Chemistry 2202–006 Organic Chemistry Laboratory II Spring 2020

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Text: *Organic Chemistry Laboratory*, 3nd Edition, Bell, Taber and Clark, Thomson Brooks/Cole, 2001.

Lab Notebook: *Organic Chemistry Laboratory Notebook*: this 100-page notebook is available at the Villanova bookstore.

Laboratory: R 2:30 – 5:20 pm, Mendel 385/393

Contents:
This class will involve the synthesis, isolation, purification, and characterization of a variety of organic molecules. The laboratory is designed to reinforce concepts from CHM 2212 and to allow you to learn the basic techniques and skills employed by practicing organic chemists.

As a courtesy to your peers, please turn off all cell phones during lab. When your phone is needed as a timer, use a plastic baggie to cover your phone - don't use your touch screen with gloved hands!!!

Academic Integrity:
All students are expected to uphold Villanova's Academic Integrity Policy and Code. Any incident of academic dishonesty will be reported to the Dean of the College of Liberal Arts and Sciences for disciplinary action. For the College's statement on Academic Integrity, you should consult the *Enchiridion*. You may view the university's Academic Integrity Policy and Code, as well as other useful information related to writing papers, at the Academic Integrity Gateway web site: http://library.villanova.edu/help/academicintegrity

Office of Disabilities (ODS) and Learning Support Services (LSS):
It is the policy of Villanova to make reasonable academic accommodations for qualified individuals with disabilities. Go to the Learning Support Services website (http://learningsupportservices.villanova.edu) for registration guidelines and instructions. For physical access or temporarily disabling conditions, please contact the Office of Disability Services at 610-519-4095 or email Stephen.mcwilliams@villanova.edu. Registration is needed in order to receive accommodations.

Absences for Religious Holidays:
Villanova University makes every reasonable effort to allow members of the community to observe their religious holidays, consistent with the University's obligations, responsibilities, and policies. Students who expect to miss a class or assignment due to the observance of a religious holiday should discuss the matter with their professors as soon as possible, normally at least two weeks in advance. Absence from classes or examinations for religious reasons does not relieve students from responsibility for any part of the course work required during the absence.
https://www1.villanova.edu/villanova/provost/resources/student/policies/religiousholidays.html

General Policies:

Partners and Lab Reports: Students will typically work in pairs for experiments. The instructor will assign partners at the start of each experiment. While students are encouraged to work together as lab partners and to discuss lab results as a group, *all entries in your lab notebook and all lab reports must be written in your own words and submitted individually*. IT IS UNETHICAL TO COPY ANY PORTION OF YOUR LAB REPORT FROM OTHER PERSONS OR SOURCES.

On-time arrival: At the beginning of the lab period, safety instructions and other procedures will be discussed and prelaboratory assignments will be checked for completeness. Next, students will take a quiz based on this information. LATECOMERS WILL NOT BE PERMITTED TO SUBMIT THE PRELABORATORY ASSIGNMENT, TAKE THE QUIZ, OR CONDUCT THE EXPERIMENT.

Chemical use and lab cleanliness: Common sense and consideration of fellow workers must be exercised rigorously and constantly. This includes replacing caps on chemical bottles when finished dispensing them, alerting your instructor about any chemical spills and cleaning up minor spills as they occur, cleaning glassware and disposing of chemical waste properly, and keeping the laboratory workspaces clean. All students are required to insure his or her lab bench and hood space are clean before leaving lab for the day. ALL OF THESE FACTORS WILL BE AN IMPORTANT PART OF YOUR TECHNIQUE GRADE.

Safety attire: STUDENTS MUST WEAR MONO-GOGGLE SAFETY GLASSES AND LAB COATS AT ALL TIMES. Wear gloves during each experiment, and dispose of them if they become soiled, torn, or if you need to leave the laboratory. CARRY OUT ALL CHEMICAL MANIPULATIONS INSIDE THE FUME HOOD. EXPERIMENTERS MUST WEAR PROPER LAB ATTIRE. Appropriate attire for a chemistry laboratory course might include: t-shirt, jeans, and sneakers / tennis shoes with socks that are long enough to cover the ankles. We will discuss this further during the first lab session. Safety must be everyone's first priority in the laboratory. Students will be dismissed from the laboratory and assigned a zero for the lab period for *any* infraction of the safety protocols described in class or in the general syllabus.

Safety, food and drink: Eating, drinking, and gum chewing are not allowed in the laboratory.

Sign-out: Once you have cleaned up your fume hood and common areas at the end of the lab period, SIGN-OUT WITH YOUR INSTRUCTOR OR TA BEFORE LEAVING FOR THE DAY.

Email: Aside from in-class announcements, e-mail will be my primary form of communication with you. Please check your Villanova email address regularly. If you want to get in touch with me, you can reach me by email, during office hours, or by appointment. I'll do my best to respond to emails within 24 hours during the week and 48 hours during weekends.

Diversity, Equity, & Inclusion: One of my goals as an educator is to foster an effective learning environment for all students based on mutual respect and inclusion. You may read more about Villanova University's commitment to Diversity & Inclusion on the following webpage: https://www1.villanova.edu/villanova/provost/diversity/diversitystatement.html

Please refer to the general syllabus and the example grading for lab notebooks handout for more information on attendance, grading, laboratory attire, technique grades, quizzes, laboratory notebook requirements, and a schedule of experiments for the semester.

Chemical Safety:
If you wish to learn more about the reagents we are using in the lab, you may utilize the MSDS Online program, which is a database of material safety datasheets (MSDS). The link to MSDS Database (MSDS Online) may be found under the Safety Resources tab of this page of the Dept. of Chemistry website:
https://www1.villanova.edu/villanova/artsci/chemistry/Safety_Page.html
and also on the right side of the Villanova University Environmental Health and Safety website:
https://www1.villanova.edu/villanova/fmo/ehs.html

Villanova's on-line lab safety training program:
Prior to our first experiment (January 23rd), you are expected to complete computer based laboratory safety training, available for self-enrollment via Blackboard.

This training is mandatory and will be included as part of your lab notebook grade for the course. (please note that these modules are best viewed in Chrome):

Students who previously completed the three required training modules may choose the Laboratory Safety Refresher in lieu of repeating the three initial modules.

- Log in to Blackboard (http://elearning.villanova.edu)
- In the Organization Catalog module, click the link for "Available for Self-Enrollment"
- Under the "Search Catalog" heading, click the "Search Entire Catalog" radio button
- Enter Spring 20 in the search box
- You will see the result: envSafety_Spring20_labsafety.
- Put your cursor over the "envSafety_Spring20_labsafety" and click the **down arrow** that appears to the right.
- Click "Enroll" then "Submit" then "OK". You will then be enrolled in the organization.

You will see three folders:
- Required training modules
- Laboratory safety refresher
- Optional training modules

Students who *have not* previously completed the on-line training must complete the three modules in the Required Training Modules folder:
1. University Laboratory Safety – Analyzing Hazards
2. University Laboratory Safety – Developing and Using Controls
3. University Laboratory Safety – Working Safely

Students *who previously* completed the three required training modules may choose the Laboratory Safety Refresher in lieu of repeating the three initial modules.

When you finish your online training, click on "Print Certificate" (left menu bar). Then, click on your Safety Certificate and save it as a .pdf file (For me, it was labeled as "Fall 19 Lab Safety Refresher Completion", even though the certificate itself listed Spring 2020 as the correct completion date).

Upload this .pdf file to our course Blackboard site for the assignment "Villanova's on-line lab safety training program" to receive credit for safety training course completion.

Syllabus
CHM 2202 Organic Chemistry Laboratory II
Spring 2020

Required materials for both Organic Chemistry Laboratory I and II:

- C.E. Bell, D.F. Taber and A.K. Clark, *Organic Chemistry Laboratory with Qualitative Analysis*, 3rd edition, Brooks/Cole-Thomson Learning, Pacific Grove, CA, 2001. ISBN: 9780534647445
  There are copies of the book in the Reserve section of the library that you can use if you do not buy the book.
- Organic Chemistry Laboratory Notebook. Brooks/Cole Laboratory Series. 1st ed; 2000. ISBN: 9780875402536 (100 carbonless sets of pages with spiral binding)

Laboratory Location: Mendel 385, 393, or 283

Course Description and Objectives: The second semester Organic Chemistry Laboratory II course incorporates many of the organic chemistry laboratory techniques (extraction, filtration, recrystallization, evaporation, and thin layer chromatography for example) covered in Organic Chemistry Laboratory I to carry out and to analyze/purify the products from a variety of classic organic reactions. Examination of the chemical and/or physical properties of compounds containing certain organic functional groups will also be carried out. Students will also learn about and perform an experiment where energy from a chemical reaction is released as light without the involvement of heat (chemiluminescence). Also emphasized throughout the semester will be the analysis of nuclear magnetic resonance, infrared and/or mass spectra of starting materials and products in order to learn how to interpret and assign spectral absorption bands/peaks to determine the structures of organic compounds.

Attendance:

- Attendance is required for all laboratory sessions. *The instructor reserves the right to count tardiness as an absence.* Missing the prelab lecture in part or in its entirety constitutes a safety hazard.
- There are **NO** make-up labs.
- If you miss a lab, or plan on missing a lab, for a legitimate reason (an **excused absence**, such as illness or university obligation) you need to *contact your instructor immediately to discuss your absence*.
- **Excused absences:** As stated by the Office of the Provost, students may be required to submit documentation to petition for excused absences to the appropriate Assistant or Associate Dean of their college, who will be contacted by the instructor to verify the absence. You are still required to submit a complete laboratory report (pre-lab, in-lab, and post-lab) associated with the missed lab session no later than a date determined by the instructor. The "technique and products" grade is waived for the missed period. The instructor will decide whether the quiz is waived as well. For more information on Villanova's Attendance Policies go to:
  https://www1.villanova.edu/villanova/provost/resources/student/policies/attendance.html
- Multiple absences may ultimately lead to a failing grade in the course.
- **Unexcused absences** will result in a grade of "zero" for all work associated with the missed laboratory session.

Grading: You will be evaluated based on the following approximate emphasis:

1. Lab Notebook and lab safety modules: 50%
2. Quizzes: 30%
3. Technique and Products: 20%*

* *Grading may vary, depending on your instructor.*
* *Faculty members are responsible for maintaining the integrity of the evaluation and grading consistent with Villanova University's Undergraduate Grading System.*

Academic Integrity:

All students are expected to uphold Villanova's Academic Integrity Policy and Code when working on experiments, lab notebooks and write-ups, quizzes (in lab and on-line) and exams. In the organic chemistry labs, you will often work with a partner. Even though you will share data with your partner, you are expected to work in your pre-lab, in-lab, and post-lab independently. In no way you are to copy the pre-lab, in-lab, post-lab, figures, graphs, calculations, answers to questions, etc. off each other or from unauthorized sources. Doing so represents a violation to the Academic Integrity Code and the students will be reported to the Dean of the College of Liberal Arts and Sciences for disciplinary action in addition to obtaining a grade of zero for the work in question. For more information on Villanova's Academic Integrity Policy refer to:
https://www1.villanova.edu/villanova/provost/resources/student/policies/integrity/code.html.
For useful information related to writing papers visit the Academic Integrity Gateway web site at:
http://library.villanova.edu/help/academicintegrity.

Laboratory Attire:

1. **Approved safety *goggles* must be worn at all times while in the lab during the lab period**. They must be worn over the eyes, not on the forehead.
2. **No tank tops**. Students must wear shirts that cover their shoulders and torso. Oversized or baggy shirts and sweaters are not appropriate.
3. **No exposed skin below the waist**. *Unacceptable clothing includes* (but is not limited to): shorts, skirts, capri pants, tights, leggings, 'jeggings', yoga pants, 'skinny' jeans, sandals, open-toe shoes (or any shoes in which the top of the foot is exposed – *e.g.*, ballet flats), etc.

Appropriate attire for a chemistry laboratory course might include: t-shirt, jeans, and sneakers / tennis shoes *with socks*.

Regarding points 2 and 3, students in violation of **either** of these rules **are not allowed in the lab; no exceptions will be made**. Students may be given the option of returning to lab after they have changed into proper attire, but they will not be given extra time at the end of the period to make up the lost time or to complete assignments.

Students who are in violation of attire / behavior rules or those outlined in the safety contract that is signed at the beginning of the semester may be issued a warning (student signature required). Repeat violations will result in dismissal from the lab for the period with an unexcused absence (grade of 0) recorded for the period. The Laboratory Absence (Attendance) Policy will apply in these cases.

Technique Grades:

Technique grades are based on:

- Preparation for the lab
- Observance of **SAFETY** guidelines – safety glasses worn at all times after lesson introduction is finished; wearing proper attire; safe handling of chemicals; removal of safety gloves when exiting the lab. See the Laboratory Attire policy (above). Always replacing caps on reagent bottles after finished using the reagents; not leaving the cap off for the next person. Complying with safety rules as outlined in front of your laboratory notebook.
- Cleanliness of your bench/hood areas as well as common areas used by the entire lab (weighing areas, hood, etc.). If your hood/bench area is not clean after you leave the lab for the day, your technique grade for the day will be adversely affected! Likewise, if the community hood and balance areas are not clean at the end of the lab, the entire class's technique grade will be lowered. If you spill something in the hood or at the balance area, immediately clean it up.

- Effort, proficiency and neatness in setting up equipment, carrying out experiments, collecting data and keeping up to date lab records. Do not record data on scraps of paper and then add to your notebook. All data is to be recorded directly in your notebook.
- Teamwork: Students may be working in teams of two to four for some of the experiments carried out during the semester. Each team member will be expected to make a significant contribution to successfully performing the experiment. Successful and smoothly operating teams are able to complete experiments in an efficient manner by having each team member assigned to specific tasks in preparation for performing the main experiment(s).
- Mastery of new lab techniques: Read the text carefully and pay attention during the lab introductory lecture so that you have some familiarity with new lab techniques before you perform the experiment.

Quizzes:

There will be quizzes during the semester. Depending on your instructor, quizzes may cover material from the lab text, the introductory laboratory lecture and/or from the experiment carried out in the lab. The quizzes may be open or closed book, again depending on your instructor.

Laboratory Notebook Requirements:
(MUST also refer to the document: Example Grading for CHM 2201 / 2202 Laboratory Notebooks)

All write-ups must be put down in the Organic Chemistry Laboratory Notebook, available along with your text, in the Villanova Bookstore. Use a blue or black ballpoint pen for writing and place all information directly in the notebook as it is obtained. Complete the Table of Contents as you go. It is important that you write clearly and legibly. However, since some writing must be done in the laboratory, you will not be expected to provide polished, formal reports. Note that only the tear-out copies from the notebook are to be handed in for marking. The original copies are to remain in your possession.

Each experimental write-up will consist of three parts:

1. A **Pre-Lab** which you must complete before lab and hand in to your TA when entering the lab. It is imperative that you complete the reading assignments found on the table "Schedule of Laboratory Experiments" and compose **your own** pre-lab reports.
2. An **In-Lab** which consists of notebook pages containing your observations recorded in lab, along with any in-lab questions. The in-lab **must be initialed and dated by your professor or TA before you leave lab for the day.** The in-lab is due at the start of lab one week after the experiment completion.
3. A **Post-Lab** which you complete during or after lab, as directed. It is turned in one week after experiment completion, unless instructed otherwise.

A **Handwritten Example of a Laboratory Write-up** will be provided as a handout along with a grading rubric titled: **Example Grading for CHM 2201 / 2202 Laboratory Notebooks** to guide you as you prepare the three parts of the experimental write-up. Note that your Instructor or TA may also have additional items that they want to be included in experimental write-ups.

Failure to submit work by the required deadline will result in point deductions that start right after the deadline and accrue every 24 h.

Office of Disabilities and Learning Support Services:
Students with disabilities who require reasonable academic accommodations should schedule an appointment to discuss specifics with me. It is the policy of Villanova to make reasonable academic accommodations for qualified individuals with disabilities. You must present verification and register with the Learning Support Office by contacting 610-519-5176 or at learning.support.services@villanova.edu or for physical access or temporary

disabling conditions, please contact the Office of Disability Services at 610-519-4095 or email stephen.mcwilliams@villanova.edu. Registration is needed in order to receive accommodations.

Schedule of Laboratory Experiments:

Lab/ Week #	Month	Day/Date						Experiment/Activity	Lab Text[1] Pages / Carey *et al.*[2] Pages
		M	Tu	W	Th	F	M		
1	Jan	13	14	15	16	17	-	Check-in, Review of Class Goals and Procedures, Safety Rules	
2	Jan	-	21	22	23	24	27	Friedel-Crafts Reaction, **Exp. 26B**	237-242 485-487
3	Jan Feb	-	28	29	30	31	3	Nucleophilic Aromatic Substitution, **Exp. 28A, B**	249-253 511-516
4	Feb	-	4	5	6	7	10	Structure Determination of Unknowns using Spectroscopy (^{1}H NMR, ^{13}C NMR, IR and MS), **Spectra of unknowns will be provided**	93-106 107-142 Chapter 14
5	Feb	-	11	12	13	14	17	Grignard Reaction, **Exp 19B**	197-204 600-609
6	Feb	-	18	19	20	21	24	Properties of Alcohols, **Exp. 18B, C, D, E**	193-196 180-201 649-653
7	Feb Mar	-	25	26	27	28	9	Williamson Ether Synthesis, **Handout**	____ 648-649
******	Mar	2	3	4	5	6	-	Semester Recess – no lab	******
8	Mar	-	10	11	12	13	16	Chemiluminescence, **Exp. 30A, B**	259-263
9	Mar	-	17	18	19	20	23	Oxidation and Reduction, **Exp. 21D, E**	211-217 871-873 641-644
10	Mar	-	24	25	26	27	30	Aldehydes and Ketones, **Exp. 22A, C, D, E**	219-223 Chapter 18
11	Mar/ Apr	-	31	1	3	4	6	Carboxylic Acid Derivatives: Synthesis of Naphthalene Acetamide, **Exp. 34A**	279-282 489 800-808
******	Apr	-	7	8	9	10	13	Easter Recess – no lab	******
12	Apr	-	14	15	16	17	20	Properties of Amines, **Exp. 29A, B, C, D1,2**	255-258 Chapter 22
13	Apr	-	21	22	23	24	27	Checkout	

1. CHM 2201/2202 Organic Chemistry Laboratory Text: C.E. Bell, D.F. Taber and A.K. Clark, *Organic Chemistry Laboratory with Qualitative Analysis*, 3rd edition, Brooks/Cole-Thomson Learning, Pacific Grove, CA, 2001.
2. CHM 2211/2212 Organic Chemistry Lecture Text: F.A. Carey, R.M. Giuliano, N. T. Allison and S. L. Bane, Organic Chemistry, 11th edition, McGraw-Hill, New York, NY, 10020.