

**Faculty of Science Course Syllabus**  
**Department of Chemistry**

*Chemistry 2201A*  
*Introductory Analytical Chemistry*  
*Fall, 2019*

- Professor:** Dr. Peter D. Wentzell  
Room 511, Chemistry Ph. 494-3708 e-mail: peter.wentzell@dal.ca
- Lab Instructor:** Dr. Rory Chisholm  
Room 109, Chemistry Ph. 494-6493 e-mail: roderick.chisholm@dal.ca
- Lectures:** MWF 10:35-11:25, Chemistry Room 226.
- Laboratories:** Weekly, starting week of September 9.
- Tutorials/Help:** M 1:00-2:00, Th 9:30-10:30, F 4:00-5:00 Chemistry Concept Room (optional)
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**Course Description (from calendar)**

The basic principles of analytical chemistry are presented, including chemical and instrumental methods of analysis. Instrumental techniques covered include chromatography, spectroscopy, and electrochemistry. Laboratory experiments explore all of these topics, and illustrate the techniques with practical examples.

**Course Prerequisites**

CHEM 1011/1012 or equivalent with a grade of C- or better

**Textbook**

"*An Introduction to Analytical Chemistry*", **8<sup>th</sup> Edition** by Ramaley, Wentzell, Doucette and Guy (required). Available online (free), or coil-bound (~\$28) at the Dalhousie Bookstore. Also available as print-on-demand.

**Laboratory Manual**

Available at the Dalhousie Bookstore, (~\$17) (required, unless exempt from the lab).

**Web Sites**

Brightspace sites have been established for both the lecture and the lab.  
There is also a site for the Laboratory Safety Module.

**Office Hours**

- P. Wentzell Tutorials in the Chemistry Concept Room will double as office hours.  
M 1:00-2:00, Th 9:30-10:30, F 4:00-5:00 **Chemistry Concept Room**  
Individual appointments can also be arranged on request.
- R. Chisholm M 11:30-12:30, Th 3:00-4:00 in Room 109.

## Laboratories

The analytical laboratories are located in Rooms 111-114P. More details on the laboratory program will be provided by Rory Chisholm.

## Laboratory Teaching Assistants

Venus Baghalabadi (M,T), Morgan Benoit (F), Steve Driscoll (R,F), Phil Jakubec (T,R), Jessica Nickerson (M,W), Jamie Stark (W).

## Course Assessment

<u>Component</u>	<u>Weight</u>	<u>Date(s)</u>
CAPA Quizzes	5%	~Weekly
Term Test #1	10%	Monday, September 30, in class (date subject to change)
Term Test #2	15%	Wednesday, October 30, evening (date subject to change)
Term Test #3	10%	Wednesday, November 27, in class (date subject to change)
Labs	30%	
Final exam	30%	Scheduled by Registrar

**Note:** The **laboratory skills test** must also be passed to pass the laboratory component.

**CAPA Quizzes:** Computer-based exercises using CAPA will be used encourage the development of problem-solving skills. Several CAPA units will be given and will be based on problems from the textbook. Within each unit, students will be presented with a new CAPA quiz each day while the unit is active and will have a time limit to solve the problem correctly. Only one quiz needs to be completed correctly to obtain full credit for the unit (5/5). These quizzes are open book, but must be completed independently.

**The average mark for the CAPA and in-class quizzes will be calculated, with the lowest mark being dropped.**

**Tests:** Three term tests will be administered, two within the class period and one in the evening. These will emphasize both problem solving and qualitative material.

**Final Exam:** The final examination (three hours) is scheduled by the Registrar and is comprehensive. There is no supplemental examination.

## Grade Scale

Conversion of numerical grades to final letter grades follows the Dalhousie Common Grade Scale.

A+	A	A-	B+	B	B-	C+	C	C-	D	F
90+	85+	80+	77+	73+	70+	65+	60+	55+	50+	<50

- A+, A, A-** Considerable evidence of original thinking; demonstrated outstanding capacity to analyze and synthesize; outstanding grasp of subject matter; evidence of extensive knowledge base.
- B+, B, B-** Evidence of grasp of subject matter, some evidence of critical capacity and analytical ability; reasonable understanding of relevant issues; evidence of familiarity with the literature.
- C+, C, C-** Evidence of some understanding of the subject matter; ability to develop solutions to simple problems; benefitting from his/her university experience.
- D** Evidence of minimally acceptable familiarity with subject matter, critical and analytical skills (except in programs where a minimum grade of 'C' or "C+" is required).

## Course Policies

**Absences.** If students are unable to complete a graded requirement (test, exam, laboratory) at the scheduled time due to illness or other valid reasons, they are responsible for notifying the Professor or Laboratory Instructor **as soon as possible** (phone, e-mail or in person).

For laboratories, the alternative arrangements may be made to complete the laboratory. Consult with the laboratory syllabus for more information.

For missed tests due to short-term circumstances (<3 days), students should complete the **Student Declaration of Absence Form** (in Brightspace) within three days following the last day of absence.

For tests and exams, the option of a make-up test or prorating of marks is at the discretion of the professor. For quizzes, a single missed quiz will constitute the low mark and will be dropped (no notification required).

**E-mail.** Use e-mail for issues related to administrative matters or short queries related to content. PDW will not reply to e-mails asking how to solve problems or asking to repeat information from the lecture.

**Electronics.** Cell phones should be turned off while in lecture and lab.

## Course Content

The following is a list of topics covered in this course.

1. An Overview of Analytical Chemistry
2. Statistical Treatment of Data
3. Propagation of Errors
4. Linear Regression
5. Volumetric Calculations
6. Introduction to Instrumental Methods
7. Standard Addition and Internal Standards
8. Introduction to Ionic Equilibria
9. Non-Ideal Solutions
10. Acids and Bases
11. Buffers and Titrations
12. Spectroscopy
13. Redox Reactions and Electrochemistry
14. Chromatography

## Course Objectives/Learning Outcomes

- Evaluate the quality of analytical results using statistical methods.
  - Calculate uncertainty in a result through the propagation of errors.
  - Apply linear regression for the purpose of calibration.
  - Transform between chemical quantities (mass, moles, concentrations, percentages).
  - Determine an analytical result on the basis of titration data.
  - Relate instrumental response to concentration in the determination of an analyte.
  - Apply the methods of standard addition and internal standards to analytical determinations.
  - Write and manipulate equilibrium constant expressions for chemical reactions.
  - Calculate quantities associated with chemical equilibria.
  - Distinguish between activity and concentration.
  - Determine activities using the Debye-Hückel Equation.
  - Apply activity calculations to simple equilibria.
  - Classify aqueous solutions according to their acid-base properties.
  - Calculate the pH of different types of aqueous solutions.
  - Predict the reactions of acids and bases and the pH of the resulting solution.
  - Determine the quantities needed to prepare a buffer from different starting materials.
  - Distinguish the shapes of titration curves for different conditions.
  - Describe the components of different types of spectroscopic instrumentation.
  - Apply Beer's law to spectroscopic measurements.
  - Describe the applications and limitations of different spectroscopic techniques.
  - Identify the components of an electrochemical cell and represent it in shorthand notation.
  - Apply the Nernst Equation to calculate electrochemical cell potentials.
  - Calculate analytical concentrations from the potentials of redox and membrane electrodes.
  - Describe the components of a chromatograph for different types of chromatography.
  - Recognize the important features of a typical chromatogram.
  - Determine and interpret the parameters associated with the quality of a separation.
  - Describe and calculate the factors affecting a separation through rate theory.
  - Describe different types of chromatography and their applications.
  - Carry out quantitative and qualitative analysis on the basis of chromatographic data.
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# Faculty of Science Course Syllabus (Section B)

## Chemistry 2201A

### University Policies and Statements

**This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate**

#### Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.

**Information:** [https://www.dal.ca/dept/university\\_secretariat/academic-integrity.html](https://www.dal.ca/dept/university_secretariat/academic-integrity.html)

#### Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

**Information:** [https://www.dal.ca/campus\\_life/academic-support/accessibility.html](https://www.dal.ca/campus_life/academic-support/accessibility.html)

#### Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.

**Code:** [https://www.dal.ca/dept/university\\_secretariat/policies/student-life/code-of-student-conduct.html](https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.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](mailto:elders@dal.ca)).

**Information:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

**Important Dates** in the Academic Year (including add/drop dates)

[https://www.dal.ca/academics/important\\_dates.html](https://www.dal.ca/academics/important_dates.html)

#### University Grading Practices

[https://www.dal.ca/dept/university\\_secretariat/policies/academic/grading-practices-policy.html](https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html)

**Missed or Late Academic Requirements due to Student Absence (policy)**

[https://www.dal.ca/dept/university\\_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html](https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html)

## Student Resources and Support

### Advising

**General Advising** [https://www.dal.ca/campus\\_life/academic-support/advising.html](https://www.dal.ca/campus_life/academic-support/advising.html)

**Science Program Advisors:** <https://www.dal.ca/faculty/science/current-students/academic-advising.html>

**Indigenous Student Centre:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

**Black Students Advising Centre:** [https://www.dal.ca/campus\\_life/communities/black-student-advising.html](https://www.dal.ca/campus_life/communities/black-student-advising.html)

**International Centre:** [https://www.dal.ca/campus\\_life/international-centre/current-students.html](https://www.dal.ca/campus_life/international-centre/current-students.html)

### Academic supports

**Library:** <https://libraries.dal.ca/>

**Writing Centre:** [https://www.dal.ca/campus\\_life/academic-support/writing-and-study-skills.html](https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html)

**Studying for Success:** [https://www.dal.ca/campus\\_life/academic-support/study-skills-and-tutoring.html](https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html)

**Copyright Office:** <https://libraries.dal.ca/services/copyright-office.html>

**Fair Dealing Guidelines** <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>

### Other supports and services

**Student Health & Wellness Centre:** [https://www.dal.ca/campus\\_life/health-and-wellness/services-support/student-health-and-wellness.html](https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html)

**Student Advocacy:** <https://dsu.ca/dsas>

**Ombudsperson:** [https://www.dal.ca/campus\\_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html](https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html)

### Safety

**Biosafety:** <https://www.dal.ca/dept/safety/programs-services/biosafety.html>

**Chemical Safety:** <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

**Radiation Safety:** <https://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

**Scent-Free Program:** <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>