Name: ______________________________ Block: ______ Date: ____________________

Chemistry 11

Building Organic Molecules

Purpose

To gain an understanding of various structural aspects of hydrocarbons.

Objectives

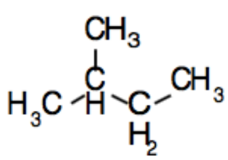
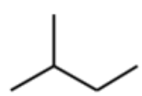
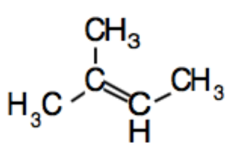
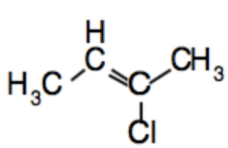
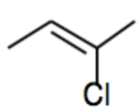
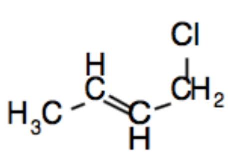
1. To name a hydrocarbon when given its structural formula.
2. To draw the structure of a hydrocarbon when given the name.
3. To build molecules using a chemistry model kit in order to visualize their three-dimensional (3-D) structures.

Key to Model Building

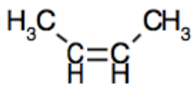
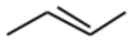
Atoms:			Bonds:	
C	carbon	black	short white	C-H bonds
H	hydrogen	white	short grey	single bonds
Cl	chlorine	green	long grey	double or triple bonds (use 2 or 3)

Time to Build!

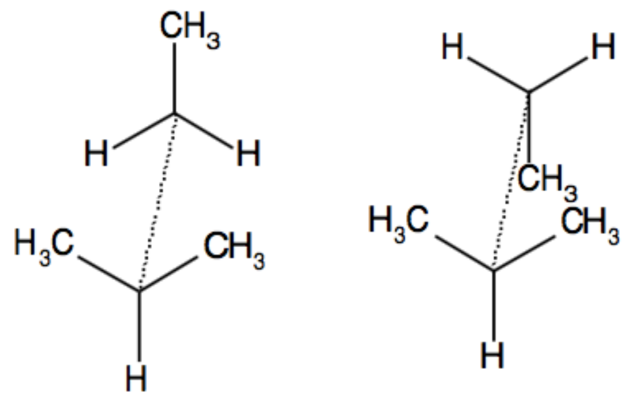
When you build a model, refer to the discussion of that molecule that follows and address all the points mentioned.

	structural	abreviated	molecular	name
1			C_5H_{12}	____________
2			________	____________
3			________	____________
4			________	____________

5 ________ trans - 2 - butene

6   ________ ________________ ________

Model Building Discussion



#1 This molecule is a branched hydrocarbon and a saturated alkane. Notice how the dimethyl end of the molecule is able to rotate freely so that either methyl can be closest to the single methyl group on the other end. You can also rotate the dimethyl end so that both methyls are the same distance from the single methyl end. Looking over the central bond, this should look something like the figure to the right. These are called **conformations**, and the molecule is free to adopt conformation (A) or (B) or something in between. In reality, the methyls don't "like" to be too close together and the molecule is typically found more in the conformation (B).

#2 This molecule is a branched hydrocarbon and an unsaturated alkene. Notice how the dimethyl end of the molecule is NOT able to rotate freely. This is due to the C=C double bond. The carbon backbone for this molecule is FLAT and can be drawn accurately in two dimensions. Also notice that the double bond appears fatter than the single bond; there is electron density (bond) above and below the plane of the molecule. This makes double bonds both *stronger* than single bonds and also *more accessible to chemical reactions*.

#3 and **#4** These molecules are **structural isomers**: they have the same number of atoms, but these atoms are arranged in a different order. Their molecular formulas are identical, but a picture can be worth a thousand words because they are very different chemically. Correctly naming a compound will allow you to draw an accurate picture of it and let you make some educated guesses about its chemistry. As you might guess, as the number of carbons in a molecule increase, so do the number of possible structural isomers; methane and ethane have but one isomer, propane and butane two, pentane has three, octane has eighteen etc. The Cl atom on molecule #3 is attached one end of a C=C double bond, while the Cl atom in molecule #4 is attached to a singly bonded carbon. **Which of these Cl atoms would you expect to be more chemically reactive?**

#5 and **#6** These molecules are a type of **geometric isomers**, called **cis/trans isomers**. These isomers are bonded in the exact same order, but they have different conformations and unlike molecule #1 they are NOT free to move between them. It is the C=C double bond which "locks" these conformations. Which is *cis* and which is *trans*? Given the discussion above about molecule #1's preferred conformation, **what do you think might be important chemical differences between molecules #5 and #6?**

With any time you have left, build a few 4-5 carbon molecules, draw their structures and try to name them.

Structure	Molecular Formula	Name