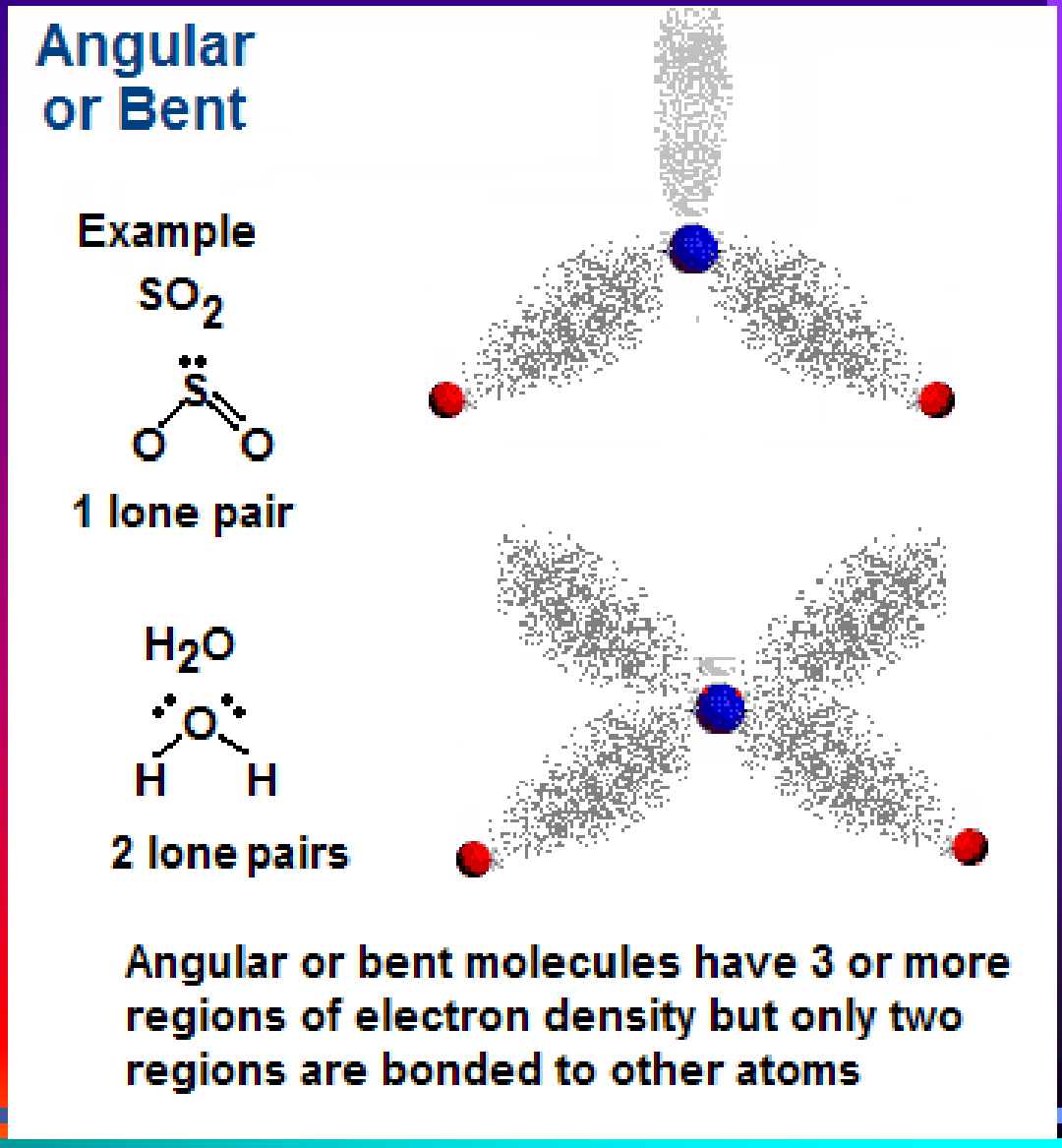
There are 2 regions of electron density around the central atom. Both are occupied by other atoms

Examples

CO_2 O = C = O

Angular or Bent

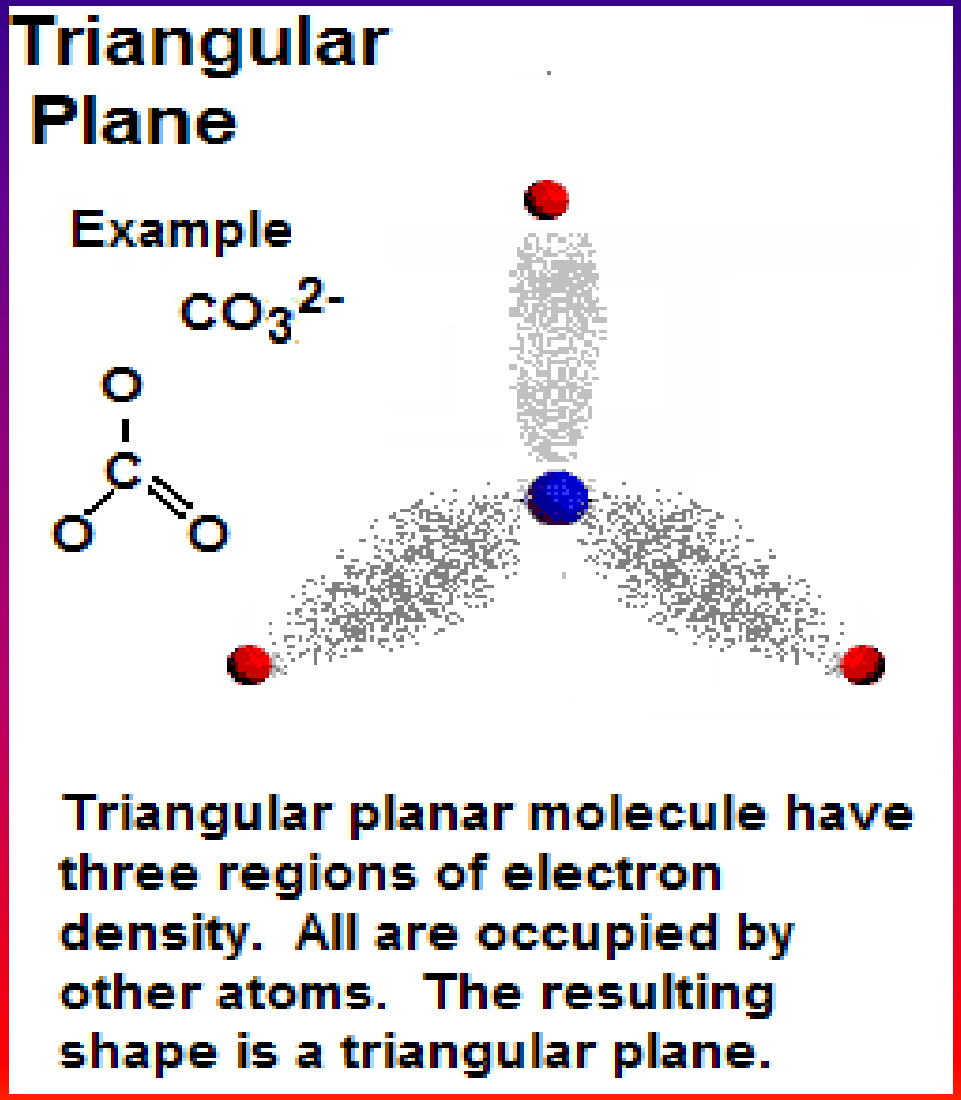
Angular or bent molecules have at least 3 regions of electron density, but only two are occupied



Triangular Plane

Triangular planar molecules have three regions of electron density.

All are occupied by other atoms



Tetrahedron

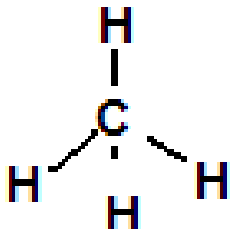
Tetrahedral molecules have four regions of electron density.

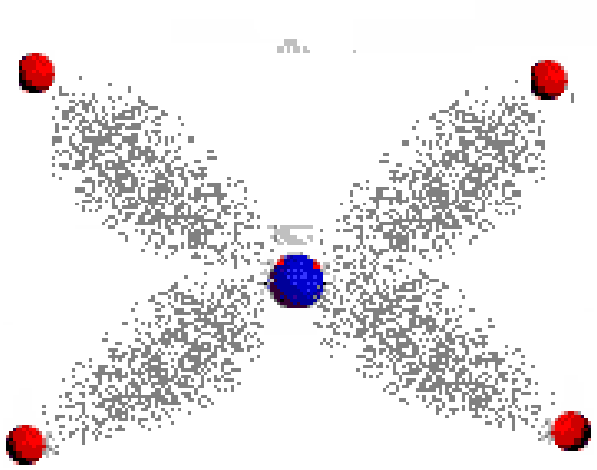
All are occupied by other atoms

Tetrahedron

Example

CH_4





A tetrahedral molecule has four regions of electron density. All are occupied by other atoms. The result is a three dimensional figure with bond angles of about 109°

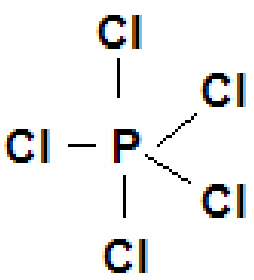
Trigonal Bipyramid

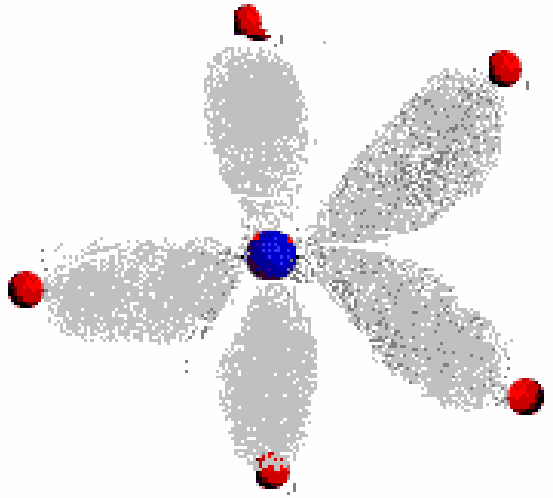
A few molecules have expanded valence shells around the central atom. Hence there are five pairs of valence electrons. The structure of such molecules with five pairs around one is called trigonal bipyramid.

Trigonal Bipyramid

Example

PCl_5





In a trigonal bipyramid the centrral atom is surrounded by 5 pairs of bonded electrons. The valence shell around the central atom is expanded to ten electrons instead of the usual eight.

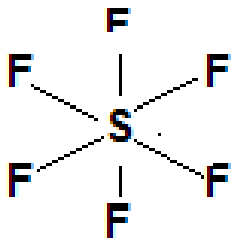
Octahedron

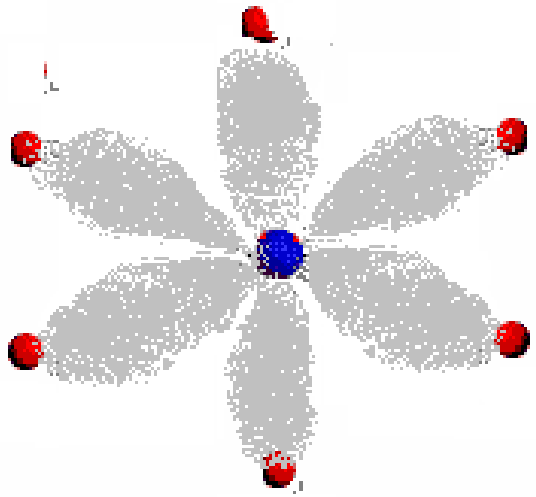
A few molecules have valence shells around the central atom that are expanded to as many as six pairs or twelve electrons. These shapes are known as octahedrons

Octahedron

Example

SF_6





An octahedral molecule has six regions of electron density around the central atom. The valence shell is expanded to 12 electrons instead of the usual eight