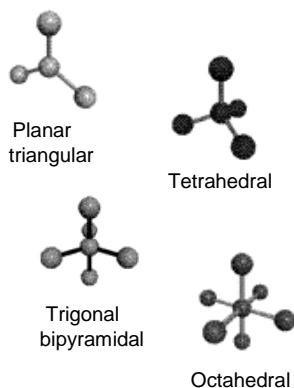


Valence Shell Electron Pair Repulsion Theory



VSEPR Theory

- Based on Lewis structures we can know the shape or “geometry” of molecules
- The theory that predicts geometry (based on Lewis structures) is abbreviated VSEPR
- VSEPR (pronounced “vesper”) stands for Valence Shell Electron Pair Repulsion
- VSEPR, as the name suggests, predicts geometry based on the repulsion of electron pairs (in bonds or by themselves)
- Electrons around the central nucleus repel each other. Thus, resulting structures have atoms maximally spread out (balloon demo)

VSEPR overview

- The balloons represent electron clouds. At the end of each balloon will be a peripheral atom. The balloons meet at a central atom.
- Each shape containing 2-6 peripheral atoms has a name (you will have to know these)
- Sometimes the molecules are represented by AX_Y , where Y is the # of peripheral atoms
 - AX_2 = linear
 - AX_3 = planar triangular
 - AX_4 = tetrahedral (tetra = 4 faces)
 - AX_5 = trigonal bipyramidal (2 pyramids)
 - AX_6 = octahedral (octa = 8 faces)

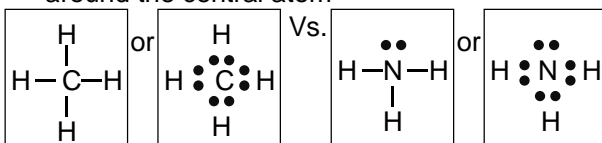
Work on handout (follow instructions on sheet)

VSEPR: Lone Pairs



Lone pairs

- Thus far we have considered (built) only structures where there are no free electrons around the central atom



- These electrons that are not involved in bonds are called “lone pairs”
- Essentially, they have the same influence on molecular structure as electron pairs in bonds
- The result is some weird shapes and names...

Variations on Tetrahedral Molecule



- The tetrahedral molecule is AX_4
- Lone pairs can be indicated with AX_YE_Z , where Z is the number of lone pairs
- By replacing 1 bond with a lone pair the tetrahedral shape becomes “trigonal pyramidal”
- AX_3E
- By replacing two bonds with lone pairs we get a “bent” (non-linear) shape (AX_2E_2) (Fig. 7.7, pg. 249)

Variations on Trigonal Bipyramidal



- AX_5 is trigonal bipyramidal



- AX_4E is unsymmetrical tetrahedron



- AX_2E_3 is linear



- AX_3E_2 is T-shaped

See Fig. 7.8 on pg. 251

Variations on Octahedral Shape



- AX_6 is octahedral



- AX_5E is square pyramidal



- AX_4E_2 is square planar

See Fig. 7.9 on pg. 252