

CHEM 3305A/B

Advanced Analytical Chemistry Laboratory

Fall-Winter 2026-2027

Instructor:	Dr. Edward Lai Office: Steacie 230 E-mail: edward.lai@carleton.ca
Office hours:	Email to arrange a virtual meeting
Teaching assistant:	Jocelyn Menard (jocelynménard@cmail.carleton.ca) - virtual/in-person office hours by appointment
Lab:	Steacie 305A Tuesday 8:35-12:25 p.m.
Modality:	In person (laboratory 4 hours a week)
Lab supervisor:	Graham Galway (graham.galway@carleton.ca) – virtual/in-person office hours by appointment
Schedule:	Posted on Brightspace
Manual:	Available on Brightspace
General notes by TAs:	Available on Brightspace. Students are advised to read them before starting lab work on each experiment.
Error analysis handout:	Available on Brightspace. Students are advised to read it before starting to write their first report.
Course description:	Advanced instrumentally based techniques of analysis. Emphasis on identification and quantitation of low-level contaminants in environmental matrices using chromatographic and spectroscopic methods, including sampling, cleanup, measurement and reporting of results.

Experiments:

1. Determination of Phenols in Water
2. Determination of PCB organic compounds in a Sediment Sample
3. Determination of Atrazine by Immunoassay
4. Determination of Aldehydes in Indoor Air
5. Determination of Arsenate in Beer
6. Determination of Atrazine and Simazine in Water
7. Determination of Selenium in Pharmaceutical Products

Students are scheduled to complete 5 (out of the seven) experiments. For each experiment, you will be required to complete the lab work, show acceptable data precision, write up all experimental results, and submit a report either Short or Formal.

Mandatory required materials: Computer, Microsoft Word and Excel (or equivalent software for Mac computers)

Costs of educational material: Students are not required to purchase textbooks or other learning materials for this course.

Reports:

Reports should be submitted 2 weeks after each experiment is finished. All reports should be submitted electronically on Brightspace for grading by the TA. Please ensure that your name, student number and lab section (A or B) appear in the file name you upload.

Formal reports are typically shorter than 10 pages (1.5-line spacing) plus figures, tables and calibration curves. The introduction need not be longer than 1 page, and 2-3 pages of theory are good enough. Students should not copy any information from the lab manual or any generative AI platform/tools. You may focus on experimental, data, calculations, results, discussion, and conclusion. A high mark will go to a report that is rich in discussion, organized in presentation, correct in calculations, logical in writing, and polished in style. More guidelines on the mark breakdown for CHEM 3305 formal reports are posted on Brightspace. Collaborating on formal reports is strictly disallowed. You must complete the formal report by yourself. If you need help, please see your TA or Dr. Lai.

Short reports are typically less than 7 pages (1.5-line spacing) plus figures, tables and calibration curves. Introduction, theory, and experimental sections are not required. More guidelines on the mark breakdown for CHEM 3305 short reports are also posted on Brightspace. Short reports may be submitted as lab partners.

Note that plagiarism is easy to detect and temptation must be resisted.

Scenarios:

All students in CHEM 3305 will complete the Scenarios assignment. The scenarios will consist of two parts, a written report graded by the TA and a presentation conducted before the class and graded by the teaching team. Each group will be provided with a scenario that will require the development of an experimental approach to answer the question or solve the problem presented. Each group will write a report that outlines their plan of action for solving the presented problem or question. The report must include but is not limited to the following concepts, sampling requirements (sampling locations, types of samples, and sample preparation etc.), the experiment design and the rationale, and any related theory to support the experimental design. The report should be no longer than 7-9 pages (double line spacing). The report will be submitted to the TA in December, graded and returned in January and presentations will be in a scheduled lab period in February. See schedule for exact dates. The oral presentation, to the class and teaching team, will utilize PowerPoint slides of the experimental design followed by a group discussion with the teaching team on the rationale for the experimental design and any related theory.

Rideau River Water Project:

All students in CHEM 3305 will participate in a project that will involve testing water samples collected from the Rideau River. These samples will be analyzed by employing the methods used in experiments 1, 2, 5, 6, and 7 as well as being analyzed for total organic carbon. Each group within a section will also collect sediment samples from the Rideau River and perform analyses on them throughout the year. The entire class will aggregate the individual group results and prepare a final report and a presentation. The report will include all raw data (i.e. chromatograms, etc.), sample calculations, individual and aggregated results with appropriate uncertainties, and a full discussion. The presentation will be 30-40 minutes which will occur during the scheduled lab period towards the end of the winter term (See schedule for exact date). The presentation should cover the methods employed and the results obtained. All students in the class are expected to participate in the presentation.

Learning outcomes:

The learning outcomes to be achieved in this lab course comprise several overarching themes:

- Analytical skills – demonstration of proper lab techniques.
- Calculation – accurate concentrations, correct unit conversion, and proper statistical analysis.
- Creativity – independent operation of instrument and implementation of procedural steps.
- Critical thinking – quality assessment of your lab work.
- Knowledge – fundamental theory and practical application of analytical techniques: electrochemical analysis, gas chromatography, immunoassay, ion chromatography, liquid chromatography, as well as sampling/preparation/treatment, analyte extraction/preconcentration/recovery, matrix purification/interference removal, standard calibration curve, internal standards, and standard additions.
- Oral communication - with lab partner, TA/lab supervisor/instructor, and other groups in describing your scenario.
- Planning – familiarization with the instrument working principle and experimental procedure.
- Problem solving – diagnosing environmental problems, researching analytical solutions, attempting first approach, assessing whether that works, and formulating alternative solution.
- Reporting – effectively sharing your Rideau River project analysis data and results in graphical and tabulated formats.

- Safety – carefully working in the lab with full understanding of potential hazards when handling chemicals.
- Teamwork – willingness to help your lab partner or assist other group members when possible.
- Time management - effective use of time during each 4-hour lab.
- Training – capacity for training by TA/lab supervisor/instructor and requesting assistance when needed.
- Written communication – skills to formulate clear and concise responses within lab reports.

Grading Scheme:

2 individual formal reports (Exp. 1/6 or Exp. 3)	30%
3 team/individual short reports	25%
Laboratory skills and techniques	
TA evaluation	10%
Instructor evaluation	5%
Co-Ordinator evaluation	5%
Scenarios	
Scenarios written report (by TA)	5%
Scenarios presentation	10%
Rideau River Project	10%

Generative Artificial Intelligence (GenAI):

As our understanding of the uses of GenAI and its relationship to student work and academic integrity continue to evolve, students are required to discuss their use of GenAI in any circumstance not described here with the course instructor to ensure it supports the learning goals for the course.

Short and Formal Reports:

Minimal Use – Basic Assistance Only

AI use in this course: Students may use AI tools for basic word processing functions, including grammar and spell checking (e.g. Grammarly, Microsoft Word Editor, Copilot).

Documenting AI use: It is not necessary to document the use of AI for the permitted purposes listed above. If you have questions about a specific use of AI that isn't listed above, please consult your instructor.

Why have I adopted this policy? This policy ensures that student voices and ideas are prioritized and authentically represented, maintaining the integrity of the work produced by students while allowing basic support to enhance clarity, correctness, layout and flow of ideas. The goal of adopting a limited use of AI is to help students develop foundational skills in writing and critical thinking by practicing substantive content creation without the support of AI.

Limitations: Students may not use AI for writing the Introduction or Theory sections of a formal report.

Scenarios

Moderate Use – Content Generation with Attribution

AI use in this course: Students may use AI tools for ideas, clarifying challenging concepts or getting started on projects. Some acceptable uses include:

- Sounding board (e.g. generating essay topics with ChatGPT, using Microsoft Word's Smart Lookup or Copilot to find inspiration and related topics).
- Creating outlines (e.g. using AI to structure an essay or presentation flow, using Microsoft Word's Outline View with AI suggestions).
- Providing definitions or explanations of complex concepts (e.g. using AI to explain a difficult theory or to find relevant information).

Documenting use of AI: It is necessary to document your use of AI in this course, using the following guidelines:

- Clearly identify and cite AI-generated text (e.g. "The following paragraph or slide was generated by ChatGPT/Microsoft Word's Researcher tool/Copilot").
- Review, edit and ensure scientific accuracy and originality of final submissions.
- AI-generated content should not exceed 30 per cent of the total report length or oral presentation.

Why have I adopted this policy? This policy supports the use of AI as a supplementary tool, helping students develop ideas and structure their work while emphasizing the importance of transparency and personal engagement with the content. AI can be used for inspiration and foundational support and can encourage students to critically assess and refine AI-generated material.

Carleton University is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the year. The accommodation request processes, including information about the *Academic Consideration Policy for Students in Medical and Other Extenuating Circumstances*, are outlined on the Academic Accommodations website (students.carleton.ca/course-outline).

Academic Accommodation for Students with Disabilities:

Carleton University is strongly committed to providing access and accommodation for all individuals with identified and duly assessed disabilities. The University has a Senate-approved policy on Academic Accommodation that forms part of its Human Rights Policy. This policy should be consulted for further information and is available at the front of this Calendar and online at: www.carleton.ca/equity. The policy promotes efforts to accommodate students with disabilities so that they will have the opportunity to meet learning objectives and be fairly evaluated in their performance. In no case, however, does academic accommodation negotiate away, lower, or remove the academic standards and learning objectives of any course or program, rule, regulation, or policy at the University.

The Paul Menton Centre for Students with Disabilities (www.carleton.ca/pmc/) is the designated unit at the University for assisting the Carleton community in integrating persons with disabilities into all aspects of Carleton's academic and community life. The Paul Menton Centre provides assessment of academic accommodation, advises students on strategies to open a dialogue with instructors and acts as consultant, facilitator, coordinator and advocate in this area for all members of the University community.

The Paul Menton Centre provides individualized support services, based on appropriate and up to date documentation, to persons who are deaf or hard of hearing, with learning disabilities, attention deficit disorder (ADD), visual impairments, head injuries, physical disabilities including mobility impairments, or who have psychiatric, other medical or non-visible disabilities. Students are responsible for applying for special services by making an appointment with the appropriate coordinator at the Paul Menton Centre. All requests will be considered on the basis of individual need. Students are advised to come to the Centre early in the term to discuss service requests.

Academic Accommodation for Students with Religious Obligations:

Carleton University accommodates students who, due to religious obligation, must miss an examination, test, assignment deadline, laboratory, or other compulsory event. The University has a Senate-approved policy on religious accommodation that forms part of its Human Rights Policy, available at: www.carleton.ca/equity. Students requesting academic accommodation on the basis of religious observance should make a formal, written request to their instructors for alternate dates and/or means of satisfying academic requirements. Such requests should be made during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist, but no later than two weeks before the compulsory academic event. Accommodation is to be worked out directly and on an individual basis between the student and the instructor(s) involved. Instructors will make accommodations in a way that avoids academic disadvantage to the student. Students or instructors who have questions or want to confirm accommodation eligibility of a religious event or practice may refer to the Equity Services website for a list of holy days and Carleton's Academic Accommodation policies, or may contact an Equity Services Advisor in the Equity Services Department for assistance. Students unable to reach a satisfactory arrangement with their instructor(s) should contact the Director of Equity Services. For more details visit the Equity Services website <https://carleton.ca/equity/accommodation/religious-observances/>

Academic Accommodation for Students with Needs Related to Family Status:

Pregnant students requiring academic accommodations are encouraged to contact an Equity Advisor in Equity Services to complete a letter of accommodation. The student must then make an appointment to discuss her needs with the instructor at least two weeks prior to the first academic event in which it is anticipated the accommodation will be required. For more details visit the Equity Services website <https://carleton.ca/equity/accommodation/academic/students/>

Student Conduct:

The University has adopted a policy to deal with allegations of academic misconduct. This policy is expressed in the document Carleton University Academic Integrity Policy, effective July 1, 2006. The policy describes in detail its scope of application, principles, definitions, rights and responsibilities, academic integrity standards, procedures, sanctions, transcript notations, appeal process, and records implications. The complete policy is available at www.carleton.ca/studentaffairs

Plagiarism:

Plagiarism is presenting, whether intentional or not, the ideas, expression of ideas, or work of others as one's own. Plagiarism includes reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the source, and presenting these as one's own without proper citation or reference to the original source. Examples of sources from which the ideas, expressions of ideas, or works of others may be drawn from include but are not limited to: books, articles, papers, generative AI platform/tools, literary compositions and phrases, performance compositions, chemical compounds, art works, laboratory reports, research results, calculations and the results of calculations, diagrams, constructions, computer reports, computer code/software, and material on the Internet.

Examples of plagiarism include, but are not limited to:

- submitting a take-home examination, essay, laboratory report or other assignment written, in whole or in part, by someone else;
- using ideas or direct, verbatim quotations, paraphrased material, algorithms, formulae, scientific or mathematical concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another's data or research findings;
- submitting a computer program developed in whole or in part by someone else, with or without modifications, as one's own;
- failing to acknowledge sources through the use of proper citations when using another's works and/or failing to use quotation marks.

For more information, see <https://carleton.ca/registrar/academic-integrity/>