Week 5
CHE 3331- Organic Chemistry

This week is Week 5 of class, and typically in this week of the semester, your professors are covering these topics below. If you do not see the topics your particular section of class is learning this week, please take a look at other weekly resources listed on our website for additional topics throughout of the semester.

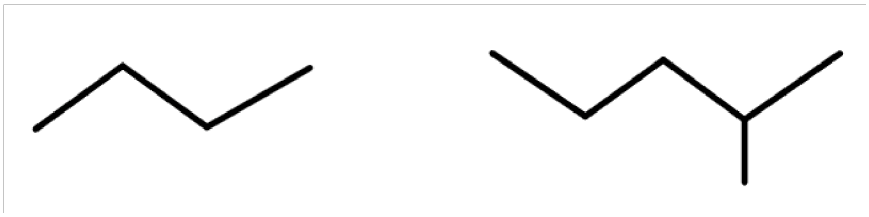
We also invite you to **look at the group tutoring chart on our website to see if this course has a group tutoring session offered this semester**.

If you have any questions about these study guides, group tutoring sessions, private 30 minute tutoring appointments, the Baylor Tutoring YouTube channel or any tutoring services we offer, please visit our website www.baylor.edu/tutoring or call our drop in center during open business hours. M-Th 9am-8pm on class days 254-710-4135.

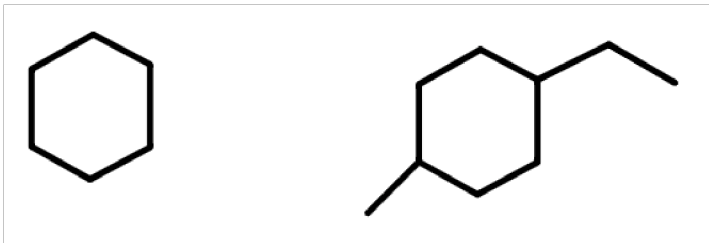
Keywords: Alkanes, Newman Projections, Staggered, Eclipsed, Degenerate

TOPIC OF THE WEEK: ALKANES

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

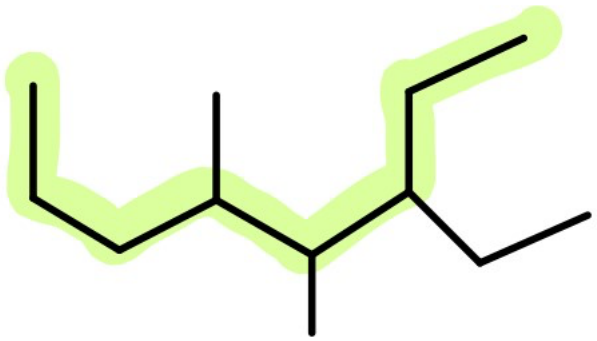


- What is a cycloalkane? An alkane, but in a ring!
  - ○ Examples:



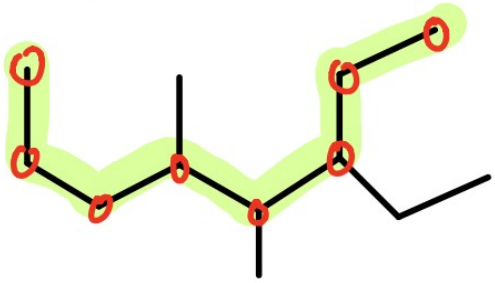
HIGHLIGHT #1: Nomenclature of alkanes and cycloalkanes

- 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



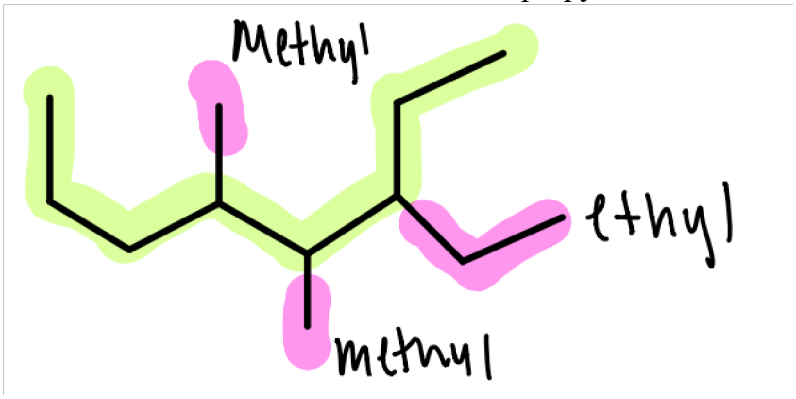
    - Name the parent chain – parent name is based off of # of carbons in longest chain (this applies to any type of molecule), however, **the suffix -ane is specific to alkANEs.** Molecules with double and triple bonds will have different suffixes.

# Carbons	*Parent name*	*Name of alkane*
1	Meth	Methane
2	Eth	Ethane
3	Prop	Propane
4	But	Butane
5	Pent	Pentane
6	Hex	Hexane
7	Hept	Heptane
8	Oct	Octane
9	Non	Nonane
10	dec	Decane

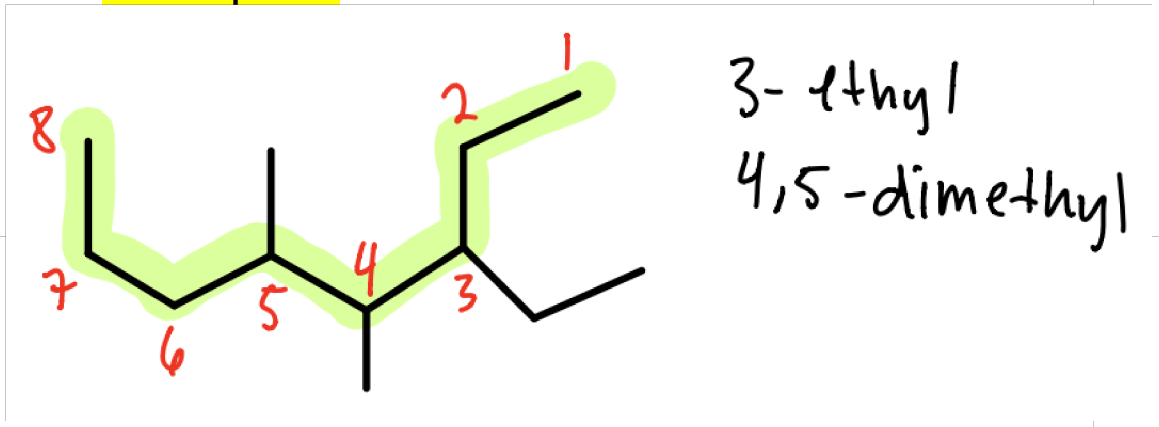


8 carbons = Octane

- 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.

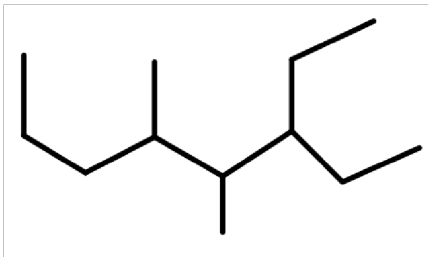


- Number the main chain using the numbering rules!!
  - Start numbering at either end of the longest chain, **never in the middle**
  - Start numbering at the end that gives the **substituents the lowest numbers possible**



- 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

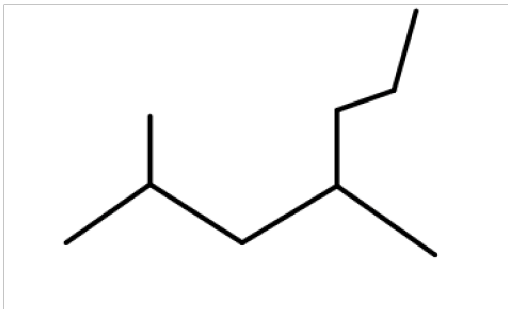
- If you have multiple of the same substituent, it should be listed one time but with a prefix denoting how many there are in the compound. (mono, di, tri, tetra, penta, hexa, hepta, octa…)



3- ethyl-4,5-dimethyloctane

Practice #1: Name the compound

1.



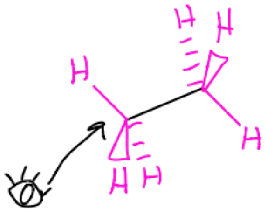
HIGHLIGHT #2: Newman Projections

- **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-structuresalkanescycloalkanes/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.

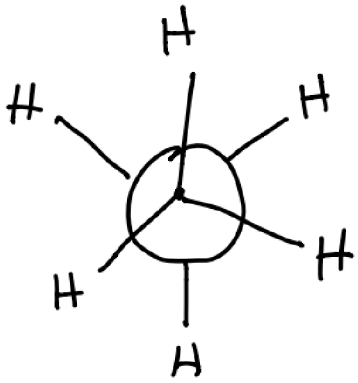
Now we are doing the exact same thing, but we have multiple different atoms to deal with.

Ethane:



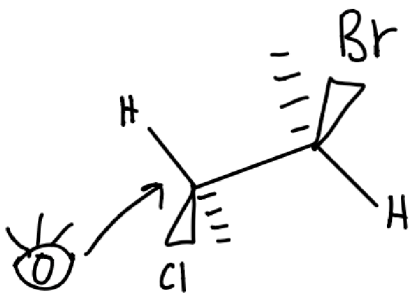
Step 1 determine which way you are looking at the molecule

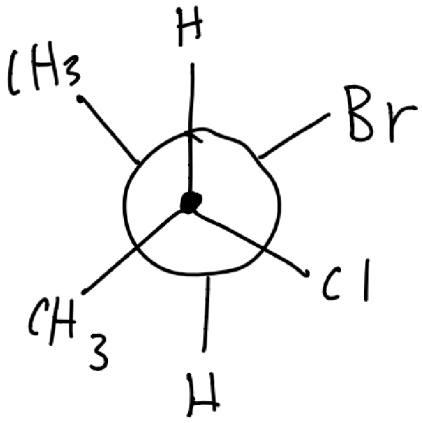
Step 2 the front carbon is represented by the dot, the back carbon is represented by the circle



Step 3: place the substitute to in the correct positions

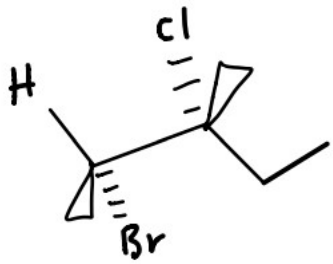
Right side: wedges
Left side: dashes
Up or down: in plane





Practice 2: Draw the newman projections of the following molecules:

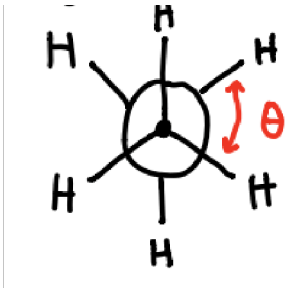
1.



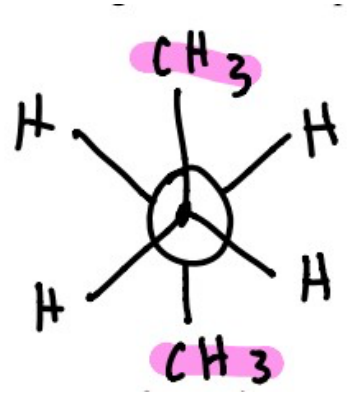
HIGHLIGHT #3: Conformational Analysis

- 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
- https://www.khanacademy.org/science/organic-chemistry/bond-line-structuresalkanescycloalkanes/conformations-alkanes-cycloalkanes/v/conformations-of-ethane
- https://www.khanacademy.org/science/organic-chemistry/bond-line-structuresalkanescycloalkanes/conformations-alkanes-cycloalkanes/v/conformational-analysis-ofbutane

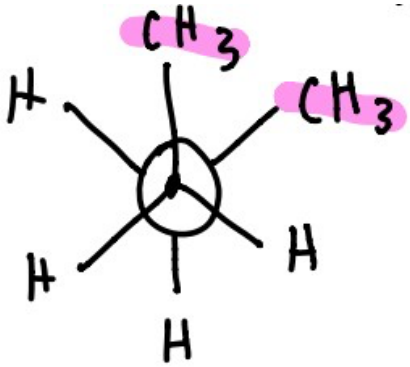
- Dihedral angle – angle between adjacent front and back atoms in a newman – this angle changes as the carbon-carbon bonds rotate ○ Can be between 0 and 180 degrees



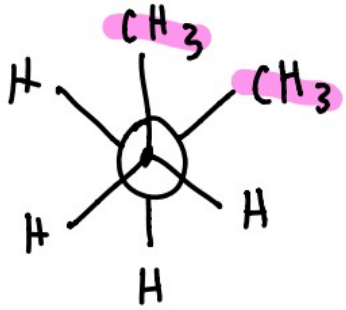
- Staggered conformation – lowest energy conformation ○ Think about the groups as wanting to be as far apart as possible. The staggered formation achieves this

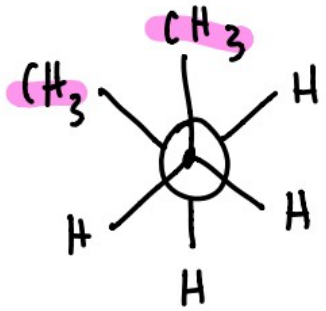


- Eclipsed conformation – highest energy conformation ○ Big groups do not want to be next to each other, so they will be higher energy when shoved next to each other

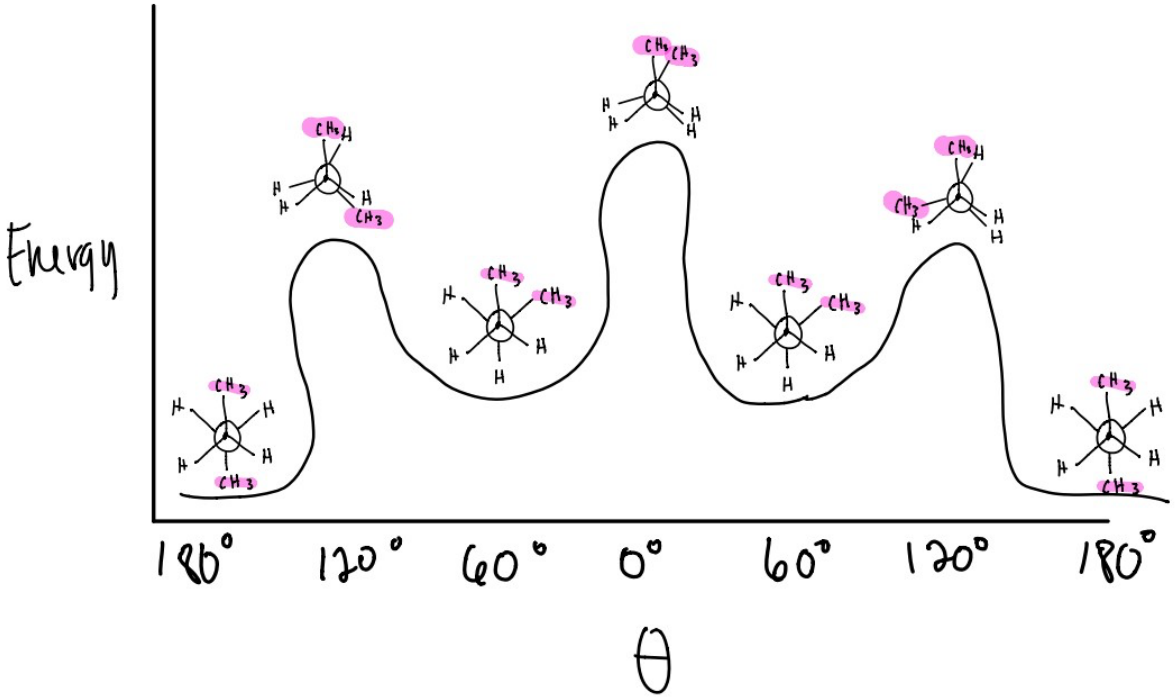


- Degenerate – the same amount of energy or the same energy level



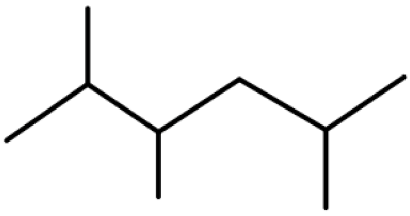


Conformational analysis energy diagram

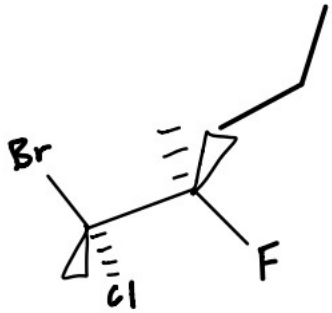


CHECK YOUR LEARNING:

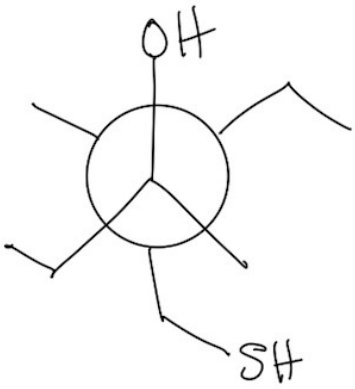
1. Name the compound:



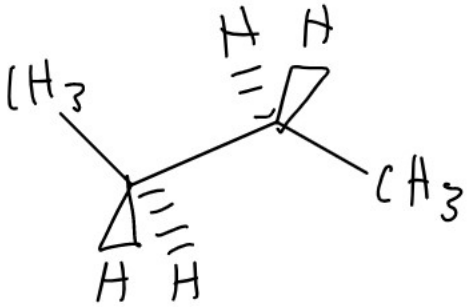
2. Draw the Newman projection



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



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



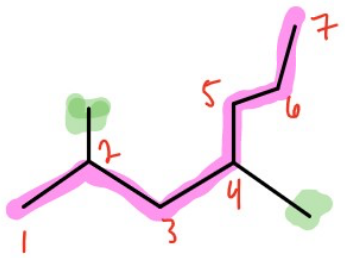
THINGS YOU MAY STRUGGLE WITH

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 perspsective than what is shown. I have found that especially for newman projectsion, using model molscules 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!

Thanks for checking out these weekly resources!
Don't forget to check out our website for group tutoring times, video tutorials and lots of other resources: www.baylor.edu/tutoring ! Answers to check your learning questions are below!

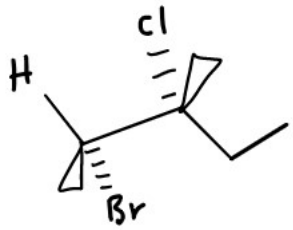
ANSWERS TO PRACTICES 1-2:

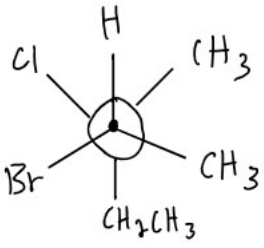
1.



2,4-dimethylheptane

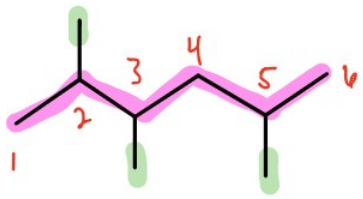
2.





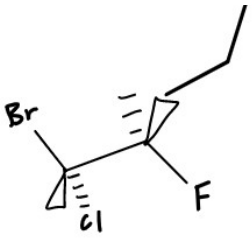
ANSWERS TO CHECK YOUR UNDERSTANDING:

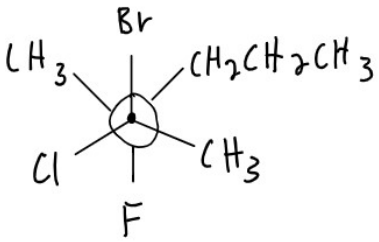
1.



2,3,5-trimethylhexane

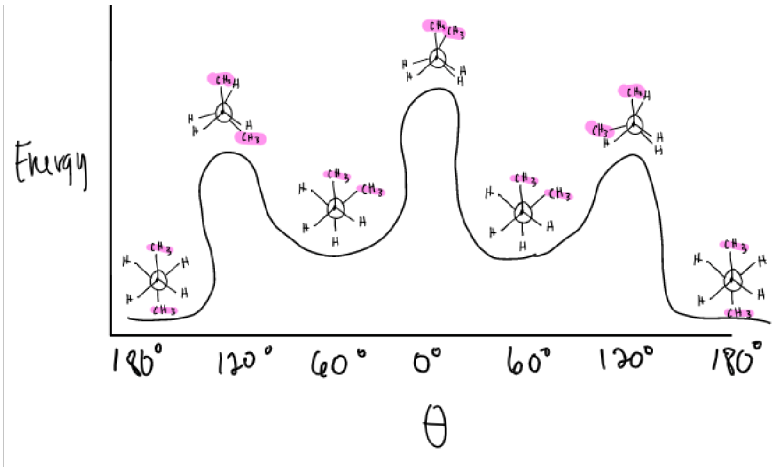
2.





3.

4.



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