Instructor: Diane Beauchemin
Office: Chernoff 308
Phone: 613-533-2619
E-mail: diane.beauchemin@queensu.ca
Questions? Open door policy.

LECTURES: BIOSCI 1102, Tuesday 9:30 a.m., Thursday 8:30 a.m., Friday 10:30

TUTORIALS: CHE 211 and CHE 213, as assigned, Wednesday 18:30-20:00. Six tutorials to be held biweekly: September 11 & 25, October 9 & 23, and November 6 & 20.

Required Textbook: Quantitative Chemical Analysis, 9th Ed., Daniel C. Harris, Freeman & Company (For those on a tight budget, the 8th Edition can also be used.)

LABS
Lab Coordinator: Igor Kozin
Office: Chernoff 124
Phone: 533-6000 x. 74665 E-mail: igor.kozin@chem.queensu.ca

Lab Room: Chernoff 210
Lab Timetable: Regular 3-hr lab sessions will be held Tuesday, Wednesday and Thursday (14:30-17:30) as assigned.

Week 1 (Sept. 10-12): Introductory Labs (~ 1.5 hrs) - assignment to lab teams and in-lab exercise/quiz – attendance mandatory.

Weeks 2-11, students rotate between the following five experiments:
1. Direct Spectrophotometric Analysis of Energy Drinks
2. UV-VIS Spectrophotometry with Multi-wavelength Detection
3. Analytical Techniques based on Fluorescence Spectroscopy
4. Absorption and Emission Flame Atomic Spectrometry
5. Elemental Analysis using Advanced Techniques of Atomic Spectroscopy

Recommended software: Lab data processing will require Microsoft Excel.

onQ: This electronic tool can only be accessed by students registered in CHEM/ENCH 213 by going to https://onq.queensu.ca/d2l/home. It contains:
- the course material (i.e. syllabus, slides and practice problems)
- a week-by-week calendar of the topics/tests,
- your grades
- tips to further help you
- a discussion board where questions can be asked about the course material.
Learning objectives

The instructor will:
♦ Explain the fundamentals of analytical chemistry in a down-to-earth, relevant way.
♦ Review and deepen some of the knowledge acquired in first year chemistry.
♦ Teach new material using in-class learning activities involving student participation to deepen student learning.
♦ Entice students to think critically by deliberately making mistakes for students to find.
♦ Inasmuch as possible, answer questions on onQ by the next workday.
♦ Give lots of examples both in class and on onQ.

Learning expectations and outputs

Students will:
♦ Come prepared to every lab.
♦ Submit lab reports on time.
♦ Attend every lecture and participate in the learning activities.
♦ Do the (unmarked) assignments and the (marked) alternating bi-weekly online quizzes and in-class tests.
♦ Be valued members of their team during bi-weekly group tests.
♦ Ask questions on onQ so that everybody may benefit from the answers.

Learning outcomes

At the end of this course, students will be able to:
♦ Demonstrate the proper use of the balance, pipettes, burets and volumetric flasks.
♦ Assess the quality of a result and the validity of a method.
♦ Accurately analyse samples by UV-visible spectrophotometry, fluorescence and atomic spectrosopies.
♦ Calculate the concentrations of different species of a compound in solution.
♦ Prepare buffers in various ways.
♦ Perform titrations successfully and interpret the results correctly.

Topics covered

Analytical Process
1. The Analytical Chemist’s Job, General Steps in a Chemical Analysis, SI Units, Chemical Concentrations, Preparing Solutions and Stoichiometry Calculations. (Chapters 0-1)

Tools
2. Proper use of the analytical balance, buret, volumetric flask and pipets (Chapter 2)

Measurements
3. Types of Error, Gaussian Distribution, Mean, Standard Deviation, Significant Figures, Propagation of Uncertainty. (Chapters 3-4)

4. Confidence Intervals, Comparison of Means with Student’s t, Grubbs Test for an Outlier. (Chapter 4)

5. Calibration curves, Linear Regression and Least Squares, Standard Addition, Internal Standards, Quality Assurance and Method Validation (Chapters 4-5)
Atomic spectroscopy
6. Atomic Spectroscopy with flame, graphite furnace and inductively coupled plasma: fundamentals, instrumentation and applications (Chapter 21)

Spectrophotometry
7. Spectrophotometry: fundamentals, instrumentation and applications (Chapters 18-20)
8. Fluorescence and phosphorescence in chemical analysis (luminescence) (Section 18-7)

Chemical Equilibrium
9. Equilibrium constant, solubility product, complex formation, protic acids and bases, pH, systematic treatment of equilibrium (Chapters 6, 8, 13)
10. Monoprotic and polyprotic acids, bases and buffers (Chapters 9-10)

Titrations
11. Titrations: Calculations, Potentiometric, Spectrophotometric, Precipitation and complexometric Titrations, Titration of a Mixture, End-Point Detection (Chapters 7, 11-12).

ASSESSMENT AND COURSE POLICIES
Lab reports (5): 30%
Open book on-line quizzes* (5): 10%
Open book in-tutorial tests* (6): 27% (individual: 18%; group: 9%)
Open book final exam: 33%

* There is no make-up test if you miss one. Flexibility was built in to facilitate academic consideration:
  • The best 4 out of 6 in-tutorial tests will be used to calculate the overall test mark.
  • The best 4 out of 5 on-line quizzes will be used to calculate the overall quiz mark.
  • If you perform better in the final exam than in the tests and quizzes, the weight of all the tests and quizzes will be shifted to the final.

Students must pass BOTH the lecture and the laboratory components to pass the course. Otherwise, the lowest of 47% or the student's actual mark will be allocated. Students who do not attend all lab sessions may be assigned a grade of incomplete (IN) and be required to attend and pass the missed lab(s) the following year before the IN is cleared from their transcript. Students who feel that there are reasons to review their grades should follow the steps set out in Regulation 13 'Review and Appeal of Grades.'

All components of this course will receive numerical percentage marks. The final grade you receive for the course will be derived by converting your numerical course average to a letter grade according to:

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Location and Timing of Final Examinations
The exam dates for each Term are listed on the Faculty of Arts and Science webpage under “Important Dates.” Student exam schedules for the Fall Term are posted via SOLUS immediately prior to the Thanksgiving holiday; for the Winter Term they are posted on the Friday before Reading Week, and for the Summer Term they are individually noted on the Arts and Science Online syllabi. **Students should delay finalizing any travel plans until after the examination schedule has been posted. Exams will not be moved or deferred to accommodate employment, travel/holiday plans or flight reservations.** Also, as indicated in Academic Regulation 8.3, students must write all final examination in all on-campus courses on the Kingston campus.

Calculator Policy
Calculators acceptable for use during quizzes, tests and examinations are intended to support the basic calculating functions required by most Arts and Science courses. For this purpose, the use of the Casio 991 series calculator is permitted and is the only approved calculator for all faculties.

Academic Integrity
Queen’s students, faculty, administrators and staff all have responsibilities for upholding the fundamental values of academic integrity; honesty, trust, fairness, respect, responsibility and courage (see [www.academicintegrity.org](http://www.academicintegrity.org)). These values are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic integrity forms a foundation for the "freedom of inquiry and exchange of ideas" essential to the intellectual life of the University (see the Senate Report on Principles and Priorities [http://www.queensu.ca/secretariat/policies/senate/report-principles-and-priorities](http://www.queensu.ca/secretariat/policies/senate/report-principles-and-priorities)).

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments and their behaviour conform to the principles of academic integrity. Information on academic integrity is available in the Arts and Science Calendar (see Academic Regulation 1 [http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations/regulation-1](http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations/regulation-1)), on the Arts and Science website (see [https://www.queensu.ca/artsci/students-at-queens/academic-integrity](https://www.queensu.ca/artsci/students-at-queens/academic-integrity)), and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulation on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.
Copyright of Course Materials
All CHEM/ENCH 213 course materials created by Diane Beauchemin, including all slides, presentations, handouts, tests, exams, syllabus, and other similar course materials, are the intellectual property of Diane Beauchemin. It is a departure from academic integrity to distribute, publicly post, sell or otherwise disseminate Diane Beauchemin’s course materials or to provide them to anyone else for distribution, posting, sale or other means of dissemination, without Diane Beauchemin’s express consent. A student who engages in such conduct may be subject to penalty for a departure from academic integrity and may also face adverse legal consequences for infringement of intellectual property rights.

Accommodation
Queen's University is committed to achieving full accessibility for people with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. The Senate Policy for Accommodations for Students with Disabilities was approved at Senate in November 2016 (see https://www.queensu.ca/secretariat/sites/webpublish.queensu.ca.uslcwww/files/files/policies/senateandtrustees/ACADACCOMMPOLICY2016.pdf). If you are a student with a disability and think you may need academic accommodations, you are strongly encouraged to contact the Queen's Student Accessibility Services (QSAS) and register as early as possible. For more information, including important deadlines, please visit the QSAS website at: http://www.queensu.ca/studentwellness/accessibility-services/

Academic Considerations for Students with Extenuating Circumstances
Queen’s University is committed to providing academic consideration to students experiencing extenuating circumstances that are beyond their control and are interfering with their ability to complete academic requirements related to a course for a short period of time. The Senate Policy on Academic Consideration for Students in Extenuating Circumstances is available at http://www.queensu.ca/secretariat/sites/webpublish.queensu.ca.uslcwww/files/files/policies/senateandtrustees/Academic%20Considerations%20for%20Extenuating%20Circumstances%20Policy%20Final.pdf

Each Faculty has developed a protocol to provide a consistent and equitable approach in dealing with requests for academic consideration for students facing extenuating circumstances. Arts and Science undergraduate students can find the Faculty of Arts and Science protocol and the portal where a request can be submitted at: http://www.queensu.ca/artsci/accommodations. Students in other Faculties and Schools who are enrolled in this course should refer to the protocol for their home Faculty.

If you need to request academic consideration for this course, you will be required to provide the name and email address of the instructor/coordinator. Please use the following:
Instructor Name: Diane Beauchemin
Instructor email address: diane.beauchemin@queensu.ca