Hi everyone! By now most people have taken their first test, and I hope all went well! This week we will be covering nomenclature of alkanes, cycloalkanes, as well as conformational analysis! This is a dense chapter, so get in all the practice you can before your next quiz or test. 

Don't forget that group tutoring is every Thursday from 6:30-7:30!! Here is the link to sign up. https://www.baylor.edu/support_programs/index.php?id=40917

Keywords: alkanes, conformational analysis, newman projections

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**TOPIC OF THE WEEK: ALKANES**

- **What is an alkane?** An alkane is a hydrocarbon that are completely saturated with hydrogens (no double or triple bonds)

Examples:

- **What is a cycloalkane?** An alkane, but in a ring!

Examples:

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**HIGHLIGHT 1: Nomenclature of alkanes and cycloalkanes**

Now that we know what an alkane is, we need to know how to name them! IUPAC (international union of pure and applied chemistry) is group of chemists who came up with a systematic way of naming molecules that is called IUPAC nomenclature. This ensures understanding across nations and languages.

- **Steps for naming alkanes**

  1. Find the parent chain - The parent chain is the longest continuous carbon chain
2. Name the parent chain – parent name is based off of # of carbons in longest chain (this applies to any type of molecule), however, the suffix -ane is specific to alkANEs. Molecules with double and triple bonds will have different suffixes.

<table>
<thead>
<tr>
<th># Carbons</th>
<th>Parent name</th>
<th>Name of alkane</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Meth</td>
<td>Methane</td>
</tr>
<tr>
<td>2</td>
<td>Eth</td>
<td>Ethane</td>
</tr>
<tr>
<td>3</td>
<td>Prop</td>
<td>Propane</td>
</tr>
<tr>
<td>4</td>
<td>But</td>
<td>Butane</td>
</tr>
<tr>
<td>5</td>
<td>Pent</td>
<td>Pentane</td>
</tr>
<tr>
<td>6</td>
<td>Hex</td>
<td>Hexane</td>
</tr>
<tr>
<td>7</td>
<td>Hept</td>
<td>Heptane</td>
</tr>
<tr>
<td>8</td>
<td>Oct</td>
<td>Octane</td>
</tr>
<tr>
<td>9</td>
<td>Non</td>
<td>Nonane</td>
</tr>
<tr>
<td>10</td>
<td>dec</td>
<td>Decane</td>
</tr>
</tbody>
</table>

3. Name the substituents (all of the stuff not on the parent chain)
   i. Substituents are names using the same root names as the parent chain, but they have the suffix -yl. For example if a substituent has 3 carbons, its name would be propyl.

4. Number the main chain using the numbering rules!!
   i. Start numbering at either end of the longest chain, never in the middle
   ii. Start numbering at the end that gives the substituents the lowest numbers possible
5. You have all the pieces, so now put the name together
   i. Numbers are separated by commas, numbers and letters are separated by a dash
   ii. Substituents are written first followed by parent name
   iii. Substituents should be written in ALPHABETICAL ORDER, not based on number
   iv. If you have multiple of the same substituent, it should be listed one time but with a
      prefix denoting how many there are in the compound. (mono, di, tri, tetra, penta,
      hexa, hepta, octa…)

Practice #1 give the following compounds systematic names

a.

b.

HIGHLIGHT 2: Newman Projections

A Newman projection is a lateral view of a molecule. You can also think of this as if you are looking at a
molecule with a 90 degree rotation. I have attached a video below from Khan Academy, Sal does an
amazing job explaining this topic.
https://www.khanacademy.org/science/organic-chemistry/bond-line-structures-alkanes-
cycloalkanes/conformations-alkanes-cycloalkanes/v/newman-projections

- We are first going to learn how to draw the newman projection of ethane for simplicity sake, and then I
  will show an example of a more challenging molecule.
Ethane:

Step 1 determine which way you are looking at the molecule

Step 2 the front carbon is represented by the dot, the back carbon is represented by the circle

Step 3: place the substitute to in the correct positions
Right side: wedges
Left side: dashes
Up or down: in plane

Now here we are doing the exact same thing, but we have multiple different atoms to deal with.

Practice #2 draw the newman projections of the following molecules

a.

b.
HIGHLIGHT 3: Conformational Analysis

So why do we need to know how to draw Newman projections anyways? Newman projections allow us to determine the lowest energy conformation of a molecule! Remember that single bonds have rotation, so molecules could in theory be rotated anyway at any time, but there are certain energetic reasons that make some conformations more favorable than others.


Some definitions to know:

- **Dihedral angle** – angle between adjacent front and back atoms in a newman – this angle changes as the carbon-carbon bonds rotate
  - Can be between 0 and 180 degrees

- **Staggered conformation** – lowest energy conformation
  - Think about the groups as wanting to be as far apart as possible. The staggered formation achieves this

- **Eclipsed conformation** – highest energy conformation
  - Big groups do not want to be next to each other, so they will be higher energy when shoved next to each other

- **Degenerate** – the same amount of energy or the same energy level
Conformational analysis energy diagram

Practice #3 Draw a full energy diagram of the following molecule and label all parts (x-axis, y-axis, all conformations, which conformations are degenerate…)

THINGS YOU MAY STRUGGLE WITH

- Drawing newman projections takes a lot of practice. This is the first part of o chem where you have to imagine the molecule in a different perspective than what is shown. I have found that especially for newman projections, using model molecules is really helpful. Using models allows you to actually look at the molecule in the perspective that you want to draw it in.
- Naming takes a lot of practice, but it is all pattern based, so once you get it down, it will be easy points on future tests.
Answers to practice:

1.
   a. 
   b. \[ \text{2,4-dimethylheptane} \]

2.
   a. 
   b. \[ \text{2,3,5-trimethylhexane} \]

3. 
   [Diagram showing energy vs. angle, from 180° to 0° to 180°]