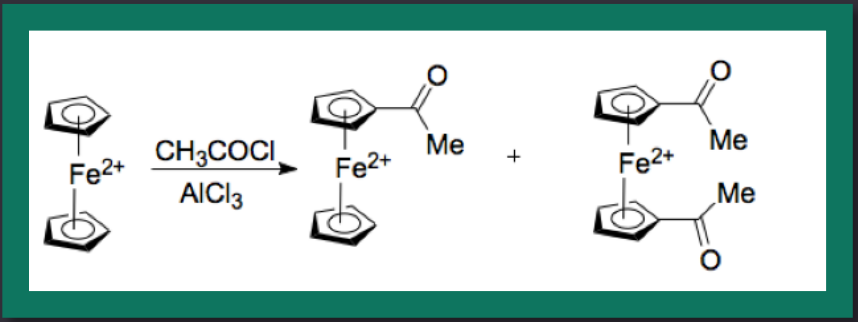
CHEM 242

Section AA - Hao Nguyen – Spring 2021

Basic O-Chem Techniques

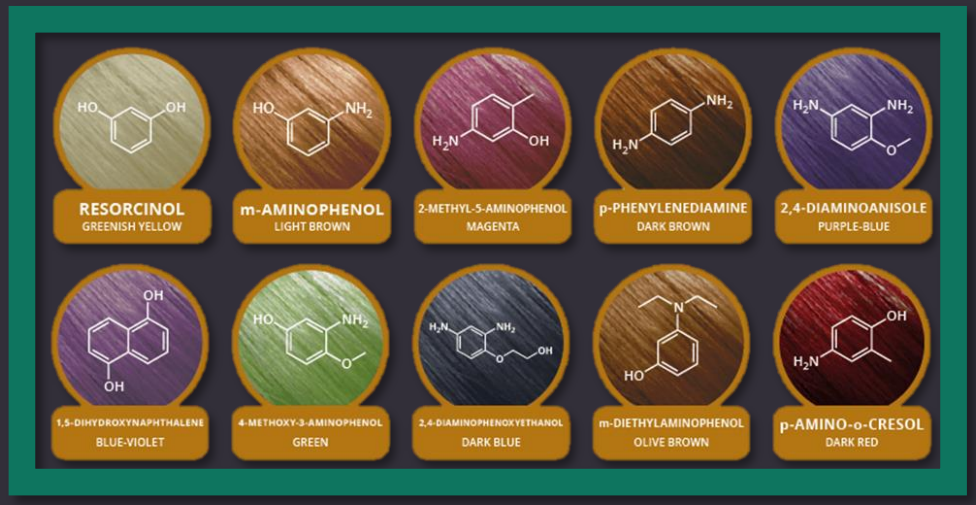
Reactions

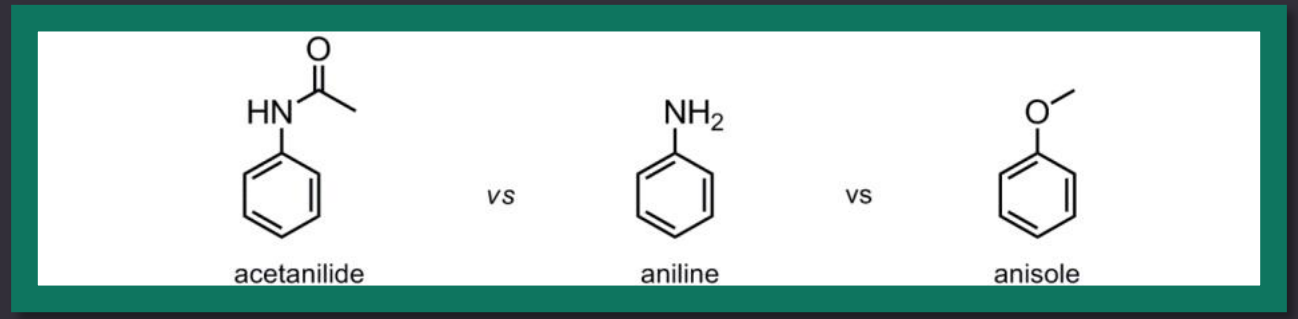
Friedel-Crafts



Reactions

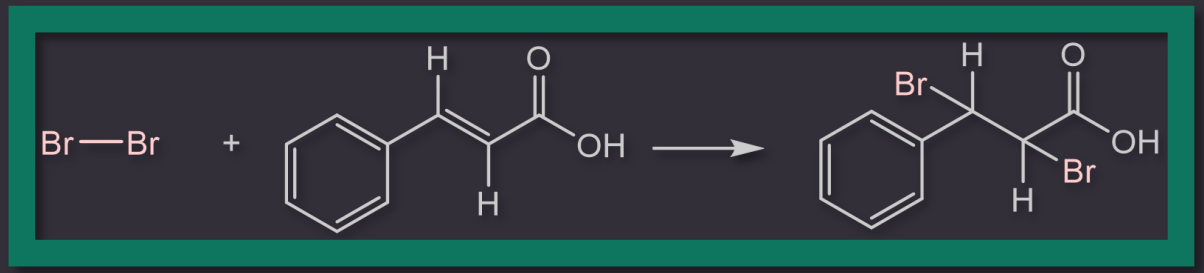
Reactivities of aromatic compounds





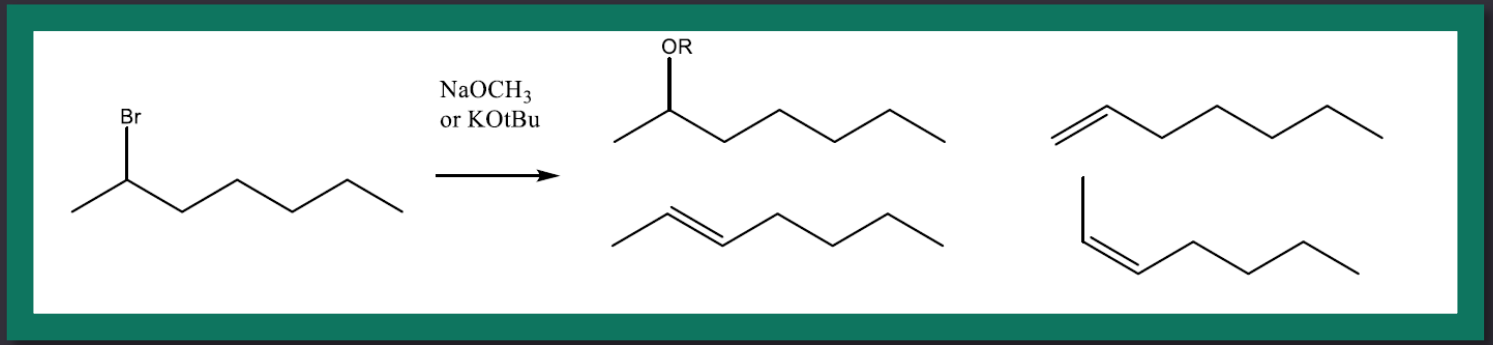
Reactions

Alkene bromination



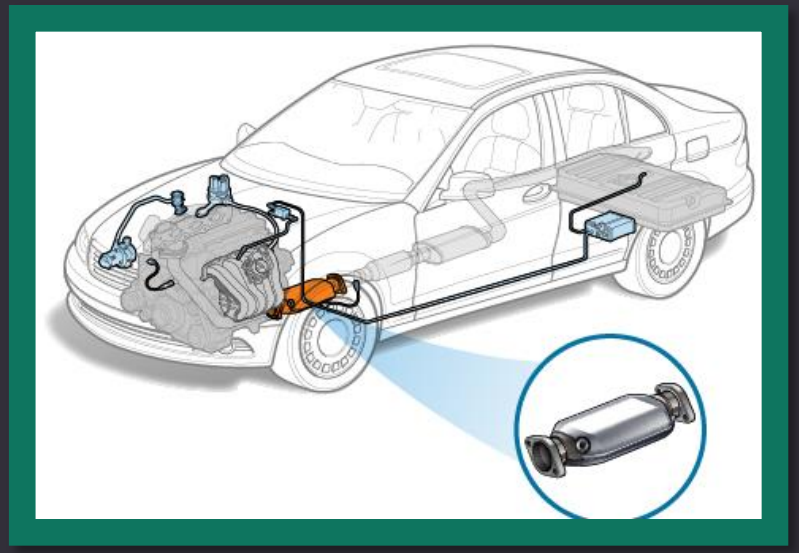
Reactions

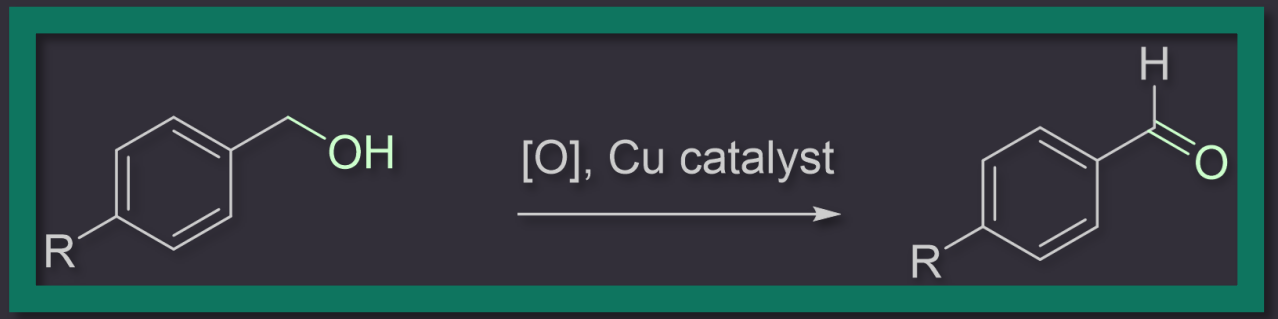
Alkyl Halide Reactions



Reactions

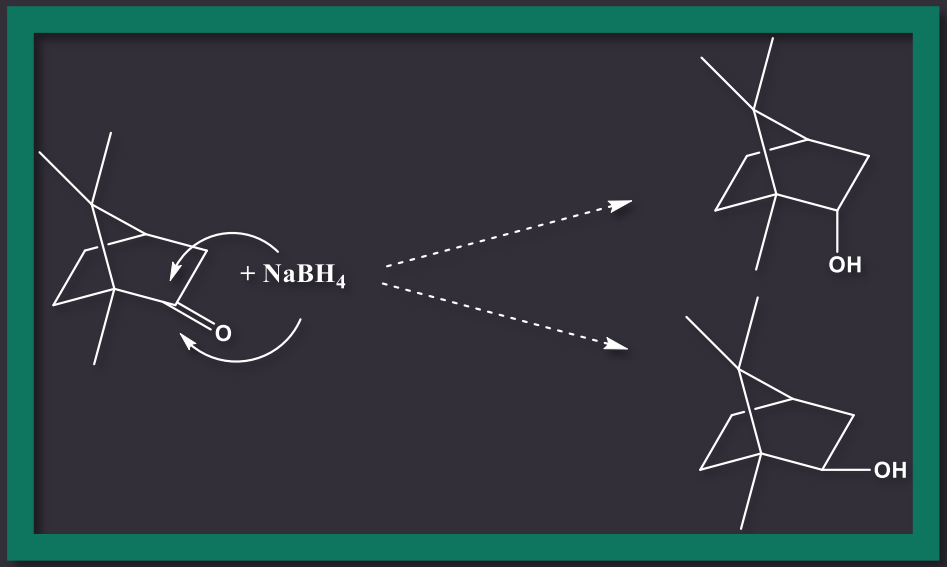
Green Alcohol Oxidation





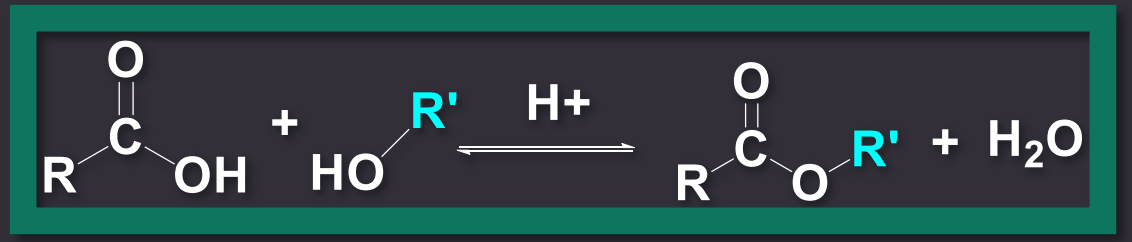
Reactions

Reduction of Camphor



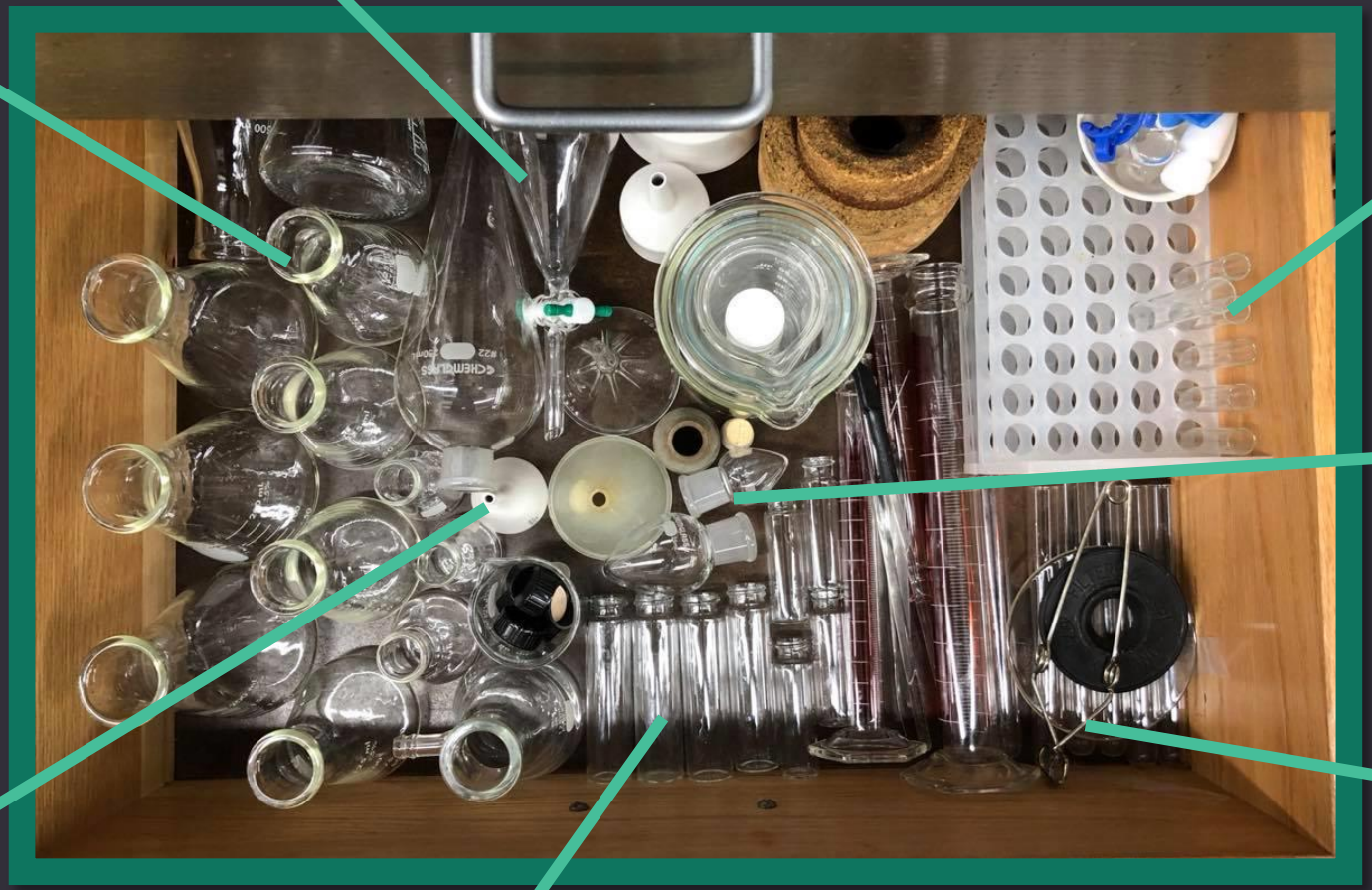
Reactions

Esterification



Separating funnel for extractions of Grignard, Friedel Crafts, and Reduction reactions

I wish I could show you pics of crystals I grew in these Erlenmeyer flasks



Test tubes for Michael – Aldo reaction

Pear-shaped flask for Diels-Alder reaction

Ceramic funnel for filtration of Azo dyes

Flame striker for flame tests

April 25th, 2019

Vials to store products

Final Exam Review

1. How to write a ~~good~~ better answer

Know what you write

Q: Why (1-2 sentences) is acetic acid used as the solvent rather than using a standard solvent like diethyl ether?

A: To push the equilibrium towards the right using Le Chatelier's principle by using more of 1 equivalent of reactant because using acetic acid as a solvent means we have excess reactant.

A: Acetic acid creates more acidic conditions than diethyl ether and it is more accessible.

1. How to write a ~~good~~ better answer

Understand and use definitions

Q: In order to directly compare the WebMO heat of formation for 2 compounds, they must have the same chemical formula and be calculated at the same level of theory. Why (2-3 sentences)?

A: Heat of formation is based on the energy consumed or released from individual atoms / particles. If 2 compounds have different formulas, they are built from different atoms, which will give different energies regardless of which compound is more stable. Different levels of theory Use different approximation and calculations.

A: Because if the chemical formulas are different, they will result in different molecular weight. In that case, we are not able to directly compare the heat of formation

1. How to write a ~~good~~ better answer

Understand the purpose of the question

Q: Usually, we are interested in isolating solely the product. Why (1-2 sentences) in this experiment are we okay with a mixture of alcohol and ester?
alcohol and ester were present.

A: The main scientific question we are asking is how well we were able to push the equilibrium by using acetic acid as solvent. To answer that question, we need to be able to determine how much of both.

A: The goal of the experiment was to identify our starting alcohol, so there was no need to separate out any alcohol we had remaining in our product as this could help us to identify the alcohol we started with. Also, our GC analysis would separate alcohol and ester compounds before MS testing and the NMR spectra for our alcohol and ester product would be identical so a large amount of alcohol mixed in with our ether product would only affect our IR spectroscopy data

2. How to make graders like your answers

Be clean and clear

a) Increasing the amount of sulfuric acid would not increase the yield of ester. Why not (1-2 sentences)?

Sulfuric acid is a catalyst in this reaction and is not consumed through the reaction process. As a result, the amount of sulfuric acid we start with will not affect the equilibrium concentrations of each product and reactant.

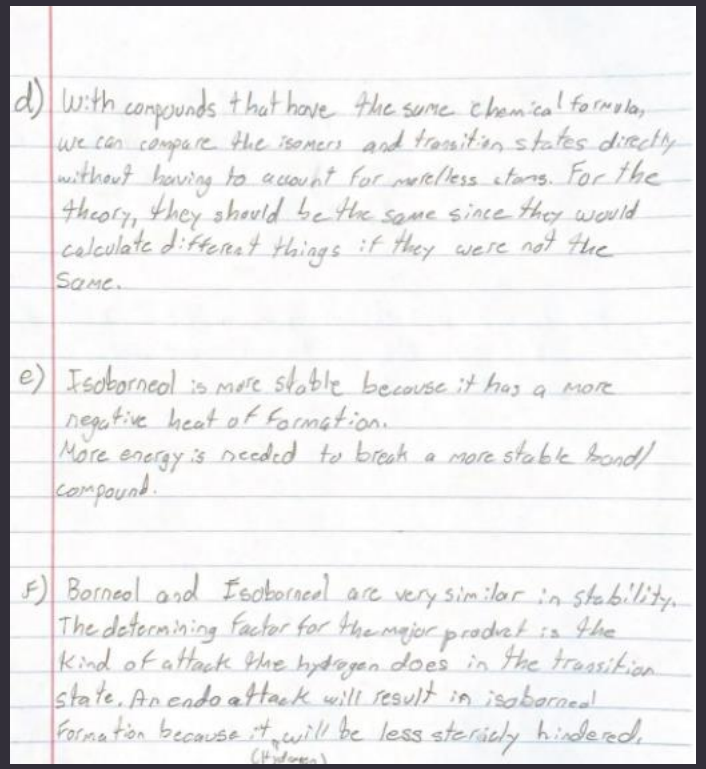
a) Increasing the amount of sulfuric acid would not increase the yield of ester. Why not (1-2 sentences)?

In this case, H_2SO_4 acts as a catalyst, not a consumable reagent, so adding more won't do much since the amount of H_2SO_4 is not limiting the rxn.

a) This is due to the fact that Sulfuric acid is a catalyst and has no effect on the equilibrium of the reaction, it just speeds it up like changing the heat.

2. How to make graders like your answers

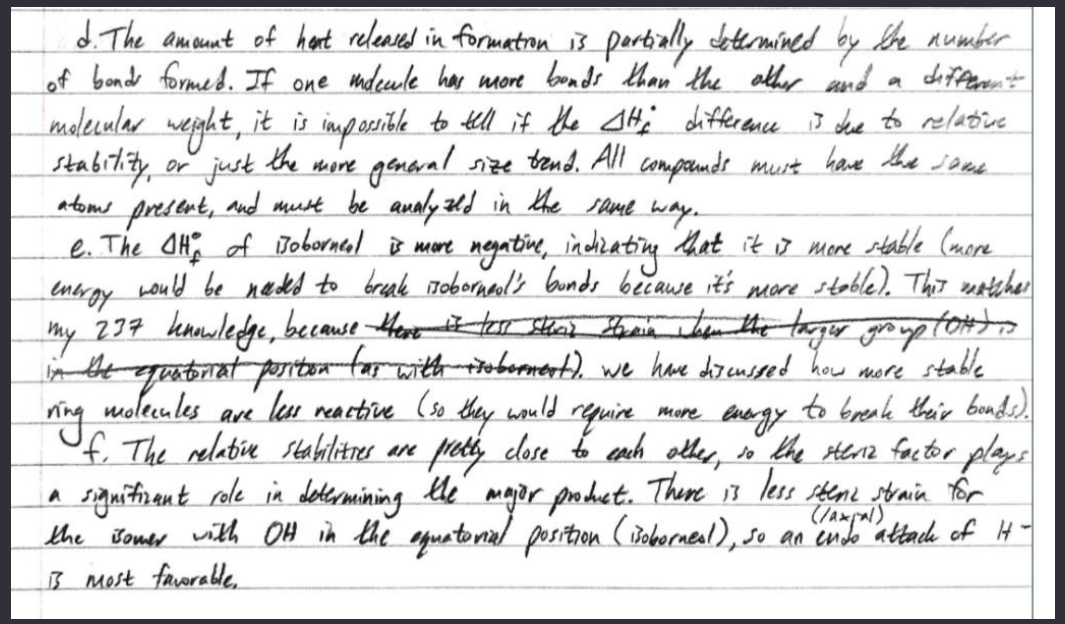
Use Space/Paragraphs



d) With compounds that have the same chemical formula, we can compare the isomers and transition states directly without having to account for more/less atoms. For the theory, they should be the same since they would calculate different things if they were not the same.

e) Isoborneol is more stable because it has a more negative heat of formation.
More energy is needed to break a more stable bond/compound.

F) Borneol and Isoborneol are very similar in stability. The determining factor for the major product is the kind of attack the hydrogen does in the transition state. An endo attack will result in isoborneol formation because it will be less sterically hindered. (Hydrogen)



d. The amount of heat released in formation is partially determined by the number of bonds formed. If one molecule has more bonds than the other and a different molecular weight, it is impossible to tell if the ΔH_f° difference is due to relative stability, or just the more general size trend. All compounds must have the same atoms present, and must be analyzed in the same way.

e. The ΔH_f° of isoborneol is more negative, indicating that it is more stable (more energy would be needed to break isoborneol's bonds because it's more stable). This matches my 237 knowledge, because ~~there is less steric strain than the larger group (OH) is in the equatorial position (as with isoborneol)~~. we have discussed how more stable ring molecules are less reactive (so they would require more energy to break their bonds).

f. The relative stabilities are pretty close to each other, so the steric factor plays a significant role in determining the major product. There is less steric strain for the isomer with OH in the equatorial position (isoborneal), so an endo (axial) attack of H⁻ is most favorable.

2. How to make graders like your answers

Use underline, highlight, ...

A: To push the equilibrium towards the right using Le Chatelier's principle by using more of 1 equivalent of reactant because using acetic acid as a solvent means we have excess reactant.

How to prepare for the final?

Tests

Tests	Test for	Main Reactions	Mechanism of reactions	Positive/Negative What causes the color?	False positive/negative	Practical notes
Solubility	Depends on solvents		Like dissolves like			
Ignition	Unsaturation			Sooty flame/ clean flame A sooty flame is observed if there is incomplete combustion of saturated hydrocarbons due to insufficient air supply	...	
DNP	Aldehyde/ketone	...	...		Benzylic alcohol. why?	
...						

Spectroscopy

NMR: Shift, integration, splitting, impurities

IR: signal regions, signal shapes, H-bonding

MS: isotopes, Br, Cl, # of carbon & nitrogen

Practical notes

Common solvents (impurities): methanol, ethanol, butanol, DCM, hexanes, diethyl ether, acetonitrile, water, pentane, THF, ...

Common cleaning solvents (impurities): water, acetone, toluene, hexanes, alcohol, diethyl ether, DCM, ...

Common NMR solvents (impurities): chloroform-d

Ask questions!

Why do we use $CaCl_2$ glass for IR cell?
Why do we use deuterated solvents for NMR?
Why do NMR solutions have to be clear (no precipitate)?

...