WLHS / Chem / Monson

Name_____
Date_____Per_____

ACTIVITY: Molecule Shapes Computer Simulation

MODEL 1: (http://phet.colorado.edu/en/simulation/molecule-shapes)

PART I: ELECTRON DOMAINS

1) Explore the *Model* screen of the simulation. As you explore, answer the following questions.

A) How does adding an **atom ("bonding")** affect the position of existing atoms or lone electron pairs?

B) How does adding a **lone pair (of electrons)** affect the position of existing atoms and lone electron pairs?

2) Is the effect of adding **bonded atoms** and **lone pairs** to the central atom similar? Explain why this could be the case.

We can think of a bond or a lone pair of electrons as a "domain" of electrons. **Single bonds, double bonds, and triple bonds each count as ONE domain.**

3) How do the electrons in bonds (bonding domains) differ from lone pairs (non-bonding domains)?

4) What happens to the **bond angle** when you add or remove an electron domain?
(HINT: under "Options" you can click on the box that says "Show Bond Angles")

5) What is the difference between *Electron Geometry* and *Molecule Geometry*?
(HINT: under "Name" you can click on the boxes that say "Molecule Geometry" and "Electron Geometry")

6) In one or two sentences, write a clear definition / explanation for the term ***Molecule Geometry*.**

PART 2: DRAWING MOLECULES TO SHOW 3-DIMENSIONALITY

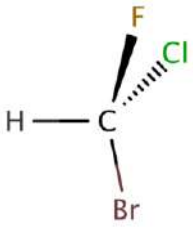
MODEL 2: Line, Wedge and Dash Drawings

Line: In the plane of the paper: ——

Wedge: Coming forward, in front of the plane of the paper:

Dash: Going backward, behind the plane of the paper:

1) Where is each of the 5 atoms in the molecule CHFClBr?
In the plane of the paper: _____ _____ _____
In front of the plane of the paper: _____
Behind the plane of the paper: _____



2) Using the *Model* screen, add bonding domains (●) to the central atom (○). Using lines, wedges and dashes from Model 2, draw each molecule's shape.

Bonding Domains Around Central Atom	Drawing of Shape	Electron Geometry	Bond Angles
2	● – ○ – ●	Linear	180º
3	○		
4	○		

3) In the following table, sketch and record the **molecular geometry** and make a sketch of the molecule
Possible molecule geometries are: Bent, linear, tetrahedral, trigonal planar & trigonal pyramid*

Predict First, Then Compare with the Simulation				
Number of Domains Around Central Atom **(Bonds and Lone Pairs)**	0 Lone Pairs	1 Lone Pair	2 Lone Pairs	3 Lone Pairs
2				
3				
4				

EXERCISES:
Possible electron geometries are:** **Bent, linear, tetrahedral, trigonal planar & trigonal pyramid*
Possible molecule geometries are:** **Bent, linear, tetrahedral, trigonal planar & trigonal pyramid*
Possible bond angles are:** **90°, 109.5°, 120°, 180°*

1) A molecule has 2 double bonds on the central atom and no lone pairs. Predict the electron geometry. Predict the molecule geometry. What do you think the bond angles would be?

Electron geometry:_____

Molecule geometry:_____ Bond angles:_____

2) For each of the molecules below, determine the electron geometry, molecule geometry, and label the bond angles. Draw pictures to show your geometries.

A) CCl_4 (4 Cl atoms, no lone pairs on C)

B) PF_3 (3 F atoms, 1 lone pair on P)

C) OF_2 (2 F atoms, 2 lone pairs on O)

D) H_2O (Oxygen in center; 2 H atoms; 2 lone pairs on O)