CHEM 3D03 Organic Chemistry

Textbook: Claydon et al's Organic Chemistry

Course Plan:
This course continues the study into the structure and interconversion of carbon-based molecules begun in Chem 2BA3 and 2BB3, but with increasing emphasis on the underlying mechanisms common to many chemical transformations. The course currently uses Claydon's Organic Chemistry as primary textbook, and includes case studies from organic and biomolecular chemistry, as well as papers from the current literature. The course content will vary somewhat with the instructor, but will generally include the following concepts:

Review of General Concepts: Structure of molecules and functional groups; spectroscopy and functional group interconversions; C=C, C=X double bonds

Chemoselectivity: taking advantage of the slight differences in reactivity between related functional groups to carry out selective transformation on multi-functional molecules. Classical examples include selective reductions of aldehydes in presence of ketones, and vice versa.

Enolates: hydrogens in position alpha to carbonyl groups are easily removed by strong bases. The resulting anionic charge tends to shift to the carbonyl oxygen to form 'ene-alcoholates' or enolates, a family of reactive nucleophiles capable of a host of reactions.

Retrosynthetic analysis: The enormous variety of carbon-based compounds and their reactions often requires a focused, target-oriented approach to synthetic design. Retrosynthetic design, also called disconnection approach, proceeds from a target molecule in several steps backwards to commercial starting materials, looking at each step for easy ways to disconnect the target molecule into simpler precursors. Practice of this skill will allow the student to tackle quite advanced synthetic targets with a sense of confidence.

Wittig-type reactions: Wittig and related reactions are an importance class of C-C forming reactions that permit formation of E and Z double bonds with chemo and stereo-selectivity.

Diels-Alder reactions are a class of powerful pericyclic cycloaddition reactions that enable the formation of ring structures with excellent control over several stereo centers due to steric and electronic control.

The course will include examples of analysis of stereochemistry using NMR, and time permitting, will introduce examples of radical reactions as well as biological chemistry

Lab Experiments:

The course includes seven lab experiments, carried out over 2 weeks each, on average, and including reactions designed to illustrate the course material. Typically, six of the seven experiments require only short, informal lab reports that focus on relevant findings, with one experiment requiring a more formal report. The lab manual will be available for about $5 at the start of the course.

The informal lab reports should contain:

1. a brief introduction to the aim of the experiment,
2. chemical structures and mechanism,
3. 1 - 2 paragraph experimental, with reference to the lab manual
4. observation and interpretation (this is the important part…)
5. spectra and other supporting information

The formal experimental report will be written in form of a short journal article, and should contain (see below for more detailed information):

1. Abstract
2. Introduction including brief history of this reaction (text book and scifinder)
3. Experimental Section (Chemicals, Reactions, Characterization)
4. Results and Discussion
5. References
6. Acknowledgements

All reports are due at noon on the Monday after we finish that experiment, in the TA drop boxes on the first floor. The formal report will be assigned from one of the latter labs.

Course Marks (typical):

Labs	20
Three assignments	15
Midterm	20
Final	45

Instructions for the Formal Lab Report for CHEM 3D03

The formal report will will be based on lab 6 or 7 as asigned, will be written in journal article format (examine *The Journal of the American Chemical Society*, http://pubs.acs.org/), and should include:

Your name and affiliation

Abstract:

- Approximately one paragraph in length
- State the purpose of the experiment and **your** final conclusions

Introduction:

- Give some background to the topic and reactions being performed in the lab - be specific, and make it relevant.

Experimental:

- Give a brief yet complete description of the experiments, with sufficient information that another equally skilled researcher could reproduce your experiments. Note any changes from the literature (i.e. lab manual).

Results and discussion:

- Everything should be in paragraph form
- State your results, discuss and interpret them.
- Any spectroscopic evidence should be in table format, with relevant spectra appended at the end of the report.
- Discuss sources of error---mechanical handling is not the only one!
- Include the questions from the lab manual, in paragraph form, in the discussion.

Conclusions:

- A brief paragraph stating the final results vis-à-vis the original goal.

References:

- Must be in JACS format
- Must include at least 1 journal reference as well as reference to the lab manual

Acknowledgements:

- Where appropriate, acknowledge your lab mates and TA for helpful discussions

Additional info:

- approx. 15 pages in length, double-spaced
- all structures must be drawn using drawing software (ie. Chemoffice or ISIS)
- style, grammar and “scientific language” are important.
- attach spectra to the back of the report, number them in sequence, and refer to them in your discussion, as in: “The proton NMR spectrum of the final product, shown in Figure 3, confirms the absence of starting material (no peak at X ppm), and shows only small signals arising from acetone…)
- all tables, diagrams, etc. should be titled and numbered.