## Nomenclature and Conformational Analysis

### Nomenclature

The formal system of nomenclature used today is one proposed by the International Union of Pure and Applied Chemistry (IUPAC). The fundamental principle of IUPAC system is: *Each different compound should have an unambiguous name.* The details are discussed in section 4.3 in the textbook.

### What is conformational analysis?

Groups bonded by only a sigma (\( \sigma \)) bond (i.e., by a single bond) can undergo rotation about that bond with respect to each other. The temporary molecular shapes that result from rotation of groups about single bonds are called *conformations* of a molecule. Each possible structure is called a *conformer*. An analysis of the energy changes associated with a molecule undergoing rotation about single bonds is called *conformational analysis*.

### Why study conformational analysis?

*Conformational analysis* is important because the structure of a molecule can have a significant influence on the molecular properties, including dictating the outcome of a reaction. Although the ideas are developed for the simplest functional groups, the alkanes, the same principles can be expanded and applied to other functional groups.

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1. Consider the following haloalkane. Build this using your model kit if you have one.

   ![Haloalkane](image)

   a) Give a correct IUPAC name.

   b) Draw the three staggered and three eclipsed conformations that arise from rotation about the indicated C-C bond, using Newman projections. Label them as 1-6.

   c) Perform a conformational analysis by sketching a curve showing the relative energy differences between each of your six conformations, labeling all energy maxima and minima with your labels (1-6). You do not need to determine actual numerical energy values.

   d) Draw a Sawhorse projection, using wedges and dashes, of the most stable conformer.

2. Give a correct IUPAC name for the following bicyclic alkanes.

   ![Bicyclic Alkanes](image)
3. Your TA will select one of these four structures below for your group to use for this problem.

a.  

b.  

c.  

d.  

Propose a synthesis for your compound using reactants containing four carbon atoms or less and the library of synthetic reactions (see below).

<table>
<thead>
<tr>
<th>Structure</th>
<th>Reaction 1</th>
<th>Reaction 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{C} \equiv \text{C} )</td>
<td>( \Theta \text{OH} )</td>
<td>( \text{C} \equiv \text{C} )</td>
</tr>
<tr>
<td>( \text{C} - \text{Br} )</td>
<td>Li</td>
<td>C-Li</td>
</tr>
<tr>
<td>( \text{C} - \text{Br} )</td>
<td>Li</td>
<td>C-Li</td>
</tr>
</tbody>
</table>

Here is an example of the organolithium reaction shown above. Labels a and b are there to help you see where the carbon atoms in the reactants are located in the product. Notice that the carbonyl compound (second reactant) is the \( \text{C}=\text{O} \) molecule represented in the box above. The reaction between these two reactants is the first step. The second step is the addition of \( \text{H}_3\text{O}^+ \). The sequence can be shown in different ways. Two ways are shown below.

\[ \text{a. Li} + \text{b. CO} \rightarrow \text{H}_3\text{O}^+ \rightarrow \text{a. OH} \]

\[ \text{a. Li} \rightarrow \text{b. CO} \rightarrow \text{1. H}_3\text{O}^+ \rightarrow \text{a. OH} \]