

Chem 3203: Advanced Analytical Laboratory
Winter, 2020

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Office: Chem 109; Office hours: By appointment

Lectures: N/A

Laboratory: Two × 4-hour labs per week (M/W; T/R am; T/R pm).

First lab = Jan 06 or 07 as scheduled

Tutorial: Weekly, as presented within normally scheduled lab hours.

Website: Brightspace includes a complete lab schedule, electronic copy of the lab manual, videos, supplementary notes and readings, practice problems, and grades.

Lab Manual: Hard copies will be available at Dalhousie Student Bookstore. Please bring a complete, bound copy of your manual to each lab. Lab notebooks are not required, as space is provided within the manual to take notes.

Course Description:

An introduction to the fundamentals of instrumental chemical analysis is presented in a laboratory environment, with emphasis on selection of appropriate analytical techniques, sample treatment, data handling, and communication of experimental results. Instrumental techniques include chromatography, spectrophotometry, mass spectrometry, and electrochemistry, with applications in biological, environmental, forensic and health-related areas.

Course Prerequisites:

Chem 2201 or equivalent. Grade of C- or better.

Exclusion: Chem 3201

Lab Objectives/ Learning Outcomes:

The learning outcomes associated with each experiment are described in your lab manual. There are several overarching themes:

- Time management, including proper planning and familiarization with the theory and protocols ahead of lab, and effective use of time during lab.
- Team work with lab partner, TA's and instructors, including requesting assistance when needed, providing assistance when possible.
- Written communication, by formulating clear and concise responses within lab reports, and through your posters.
- Oral communication, with partner, TA's and instructors, and in describing your research project to the class.
- Effective reporting of data in graphical and tabulated formats.
- Calculation of concentrations, and unit conversion, statistical analysis
- Problem solving, which first relates to recognizing that you are facing a problem, diagnosing the problem, researching solutions, requesting assistance, attempting an alternative solution, and assessing whether that solution worked.
- Critical assessment of the quality of your work.
- Demonstration of proper lab technique
- Creativity and independence
- Working safely in the lab
- Become familiar with the fundamental theory and practical application of the following analytical techniques: atomic and molecular absorbance and emission; gas and liquid chromatography; mass spectrometry, tandem MS and different modes of ionization; electrophoresis; titrations; ion selective electrodes; as well as analytical sample preparation, buffer preparation, analyte extraction, derivatization, purification and recovery, methods of calibration including direct standardization, internal standards and standard addition.

Course Format:

While there is no associated lecture component of the course, this class still places emphasis on fundamental understanding of the theoretical principles governing the analytical experiments being conducted in lab. Experiment 1 will be conducted during the first 3 lab periods. This experiment is a review of analytical concepts and laboratory techniques. Students are expected to know these concepts to ensure success with the remainder of the course. The practice labs include a series of videos and practice problems as a review of basic analytical concepts. Students may wish to refer to their 2nd year analytical textbook if they are not fully comfortable with these concepts. Additionally this lab aids in students knowing/understanding the expectations of prelab preparation, inlab organization, hands on laboratory skills and the expectations of chem 3203 reports.

Experiments 2 through 6 each constitute a 2 (or 3) day lab, and will be completed in groups of 2 or 3 students. Lab partners will change as the term progresses. The individual order for completed these experiments will be posted on the course website. Each experiment concludes with a written lab report (see 'Reports' for further information).

Experiment 7 (research project) which will be completed over a 3 week period (Mar 9 – Mar 26; 6 lab sessions). This project will also be completed in groups of 2. Deadlines for associated aspects of the project (*eg* selection of topic; formal proposal; detailed experimental outlines) will be posted throughout the term. The project concludes with a poster presentation based on the research project (April 3rd).

There is a normal (written) final exam, as scheduled during the final exam period.

Course Assessment:

<u>Assessment</u>	<u>Weight</u>	<u>Date</u>
Reports (Experiments 1-6)	25%	As scheduled ¹
Research project proposal	2%	Feb 7
Midterm 1	12.5%	Feb 12 (6pm-7:30pm)
Midterm 2	12.5%	Mar 11 (6pm-7:30pm)
Research project lab performance	7%	Mar 9 – Mar 26
Progress Reports	3%	As scheduled ²
Poster (12-3pm; resource center)	5%	April 03
Poster presentation (3-6pm)	3%	April 03
Final Exam*	30%	<i>(Schedule by registrar)</i>

¹See 'Reports' for information on report due dates.

²See 'Progress Reports' for information on due dates.

*Final exam is a cumulative written test covering all aspects of the course

Conversion to Final Letter Grades as per Dalhousie Common Grade Scale:

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (<50)
A- (80-84)	B- (70-72)	C- (55-59)	

School Cancellations:

Weather-related closure of the University may impact submission of your lab report, in which case the due date will be moved to the next day that the University is open. In the event of a missed lab due to school cancellation, you will be required to make up this experiment. The next available Friday afternoon is the default time for lab makeups; if in conflict with this time your lab will be rescheduled at a mutually agreeable time.

Reports:

Experiments 1 through 6 are graded through written lab reports. Reports are due on the listed due dates (by 1:30pm). If completed before the due date, reports may be submitted earlier. Only hard copies of the report will be accepted (with exception of illness, see below for details).

Experiments 1 through 6 are to be graded out of 10 marks. 9 marks are included in the evaluation of the experiment reports. 1 mark for each experiment is included as the prelab questions. Prelab questions must be completed prior to conducting the experiment and will be checked at the start of each lab period. Over the course of the experiment you will be required to complete multiple prelab questions. The sum of all of the prelab questions (per experiment) will total 1 mark. The percent total for each report in relation to the calculation of the final grade is presented in the table to the right.

Report	Total % of Final Grade
Exp 1	3
Exp 2	4
Exp 3	4
Exp 4	4
Exp 5	4
Exp 6	4
Exp 6 - Presentation	2

It is encouraged to complete the prelab questions well in advance of the experiment and discuss your answers with your teaching assistants or instructor if you encounter any confusion.

All data collected within a group for a given experiment must be fully shared among all members of the group, regardless of the workload shared in lab (this applies even if the student was absent from that lab – see ‘Missed Labs’ for further information).

Students are welcome (and encouraged) to collaborate with any other members of this class to complete their reports. However, the report must exclusively present the results collected within the student’s own group. Reports may be prepared individually, or alternatively a single copy of the report may be submitted from the group (all members will receive the same grade). The default is that reports are submitted individually. If students choose to submit a group report, it must be agreed upon by all members and communicated to the instructor (email) at least one week prior to the report due date.

To pass the course student must submit 5 of the 6 reports from experiments 1 through 6. Please note that all reports will be graded, and we will not drop the lowest report grade in determining the final grade (*ie* if you only complete 5 reports, you will receive a grade of zero for the 6th report. If you only

hand in 4 reports, you will not be allowed to pass this course). See 'Missed Labs/Illness' for more information.

Progress Reports:

Progress reports will be completed throughout the duration of the research projects. The content of the progress reports will vary week-to-week however each will include an updated plan for the work to be conducted during the upcoming week. The intent of these reports are to have you preparing various components of the research poster over the three weeks of research. Details of each report will be available on brightspace and discussed within the lab. Progress reports are due at the start of each research week (see laboratory calendar). Failure to complete/submit a progress report demonstrates not being prepared and a safety hazard within the laboratory and will result in not being able to conduct the research project until the progress report is submitted to a quality that demonstrates preparedness.

Feedback:

Written reports can only be returned to the student once the entire class has completed and submitted the report for that particular experiments. However, grades will be posted within 1 week of report submissions, and general feedback will be posted through the course website, or discussed during the course tutorials. Students are also encouraged to meet with the instructor to discuss their reports.

Late report policy:

Late labs (anywhere from 5 minutes overdue to 1 week late) will receive a grade of zero. One (and only 1) of your reports may be handed in up to 1 week late without penalty, ***so long as the instructor is informed prior to the normal due date***. Illness does not grant further extension of reports (*ie* you still only get an extension for one report. However, students may email an electronic copy of the report, together with a declaration of illness at the same time (hard copy supplied by your next lab day).

Missed Labs /Illness:

All missed labs require a declaration of illness. For experiments 1 through 5, **if you miss a single lab day out of the 2-day experiments**, we ask that you contact the instructor (and also your partner) before the lab begins, as your absence will affect your partner's work (your partner will complete the lab individually). The student who missed the lab will not be given opportunity to make up that lab. The data collected by the group will still be shared with the absent partner, and the absent student is still required to submit a lab report on the normal due date (individually, or as a group).

To substitute for the missed lab, the absent student is also expected to **submit a 1000-1500 word essay** (due together with the report). The essay topic is chosen by the instructor and relates to the material covered in the given experiment. This essay will be graded on a scale of 0 to 3 (0 = not completed; 1 = partially complete, or poorly done, essentially a failing grade; 2 = a minimal effort, essentially a grade of C- or below; 3 = acceptable). The corresponding percentage will be multiplied by the report grade.

If you miss both lab days for a given experiment, the data collected by the group will no longer be shared with the absent partner (the remaining partner will be offered assistance in lab to complete the experiment). The absent student will not be asked to submit a normal report. The associated 6% grade for the report will be transferred to the final exam.

To substitute for missing the entire experiment, the absent student will be required to write **three 1000-1500 word essays** (due at the start of the final exam) covering topics related to the missed lab

experiment as chosen by the instructor. The essays will again be graded on a scale of 0 to 3, and the percentage will be multiplied by the final exam grade to determine the grade for the report (out of 6).

Another reminder that students must complete a minimum 5 of 6 reports. The three essays do not substitute for a report. Thus, students cannot miss more than one 2-day experiment. Exceptional circumstances due to extended illness will be considered to grant makeup labs.

Lab safety:

The Chemistry Department recognizes its responsibility to undertake laboratory teaching activities in a safe and environmentally responsible fashion. Responsibilities of the University, departmental chairs, laboratory supervisors, staff and students are defined in Dalhousie policy manuals made available by the Office of Environmental Health and Safety at <http://safety.dal.ca>. A detailed description of laboratory safety is provided in your manual. Students must complete the online portion of the Safety Module only once per academic year. The due date for the 2020 winter term safety module is Jan 20, 2020.

Accommodation Policy For Students:

Students may request accommodation as a result of barriers related to disability, religious obligation, or any characteristic protected under Canadian Human Rights legislation. **Student Accommodation Policy:** http://www.dal.ca/campus_life/student_services/academic-support/accessibility.html

Students who require accommodation for classroom participation or the writing of tests and exams should make their request to the **Advising and Access Services Centre (AASC)** prior to or at the outset of the regular academic year. More information and the **Request for Accommodation** form are available at www.dal.ca/access.

Academic Integrity:

Academic integrity, with its embodied values, is seen as a foundation of Dalhousie University. It is the responsibility of all students to be familiar with behaviours and practices associated with academic integrity. Instructors are required to forward any suspected cases of plagiarism or other forms of academic cheating to the Academic Integrity Officer for their Faculty.

Policy on Intellectual Honesty and Faculty Discipline Process:
https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Student Code of Conduct:

Dalhousie University has a student code of conduct, and it is expected that students will adhere to the code during their participation in lectures and other activities associated with this course.
http://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Copyright:

All members of the Dalhousie community are expected to comply with their obligations under Canadian copyright law. Dalhousie copyright policies and guidelines, including our Fair Dealing Guidelines, are available at <http://www.dal.ca/dept/copyrightoffice.html>.

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness

Statement: <http://www.dal.ca/cultureofrespect.html>

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).

Information: https://www.dal.ca/campus_life/communities/indigenous.html

Services Available to Students:

The following campus services are available to all Dalhousie students. Unless noted otherwise, the services are free.

Service	Support Provided	Location	Contact
General Academic Advising	Help with <ul style="list-style-type: none"> - understanding degree requirements and academic regulations - choosing your major - achieving your educational or career goals - dealing with academic or other difficulties 	Killam Library Ground floor Rm G28 Bissett Centre for Academic Success	In person: Killam Library Rm G28 By appointment: <ul style="list-style-type: none"> - e-mail: advising@dal.ca - Phone: (902) 494-3077 - Book online through MyDal
Dalhousie Libraries	Help to find books and articles for assignments Help with citing sources in the text of your paper and preparation of bibliography	Killam Library Ground floor Librarian offices	In person: Service Point (Ground floor) By appointment: Identify your subject librarian (URL below) and contact by email or phone to arrange a time: http://dal.beta.libguides.com/sb.php?subject_id=34328
Studying for Success (SFS)	Help to develop essential study skills through small group workshops or one-on-one coaching sessions Match to a tutor for help in course-specific content (for a reasonable fee)	Killam Library 3rd floor Coordinator Rm 3104 Study Coaches Rm 3103	To make an appointment: <ul style="list-style-type: none"> - Visit main office (Killam Library main floor, Rm G28) - Call (902) 494-3077 - e-mail Coordinator at: sfs@dal.ca or - Drop in to see us during posted office hours All information can be found on our website: www.dal.ca/sfs
Writing Centre	Meet with a tutor to discuss writing assignments (lab report, research paper, thesis, poster) <ul style="list-style-type: none"> - Learn to integrate source material into your own work appropriately - Learn about disciplinary writing from a peer or staff member in your field 	Killam Library Ground floor Learning Commons & Rm G25	To make an appointment: <ul style="list-style-type: none"> - Visit the Writing Centre in the Killam Learning Commons (Rm G40) and book an appointment - Call (902) 494-1963 - e-mail writingcentre@dal.ca - Book online through MyDal We are open six days a week See our website: writingcentre.dal.ca