V.S.E.R Theory

Valence Shell Electron Pair Repulsion Theory

The idea of a correlation between molecular geometry and number of valence (shell) electron pairs (Both B.P & NB) was originally proposed in 1939 by R. Tsuchindo (Japan)
In 1940, it was presented by Sidgwick and Powell in University of Oxford.

In 1957 Ronald Gillespie and Ronald. S Nyholm of University College London refined this concept into a more detailed theory

Valence shell electron pair repulsion theory is a model used to predict the Geometry of individual molecule in three dimensional space on the basis of numbers of electron pairs surrounding Central atom.

The Premise of V.S.E.P.R Theory is that the valence electron pair surrounding an atom. to repel each other and will therefore adopt an arrangement that minimise this repulsion, SO, it decreases the energy of a molecule and increases the stability of molecules.

or in other words it explains the shape of Simple molecules and ions on the basis of repulsions among the electron pair present in the valence shell of their Central atoms

This theory may be pointed as follows,

Valence electrons of the Central atom of molecules or ions form pairs with antiparallel spins.
Each electron pair occupies a reasonably well defined region in the space and other electron pairs are effectively excluded from this space.

(2) The electrons already present in valence (outermost) shell and the additional electrons acquired by the central atom as a result of bonding with others are called valence electrons or valence shell electrons.

(3) These electron pairs stay as far apart from one another in space as possible to minimise the mutual repulsions to form stable geometrical shape or arrangement.

4. The most stable geometrical arrangement of, two, three, four, five & six (2, 3, 4, 5, & 6) electron pairs is linear, trigonal plano tetrahydral, trigonal bi-pyramid and Octahedral respectively

5. Some or all electron pairs may be involved in boudings called Bond Pairs (B.P.) while others are called lone pairs (L.P) or non-bondings.

6. If the central atom in molecule is surrounded by only Bond pairs then the molecule has regular or symmetrical geometry but in case of BPs and LPs, the molecule does not have regular geometrical shape e.g in CH_4, the four sp^3 hybridised orbitals have bond pairs resulting in a symmetrical tetrahydral shape,

As in case of NH_3, H_2O & HF have one, two and three lone pairs on the central atoms, hence they have Pyramidal, Angular and Linear shape respectively, but not the tetrahydral shape, though they have the same sp^3 hybridisation and tetrahydral - structure.