Hi everyone! My name is Sowmya Duddu and I am the Master Tutor for O-chem 1 this semester! This class is known to be very difficult, but it is also very doable if you put in the effort. I am super excited to be helping y’all out this semester! I will be providing a resource like this one once a week that will help clarify major topics and give some good examples for the more tricky concepts. Please feel free to reach out if you have any questions or concerns about the resource!

Additionally, I will be offering weekly Group Tutoring sessions for biology 1306/1406. These sessions will happen every Monday from 6:30 – 7:30 PM in Sid Rich Room 75. Please visit baylor.edu/tutoring for more information about group tutoring. Feel free to reach out to me at Sowmya_duddu1@baylor.edu for any questions you have!

**Keywords:** Alkanes, Newman Projections, Staggered, Eclipsed, Degenerate

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**TOPIC OF THE WEEK: ALKANES**

- **Alkanes are hydrocarbons that are completely saturated with hydrogens** (no double or triple bonds)
  - Examples:

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

**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:**
Find the parent chain - The parent chain is the longest continuous carbon chain

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>

8 carbons = Octane
- Name the substituents (all of the stuff not on the parent chain)
  - 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.

- Number the main chain using the numbering rules!!
  - Start numbering at either end of the longest chain, **never in the middle**
  - Start numbering at the end that gives the **substituents the lowest numbers possible**

- You have all the pieces, so now put the name together
  - Numbers are separated by **commas**, numbers and letters are separated by a **dash**
  - Substituents are written first followed by parent name
  - Substituents should be written in **ALPHABETICAL ORDER**, not based on number
  - 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…)

```
3-ethyl
4,5-dimethyl
```

```
3-ethyl - 4,5-dimethyl octane
```
**Practice #1: Name the compound**

1.

![Chemical structure image]

**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](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 diagram]

*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 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:

1.

HIGHLIGHT #3: Conformational Analysis

- 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

• 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
CHECK YOUR LEARNING:

1. Name the compound:

![Compound Image]

2. Draw the Newman projection

![Newman Projection Image]

3. Draw the wedge dash projection using the Newman projection:

![Wedge Dash Projection Image]

4. Draw a full energy diagram of the following molecule and label all parts (x-axis, y-axis, and all conformations)

![Energy Diagram Image]
THINGS YOU MAY STRUGGLE WITH

1. Drawing new 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 projection, 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.
   a. There are model kits available for use at the tutoring center if you do not have access to one. Grab one and practice!
2. Naming also takes practice, but it is all pattern based, so once you get it down it will be easy points on future exams. Keep practicing!

ANSWERS TO PRACTICES 1-2:

1. 

```
2,4-dimethyl heptane
```

2. 

```
Cl
H

Cl
Br

H

CH₃
CH₃

CH₃
```

ANSWERS TO CHECK YOUR UNDERSTANDING:

1. 

\[
\begin{align*}
\text{2, 3, 5-trimethylhexane}
\end{align*}
\]

2. 

\[
\begin{align*}
\text{Br} & \quad \text{CH}_3 \\
\text{Cl} & \quad \text{CH}_3 \text{CH}_2 \text{CH}_3 \\
\text{F} & \quad \text{Br}
\end{align*}
\]

3. 

\[
\begin{align*}
\text{HO} & \quad \text{S} \text{H}
\end{align*}
\]

4. 

\[
\begin{align*}
\text{Energy vs. Angle ( } \theta \text{ )}
\end{align*}
\]
I hope this resource was helpful for you. Don’t forget that these weekly resources are available for you in the tutoring center website, at: https://www.baylor.edu/support_programs/index.php?id=967950

You can also check out the tutoring website for videos explaining concepts in Ochem-1: https://www.baylor.edu/case/index.php?id=978624

Here is the video explaining newman projections: https://www.youtube.com/watch?v=M1x7hk2dgRs