CHE 212 Opportunity #2
Spring 2013

General rules and regulations:

Open notes, open book, open web, open mind. You absolutely may not discuss any portion of Questions I – IV on this opportunity with any entity (other than the professor) in any medium until class on Friday, April 12. Prayer is the only exception. You may not use old opportunities from any student to assist in your solutions. You may not share notes with others. Any violation of these rules is a serious breach of academic honesty which could lead to a failing grade in the course. Each page of the opportunity must contain the honor pledge ("No aid; no violation") along with your signature, signifying that you have neither received/given any aid from/to others.

This opportunity will be collected at the *beginning of class* on Friday morning, April 12. Any paper submitted after the class begins on Friday will be not be accepted. Really. Don't do that. There are no exceptions without the written advice of the Health Center or CSD.

Follow all instructions carefully in order to receive full credit. Please . . .

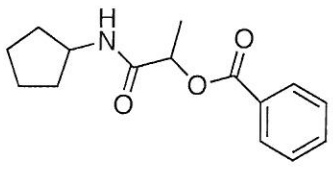
- Place your name and the honor pledge on each page
- Use one side of paper, not both, beginning each question (I-IV) on a fresh sheet of paper
- Use the provided answer sheet for Question V
- Trim edges if you use spiral notebook paper
- Staple all answer pages together in the correct order

Micah 1:8 ~ Romans 12:11 ~ Philippians 4:4-9

Question I (15 points) Name Reactions

In our course, we have learned of many famous reactions that are named for their discoverer(s). In this question you will see how chemists used these reactions in normal synthetic projects.

Suppose that you get a summer research opportunity and you join a team that is interested in your ability to synthesize molecules for their research team. On the first day the team leader asks you to make the picture molecule. She thinks it can be made with a name reaction but can't remember which one.



She scribbles a few names on a sheet of paper for you – Baylis-Hillman, Biginelli, Passerini, Pechmann – but she said she can't remember which one it is for certain.

Impress the leader by answering both of these questions:

a. Choose the correct name reaction to make the molecule.
   Hint: there are many web sources (other than Wikipedia) with info about name reactions.
b. What organic reactants will you need to order so that you can synthesize the desired target using the name reaction?

Question II (20 points) Reaction Database

Submit a spreadsheet that has the following columns and complete all information.
DO NOT SUBMIT HANDWRITTEN WORK!

Target		*Synthon*	*Reagent*	*Solvent/ Conditions*	*Page #*
1° Alcohol	=>	Aldehyde			
1° Alcohol	=>	Carboxylic Acid			
1° Alcohol	=>	Carboxylic Ester			
2° Alcohol	=>	Ketone			
Ketone	=>	2° Alcohol			
Aldehyde	=>	1° Alcohol			
Carboxylic acid	=>	1° Alcohol			
Carboxylic acid	=>	Aldehyde			
RMgX	=>	RX			
Alkoxide ion	=>	RMgX & alcohol			
1° Alcohol	=>	RMgX & oxirane			
1° Alcohol	=>	RMgX & formaldehyde			
2° Alcohol	=>	RMgX & aldehyde			
3° Alcohol	=>	RMgX & ketone			
3° Alcohol	=>	RMgX & carboxylic ester			
Allylic halide	=>	Alkene			
Cyclohexenes	=>	Conjugated diene & dienophile			
Haloarene	=>	Arene			
Nitroarene	=>	Arene			
Arenesulfonic Acid	=>	Arene			
Arene	=>	Arenesulfonic acid			
Alkylarene	=>	Arene			
Phenone	=>	Arene			
Benzoic acid	=>	Arene with oxidizable side-chain			
Alkylarene	=>	Phenone			
Acyl chloride	=>	Carboxylic acid			
Aldeyhyde	=>	Acyl chloride			
Ketone	=>	RMgX & nitrile			
Acetal	=>	Ketone/Aldehyde			
Imine	=>	Ketone or Aldehyde			
Oxime	=>	Ketone or Aldehyde			
Hydrazone	=>	Ketone or Aldehyde			
Triphenylphosphonium	=>	Alkyl halide			
Phosphorus ylide	=>	Triphenylphosphonium			
Alkene	=>	Ketone or Aldehyde & Phosphorus ylide			
Carboxylic acid	=>	RMgX			
Carboxylic ester	=>	Carboxylic acid			
Amide	=>	Carboxylic acid			
Carboxylate ion & alcohol	=>	Carboxylic ester			

Question III (20 points) Principles of Green Chemistry

*** Choose *one* of the following two questions ***

Question 1. Microwave-Assisted Organic Synthesis

a. Find an interesting example of a microwave-assisted organic synthesis (MAOS). Yes, I know that "interesting" is subjective, but I believe that you know what I mean. Maximum credit will be awarded for an example that requires either no solvent or water as the solvent and that requires less than 1 hour of microwave irradiation.

   Provide an annotated list of references to all sources you consult.

b. What does MAOS have to do with green chemistry?

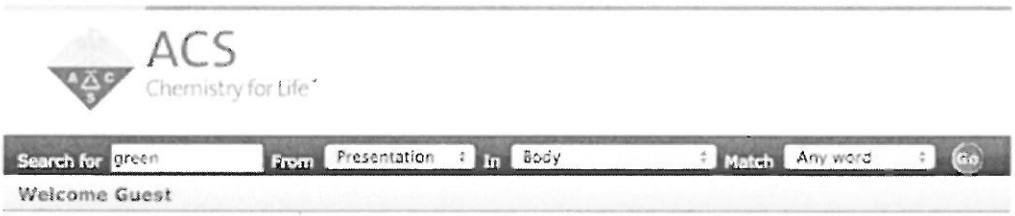
Bonus (5pt): Who is Raj Varma and why is his work relevant to this question?

Question 2. Green Chemistry at the ACS National Meeting

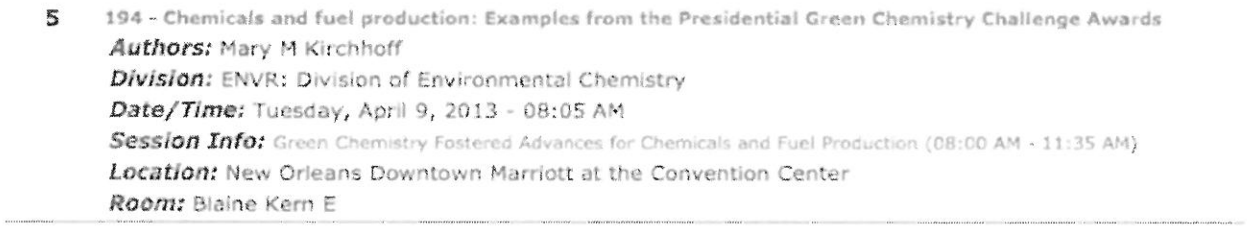
Go to the web site for the American Chemical Society and do some browsing in the Technical Program by visiting this link:

http://abstracts.acs.org/chem/245nm/program/divisionindex.php

This should take you to a rather blank web page with this search bar at the top left:



Enter "green" and search for the term in the body of an abstract by clicking "Go". Make a tally of the names of the divisions of the ACS and tally up the number of papers about green chemistry in each division. For example, in this paper you would tally one for the division with the acronym ENVR. If the title of the paper makes it seem like an "accidental hit" then forget about it. For example if Joe Green (Giuseppe Verdi?) is author, then the paper might come up even though it's about something totally outside green chemistry.


5 194 - Chemicals and fuel production: Examples from the Presidential Green Chemistry Challenge Awards
Authors: Mary M Kirchhoff
Division: ENVR: Division of Environmental Chemistry
Date/Time: Tuesday, April 9, 2013 - 08:05 AM
Session Info: Green Chemistry Fostered Advances for Chemicals and Fuel Production (08:00 AM - 11:35 AM)
Location: New Orleans Downtown Marriott at the Convention Center
Room: Blaine Kern E

a. How many papers at the meeting are related to "green chemistry"?

b. Prepare a bar chart showing the number of papers about green chemistry for each division.

Bonus (5pt): Find a topic that sounds interesting to you, read the abstract and explain it in your own words, especially explaining what it has to do with the "12 Principles of Green Chemistry".

Question IV (25 points) – Reaction discovery

*** Choose *one* of the following two questions, all parts of either Question 1 or Question 2 ***

Question 1.
Fact: When an excess of ethyl acetate is treated with a strong base, sodium ethoxide (NaOEt), a useful organic product forms that has more carbons that the ethyl acetate reactant.

a. Draw the major organic product that would be obtained after the reaction is complete and the base has been neutralized by acid.
Note: You have not explicitly studied this reaction, but you should be able to figure it out.

b. Provide a step-by-step mechanism showing how the product is formed.

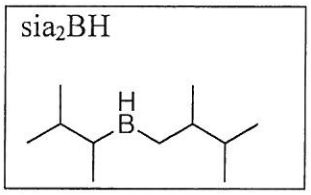
c. Why is the product of this reaction useful? Be specific. For what can it definitely be used?

Question 2.
Fact: When 1-hexyne reacts with water and catalytic acid, an organic product forms.

a. Draw and name the major organic product.
Note: You have not explicitly studied this reaction, but you should be able to figure it out.

b. Provide a step-by-step mechanism showing how the reactant is transformed into the final product.

c. When 1-hexyne reacts with sia_2BH in THF, then with basic hydrogen peroxide, a different organic product forms. What is the product in this case (drawing and name)?



d. Write two new retrosynthetic facts that describe the reactions you have discovered in parts a) and c) above. All I want from you are retrosynthetic statements: *such-and-such => so-and-so*

Question V (20 points) – NMR Problem Solving

This section will be handed to you separately because the rules are not the same. You are *encouraged* to work with one another as you solve this particular question. Do not abuse the freedom of this question by violating the restriction for questions I through IV. Of course, you will want to wait to get started until after lab on Tuesday.