Representing Molecules 3-Dimensionally: VSEPR Theory

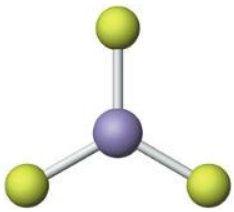
(VSEPR stands for V_____ S_____ E_____ P_____ R_____)

- The shape of a molecule is a description of the 3-D arrangement of the atoms surrounding the central atom in the molecule
- A repulsion exists between the **regions** where valence pairs of electrons exist around the centre atom
- These regions may consist of 1 pair of bonding electron (single bond), 2 pairs of bonding electrons (double bond), 3 pairs of bonding electrons (triple bond) or lone pairs of electrons
- The repulsion pushes these regions of valence pairs as far away from each other as possible and thereby determines the shape of the molecule

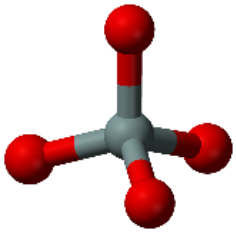
Consider the following:

If all of the electron pairs around the centre atom are found in **two regions**, the farthest these electrons can be apart is _____°.

If all of the electron pairs around the centre atom are found in **three regions**, the farthest these electrons can be apart is _____°.



If all of the electron pairs around the centre atom are found in **four regions**, the farthest these electrons can be apart is _____°.



We can use this theory to accurately predict the shapes of molecules.

CO_2	Lewis diagram	Structural diagram
# of regions	Diagram of shape	Name of shape

CH_2O	Lewis diagram	Structural diagram
# of regions	Diagram of shape	Name of shape

CCl_4	Lewis diagram	Structural diagram
# of regions	Diagram of shape	Name of shape

NH_3	Lewis diagram	Structural diagram
# of regions	Diagram of shape	Name of shape

SO_2	Lewis diagram	Structural diagram
# of regions	Diagram of shape	Name of shape

H_2O	Lewis diagram	Structural diagram
# of regions	Diagram of shape	Name of shape

For the following molecules/polyatomic ions: SO_3 SO_4^{2-} SiH_4 PCl_3 HCN

1. Draw the Lewis and/or structural diagram
2. Draw and name the 3-D shape