

**Chem 3203: Advanced Analytical Laboratory**  
**Winter, 2019**

**Instructors:** Dr. Rory Chisholm (902) 494-6493 [roderick.chisholm@dal.ca](mailto:roderick.chisholm@dal.ca)

*Office: Chem 109; Office hours: By appointment*

**Lectures:** N/A

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

*First lab = Jan 07 or 08 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 the 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 your lab manual to take notes.

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**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; gel electrophoresis; titrations; ion selective electrodes; analytical sample preparation including buffer preparation, analyte extraction, sample derivatization, purification and recovery; methods of calibration including direct standardization, internal standards and standard addition.

**Course Format:**

While there is no associated lecture component to the course, this class still places emphasis on fundamental understanding of the theoretical principles governing the analytical experiments conducted in lab. Experiment 1 will be conducted during the first 3 lab periods. This experiment provides 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 2<sup>nd</sup> year analytical textbook if they are not fully comfortable with these concepts. Additionally this lab aids in students knowing/understanding the expectations related to prelab preparation, in-lab organization, hands on laboratory skills and how to prepare the 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 completing 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) will be completed over a 3 week period (Mar 11 – Mar 28); 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; progress reports) will be posted throughout the term. The project concludes with a poster presentation based on the research project (April 5<sup>th</sup>).

Classroom-based written midterms and the final exam are scheduled throughout the term as described below.

**Course Assessment:**

<u>Assessment</u>	<u>Weight</u>	<u>Date</u>
Reports (Experiments 1-6)	25%	As scheduled <sup>1</sup>
Research project proposal	3%	Feb 8
Midterm 1	12.5%	Feb 14 (6:00-7:30 pm)
Midterm 2	12.5%	Mar 13 (6:00-7:30 pm)
Research project lab performance	10%	Mar 11 – Mar 28
Progress reports	4%	As scheduled <sup>2</sup>
Poster (12-3pm; resource center)	5%	April 05
Poster presentation (3-6pm)	3%	April 05
Final Exam*	25%	(Schedule by registrar)

<sup>1</sup>See 'Reports' for information on report due dates.

<sup>2</sup>See 'Progress Reports' for information on due dates.

\*The final exam is a cumulative written test covering all aspects of the course.

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

<b>A+</b> (90-100)	<b>B+</b> (77-79)	<b>C+</b> (65-69)	<b>D</b>	(50-54)
<b>A</b> (85-89)	<b>B</b> (73-76)	<b>C</b> (60-64)	<b>F</b>	(<50)
<b>A-</b> (80-84)	<b>B-</b> (70-72)	<b>C-</b> (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. Experiment 6 also includes a presentation (in lab). Reports are due on the listed due dates (by 1:30 pm). Only printed 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 assigned to the associated report, with the remaining 1 mark relating to the prelab questions. Reports carry different relative weights, as presented in the table to the right.

*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.*

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

For any given experiment, all data collected within a group must be fully shared among the members of the group (this applies even if a 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** (or essays – see Missed Labs/ Illness for details) 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 6<sup>th</sup> 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 reports will also summarize work completed over the prior week of lab. Detailed instructions on the preparation of each progress report will be posted on Brightspace and discussed during lab. Progress reports are due at the start of each research week (see laboratory calendar).

**Feedback:**

Written reports can only be returned to the student once the entire class has completed and submitted the report for that particular experiment. 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 still complete the lab, with appropriate assistance from others). The student who missed the lab will not be given opportunity to make up that lab. However, the data collected by the group will 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 a single missed day of lab, the absent student is also expected to **submit a ~1000 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. The essay will represent 3 of the 10 marks associated with the report.

**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 absent student will not be asked to submit a normal report. To substitute for missing the entire experiment, the absent student will be required to write **three ~1000 word essays** (due on or before the last day of term) covering topics related to the missed lab experiment as chosen by the instructor. Each essay will again be graded out of 3, and summed to represent the total grade of the missed report.

As another reminder, students must complete a minimum 5 of 6 reports (or essays). 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 2018 winter term safety module is Jan 22, 2018.

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**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](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](http://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](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](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>.

**Services Available to Students:**

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

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