



**Faculty of Arts and Sciences
Department of Chemistry**

Prof. M. J. Haddadin
Spring 2017-18

**CHEMISTRY 231
Organic Synthesis (1.4; 3 cr.)**

Lecture: Monday: 3:00 p.m., Chem.101

Laboratory: Section 1 - Wednesday: 1:00 – 5:00 p.m., Chem 303

Section 2 - Friday: 1:00 – 5:00 p.m., Chem 303

Course Description:

Chem. 231 is designed to introduce students to the art of organic synthesis.

The experiments include: Separation-Extraction (identification of an unknown), substitution reactions, rearrangements, Wittig reaction, Diels-Alder reaction, ester hydrolysis, decarboxylation reactions, trapping of a transient intermediate (benzyne), stable free radicals, and preparation of 2-hydroxyphenazine-5,10-dioxide: an example of the Beirut Reaction.

Reference:

“Organic Experiments”, K.L. Williamson, 9th Ed., Houghton Mifflin Company, Boston, 2004 (Science Library - Reserve Shelf).

Grading:

Drop Quizzes	20%
Midterm Exam	20%
Lab. Reports	20%
Evaluation	10%
<u>Final Exam</u>	<u>30%</u>
Total	100

Experiments

Number of Lab. Sessions	Title of Experiment(s)	Reference	Assigned Questions
Two Sessions	Separation by Extraction (Identification of an Unknown)	Handout	
One Session	1- Bromobutane	Williamson, p.220	2,6, and 7
Two Sessions - Session I - Session II	Benzoin, Benzil, Benzil Quinoxaline, and Benzilic Acid 1. Benzoin Condensation – Cyanide Ion Catalyzed. 2. Oxidation of Benzoin to Benzil 1. Preparation of Benzil Quinoxaline 2. Rearrangement of Benzil to Benzilic Acid	Williamson, p.521 Experiment 1 Williamson, p.526 Experiment 1 Williamson, p.529 Handout	1
Two Sessions - Session I - Session II	p-Terphenyl Synthesis of 1,4-Diphenyl-1,3-butadiene p-Terphenyl by the Diels-Alder Reaction	Williamson, p.401, Experiment 2 Williamson, p.508	1 and 3 1 and 3
One Session	Triptycene via Benzyne	Williamson p.359	1
Two Sessions - Session I - Session II	1,3,5-Triphenylverdazyl Preparation of Triphenylformazan Preparation of 1,3,5-Triphenylverdazyl	Handout Handout	
One Session	Beirut Reaction Preparation of Benzofurazan Oxide and 2-Hydroxyphenazine-5,10-dioxide	Handout	

Lab. Sessions Schedule

Wednesday	Friday
January 31 Check-in and Separation by Extraction	February 2 Check-in and Separation by Extraction
February 7 Separation by Extraction (Identification of an Unknown)	holiday Separation by Extraction (Identification of an Unknown)
February 14 1- Bromobutane	February 16 1- Bromobutane
February 21 Benzoin; Benzil	February 23 Benzoin; Benzil
February 28 Benzil Quinoxaline; Benzilic Acid	March 2 Benzil Quinoxaline; Benzilic Acid
March 7 1,4-Diphenyl-1,3-butadiene	March 9 1,4-Diphenyl-1,3-butadiene
March 14 p-Terphenyl by the Diels-Alder Reaction	March 16 p-Terphenyl by the Diels-Alder Reaction
March 21 Triptycene via Benzyne	March 24 Triptycene via Benzyne
March 28 Triphenylformazan	holiday Triphenylformazan
April 4 1,3,5-Triphenylverdazyl	holiday 1,3,5-Triphenylverdazyl
April 11 Beirut Reaction	13
April 18 Make-Up and Check-Out	April 20 Beirut Reaction
April 25 No Lab	April 27 Make-Up and Check-Out

Course Policy

Attendance and Make-ups:

Students must attend all laboratory lectures and sessions. A make-up for a missed laboratory session is approved only upon presenting a valid excuse (an official medical report from the university infirmary), otherwise, zero grade will be given for the missed work.

Students with Special Needs (if any):

'AUB strives to make learning experiences as accessible as possible. If you anticipate or experience academic barriers due to a disability (including mental health, chronic or temporary medical conditions), please inform me immediately so that we can privately

discuss options. In order to help establish reasonable accommodations and facilitate a smooth accommodations process, you are encouraged to contact the Accessible Education Office: accessibility@aub.edu.lb; [+961-1-350000](tel:+961-1-350000), x3246; West Hall, 314'.

Laboratory Safety:

Students must be aware of the general laboratory safety rules. They are required to carefully read and understand the related safety information in any of the suggested references for this course and the safety regulations circulated by the Environmental Health, Safety, and Risk Management Center at AUB, and to abide by them. Violation of the mentioned rules and regulations will result in dismissal from the lab. and a grade of zero.

Laboratory Work Requirements:

During each laboratory session, students are required to:

- Have their detergent, sponge, towel, matches/lighter, and the cabinet key.
- Wear a white gown and safety goggles.
- Abide strictly by the safety rules and laboratory regulations.
- Have their experiment handout and to be well prepared to perform the experiment and to complete their work efficiently. Further, they are advised to prepare an outline of the experimental procedure to be followed.
- Clean everything after finishing the experiment (used equipment, glassware, benches, and sinks, etc.)

Laboratory Reports:

A report is required for each experiment. It has to be submitted at the end of the lab session, unless announced otherwise. Each student should submit his/her own separate report, even in the case of group work.

Therefore, students must prepare their reports before the lab. session (look up any needed physical constants, calculate quantities, answer assigned questions, etc.), record the experimental data/observations collected while performing the experiment directly in the report sheet (never record anything on scraps of paper), complete the remaining parts, and submit it at the end of the lab. session.

A formatted report sheet is provided for the first experiment only. Students will write their own reports for the remaining synthesis experiments.

The **Report Format** must comprise the following:

Title page: this page includes the course number and title, date submitted, title of the experiment, and your name (and the name of your partner when applicable).

Purpose:

Main Reaction(s) and Mechanism(s):

Procedure: you don't have to copy the procedure from the text. Mention the references used and include any changes, if applicable.

Table of Main Reagents / Product(s):

Reagent / Product	Molar mass	Mass (g)	Volume (mL)	# of moles	Useful data

Results and Calculations:

Limiting Reactant	Exp. Yield (g)	Theo. Yield (g)	% yield	Melting point

Sample Calculation:

Discussion: Write this part in a narrative form. Comment on the results obtained, mention any side products and the mechanism of their formation, the experimental errors that affected the yield/results quantitatively or qualitatively, propose suggestion for improvement, etc.

Assigned questions: