

Valence Shell Electron Pair Repulsion Theory (VSEPR Theory)

Shapes of Molecules

Once we have a Lewis structure (remember it is a 2D representation of a 3D molecule), we can determine the shape by examining bonding and non-bonding pairs of electrons about the central atom

Rules:

- Electron clouds (areas of negative charge) around a central atom will repel each other to be positioned as far apart as possible.
- Electrons are arranged in pairs. Neon has 8 valence electrons, therefore has 4 electron clouds (areas of negative charge)
 - Single covalent bond = 1 cloud, contains 2 electrons
 - Double covalent bond (O_2) = 1 cloud containing 4 electrons
 - Triple covalent bond (N_2) = 1 cloud containing 6 electrons.
- The shape of a molecule is determined by the position of the atoms **and** the non-bonding electron pairs around the central atom

Steps for determining shape

- 1) Draw the Lewis Diagram for the molecule
e.g. CO_2 , H_2O , NH_3
- 2) Count the regions of negative charge (electron clouds) around the central atom
- 3) Arrange the clouds apart as far as possible.
- 4) Name the resulting shape, taking into account the non-bonding electron clouds

Drawing 3D molecules

- Bold lines represents a bond coming out of the page
- Dashed line represents a bond going behind the page
- Normal line represents a bond in the plane of the page

e.g. CH_4 , NH_3 , H_2O

