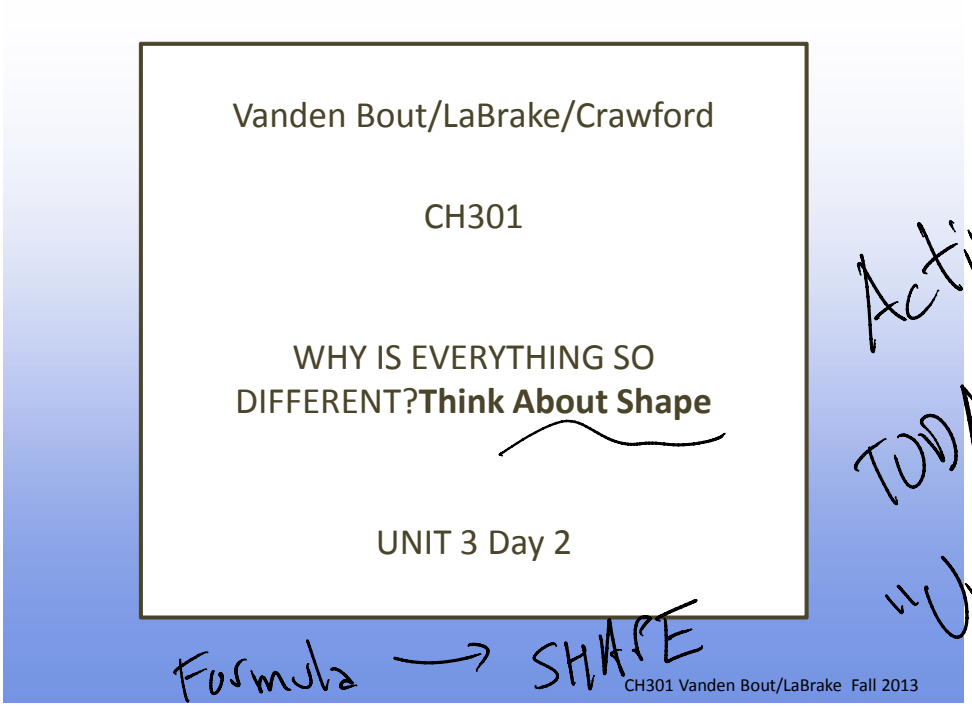
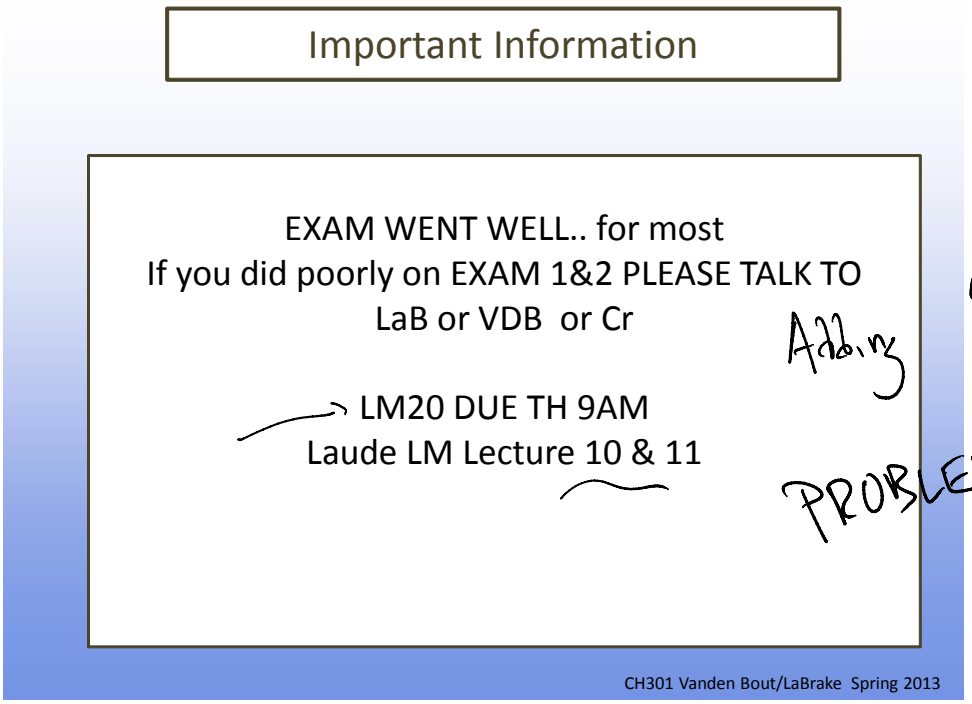
Unit3Day2-VandenBout

Tuesday, October 15, 2013
8:17 AM



Activity TODAY "Understanding Shape"



Adding 4 pts.

PROBLEM #1 FR.

What are we going to learn today?

Molecular Shape is an Important Predictor of Physical and Chemical Properties

Shape → Predict Polarity → Properties

Determine the Molecular Shapes around the "Central Atoms" in Molecules

CH302 Vanden Bout/LaBrake Fall 2012

Quiz: CLICKER QUESTION 1

Which of the following bonds would have the greatest dipole moment?

a) F-F
b) H-H
c) H-C
d) H-Cl
e) Na-Cl

CH301 Vanden Bout/LaBrake Fall 2013

Compare Ionic to Covalent Compounds

$$\mu = Q r$$

Molecule	Dipole Moment (D)
CO	0.112
HF	1.83
HCl	1.11
HBr	0.78
HI	0.38

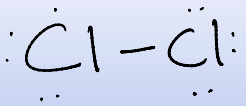
Molecule	Dipole Moment (D)
CO	0.112
HF	1.83
HCl	1.11
HBr	0.78
HI	0.38
NaCl	9.00
LiF	6.33
KF	8.60
KBr	10.41

$\Delta EN \downarrow = \delta \downarrow$

Shape Matters –

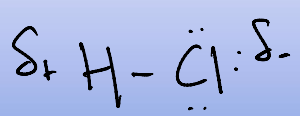
Go from a 2 dimensional model to a 3 dimensional shape

Take a look at Cl_2



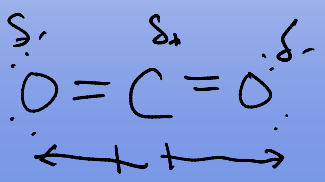
pure covalent $\mu = 0$

Take a look at HCl



$\mu \neq 0$ "polar"

Take a look at CO_2



$\mu = 0$

GUIDED LEARNING ACTIVITY

-Study the table on the learning activity

-With your neighbor(s) answer the questions

-Be prepared to share your answer with others in your sector.

-Each sector choose a representative to speak on your behalf.

POLL: CLICKER QUESTION 2

According to the data table a BONDING region is:

a) a single bond
b) a double bond
c) a triple bond
d) either a single, double or triple bond
e) a region where there are nonbonding pairs of electrons

POLL: CLICKER QUESTION 3

The bond angles from the data table can be grouped around:

a) 180°, 120°, 109.5°

a) 120°, 109.5°, 107°

The bond angles from the data table can be grouped around:

A a) 180°, 120°, 109.5°

B a) 120°, 109.5°, 107°

C a) 107°, 104.5°, 120°

D a) 109.5°, 121.1°, 180°

POLL: CLICKER QUESTION 4

The correlation between the last two columns in the data table is:

a) # bonding regions correlates with bond angle
b) # bonding regions - # nonbonding regions correlates with bond angle
c) # bonding regions + # nonbonding regions correlates with bond angle
d) This makes absolutely no sense whatsoever

4 → ~109°

3 → 120°

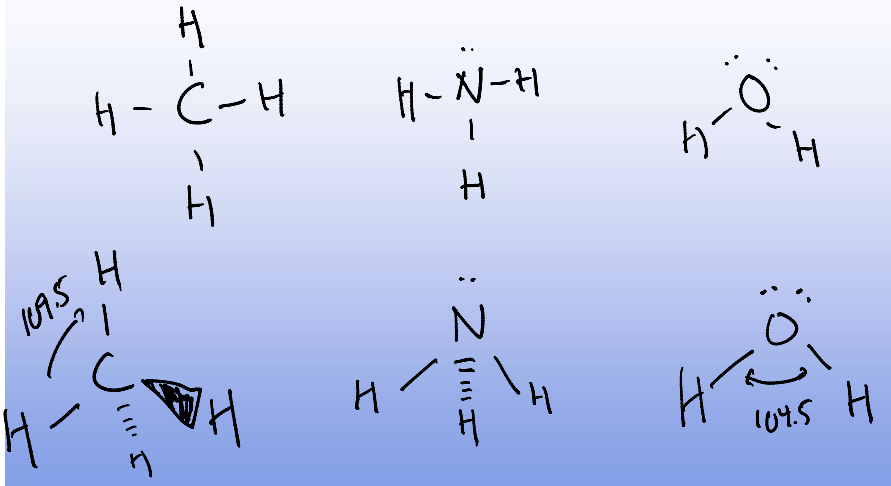
2 → 180°

RHED

regions of high electron density

SKETCH SHAPES & LABEL SHAPES

H_2O, CH_4, NH_3



Electron Domains (regions)- Model Balloons

Model Supports Bond Angle Data

Nonbonding Electron Domain – one balloon

Single Bond Electron Domain – one balloon

Double Bond Electron Domain – one balloon

Triple Bond Electron Domain – one balloon

Put the domains on a central atom…..
balloon art?

Electron Domains (regions)- Balloons

	e⁻ GEOMETRY	BOND ANGLE
2 Electron Domains –	LINEAR	180
3 Electron Domains –	Trigonal Planar	120°
4 Electron Domains –		

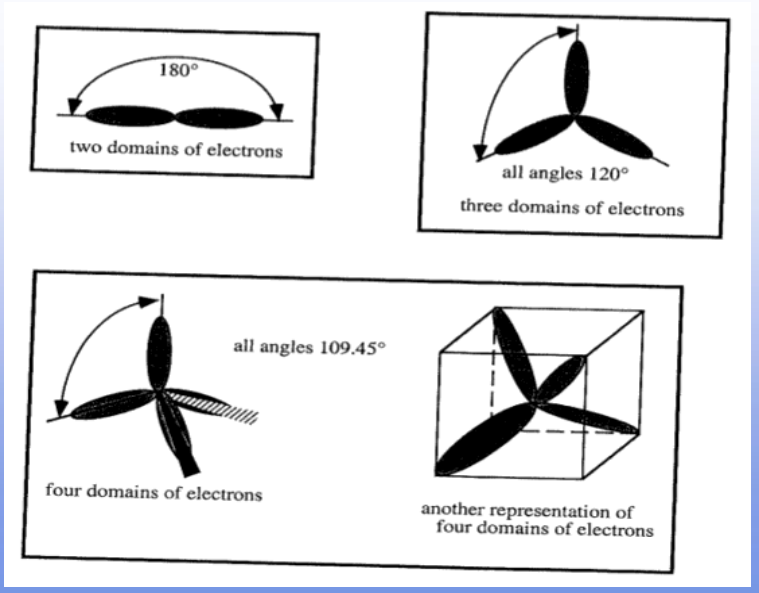
	GEOMETRY	BOND ANGLE
2 Electron Domains –	Linear	180°
3 Electron Domains –	Trigonal Planar	120°
4 Electron Domains –	Tetrahedral	109.5°
5 Electron Domains–	Trigonal Bipyramid	120°, 90°
6 Electron Domains-	Octahedral	90°

Domains of electrons around a central atom will orient themselves to minimize the electron-electron repulsion between the domains.

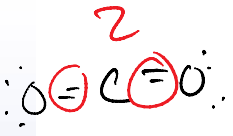
ELECTRONIC GEOMETRY

VSEPR Valence shell electrons pair repulsion

Electron Domains and Bond Angles

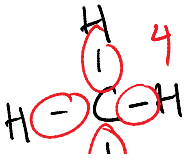


POLL: CLICKER QUESTION 5



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

RHED



A ~~a)~~ 4,4,4,4,4

a) 4,4,4,3,2

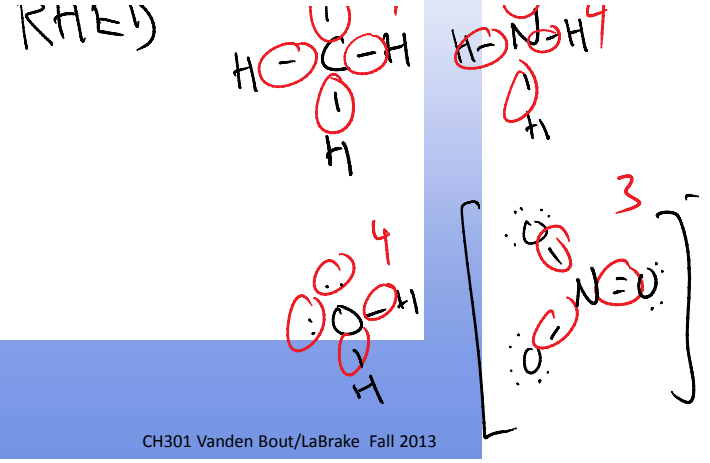
The number of electron domains for the following molecules, CH_4, NH_3, H_2O, NO_3^-, CO_2 are:

A ~~a)~~ 4,4,4,4,4

B ~~a)~~ 4,4,4,3,2

C ~~a)~~ 4,3,2,3,2

D ~~a)~~ 4,3,2,4,2



CH301 Vanden Bout/LaBrake Fall 2013

POLL: CLICKER QUESTION 6

4, 4, 4, 3, 2

The bond angles for the following molecules, CH_4, NH_3, H_2O, NO_3^-, CO_2 are:

A ~~a)~~ 109.5°,109.5°,109.5°,120°,180°

B ~~a)~~ 109.5°,107.5°,104.5°,120°, 180°

CH301 Vanden Bout/LaBrake Fall 2013

POLL: CLICKER QUESTION 7

Consider a set of molecules with the same number of electron domains (electronic geometries) such as Methane, ammonia and water. Explain why the measured bond angles in the molecules are different.

A) Student A's explanation
B) Student B's explanation
C) Student C's explanation

Lone Pair can affect angle bigger
Different Dipole or Minor

Lone Pairs Large Repulsion

POLL: CLICKER QUESTION 8

Considering the possible electron geometries, explain why the bond angle in bent molecules can be close to either 109° or 120°.

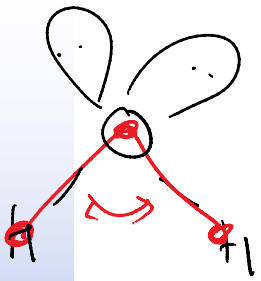
A) Depends on the number of bonding regions

B) Depends on the number of nonbonding regions and bonding regions

Lewis Structures, Electronic Domains & Molecular Shape – Take a Little Moment

The names for molecular shapes are based on the position of the atoms in the molecule –
not on the position of the electron domains!

Lewis Structures, Electronic Domains & Molecular Shape – Take a Little Moment

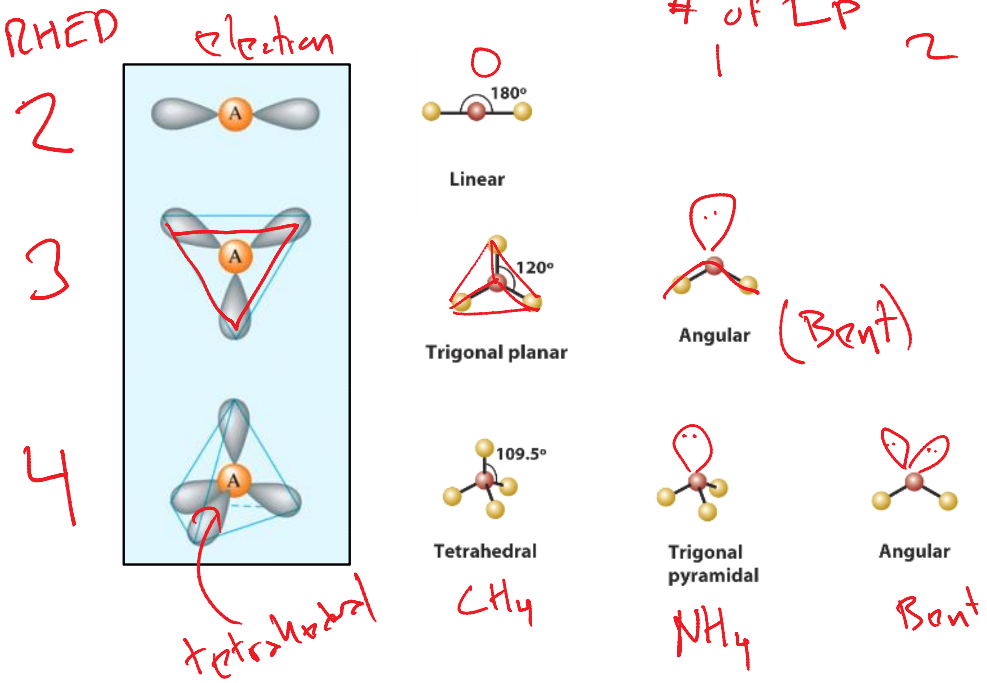


The names for molecular shapes are based on the position of the atoms in the molecule –
not on the position of the electron domains!

Look at water as an example:

Molecular Geometry

MEMORIZE NAMES OF ELECTRONIC GEOMETRIES AND MOLECULAR GEOMETRIES



5 Regions – Trigonal Bipyramidal

6 Regions – Octahedral

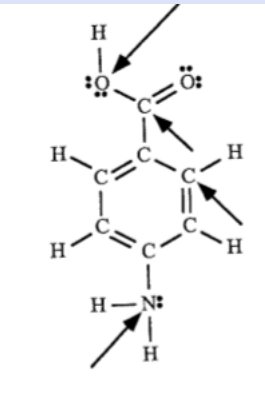
Memorize

6 Regions – Octahedral

Names and Shapes of expanded octet in LM20 – Jot them down, memorize them, practice

Based on what you have learned today

Predict the # of electron domains (electronic geometry), bond angles, and molecular geometry around each atom with an arrow:



Mini Lesson on Line Drawings:

Carbons are implied at corners
Hydrogens are left off structure

IMPORTANT TO LEARN TO PREDICT SHAPES
SO
YOU CAN NEXT PREDICT SYMMETRY THEN
PREDICT POLARITY OF COMPOUNDS

DOES THE MOLECULE CONTAIN A NET DIPOLE MOMENT?

What have we learned?

Predict Bond Geometries based on Bond Angles

Predict Bond Angles based on electronic geometry and molecular geometry

Names of common Electronic Geometries

Learning Outcomes

Apply the VSEPR model to determine a molecule's electronic geometry and molecular geometry from it's Lewis dot structure

Interpret line drawing of chemical compounds with implicit hydrogen, carbon and lone pairs