Laboratory Investigation Name _____

Chemistry: Form L11.2A Date _____ Period _____

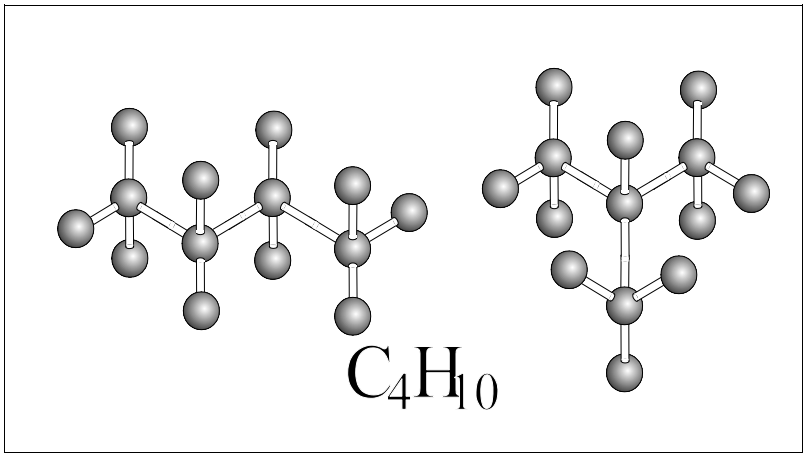
Constructing Isomers

PROBLEM

How can two different molecules have the same formula?

INTRODUCTION

Carbon compounds often have complicated structures. Molecular models are used to study them. Even simple compounds, such as butane (C_4H_{10}), have a few structural surprises that can be seen by using molecular models. The diagram of the molecular models to the right shows that there is more than one way to arrange the four carbons and ten hydrogens in butane. Molecules with the same simple formulas but different structures, such as the two forms of butane shown to the right, are called isomers. In this laboratory investigation, you will construct models of all the isomers of a carbon compound. Then you will draw a picture of each model and write the corresponding structural formula.



MATERIALS (*per group*)

Molecular model kit

PROCEDURE

1. Obtain a molecular model kit containing colored spheres to represent atoms and sticks or springs to represent bonds. Table I shows the characteristics of each of the types of spheres.

2. Construct a model of $C_5H_{11}Cl$. Use long sticks to represent bonds between carbons, and short sticks to represent other bonds. Attach the spheres together in such a way that all the holes are filled.

3. Based on the model of $C_5H_{11}Cl$, draw a molecular diagram of the compound on the next page. Draw a circle for each atom labeled with its symbol and a line for each bond. For bonds going behind the plane of the paper draw a dotted line. For bonds in the plane of the paper draw a single line. For bonds coming out of the plane of the paper, draw a heavy line in perspective.

4. Below the diagram of the molecular model of $C_5H_{11}Cl$ draw the structural formula for the compound.

5. Move carbons and chlorine atoms to produce different structures with a formula of $C_5H_{11}Cl$. Repeat steps 2-5 of the procedure as often as necessary to find all the ***DIFFERENT*** arrangements for $C_5H_{11}Cl$. Keep in mind that turning the model so its orientation is different does NOT produce a different arrangement.

Table I. Characteristics of spheres representing atoms

Element	Color	Holes
Carbon	Black	4
Hydrogen	Yellow	1
Oxygen	Red	2
Nitrogen	Blue	5
Chlorine	Green	1
Bromine	Orange	1
Iodine	Purple	1

OBSERVATIONS

Drawings of the isomers of $C_5H_{11}Cl$

CONCLUSIONS

1. Finding all the isomers of a compound isn't easy. The trickiest part is finding structures that really are ***DIFFERENT***. Sometimes structures that look different on paper are really not different at all. What are some of the reasons structures look different on paper without being really different? _____

2. If isomers have the same simple formula, what makes them different? Why might the different isomers of $C_5H_{11}Cl$ have different properties? _____