

Unit 3 Day 2 Notes

What are we going to learn today?

1) Shape \rightarrow predict polarity \rightarrow properties

Chemical Physical

2) determine the molecular shapes around 'central atoms' in molecules

clicker Q:

Which of following bonds would have the greatest dipole moment?

a) F-F

b) H-H c) H-C

d) H-Cl

correct \rightarrow e) Na-Cl (greatest difference in electronegativity) $+Q \frac{-Q}{r}$

Compare Ionic to Covalent compounds

- ionic ~~are~~ greater dipole moment than covalent b/c greater diff. in electronegativity

Shape Matters

• go from 2D to 3D

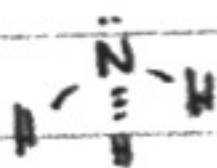
• $\text{Cl}_2 = \text{:Cl} - \text{Cl:}$ pure covalent $M=0$

• $\text{HCl} = \text{H} - \text{Cl:}$ $M \neq 0$ "polar"

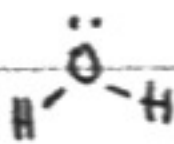
• $\text{CO}_2 = \text{:O} = \text{C} = \text{O:}$ can have nonpolar molecule w/ polar bonds;
 $M=0$; charges cancel out

Sketch and Label Shapes

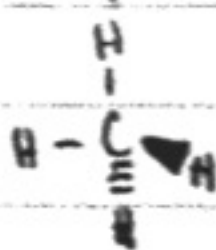
NH_3



H_2O



CH_4



Electron Domains (region) - Model Balloons

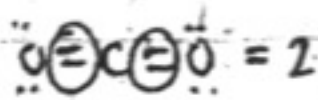
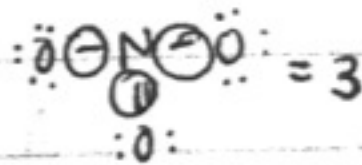
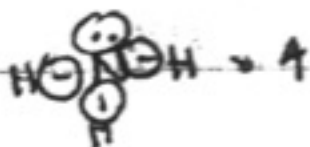
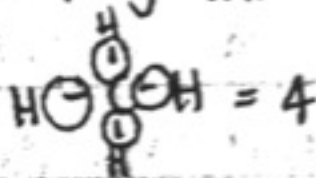
Model supports Bond Angle Data

- nonbonding electron domain: one balloon
- single, double, triple bond electron domain: one balloon
- put the domains on a central atom... balloon art?
 - 2 electron domains - linear 180°
 - 3 electron domains - trigonal planar 120°
 - 4 electron domains - tetrahedral 109.5°
 - 5 electron domains - trigonal bipyramid $120^\circ, 90^\circ$
 - 6 electron domains - octahedral 90°
- electron geometry \rightarrow ~~VSEPR~~ VSEPR valence shell electron pair repulsion

clicker Q #5 -

The # of electron domains for following molecules, CH_4 , NH_3 , H_2O , NO_3^- , CO_2 are:

- correct \rightarrow
- a) 4, 4, 4, 4, 4
 - b) 4, 4, 4, 3, 2
 - c) 4, 3, 2, 3, 2
 - d) 4, 3, 2, 4, 2



#6 -

Bond angles?

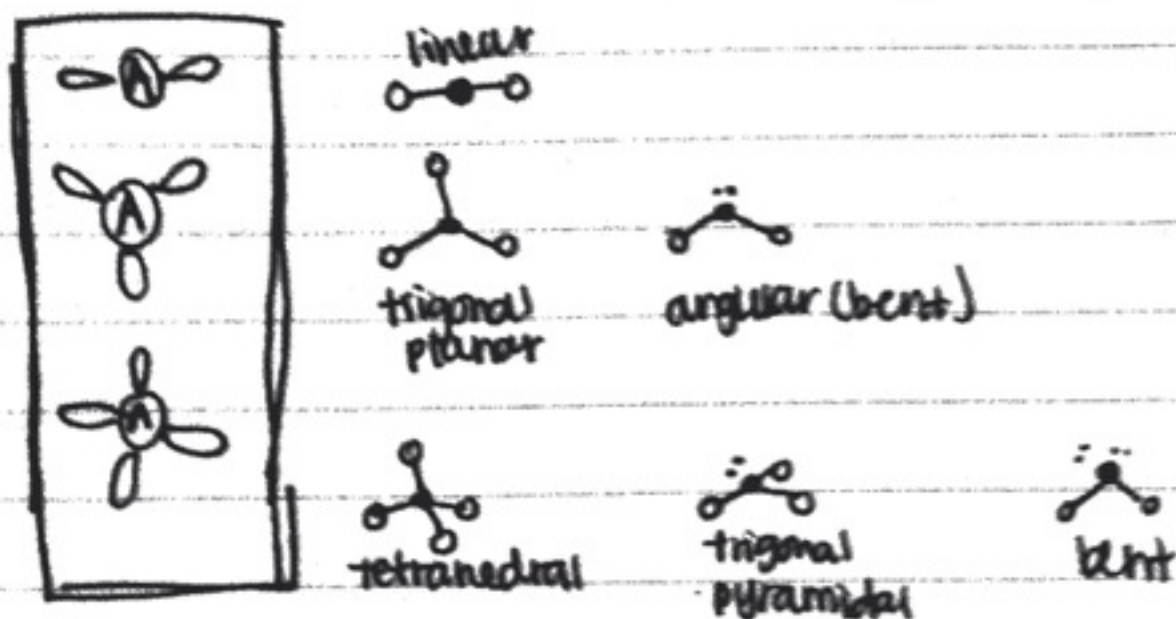
- correct \rightarrow
- a) $109.5^\circ, 109.5^\circ, 109.5^\circ, 120^\circ, 180^\circ$
 - b) $109.5^\circ, 107.5^\circ, 104.5^\circ, 120^\circ, 180^\circ$

#7 - why measured bond angles in molecules are different?

- a) lone pairs affect angle \leftarrow correct (lone pairs have more repulsion than bonds)
- b) dipole moment changes it (diff. dipole) \star bigger affect than dipole \star

Lewis Structures, Electron Domains & Molecular Shape

- the names for molecular shapes are based on the position of the atoms in the molecules
- memorize names of electronic geometry & molecular geometries



ALM 20 ↗

IMF unit, understanding shape

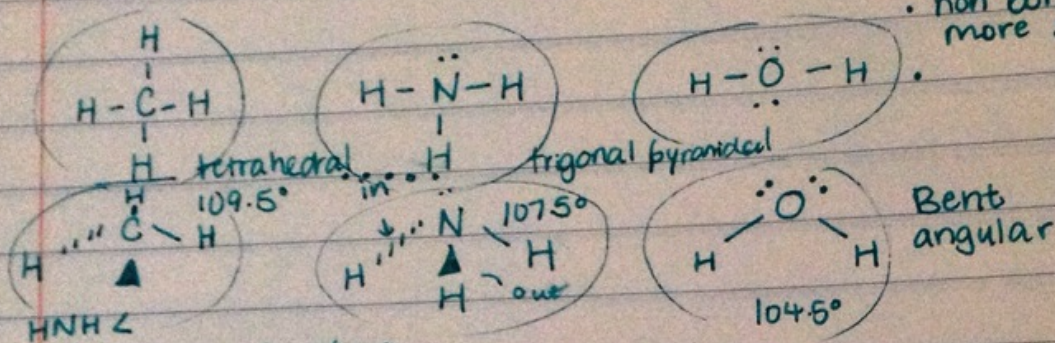
of bond regions + # non bonding regions => bond angle

Region of high e⁻ density.

VSEPR Theory:

geometry of molecules depending on Lewis structures

- Bond \angle s are diff all around.
- non bonding e⁻ takes up more space



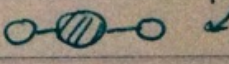
* central atom

electronic geometry determined by one that minimizes repulsions between regions.


> 2 regions = Linear 180°

Farthest apart 3 regions = 120° forming triangular shape on same plane

> 3 regions - trigonal planar 120° linear for apart

> 4 regions = tetrahedral 109.5° 

> 5 regions: trigonal bipyramid bond \angle s not all = equator 90°
120°
180°

> 6 regions: octahedral (geometry) 90° 

molecular: atoms in

electron geom =

region of e⁻ density are surrounding central atom.

- bonding

- nonbonding : ct. # of lone pairs on central atom

in covalent between 2 atoms = 1 region