

Fall 2018

CHEM 244A - Organic Chemistry II Lab

Ngozi Onyia

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Department of Chemistry and Environmental Science

Course Information

CHEM 244A.101, Organic Chemistry II Lab, 2 credits

Prerequisite: CHEM 243 Organic Chemistry I / Co-requisite: CHEM 244 Organic Chemistry II
Fall 2018

Class times: Monday, 5.45 PM – 9.50 PM

Classroom: Tier - 207

Instructor Information

Instructor: Dr. Ngozi Onyia

Office Hours: By Appointment

Email: ngozi.m.onyia@njit.edu

Course Description

This Laboratory course offers a comprehensive introduction to basic modern organic chemistry. The course will include sections determining structures of organic compounds using analytical techniques such as Infra-Red (IR) and NMR spectroscopy. The Laboratory will provide students with the required Course Enrichment Component (CEC), where students will perform experiments that put into practice the ideas discussed in the Lecture.

Catalog Description

This course offers a comprehensive introduction to basic modern organic chemistry and will be of interest to students majoring in chemistry, biochemistry, biology, and related sciences. Students taking this course will already have been introduced to the principles of organic structure (alkanes, alkenes, alkynes, alcohols, carbonyl compounds and stereochemistry), and the basic principles of infrared (IR), nuclear magnetic resonance (NMR) and mass spectroscopy. This course will build on these general principles and will include details on the synthesis and reactions of alcohols, aromatic compounds, aldehydes, ketones amines, carboxylic acids and derivatives and phenols. In addition, the course will include sections on carbohydrates, amino acids and nucleic acids. Organic chemistry is a multifaceted science that is central to other related sciences including biochemistry and medicinal chemistry. This course introduces students to the language and theoretical foundations of organic chemistry.

Course Goals

The primary goal of this course is to provide a comprehensive introduction to the principles of organic chemistry for students majoring in biochemistry, chemistry, biology, and related sciences. On completing this course, students will be expected to demonstrate a comprehensive knowledge of organic chemistry in mid-term and final examinations in the lecture and students will be expected to demonstrate a comprehensive knowledge of organic chemistry laboratory theory, experimental technique and data interpretation in laboratory reports and a final examination in the laboratory.

Students are expected to:

- Demonstrate a general knowledge of the basic area of organic chemistry and have the ability to apply it in a problem solving environment.
- Develop fundamental critical thinking skills, including pattern recognition and analogous reasoning in basic organic chemistry concepts.

- Demonstrate the ability to communicate basic organic chemistry information clearly and precisely, both orally and in writing on examinations and in laboratory reports.
- Have an understanding of the principles and applications of modern instrumentation, computation, experimental design, and data analysis for basic organic chemistry laboratory; be proficient in basic organic chemistry laboratory skills.

Texts, Readings, Materials

- Required: CHEM 244A, Organic Chemistry II Laboratory Manual
- Scientific calculator

Lab Session

Students will work in groups and submit a group lab report. Each member of the group will participate in all aspects of the laboratory. All data will be recorded in the notebook (**individual**) and carbon copies should be stapled together and submitted to the instructor at the completion of the laboratory experiment.

Lab Report

- The report for each experiment is worth 100 points each and is due 1 week after completion of the experiment.
- Late lab reports will be assessed a 5 points per calendar day penalty. You must staple reports before submitting.
- Double space all reports and questions. Use a 11 point Times New Roman font.

Final Exam

The final exam is cumulative and covers all experiments performed in the semester. The final exam date is scheduled for your last regular lab session.

Course Requirements and Grading Policy:

The evaluation of this course will be from the performance on prelaboratory (**individual**), laboratory reports (group) (70%), and a final laboratory examination (**individual**) (30%) at the end of the lab course. This does not involve performing an actual experiment but will consist of problems related to the work performed during the course of the lab.

Final letter grade awarded to each student will be based upon his/her performance in the exams and the points earned in the lab report component of the course. Your course grade will be weighted as shown below:

- Prelab/lab report - 70%
- Final lab exam - 30%

Students achieving at least the following average percentages will receive at least the indicated grade:

<u>Letter grade</u>	<u>Average</u>
A	90.0% - 100.0%
B+	85.0% - 89.9%
B	75.0% - 84.9%
C+	73.0% - 74.9%
C	65.0% - 72.9%
D	60.0% - 64.9%
F	0.0% - 59.9%

Experiment Schedule

Week	Experiment	Expt. Number
1	Check in/Safety Lecture	
2 - 4	Caffeine: Natural Product Extraction, Distillation Evaporation, Sublimation, TLC.	1
5 - 6	Pinacolone Reduction: Reaction, Extraction, Distillation, IR	2
7 - 8	Pinacoyl Alcohol Dehydration: Reaction, Distillation, GC.	3
9 - 10	Esterification: Reaction, Extraction, Distillation, IR	4
11	Aldol: Reaction, UV.(Crossed Aldol Condensation	5
12	Aspirin Synthesis: Reaction, Extraction, Recrystallization	6
13	Exam /Check out	-

Laboratory Reports and Notebooks

Laboratory reports are an important part of science education. Students in chemistry and biology will be expected to write professional laboratory report. Therefore, in this course you will be introduced to several of the major components of writing a laboratory report. It is my hope that this course will give you an advantage in upper level courses.

The format

Clarity of expression, correct grammar, spelling and paragraphing are expected. The lab report will consist of the following and must be in the order below: All components will be in paragraph form and must be double typed double spaced in New Times Roman 11-point font with 1" margins. Do not list anything. Data and results must be put in tables.

Tables

You must use tables. They must be numbered using Roman Numerals: (I, II, III----etc)
 FIGURES & Graphs – Should be number using alpha numerals (1, 2, 3-----etc)

Abstract (150 -300 words)

The abstract is a very terse accounting of what you did. There should be one sentence stating the following:

- What the objective of the experiment was. Note: do not state that the objective was “to learn...” Your objective is to measure, synthesize, determine...etc.
- Indicate the method you used to achieve your objective.
- Did you use any (not ordinary lab equipment) special equipment like spectrometers? If so, state the make and model number.
- State your results. Do not include any raw data or procedural steps.
- Draw a conclusion; ie, “ the product’s melting point indicates that it is ----- because the accepted melting point of ----- is 123°C¹”

Introduction (500 -2000 words)

The introduction must contain a discussion of the basic principles the lab is illustrating. This must be in your own words and not a paraphrase of the published experiment in your lab manual. You must cite statements of fact not ordinarily known using the following method: [#] at the end of the sentence containing the information. Do not include extraneous facts that do not pertain directly to the objective of

the lab. Any equations used should be included along with a discussion of how they will be used. Be sure to identify all variables in every equation you discuss.

Experimental

Writing a procedure for a chemical experiment involves using a formal and stylized writing approach. The experimental section will consist of a short paragraph that includes a sentence that refers the reader to some source for the procedure. For example, the student may write: “The procedure for this experiment has been described in the laboratory handout.¹” The number refers to the citation number. This number is used to refer the reader to the citation in the References section where the full reference (including information such as the name of the author, title of book or web site, date of publication, and page number or exact web address) will appear next to number 1. In addition to the reference citation, details from the published procedure and any experimental hints or tips that may aid the reader in understanding and repeating the experiment should be included. All reagents used must be reported in as the **quantity you actually used** (in parentheses, followed by the number of moles). All products used must be reported in as the **quantity you actually used** (in parentheses, followed by the number of moles) and % yield.

Results

The results section should contain tables, graphs and illustrations.

- Table should be numbered using ROMAN NUMERALS. (Table I, Table II, Table III...)
- Graphs and illustrations should be numbered using ALPHANUMERICS (Figure 1, Figure 2, Figure 3...)
- Label the x and y axes of your graphs with an informative label and include the units. For instance for a titration the x axis would be “Volume NaOH (mL)” while the y axis might be “Voltage (mv)”.
- Do not just connect the dots. At this level most graph can be fit to the best straight line ($y = mx + b$) using linear regression. In MSExcel you can use TRENDLINE.
- All tables, graphs and illustrations should have an informative title:

Table I – Experimental Melting Points

- All raw data that is used to perform calculations must be put in a table.

Calculations

- Show all equations you used to calculate your result. For instance, if you are calculating percent error you must first include the equation for percent error as follows:

$$\% \text{ error} = \frac{|ExpVal - AccptVal|}{AccptVal} \times 100$$

- This can be typed (good time to learn how to use the equation writer in MSWord) or neatly handwritten in ink.
- Follow with the actual calculation (can be neatly hand written in ink) using correct significant figures and units.
- If your lab requires repetitive calculations, you only need to include one of these calculations in your report.
- **Percent yield calculations:** Refer to General Chemistry 1 notes on Limiting reactant, theoretical yield and percent yield calculations. Show all steps for full credit

Discussion (400 and 1200 words)

This is an important part of your laboratory report. In this section you will do the following:

- Restate your final results: “The molecular mass of copper sulfate was found to be -----”
- If possible compare your results to expected or literature values.
- Explain the meaning of your results:
- Did you achieve your goal? Why or why not.
- Did your results match literature values? Report literature value and % error.

- If your value was too high, explain why. Be specific.
- If your value was too low, explain why. Be specific.
- Discuss how this laboratory relates to chemistry. Explain what principles and concepts it illustrates.

Conclusion

Provide a global conclusion regarding your experimental results. This section should be 100 – 250 words.

Questions

Type the question itself in bold then answer all questions using complete sentences using regular font. If the question requires a calculation use the rules found under the CALCULATION SECTION above.

References

Include reference over and above the laboratory manual. (five references minimum)

Include cited references in order of how they appear in your report. All references included in this section must have been cited in your report. Citation formats are:

Journal Article:

Author(s): Last name. 1st initial, *Paper Title*, Year, Vol # etc, pages.

Webpage, No author:

Title, Date accessed by you, URL of page.

Book:

Author; Last name. 1st initial, Book Title, Year, Publisher, Editor (if appropriate), city of publisher, page.

You should have a minimum of 5 references.

The Laboratory Notebook (Individual)


This is a research journal. In it you will record exactly what you did. Below is the format you will use

- Fill in all sections on the top of the page on every page you uses
- Before you come to class:
 - List all chemicals you will be using in the lab in your notebook. Include the
 - chemical name,
 - the chemical formula
 - the CAS number.
- Copy the reaction scheme, make a table showing the physical properties, outline the experimental procedure, objectives and safety in your laboratory notebook.
- **I will initial this entry and your Lab Manual at the beginning of each class. Failure to complete the list and provide your lab manual will result in a maximum of 10-point penalty.**
- **In the laboratory:** The laboratory notebook is a journal that records your activities in the lab in detail. It is written in “stream of consciousness”; that is...as it is happening. You should record
 - Everything you do in enough detail that a stranger could reproduce your work using only your lab notebook as a guide.
 - All observations as you see them.
 - All values including like masses, lengths, pressures, volumes...etc using correct significant figures and units.
 - All calculations. Any calculations should be done in your notebook. If they are done outside of class, you should submit the carbon copies of the work in the next lab session.
 - Before leaving class you must
 - Sign and date the bottom of **every** completed page
 - Have me sign your last notebook page completed in the lab session.
 - Submit the carbon copies of your notebook pages for that lab session.

Corrections to the notebook

Mistakes will occur when recording data as you collect it. The proper way of correcting mistakes in a laboratory note is to cross out the mistake with a single or double line as seen below and initial the correct entry. Do not scribble out mistake. The mistake must be clearly readable under the line. (This is a legal requirement because laboratory notebooks are legal documents admissible as evidence in court)

Example:

3.020  your initials
 Mass of empty beaker = ~~2.913~~ g

Unused space on notebook page

When you are done with a page, you must draw a diagonal line through any blank unused places on the page before you sign, date and submit the carbon copy. This is also a legal requirement. It prevents anyone from adding additional information to the page after the fact.

Attendance Policy

Attendance to all laboratory sessions is mandatory. A missed laboratory session without an excused absence will result in a grade of zero (0) for that experiment. A second unexcused absence will result in a grade of zero (0) for the course. An excused absence must be obtained from the instructor *before* the relevant lab. An excused absence will only be granted for verifiable documented reasons of serious illness or family emergency. Lateness to lab will NOT be tolerated (changes in directions/safety concerns may be given during the pre-laboratory lecture). The instructor reserves the right to dismiss you from the lab and you get a ZERO for the week. College policy states that students must notify faculty within the first three weeks of the semester if they anticipate missing any classes due to religious observance.

Electronic Forms of Communication

In accordance with College policy, I will use your NJIT email address (@njit.edu) and Moodle to communicate with you about all course-related matters. Please make sure that you check these accounts regularly.

Policy on Academic Integrity

Students are expected to read and understand NJIT's academic integrity policy, which can be found online in the *College Catalog* (<http://www.njit.edu/catalog>). Members of NJIT community are expected to be honest and forthright in their academic endeavors. Students who violate this policy will be referred to the Office of the Provost.

Students with Disabilities

If you need course adaptation or accommodations because of a disability that has been documented with Disability Support Services, please make an appointment with me. You must be registered with Disability Support Services Fenster Hall Room 260 to receive accommodations. For additional information, contact Disability Support Services at 973-596-5598

Additional Information

Anything with an on/off switch may be a distraction to the instructor and to your classmates and must be turned off or silenced prior to entering the classroom. This includes but is not limited to computers, mp3 players, and phones. Calls should not be made or taken in the classroom. Texting during class is inappropriate. The use of digital recorders (audio, video) is prohibited.

Syllabus Modification

Any modification of this syllabus will be distributed in class and via e-mail.