Experiment 33: Organic Molecules

This experiment is due by the end of the lab session.

Purpose The purpose of this experiment is to build models of organic molecules to allow for better understanding of the bonding and geometry of the molecules. IUPAC naming and drawing of structures will also be practiced.

Background The IUPAC system of naming will be used for this experiment. The following information is needed to build your models, to identify the bonds within the molecules, and to draw the structures.

Table 1: Base Part of Name (the Number of Carbons in the Main Chain)

Number of C Atoms	Base Part of Name		Number of C Atoms	Base Part of Name
1	meth		6	hex
2	eth		7	hept
3	prop		8	oct
4	but		9	non
5	pent		10	dec

.

Table 2: Names of Branches (Prefix Part of Name)

Number of C Atoms in Branch	Name of Branch	Structure
1	methyl	-CH_3
2	ethyl	-CH_2CH_3
3	propyl	-$CH_2CH_2CH_3$

Table 3: Ending Part of Name (Bonding)

Type of Bonding in between C Atoms	Ending Part of Name
All single bonds	ane
At least one double bond	ene
At least one triple bond	yne

If your molecule is a ring, you will need to use "cyclo" in the name.
If there are branches in the molecule, each branch will need an address number.
If there is a double or triple bond in the molecule, it will need an address number (use the lower address number of the two carbons involved with the double or triple bond).

Table 4: Electron Domain Geometry and Hybridization

Number of Electron Domains around the 'Central' Atom	Electron Domain Geometry	Ideal (Predicted) Bond Angle	Hybridization
2	Linear	180°	sp
3	Trigonal Planar	120°	sp^2
4	Tetrahedral	109.5°	sp^3

Procedure For molecules 1 – 6, build the structure using the modeling supplies in the lab. Show the model to your instructor, and have your instructor initial your notebook.

For each molecule you build, indicate the following information in your notebook:

1. Molecular formula
2. Expanded structural formula
3. Condensed structural formula
4. Electron domain geometry and ideal bond angle around the indicated atom
5. Hybridization of the indicated atom
6. Orbitals overlapping to make the indicated bond(s)
7. Build the model and obtain your instructor's initials

Molecules to Build

1. Ethane; use either carbon for the geometry and hybridization. Which orbitals are overlapping to make the C-C bond? Which orbitals are overlapping to make all of the C-H bonds?

2. 1-Propene; use carbon 1 for the geometry and hybridization. Which orbitals are overlapping to make the C=C bond?

3. 2-Butyne; use carbon 2 for the geometry and hybridization. Which orbitals are overlapping to make the C≡C bond?

4. Cyclobutane; use any carbon for the geometry and hybridization. Which orbitals are overlapping to make the C-H bonds?

5. 2-Methyl Propane; use carbon 2 for the geometry and hybridization. Which orbitals are overlapping to make the C-C bond between carbons 1 and 2?

6. 3-Ethyl Cyclopentene; use carbon 1 for the geometry and hybridization. Which orbitals are overlapping to make the bond between carbons 1 and 2?

Molecules to Draw

Draw the structure for each of the following molecules, in your notebook. Use either the condensed or expanded format:

7. 4-propyl-5-ethyl cyclohexene *(the double bond is in between carbons 1 and 2)*

8. 4, 4-dimethyl heptane

9. 3-ethyl-5-methyl cis-2-nonene

10. 4-methyl-2-pentyne

11. cyclopentene

12. 1-ethyl-2-methyl-3-propyl cyclobutane

Molecules to Draw and Name

Draw the structures and give the IUPAC names for four structural isomers with the molecular formula C_7H_{14}. The ratio of carbon to hydrogen atoms means the molecules can be an alkene chain or an alkane ring.

13. Structure and name

14. Structure and name

15. Structure and name

16. Structure and name