LAB [20 pts]
Molecular Model Building

Name _____
Lab Partner _____
Period _____ **Date** _____

Introduction:
In this lab, you will build models of molecules. Using these models you will draw the 3-D diagram and determine their shapes. This lab deals with very important concepts because it allows us to determine the shapes of molecules. We will find out later that knowing the shape of molecules allows us to understand a wide variety of physical and chemical properties of molecules.

Procedure: YOU MUST WRITE IN PENCIL!!!!!!

1) Draw your Lewis Dot structure. Make sure you use all of your electrons and have full octets.
2) Use the ball and stick models to build your molecule. Follow these guidelines when building:
   a) Use **WHITE** spheres to represent **hydrogen, BLACK** spheres to represent **carbon, RED** spheres to represent **oxygen** or **sulfur**, **BLUE** spheres to represent **nitrogen** or **phosphorous,** and **GREEN, ORANGE** or **PURPLE** spheres to represent **halogens** (F, Cl, Br, I)
   b) Use a stick for a single bond, two springs for a double bond, three springs for a triple bond, and a stick for a lone pair
   c) Every opening must have either a bond or lone pair of electrons occupying it (halogens do not need lone pairs in the 3-D drawings).
3) Determine the electron geometry of your molecule (Count bonding AND non-bonding regions).
4) Determine the molecular geometry of your molecule (count only bonding regions).
5) Draw a 3-D Drawing of your molecule. Try to get angles approximately correct (NO 90° angles!). ***Do not draw spheres***; instead, place the symbol of the element where its atom goes, as in our examples. You can omit lone pair electrons on single-bonded terminal atoms, but show all lone pairs and correct shapes on all central atoms as well as all double- and triple-bonded atoms.
6) **I must OK your models and drawings.** Bring your models to me after you have built and drawn 3-4 of them, for me to approve your models and 3-D drawings.

Table I: Formulas, Drawings & Shapes of Smaller Molecules [1 pt each]

Formula	# of v. e^-	Lewis Structure (All Electrons)	Electron & Molecular Geometries	3-D Drawing (No lone pairs on single-bonded terminal atoms)
1) CH_4				
2) H_2O				
3) NH_3				

Formula	# of v. e^-	Lewis Structure (All Electrons)	Electron & Molecular Geometries	3-D Drawing (No lone pairs on single-bonded terminal atoms)
4) PCl_3				
5) CCl_2F_2				
6) CO_2				
7) CO				
8) CH_2O (C is central)				
9) O_3 (O-O-O)				
10) C_2H_6* (H_3C-CH_3)				
11) C_2H_4* (H_2C-CH_2)				
12) C_2H_2* (HC-CH)				

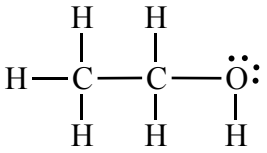
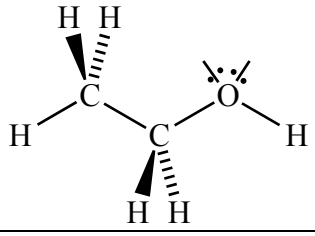
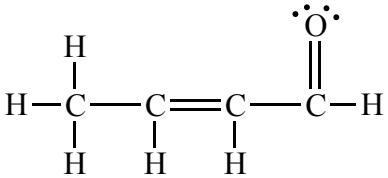
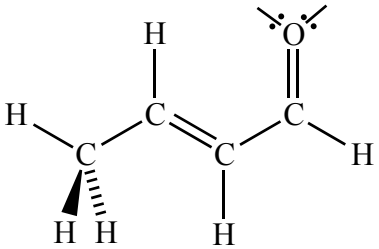
Formula	# of v. e^-	Lewis Structure (All Electrons)	Electron & Molecular Geometries	3-D Drawing (No lone pairs on single-bonded terminal atoms)
13) HCN (C is central)				
14) NH_4^+				
15) CO_3^{2-}				

*In 10-12, both carbon atoms are identical. Look at each carbon atom individually to determine the electron and molecular geometry.

Directions for the rest of the lab: Shapes of larger molecules

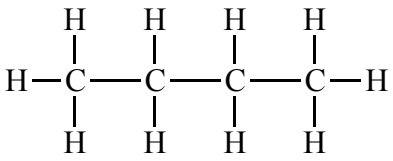
So far all the molecules you have made have been relatively small. However, most of molecules are larger, and since we will be studying some of them later in the course, it will be beneficial to see them here. I have given you the Lewis Structure, and you will determine the shape of the entire molecule, paying attention to the shape at each "central" molecule in the chain, as in the examples. Note that terminal atoms such as H or halogens have no shape.

Look at the examples below (I will make them in class and post their pictures to my website). Then proceed to finish the lab. [1 pt each]

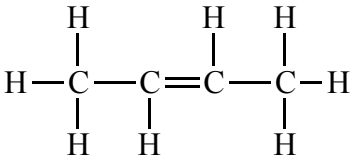
Molecular Formula	Lewis Structure	3-D Drawing
Example 1: CH_3CH_2OH (Ethanol, ethyl alcohol) • Note the zig-zag of the atoms in the chain in the 3-D drawing.		
Example 2: $CH_3CHCHCHO$ (2-butenal) • Note that all atoms attached to trigonal planar atoms are in the same plane—draw them first in the 3-D drawing.		

Molecular Formula	Lewis Structure	3-D Drawing

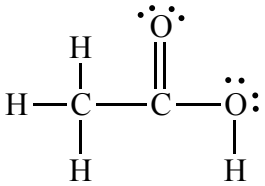
16) $CH_3CH_2CH_2CH_3$
(butane, found in cigarette lighters)



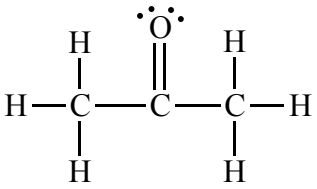
17) $CH_3–CH=CH–CH_3$
(2-butene)



18) CH_3COOH
(acetic acid, vinegar)



19) CH_3COCH_3
(acetone, the main ingredient in nail polish remover)



20) CH_3CCH
(propyne, methylacetylene, a rocket fuel)