**VSEPR THEORY(VALENCE SHELL ELECTRON PAIR REPULSION )**

**It is basically a model to predict the geometry of molecules.**

**Molecular Geometry**: The geometry of a molecule is the positions of individual atoms relative to one another around the central atom.

We have two types of molecules: Linear and non linear

**(1)Linear Geometry (linear molecules) :** When two atoms are bonded together in a diatomic molecule The only possible geometry is a straight line. Hence, such a molecular geometry (or shape) is called "linear Geometry”.

(2) **Bent," "angular," or "V-shaped(nonlinear)," :When** we have three or more bonded atoms (in a triatomic molecule), the geometry is non linear.

The following terms are commonly used in discussing the shapes of molecules.

* **Lone Pair:**This refers to a pair of [valence electrons](https://www.toppr.com/guides/chemistry/structure-of-atom/valency/) that are not shared with another atom.
* **Bond pair :** This refers to a pair of  [electrons](https://www.toppr.com/guides/chemistry/structure-of-atom/valency/) that are shared with another atom.
* **Bond Angle:** This is the angle between a bonded atoms with the central atom,

**VSEPR (Valence Shell Electron Pair Repulsion theory).**

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“Main idea of VSEPR theory is based on the fact that electron pair surrounding the central atom will repel each other in such as way that after a certain point no more repulsion will take place and the molecule acquires maximum stability and minimum energy”.

**Postulates:**

* In polyatomic molecules (i.e. molecules made up of three or more atoms), one of the constituent atoms is identified as the central atom to which all other [atoms belonging to the molecule](https://byjus.com/chemistry/atoms-and-molecules/) are linked.
* The total number of valence shell electron pairs decides the shape of the molecule.
* The electron pairs have a tendency to orient themselves in a way that minimizes the electron-electron repulsion between them and maximizes the distance between them to obtain stability.
* central atom of the molecule be surrounded by bond pairs of electrons, then, the asymmetrically shaped molecule can be expected.
* central atom be surrounded by both lone pairs and bond pairs of electrons, the molecule would tend to have a distorted shape.
* The strength of the repulsion is strongest in two lone pairs and weakest in two bond pairs.so order is LP-LP>L.P-B.P>B.P-B.P
* If electron pairs around the central atom are closer to each other, they will repel each other. This results in an increase in the energy of the molecules.
* If the electron pairs lie far from each other, the repulsions between them will be less and eventually, the [energy of the molecule](https://byjus.com/physics/energy-level/) will be low.

**Limitations**

* This theory fails to explain isoelectronic species (i.e. elements having the same number of electrons). The species may vary in shapes despite having the same number of electrons.
* The VSEPR theory does not shed any light on the compounds of [transition metals](https://byjus.com/chemistry/transition-elements/). The structure of several such compounds cannot be correctly described by this theory. This is because the VSEPR theory does not take into account the associated sizes of the substituent groups and the lone pairs that are inactive.
* Another limitation of VSEPR theory is that it predicts that halides of group 2 elements will have a linear structure, whereas their actual structure is a bent one.

## Predicting the Shapes of Molecules:

The following steps must be followed in order to decide the shape of a molecule.

* The least [electronegative](https://byjus.com/chemistry/electronegativity/) atom must be selected as the central atom (since this atom has the highest ability to share its electrons with the other atoms belonging to the molecule).
* The total number of electrons belonging to the outermost shell of the central atom must be counted.
* The total number of electrons belonging to other atoms and used in bonds with the central atom must be counted.
* These two values must be added in order to obtain the valence shell electron pair number or the VSEP number.

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| **VSEP Number** | **Shape of the Molecule** |
| 2 | Linear |
| 3 | Trigonal Planar |
| 4 | Tetrahedral |
| 5 | Trigonal Bipyramidal |
| 6 | Octahedral |
| 7 | Pentagonal Bipyramidal |
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