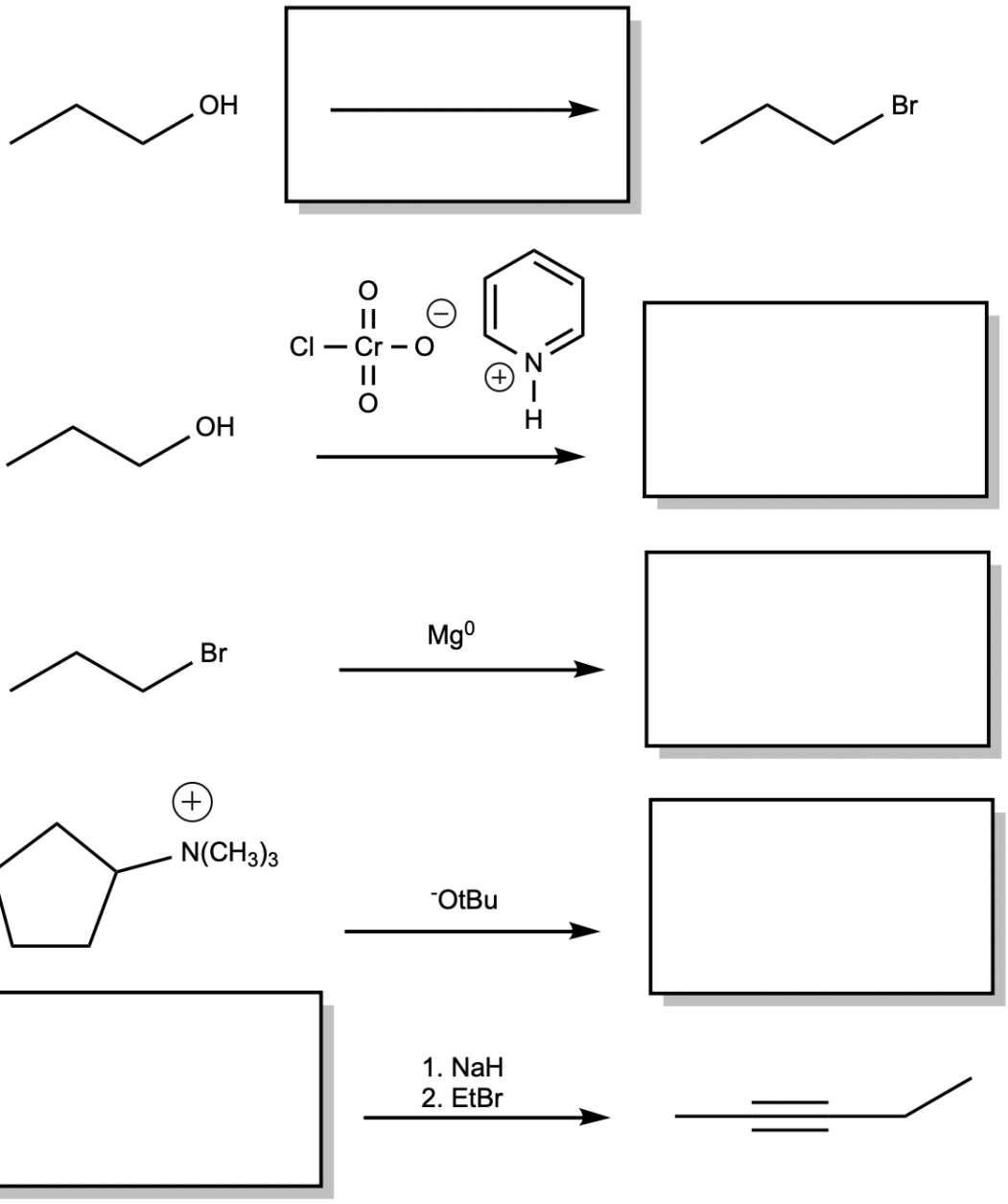
Problem Set 12

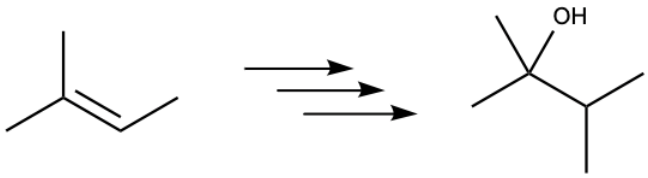
Organic Chemistry 1 (Greenberg)

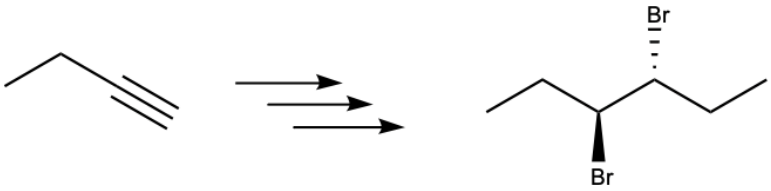
Fall 2025

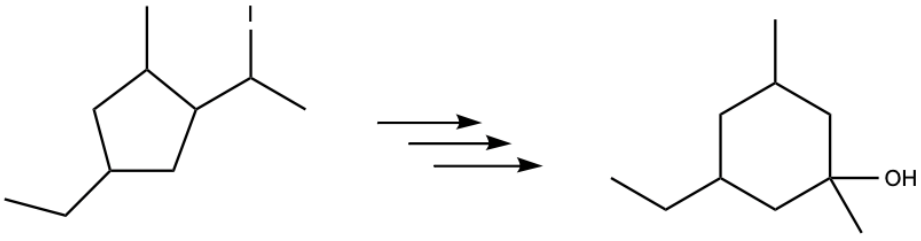
1. Some box questions before we do some synthesis/structure determination.

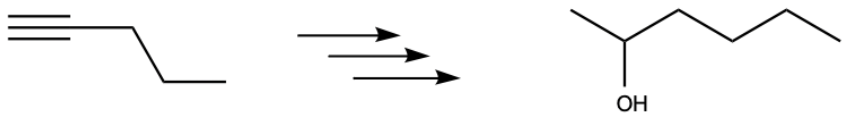


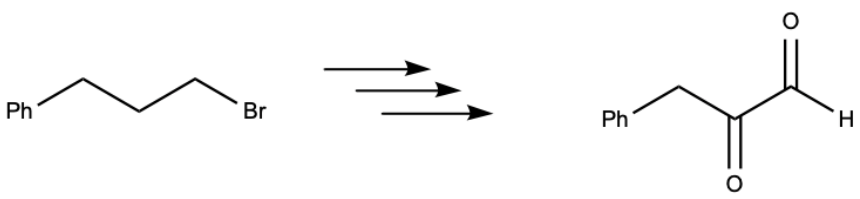
2. This is the last synthesis questions on this semesters PILOT set. Let's go out with a bang and do six in a row! For some of these problems, multiple answers are possible. When indicated, stereochemistry is important.

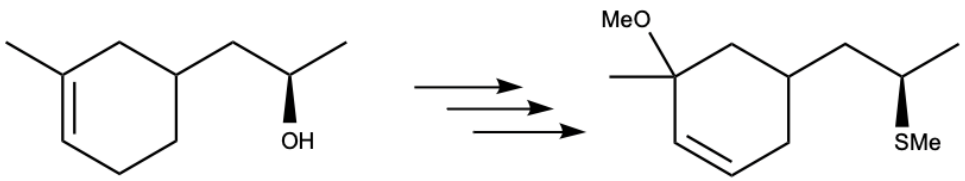




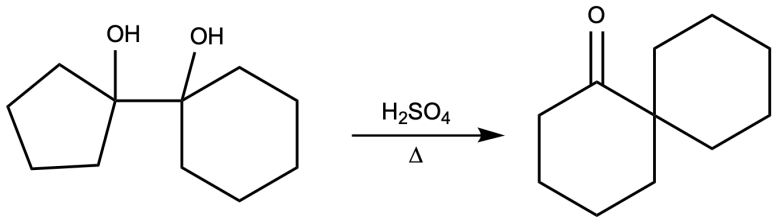



OH


Ph
Br
O
Ph
H
O


OH
MeO
SMe

3. The following reaction is the Pinacol Rearrangement. Using your knowledge of organic chemistry from this semester, propose a mechanism for the rearrangement.



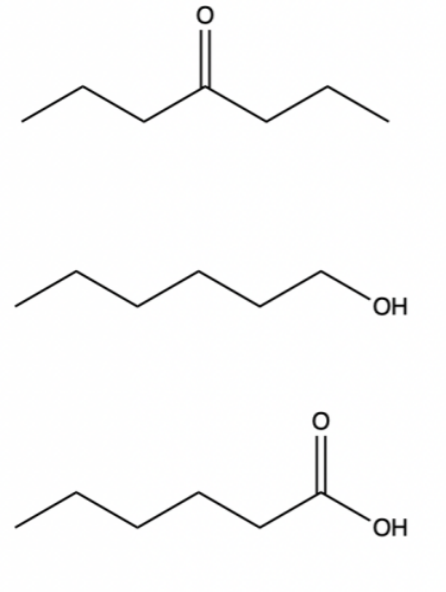
4. When chemists make a new compound—or want to confirm they made the correct one—they use a set of analytical tools to figure out its structure. Examples include ^{1}H-NMR**,** ^{13}C-NMR**,** mass spectrometry**,** infrared/Raman spectroscopy**,** UV–Vis**,** optical rotation/CD**,** and X-ray crystallography**.** In 030.205, you won't learn every one of these techniques, but it's important to understand that chemists have *many* different methods (even more than the ones listed here) to identify and verify chemical structures.

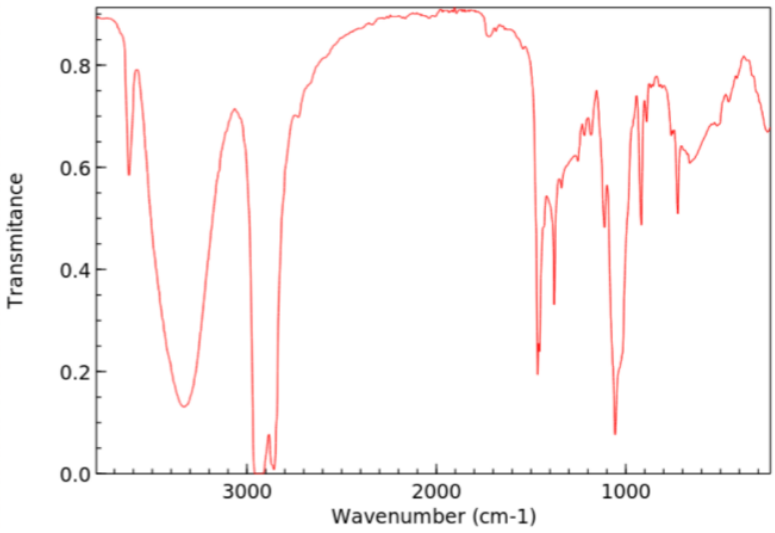
   There is a lot of physics/quantum mechanics in the underlying techniques, but we don't need to focus on that for 030.205. We will instead use information gathered from these techniques to identify molecules.

   Each technique gives different information about the molecule, such as the chemical formula, specific functional groups, etc. For your information, I have listed each of the major techniques and what chemists can learn from them below.

^{1}H-NMR**:** Looks at hydrogen environments, great for structure identification.
^{13}C-NMR**:** Looks at carbon environments, great for backbone identification.
Mass spectrometry**:** Looks at mass, great for determining molecular mass/potential formula.
Infrared/Raman spectroscopy**:** Looks at bond strength, great for determine functional groups.
UV–Vis**:** Looks at electron systems, great for identifying conjugation/aromaticity.
Optical rotation/CD: Looks at how circular polarized light is absorbed, great for chirality.
X-ray crystallography: Gives electron density in crystal form, great for finding exact structure.

5. Enough yapping, let's try it ourselves. Pick the molecule that has the following IR spectrum and briefly explain why.





6. For each of the following pairs, identify which one will show up at a higher wavenumber on an IR spectrum.

C-H or C-O

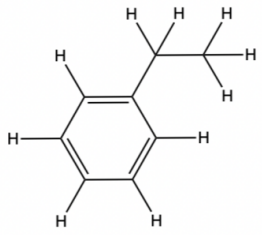
C-O or C=O

C=N or C≡N

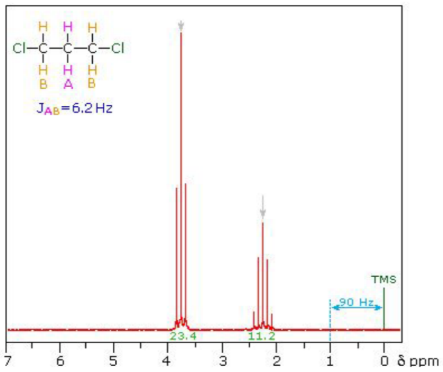
N-H or N-O

A covalent O-H bond or a hydrogen bond in water

7. Identify which protons have the same chemical environment by labeling them H_1 - H_n for n unique chemical environments.



8. Label the ^{1}H-NMR below with the correct hydrogens. Notice the integration values.



Clubs and Orgs Bulletin:

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HopTHON
Are you interested in raising money for children in need? We work with Johns Hopkins Children's Center under Children's Miracle Network of Hospitals to raise money for the families and children undergoing treatment! We have many fun ways to get involved and fundraising events throughout the year.

A Place To Talk
Need to vent about something or talk through an issue? Come visit an APTT room! Want to encourage your organizations' members to be more compassionate and welcoming? Schedule listening and empathy trainings by emailing apttexternaltraning@gmail.com.
Learn more: @jhuaptt or https://pages.jh.edu/aptt/

Tip of the Week:

Looking for off-campus housing for the summer/fall? Check out the Johns Hopkins Off-Campus website which offers resources like apartment listings and roommate matches: https://offcampushousing.jhu.edu/. Furthermore–consider becoming an RA! Info sessions will be happening through the next couple of months both in-person and virtually. Find out more @jhureslife on ig.