NAME _____ PREF ____ SECTION SC_____ DATE _____

EXPERIMENT 37: MOLECULAR MODELS OF HYDROCARBONS AND DERIVATIVES

Equipment: chemistry model kit

Carbon has four valence electrons and is able to form single, double and triple covalent bonds with many elements and itself. In this exercise you will construct molecular models in order to become familiar with the many different compounds that can be formed.

RULES TO FOLLOW IN MAKING MOLECULAR MODELS

1. Use black spheres for carbon atoms, yellow for hydrogen, green for chlorine and red for bromine.
2. One covalent bond (one pair of shared electrons) is represented by one stick or steel spring. Use steel springs when double or triple bonds are constructed.
3. Each carbon atom must share four pairs of electrons (have four bonds).

PART I: CHAIN HYDROCARBONS (THE ALIPHATICS)

The hydrogens are divided into homologous series: This grouping makes their study easier. A homologous series is a series of compounds in which each member differs from the next by the same number and kind of atoms.

A. **Alkanes:** These hydrocarbons contain only single covalent bonds. The simplest is methane. Its molecular and structural formula is given in Chart A.

Chart A

	# of C's	# of H's	Molecular formula	Structural formula
Methane	1	4	CH_4	
Ethane	2			
Propane	3			

Directions: 1. Make a model of methane.
2. Make models of the other alkanes listed.
3. Determine the molecular and structural formula for each. Fill in the chart.

Questions: 1. What are the molecular formulas for Butane (C_4) and pentane (C_5)?

2. The general formula for the alkane series is CnH___. (n=number of carbon atoms)

B. **Alkenes:** These hydrocarbons contain one double bond. Make models of the ones listed in Chart B from the models of the Alkanes that have the same number of carbon atoms. Fill in the chart.

Chart B

	# of C's	# of H's	Molecular formula	Structural formula
Ethene	2			
Propene	3			

3. The general formula for the alkene series is CnH__. (n= number of carbon atoms)

C. **Alkynes:** These hydrocarbons contain one triple covalent bond. Make models of the ones listed in Chart C from the alkenes that have the same number of carbon atoms. Complete Chart C.

Chart C

	# of C's	# of H's	Molecular formula	Structural formula
Ethyne (acetylene)	2			
Propyne				

4. The general formula for the alkynes is CnH___.

PART II: CYCLIC HYDROCARBONS

Benzene is an example of an important ring compound. Its formula is C_6H_6. Make a model of benzene and draw its structural formula below.

PART III: ISOMERS

When molecular formulas are represented by a model or structural formula several arrangements may be made. If arrangements can be made to coincide by turning or twisting them about, they are identical. If they cannot be made to coincide they are isomers, differing compounds with the same molecular formula.

D. Construct models of butane. How many isomers are there ? _____ Draw the structural formulas for the isomers, and name them. Your teacher will instruct you on the method for naming them.

E. **Pentane.** Construct models for pentane, structural formulas for them and name them.

F. Construct a model of 2,2 dimethyl pentane. Draw its structural formula.

G. Construct a model of 2,3 dimethyl pentane. Draw its structural formula.

PART IV. HALOGEN SUBSTITUTION HYDROCARBONS

Halogen atoms may replace hydrogen atoms. Construct models for the following and draw structural formulas for each.

H. monochloromethane

I. dichloromethane

J. dichloromonobromomethane

K. monochloroethane

L. Construct models for the compound whose molecular formula is $C_2H_4Cl_2$.

5. How many isomers are there? _____
6. Draw their structural formulas and name them.

M. Draw structural formulas for the isomers of C_3H_6BrCl and name them.