VSEPR Theory (Model)

This model was designed by R.J. Gillespie and R.S. Nyholm**.**

The VSEPR theory explains and predicts the geometry of molecules. The molecular geometry is the three-dimensional arrangement of the atoms that constitute a molecule.

The Valence-shell electron-pair repulsion (VSEPR) Model is a model that states that the electron pairs in a molecule lie as far apart from one another so that they experience minimum repulsion.

How is molecular geometry determined by VSEPR Theory/ Model?
1. draw the Lewis structure of molecule.

2. add the number of ligands (bonds, (single and double bond counts the same)) and the number of lone pairs of the central atom

3. determine the ψ-polyhedra

2 ligands:	linear
3 lone pairs and/or ligands:	trigonal planar
4 lone pairs and/or ligands:	tetrahedral
5 lone pairs and/or ligands:	trigonal bipyramidal
6 lone pairs and/or ligands:	octahedral

4. arrange the lone pairs and ligands (a lone pair needs more space than a ligand, a double bond needs more space than a single bond)

Examples:

a) H_2O: **2 bonds, 2 lone pairs**
→ ψ-tetrahedral, two corners are occupied by lone pairs
→ the molecule is bent
→ the bond angle H-O-H is less than 109,5° (which is the ideal angle in a tetrahedon) because the lone pairs need more space than the bonds

b) ClF_3: **3 bonds, 2 lone pairs**
→ ψ-trigonal bipyramidal, two equatorial corners are occupied by lone pairs
→ the molecule has a T-shape
→ the bond angle F-Cl-F is less than 90° because the lone pairs need more space than the bonds

c) XeF_4: **4 bonds, 2 lone pairs**
→ ψ-octahedral, two opposite corners are occupied by lone pairs
→ the molecule is square planar