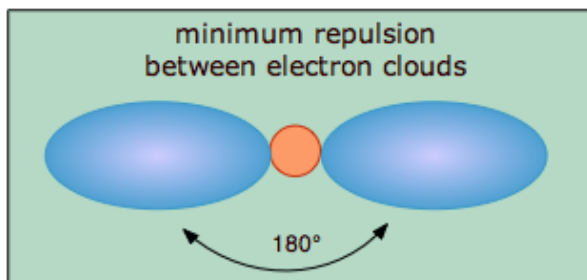


ELECTRON-PAIR REPULSION

The Lewis electron-dot structures you have learned to draw have no geometrical significance other than depicting the order in which the various atoms are connected to one another. Nevertheless, a slight extension of the simple shared-electron pair concept is capable of rationalizing and predicting the geometry of the bonds around a given atom in a wide variety of situations.

The **valence shell electron pair repulsion (VSEPR) model** that we describe here focuses on the bonding and nonbonding electron pairs present in the outermost (“valence”) shell of an atom that connects with two or more other atoms. Like all electrons, these occupy regions of space which we can visualize as **electron clouds**— regions of negative electric charge, also known as **orbitals**— whose precise character can be left to more detailed theories. The covalent model of chemical bonding assumes that the electron pairs responsible for bonding are concentrated into the region of space between the bonded atoms.



The fundamental idea of VSEPR theory is that these regions of negative electric charge will repel each other, causing them (and thus the chemical bonds that

they form) to stay as far apart as possible. Thus the two electron clouds contained in a simple triatomic molecule AX₂ will extend out in opposite directions; an angular separation of 180° places the two bonding orbitals as far away from each other they can get. We therefore expect the two chemical bonds to extend in opposite directions, producing a linear molecule.

If the central atom also contains one or more pairs of **nonbonding** electrons, these additional regions of negative charge will behave very much like those associated with the bonded atoms. The orbitals containing the various bonding and nonbonding pairs in the valence shell will extend out from the central atom in directions that minimize their mutual repulsions.

If the central atom possesses partially occupied d-orbitals, it may be able to accommodate five or six electron pairs, forming what is sometimes called an “expanded octet”.

Source: <http://www.chem1.com/acad/webtext/chembond/cb05.html>