

ORGANIC CHEMISTRY LABORATORY
Chemistry 313 Summer 2022

Coordinator and Lecturer: Dr. Sanhita Pramanik

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Lecture/ LAB: For Sections B1 and B2, the Lecture Room: SEC 208 LAB : WR 331
For Sections B3 and B4, the Lecture Room: SEC 205 LAB: WR 331

REQUIRED COURSE MATERIALS

1. **Text:** The textbook package for the course is "Macroscale & Microscale Organic Experiments by Williamson (7th ed)". This is available through the First Day Course Materials link on the course Canvas website. Please see "Welcome to Chemistry 313" module on Canvas for a link for questions about the First Day program.
2. **Laboratory Notebook:** A hardcover or soft cover notebook with numbered gridded pages and tear out carbon-copy duplicate pages is required (spiral/loose-leaf notebooks are not acceptable) for recording laboratory work. They are available in the Rutgers University Bookstore.
3. **Safety goggles:** To protect your eyes in the laboratory (must be face-fitting and form seal around eyes; ordinary glasses or other types of safety glasses including contact lenses worn under goggles are not acceptable). See Laboratory Safety Rules in this syllabus regarding contact lens policy. These can be purchased from the bookstore or on an online site. An example of the kind of goggles you need is:
https://www.amazon.com/Protective-Wide-Vision-Adjustable-Protection-Lightweight/dp/B07VF3C2CW/ref=sr_1_1_sspa?dchild=1&keywords=safety%2Bgoggles&qid=1629485495&th=1
4. A mask for the in-person lab sessions – please see below for University Mask Requirement: In order to protect the health and well-being of all members of the University community, masks must be worn by all persons on campus when in the presence of others (within six feet) and in buildings in nonprivate enclosed settings (e.g., common workspaces, workstations, meeting rooms, classrooms, etc.). Masks must be worn during class meetings; any student not wearing a mask will be asked to leave. Masks should conform to CDC guidelines and should completely cover the nose and mouth: <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/about-face-coverings.html>
5. **A simple scientific calculator:** for use on exams and quizzes.
6. High-speed internet (you will need reliable internet access), printer and scanner (or scanning app so that documents can be converted into pdf format for uploading).
7. A mobile device to take certain pictures during your lab experiment to submit with the lab report.

WHAT YOU NEED FOR THE SECOND DAY OF LAB

Items 1-5 as shown above

WHAT YOU NEED FOR THE FOLLOWING LAB PERIODS

Items 1-5 with the prelab and post lab assignments as indicated in the syllabus.

COURSE POLICIES

1. **Promptness:** Laboratory session will begin and end promptly as scheduled; students will not be allowed to work overtime or during off-hours. If a student arrives late to lab, he or she cannot stay longer than the latest student who came on time.
2. **Lectures:** Attendance in lectures is essential in order for a student to do well in this course. Significant amounts of additional material, including modifications to the lab procedure is provided in the lecture. Much of the quiz and exam materials as well as what is required in the lab report will be provided during the lecture for the course in conjunction with the textbook. Lab instructors will assume that students have attended the lecture and will not provide information that has already been provided in the lecture.
3. **MAKE-UP: A missed lab period may be made up only for valid medical reason and with a note from the dean's office. Dr. Pramanik's approval is required for a make up. Make sure you contact her immediately when you miss a lab.** For an absence to be excused, Dr. Pramanik must be contacted immediately in case there is a chance for the lab to be made up. Valid documentation **MUST** be provided within a week of the absence to your lab instructor and Dr. Pramanik. **ADDITIONALLY**, you must use the University absence reporting website <https://sims.rutgers.edu/ssra/> also within a week of the absence to indicate the date and reason for your absence. If any of the above steps are not followed, the absence will not be excused. It is highly advised that you contact Dr. Pramanik immediately after an absence even if you are not sure if the absence can be excused to see what your options are. **NOTE: A student with 3 or more absences (valid or otherwise) will not pass the course. Vacation plans are NOT valid reasons for lab make-up or absences. Religious holidays and valid school activities: Students must contact Dr. Pramanik about potential absences for any part of this course due to religious holidays and valid school activities (sports meet etc.) by 6/7/22 so that make-ups can be arranged.** Students are then responsible for e-mailing Dr. Pramanik with their detailed schedule for the week of the potential absence two weeks from the potential absence to receive instructions on a makeup or alternate arrangements. **Valid documentation (letter from religious leader/faculty advisor/coach) MUST be provided for these potential absences by 6/7/22.**
4. **Check out** is required of all students. Failure to check out will result in the assessment of a \$50.00 fee and the withholding of grade (for those who complete the course).
5. **Laboratory Notebooks** are to be maintained according to the format described in the "Guidelines for Writing Lab Reports in Laboratory Notebook".
6. **Written Exam** will be given on the specified date. The material for the exams will come from your lab experiments, readings and lecture material.
8. **Quizzes:** a short quiz (10 mins) will be given in the lab at the beginning of the lab period on the dates indicated. A safety quiz will be given on the first day of the lab. Contact Dr. Pramanik immediately in case you miss the quiz on Canvas for any reason. If the reason is valid, arrangements will be made for you to make up the quiz as close to the original time of the quiz as possible.

9. **Laboratory Reports and format** for submitting them on **Canvas** will be discussed in the posting “Guidelines for Writing Lab Reports”. Submitting late or incomplete laboratory reports and/or failure to submit lab reports will result in deduction of lab report points which may very possibly lead to the earning of an unsatisfactory/ failing grade in the course – you cannot earn points for something you do not submit. No lab report will be accepted past the due date of the lab report unless there is dean’s note to warrant the delay. **Please note that the Academic Honesty clause applies to the lab reports and all other assignments/quizzes/exam for the course.**

10. Exam will be given on the specified dates during lecture period. The material for the exams will come from your lab experiments, readings and lecture material. Since the exam is during the lecture period, students CANNOT have a conflict with the exam. Students MUST take the exam in the lab lecture session associated with their lab section. You will NOT be able to postpone/take the exam on a different date just because you have other exams that same week.

NOTE: If you end up falling ill on the day of the exam, you must make the decision if you take the exam or not. If you decide not to take it, please get a doctor’s or dean’s note to excuse you for that absence. If you do decide to take the exam even though you are ill, then you will need to be prepared to accept the consequences of the score you earn if you end up with a low score. We cannot disregard the score after the fact just because you took the exam while you were ill.

11. **Preparation:** Adequate preparation before lab will reduce frustration and prevent accidents. Attempting to perform the experiment while reading the procedure for the first time is little more than a waste of time and can lead to hazardous mistakes. Part of the evaluation points assigned by your lab instructor will be determined based on your preparation.

12. **Laboratory Safety:** All persons in the lab must observe the safety rules. Non-compliance with safety rules will result in expulsion from the lab and no make-up will be allowed.

13. **Breakage:** The student is responsible for all costs of breakages. If a student has a balance that needs to be paid when grades are assigned, the student will receive a TF. The TF will be changed to student’s actual grade only after the balance is paid at the cashier and receipt is shown at the Chemistry Department Main Office (CCB).

14. **Students with Disabilities:** If you have a disability, you are urged to speak to the course supervisor to make the necessary arrangements to support a successful learning experience. Also, you must arrange for the course supervisor to receive a letter from your College's Disability Concerns Coordinator verifying that you have a disability. The student must contact the Office of Disability Services to determine his/her Coordinator (848-445-4477 or <https://ods.rutgers.edu/>

15. **Academic honesty:** You are being graded on the work you perform. Use of lab reports from other students (past or present) is expressly forbidden. **Both the lender and the borrower are subject to severe penalties.** Some discussion about the labs is acceptable at the discretion of the lab instructor, but you must perform all the work (including the data analysis and answering of questions) yourself. **A lab report is NOT a collaborative effort- it must be written in your own words, using your own data.** The lab instructor is free to ask you at any point to explain what you are doing. This is to help the lab instructor instruct the confused and prevent copying of

answers. If you are confused, ask for help. Don't just copy an answer. Academic honesty also applies to all quizzes and exams in this course.

Unauthorized posting and sharing of course material (including but not limited to: syllabi, lecture notes, past, present and future quizzes and exams, prelab and postlab questions) in paper form or online during the current semester and/or in the future is STRICTLY PROHIBITED. The unauthorized posting and sharing of course material is a violation of copyright law AND a violation of academic integrity and appropriate action will be taken against person(s) who violate this law. Report any violations promptly.

The Rutgers honor pledge will be included on all (major) assessments for you to sign: On my honor, I have neither received nor given any unauthorized assistance on this examination/quiz/ assignment. Rutgers University takes academic dishonesty very seriously. By enrolling in this course, you assume responsibility for familiarizing yourself with the Academic Integrity Policy and the possible penalties (including suspension and expulsion) for violating the policy. As per the policy, all suspected violations will be reported to the Office of Student Conduct. Academic dishonesty includes (but is not limited to):

- Cheating
- Plagiarism
- Aiding others in committing a violation or allowing others to use your work
- Failure to cite sources correctly
- Fabrication
- Using another person's ideas or words without attribution—reusing a previous assignment
- Unauthorized collaboration
- Sabotaging another student's work. When in doubt, please consult the instructor

16. **Chain of Command:** If you have a question about grading, you should first talk about it **with your lab instructor within the following lab period after receiving your grade.** If you are not satisfied with the explanation, you may raise the question with the course coordinator. We will not intervene for questions of a small number of points. Decisions made for safety (such as ejection for violation of safety rules) can be made by any lab instructor, the stockroom personnel, or the coordinator, and these decisions are final and not subject to appeal. If you have a question about content, concepts, or procedures then you may ask any lab instructors or the coordinator for help.

17. **Students with Medical Conditions:** Some medical conditions such as pregnancy, asthma, allergies to certain chemicals, or other conditions may be affected by exposure to chemicals. If you believe you are pregnant or if you have a medical problem which might be affected by chemicals, please contact the course coordinator (Dr. Pramanik) before the lab commences or as soon as you become aware of such a condition. We will fully respect your privacy and you do not need to disclose the nature of your medical condition to us. It is, however, imperative that your physician be informed of any chemicals you may be in contact with during the semester so that he/she can determine whether it is safe for you to participate in lab assignments. We will provide you with information for your physician regarding any substances you may be exposed to. We simply require that you bring in a note from your physician indicating that they have reviewed this information and whether you may safely proceed with laboratory work. Rutgers

Environmental Health and Safety (REHS) is available to assist you if your doctor recommends that you avoid or minimize contact with certain chemicals. Please feel free to contact them at (848)445-2550 to request assistance.

18. **Lost Items:** Items that are left behind in laboratories will be turned over to the stockrooms of the respective locations. Items will only be held for about a week.

NOTES!

1. The theoretical part of each experiment will be discussed in lecture.
2. The practical part for each experiment will be discussed in the lab.
3. Read the material and be prepared before lecture and lab.
4. The pre-lab part of your report will be collected at the end of each experiment. **If you do not turn in your prelab (online) in the due time period mentioned on Canvas, there will be 10% penalty each day you will be late. All postlabs of the experiment must be turned in due time (online) posted on Canvas. Any delay in turning in the postlabs there will be 10% penalty each day you will be late.**
5. **You will need to memorize the name of your lab instructor and lab section number.** All exams will be sorted according to lab instructor name and lab section number. Incorrect lab section numbers may result in the deduction of points on your exam.

GRADING

1.	Laboratory Reports (60 points x 5 experiments)	300 points*
2.	Safety Quiz	5 points
3.	Quizzes (12 points x 5)	60 points*
4.	Written Exam	110 points*
5.	Lab instructor evaluation	25 points
	TOTAL	500 points*

* The points value may change and accordingly the total points value will also change.

Your final grade will be based on your overall percentage and number of points earned, with the final scale FOR EACH SECTION (to account for how differently each lab instructor grades) to be decided at the end of the course. The cutoff points for each letter grades will not be disclosed to you. An approximate idea of the grading scale would mimic the standard scale (shown below) PLEASE NOTE: In order to earn a passing grade in the course, you cannot miss more than 2 in-person lab sessions and you cannot miss submitting more than 2 complete lab reports

- A ≥ 90%**
- B 80-89%**
- C 65-79%**
- D 55-64%**
- F ≤ 55%**

LABORATORY SAFETY RULES

There are a few precautions that you must take to avoid accidents in the lab.

1. Face-fitting goggles and Mask must be always worn in the laboratory. Contact lenses, even with goggles are not permitted. Students that have a medical need to wear contact lenses

while working in the teaching laboratory (proper visual acuity to complete assigned tasks) will need to inform the course coordinator and their lab instructor and be evaluated by Student Health. Upon review by Student Health, the student must continue to wear appropriate splash goggles and mask always while in the teaching lab environment, and must also notify Student Health if they experience irritation or other problems while working in the lab environment so that REHS can do an assessment. **Students not in compliance will be dismissed from the lab.**

2. Know the location of laboratory exits. Know the location and use of fire extinguishers, eye-wash fountains, safety showers, and fire blankets in the laboratory.
3. Playtex-type rubber gloves are to be worn at all times when handling chemicals.
4. Open shoes/sandals, shorts, frilly or cumbersome clothing, bare backs or midriffs (or clothing that exposes backs and midriffs when a student reaches up or bends over), neckties, and unconfined long hair present considerable hazard in the laboratory and are **NOT PERMITTED**. Long hair should be tied back.
5. All experimental work is to be done in the hoods. Apparatus may be cleaned at regular benches.
6. Avoid breathing the vapors of volatile solvents. Some organic solvents may be toxic or carcinogenic (cancer-producing). Organic solvents should be used in the hood.
7. Avoid contact of chemical with your skin, eyes, and clothing.
8. Handle strong acids and bases with extreme care. Strong acids and bases must remain in the allotted hoods.
9. Dispose organic waste in labeled waste containers. No waste solvents or reaction mixtures should be poured into the sinks!
10. No smoking, eating or drinking is allowed in the laboratory.
11. Pipetting by mouth is prohibited.
12. No unauthorized experiments or other horseplay is allowed.
13. Students must be familiar with a procedure before attempting it.
14. Clean your work area, and clean dirty glassware at the end of each period. Broken glassware should be disposed of in broken glassware container and Pasteur pipettes, which are classified as Regulated Medical Waste should be discarded in sharps container. (NOT in broken glass)
15. Accidents must be reported at once to lab instructor and coordinator of the course
16. You should clean all your spills. In case in doubt as to how to clean, ask your instructor.
17. All students are responsible for knowing the safety rules and observing them. Violation may result in expulsion from laboratory.

18. If the fire alarms go off, stop all experimental work and leave all chemicals and equipment in the lab. Follow instructions of lab instructor and head for an exit and assemble outside the building to the area you were instructed to go to by the lab instructor as quickly as possible.

**REPORT EMERGENCIES TO THE RUTGERS UNIVERSITY POLICE AT
6-911**

Submission of product for grading

NOTE! ENHANCEMENT OF PRODUCT YIELD WITH OTHER MATERIALS IS CHEATING.

Use the disposable test tubes and corks supplied in your accessories kit. Make sure your sample is completely dry and free of large lumps. Label each test tube with the following information:

- Name of compound
- Structural formula of compound
- Yield; weight and percent
- Melting or boiling range
- Name of student
- Section number and name of lab instructor

Secure all test tubes with a rubber band or tape if more than one test tube is submitted.

BASIC LABORATORY OPERATIONS

Laboratory Glassware

Since your glassware is expensive and since you are responsible for it, you will want to give proper care and respect. Needless maltreatment of your equipment may cost you money; so if you read this section carefully and follow the procedures, you may be able to avoid some unnecessary expense. Mistreating equipment can also cause lost time in the laboratory. Cleaning problems and replacing destroyed glassware are time-consuming.

Cleaning Glassware

Glassware can be cleaned more easily if it is cleaned immediately after use. With time the organic residues left in the flask will harden and stick on the surface of the flask. To remove gummy material from glassware, scrape as much as you can directly in the labeled waste container; never put organic tars, paper and other solid wastes into the sink. Next, try to remove the remaining residue by using a small amount of acetone (1-2mL). The remaining small amounts of tars and dirt can then be removed with a large test tube brush bent in such a way that it will reach the inner surfaces of the flask. The use of a little washing powder or liquid detergent followed by a good water rinse will give clean glassware when it dries.

Caution!! Safety goggles must be worn when you are cleaning your glassware.

GUIDELINES FOR WRITING LAB REPORTS IN LABORATORY NOTEBOOK

The laboratory notebook is the primary record of the work you accomplish in the laboratory. It should be well organized, **legible**, and an **accurate record of your work**.

1. Use a **hardcover or soft cover bound composition book with numbered pages and tear-out carbon-copy duplicate pages**. Write your name, course number, section number and lab instructor's name on the cover.
2. Start a new experiment on a fresh page. **Make all entries in ink** - never in pencil.
3. **Hand-write directly in the notebook** not on scraps of paper; do not tear out pages (except to hand in laboratory reports to lab instructor – there **MUST** always be the duplicate record remaining in your lab notebook). Record a complete, accurate account of all experiments and results. Show all calculations. Follow guidelines for writing a laboratory report shown below.
4. Never erase incorrect entries; merely draw a line or two through blank spaces and/or incorrect words so that they are still legible.

Guidelines for writing a laboratory report

I. PRE-LABORATORY NOTES & IN-LABORATORY DATA

A. Pre-laboratory notes -

Guidelines for writing the Prelab Notes for Each Experiment

(NOTE: YOU MUST HAVE THE PRELAB SUBMITTED (online) AND PROCEDURE WRITTEN UP **BEFORE** YOU COME INTO THE LAB FOR EACH OF YOUR LABORATORY SESSIONS). YOUR LABORATORY INSTRUCTOR WILL NOT ALLOW YOU INTO THE LABORATORY UNLESS YOU HAVE THE PRELAB NOTES AND PROCEDURE COMPLETED

The pre-laboratory notes should include:

1) Title of Experiment: You will have to write the title of the experiment and **follow** it with a reference.

References:

If you used the procedure from the textbook, then the Reference would be the pages of the book from which you wrote the procedures, followed by the author's name and the title of your textbook.

Example: Recrystallization (Reference: pg. 64-65) Williamson, K. Macroscale and Microscale Organic Experiments

If you used a handout, then the Reference would be "Chemistry 313 Handout".

2. A very brief statement about the purpose of the experiment - (1-2 lines)
3. **An Introduction** section that discusses briefly the technique being used (purpose and use) and/or the reaction being carried out (in a synthesis reaction). The information needed for this section is typically found in the text and the lecture.

4. Pertinent balanced equation(s) for the reaction(s) using structures and names of reactants and products. Equations for important side-reactions should also be included.

5. A **sketch** of the apparatus set-up when a new technique is being used.

6. Chemical Hazards of the chemicals you are using and Precautions to be taken with the chemicals being used: Information can be obtained using the MSDS data found on the Rutgers Chemistry website or the Chemical Hazards posting under Resources on the Sakai website for this course or the Merck Index on the cambridgesoft.com website (free access to Rutgers users with rutgers.edu e-mail accounts. Another site is msds.chem.ox.ac.uk. You can also go to Wikipedia or do a Google search.

7. Table of reagents and/or reactants and/or products - this table will vary somewhat with the nature of the experiment. It must include literature values (if you cannot find these in your textbook, you can find it in *The CRC Handbook of Chemistry and Physics* or *The Merck Index* or other online sources)

When the experiment involves a synthesis, you must have Table for the Reactants (or you can incorporate the reactants into the table of reagents) which should include:

- (a) Physical properties (as mentioned above)
- (b) Molecular weight
- (c) Amount used in grams or mL
- (d) Moles used

When appropriate, you should identify the Limiting Reagent.

8. Brief outline of expected experimental procedure. **Write THIS PART your note book and then copy it to your postlab report.** You should divide the page into two columns. Write the outline on the left side of the page. The right side of the same page can be used for recording the In-laboratory observations and comments that are pertinent to each procedural step. Make sure that the procedure is brief!!

In Laboratory Data

In-laboratory data should include:

1. The code letters or numbers of any assigned unknowns.
2. A precise record of all experimental data including weights, volumes, boiling point ranges, melting point ranges and other measurements pertinent to the experiment.
3. Your observations and comments for each procedural step. These should include changes in color, texture, clarity of solution, temperature, smell etc.

NOTE: A large number of points for each lab report will be attributed to the observations you make. Experimental work depends VERY heavily on accurate observations.

An example of observations is shown in procedure table below.

Procedure

1. Place 42 mg benzil, 42 mg 1,3-diphenylacetone and 0.4 mL triethylene glycol in a test tube.
2. Clamp tube over hot sand bath, insert thermometer and heat until benzil is dissolved.

Observations

Benzil: yellow crystalline solid,
Weight: 40.5 mg
1,3-diphenylacetone: white powdery solid,
Weight: 41 mg
Triethylene glycol: clear, colorless, viscous liquid
Volume: 0.4 mL
Appearance of mixed solution: benzil forms a yellow suspension in clear solution
Benzil dissolves in solution when heated to form yellow clear solution at 120°C

II. POST LAB

Post Laboratory Reports should include the following:

1. Post Lab Questions. The list of post lab questions is listed in the syllabus in the Post lab Assignment section.
2. Analysis of experimental data - this will vary with the type of experiment. Include when appropriate:
 - (a) Specified calculations using experimental data. For experiments involving a synthesis, the percent yield of the product(s) should be calculated.
 - (b) Graphs using data from experiments and an analysis of graphs
 - (c) Results from analytical techniques like TLC, melting points, IR, NMR and explanations of results. (This can also be shown in the discussion section).
3. A discussion of these results.
 - (i) Each observation in the in-lab report should be explained. If an observation was a result of a chemical reaction, the balanced equation and mechanism (if applicable) should be used to explain the observation.
 - (ii) Comparison of products to accepted literature values - conclusion derived from the deviation from or similarity to literature value.
 - (iii) Possible sources of error to explain why product yield deviated from theoretical yield
4. A statement regarding the conclusions that can be drawn from these results.

Note: Make sure that you turn in the prelab and post lab in the scheduled time and date. You will lose the points(10%penalty) of that portion if you fail to do so.

Coordinator: Dr. Sanhita Pramanik

LECTURE SCHEDULE [Room : SEC 208 (B1/B2) and SEC 205 (B3/B4)]

<u>Date</u>	<u>Lecture/Topic</u>	<u>Reading Material</u>
T 5/31	Organization/safety	pp 1-40
W 6/01	Melting Point	Handout/Syllabus; pp. 41-55
T 6/07	Chromatography	Handout; pp. 165-178; 186-192
TH 6/09	Recrystallization	pp. 45-48; 57; 62-85
W 6/15	Extraction	pp. 132-151
T 6/21	Distillation	pp. 55-60; 86-101; 103-105; 117-120

Coordinator: Dr. Sanhita Pramanik

LAB/QUIZ SCHEDULE

<u>Date</u>	<u>Experiment</u>	<u>Quiz</u>	<u>Procedure</u>
T 5/31	Organization/Check-in		
W 6/01	Check-in/Safety	Safety quiz	
TH 6/02	Melting point		Expts. 2, 3, 4; pp 54
T 6/07	Melting point	M.P.	
W 6/08	Chromatography		Handout, Expt. 1; pp 176-178
TH 6/09	Chromatography	TLC	
T 6/14	Recrystallization		Expt. 5; p 82
W 6/15	Recrystallization	RECRYSTALLIZATION	
TH 6/16	Extraction		Expt. 1; pp 146-148
T 6/21	Extraction	EXTRACTION	
W 6/22	Distillation		Expt. 1A, 2A; 93-96
TH 6/23	Distillation	DISTILLATION	
T 6/28	Check-out	Hand in post lab questions for distillation	
W 6/29	No Lab		
TH 6/30	Written Exam		
W 7/6	Grades Posted		

Submission of Postlab Assignments

<u>Date</u>	<u>Experiment</u>	<u>Assignment</u>
T 6/7	Postlab Melting Point	p. 60-61 # 2, 3, 10, 11
M 6/13	Postlab TLC	p. 184-185 # 3, 5, 6, 7, 8
Sat 6/18	Postlab Recrystallization	P. 86 # 2, 3, 5, 7
W 6/22	Postlab Extraction	p. 164 # 4, 5, 6
W 6/29	Postlab Distillation	p. 101-102 # 5, 7, 9, 10