Advanced Analytical Chemistry
CHEM/ENCH 411 3.0 units
Fall 2022
Tuesday September 6th – Friday December 2nd

Instructor: Diane Beauchemin, Ph.D. (elle/she/her); you can call me Dr. B.
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Questions?

1. Use the onQ discussion forum so that the whole class may benefit from the answers to your questions.
2. Drop by my office (open-door policy).
3. Make an appointment (in person or virtual).

onQ: This electronic tool can only be accessed by students registered in CHEM/ENCH 411 by going to https://onq.queensu.ca/d2l/home. It contains:

- the course material (i.e. syllabus, slides, practice problems, answers to some past final exams, quizzes, etc.),
- your grades,
- a discussion forum to get to know each other (each posting rewarded by a related joke)
- a discussion forum where questions can be asked about the course material, and
- a discussion forum for a group test.

Equity, Diversity and Inclusivity Statement
Equity in an educational institution is achieved when all members of our society have fair and equal opportunity to participate in and enjoy the benefits of an education, including the opportunity to experience success and human dignity while developing the skills, knowledge and attitudes necessary to contribute as leaders and citizens in society.

Although asynchronous delivery is most accessible, more students (especially last year) were disengaged as can been seen in the below summary of mark distributions over the last 6 years. Hence, the course is offered again in person to maximize interactions, and thus engagement, through numerous in-class activities (review at the beginning of class, live demonstrations, bingo game, jeopardy-style review, etc.), which cannot be held online.

Year	# of students	Average	Lowest mark	Highest mark	% ≥80%
2021 (asynchronous)	51	81	34	98	29
2020 (asynchronous)	27	80	56	99	78
2019 (in person)	19	82	53	97	74
2018 (in person)	20	83	65	100	70
2017 (in person)	20	85	72	98	80
2016 (in person)	20	84	70	98	70

Recommended Text: Quantitative Chemical Analysis, 9th Ed., *Daniel C. Harris,* Freeman & Company (or other editions)

Summary of Assessment:

Individual tests (5)	20%	(best 4 out of 5)
Group tests (6)	16%	(best 4 out of 5 in class + November 11th on-line one)
Individual on-line quizzes (4)	4%	(best 3 out of 4)
12-min oral presentation	20%	(during last two weeks of class)
Final exam	40%	(3-hour exam that will include a 10% bonus question)

Assessment (all open-book) Timing and Weight

Assessment	Material covered	When (open period when online)	Weight
Test* 1 (in class)	Week 1	Friday, September 9th	6%
Test 2 (in class)	Week 2	Friday, September 16th	6%
Test 3 (in class)	Week 3	Friday, September 23rd	6%
Test 4 (in class)	Week 4	Friday, September 30th	6%
Individual quiz 1	Week 5	October 7th – 17th	1%
Individual quiz 2	Week 6	October 21st – 24th	1%
Individual quiz 3	Week 7	October 28th – October 31st	1%
Individual quiz 4	Week 8	November 5th – November 8th	1%
Online group Test**	Week 9	November 11th – November 14th	6%
Test 5 (in class)	Week 10	November 18th	6%
Oral presentation***	Literature paper	November 21st – December 1st	20%
Bonus	Oral presentations	November 21st – December 1st	≤5%
Final exam	Whole course	Date to be set by the Exams Office	40%

***** Both 4% individual test and 2% group test.

******On November 11th (class cancelled for Remembrance Day service), a group test will be written in the discussion forum.

***12-min presentations to be made in pairs in class.

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.'

Calculator Policy

As noted in Academic Regulation 9.2, "*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 Arts and Science students*."

Location and Timing of Final Examinations

As noted in Academic Regulation 8.2.1, "the final examination in any class offered in a term or session (including Summer Term) must be written on the campus on which it was taken, at the end of the appropriate term or session at the time scheduled by the Examinations Office." The

exam period is listed in the key dates prior to the start of the academic year in the Faculty of Arts and Science Academic Calendar and on the Office of the University Registrar's webpage. A detailed exam schedule for the Fall Term is posted before the Thanksgiving holiday. **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.**

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 Queen's Official Grade Conversion Scale:

Queen's Official Grade Conversion Scale

Grade	Numerical Course Average (Range)	Grade	Numerical Course Average (Range)	Grade	Numerical Course Average (Range)	Grade	Numerical Course Average (Range)
A+	90-100	B+	77-79	C+	67-69	D+	57-59
A	85-89	B	73-76	C	63-66	D	53-56
A-	80-84	B-	70-72	C-	60-62	D-	50-52
						F	≤ 49

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. 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).

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), on the Arts and Science website, 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.

We all share in maintaining a culture of integrity, if you become aware of anyone trying to share, or solicit, answers to tests or exams, please remind them that this is against the rules and inform me immediately.

Copyright of Course Materials

Course materials created by the course instructor, including all slides, presentations, handouts, tests, exams, and other similar course materials, are the instructor's intellectual property. It is a departure from academic integrity to distribute, publicly post, sell or otherwise disseminate an instructor's course materials or to provide an instructor's course materials to anyone else for distribution (including note sharing sites), posting, sale or other means of dissemination without the instructor'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.

Learning objectives

The instructor will:

- Explain advanced topics in analytical chemistry in a down-to-earth, useful way.
- Review and deepen some of the knowledge acquired in second or third year analytical chemistry.
- Teach new material using interactive activities to deepen student learning.
- Ensure students' understanding through weekly open-book quiz or test.
- Give feedback to students to group tests within a week of each weekly test.
- Inasmuch as possible, answer questions on onQ by the next workday.
- Give many examples.

Learning expectations and outputs

Students will:

- Attend every lecture.
- Participate in the learning activities.
- Take the on-line quizzes individually.
- Be valued members of their team during group tests.
- Ask questions on onQ so that everybody may benefit from the answers.
- Not wait until the last minute to prepare their oral presentation.
- Watch other students' oral presentations and objectively mark them.

Learning outcomes

At the end of this course, students will be able to:

- Select the best way to take a representative sample.
- Calculate the uncertainty associated with the primary and secondary sampling steps, as well as the overall uncertainty of the method.
- Develop analytical methods including sampling, storage and preservation, sample preparation, sample introduction into the analyzer, and calibration strategy.
- Describe the main components of a mass spectrometer and their purpose.
- Use isotopic abundance information to deduce the elemental composition of an unknown.
- Interpret mass spectra obtained using electron ionization.
- Make a clear oral presentation.

Course Outline

a) **Introduction and review of fundamental concepts** (Week 1)
b) **Sampling strategies for liquid, solid and gaseous samples** (Week 2)
c) **Storage and preservation considerations** (Week 3)
d) **Advanced sample preparation methods** (Week 4)
    a) Microwave-assisted strategies
    b) Sorbent extraction
    c) Solid-phase microextraction
    d) Chemical vaporization
e) **Flow injection analysis** (Week 5)
    a) Limited dispersion
    b) Medium dispersion
    c) Large dispersion
    d) Reduced dispersion
f) **Inductively coupled plasma (ICP) spectrometry** (Week 6)
    a) Conventional sample introduction
    b) Plasma processes
    c) Calibration strategies
    d) Hyphenation to liquid chromatography
g) **Mass spectrometry instrumentation** (Weeks 7-8)
    a) Sample introduction systems
    b) Ionisation methods
    c) Mass analysers
h) **Interpretation of a mass spectrum** (Weeks 9-10)
i) **ICP spectrometry and mass spectrometry applications:** Oral presentations (Weeks 11-12)

Netiquette / Discussion Guidelines

Queen's University is a place to share, question, and challenge ideas. Each student brings a different set of lived experiences. You can help to create a safe, respectful place for learners by promoting the following guidelines:

1. Make a personal commitment to learn about, understand, and support your peers.
2. Assume the best of others and expect the best of them.
3. Acknowledge the impact of oppression on other people's lives and make sure your writing is respectful and inclusive.
4. Recognize and value the experiences, abilities, and knowledge each person brings.
5. Pay close attention to what your peers write before you respond. Think through and re-read your writings before you post or send them to others.
6. It's alright to disagree with ideas, but do not make personal attacks.
7. Be open to being challenged or confronted on your ideas and challenge others with the intent of facilitating growth. Do not demean or embarrass others.
8. Encourage others to develop and share their ideas.

Web Browsers
onQ performs best when using the most recent version of the web browsers, Chrome, or Firefox. Safari and Edge are strongly discouraged as these web browsers are known to cause issues with onQ.

Internet Speed
While a wired Internet connection is encouraged, we recognize that most students rely on a wireless connection. A minimum download speed of 10 Mbps and up to 20 Mbps for multimedia is recommended. Click here for an Internet speed test.

Remote Course Support
For technology support ranging from setting up your device, issues with onQ to installing software, contact ITS Support Centre.

Suggested Time Commitment
In this course, you should expect to invest on average 8 hours per week. This will include the time you spend in class, studying course material, and completing quizzes or preparing for your larger assignments and exams. You are encouraged to use a term at a glance and a weekly study schedule (visit SASS) that distributes the 8 hours per week and avoid 'cramming'. This way you will be more likely to complete the course successfully and remember what you learned longer.

Accommodations for Disabilities
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 their academic activities. The Senate Policy for Accommodations for Students with Disabilities was approved at Senate in November 2016. 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.

Academic Considerations for Students in Extenuating Circumstances
Queen's University is committed to providing academic consideration to students experiencing extenuating circumstances. For more information, please see the Senate Policy on Academic Consideration for Students in Extenuating Circumstances.

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. Students in other Faculties and Schools who are enrolled in this course should refer to the protocol for their home Faculty. For guidance on **submitting requests**, please see refer to the Resource Guides available on the Academic Consideration website under "Applying for Academic Consideration."

N.B: The COVID-19 pandemic is an evolving situation. If you have symptoms or are deemed a close contact of someone with COVID, please access our **COVID-Related Absence Reference Guide** on the Academic Consideration website. This guide will provide you with information on applying for consideration, the types of documentation (including non-medical documentation) you can use to support your request, as well as insight into how the Faculty office will assess these requests.

If you need to request academic consideration for this course, you will be required to provide the following name and email address to ensure it reaches our team accordingly:

- Instructor/Course Coordinator Name: Diane Beauchemin
- Instructor/Course Coordinator email address: diane.beauchemin@queensu.ca

Students are encouraged to submit requests as soon as the need becomes apparent and to contact their Professors/Course Coordinators as soon as possible once Consideration has been granted. Any delay in contact may limit the Consideration options available.

Please follow up with me using by e-mail (diane.beauchemin@queensu.ca) within 3 days of receiving verification of your Consideration request.

For more information on the Academic Consideration process, what is and is not an extenuating circumstance, and to submit an Academic Consideration request, please see our website.

Deferred exams

Students receiving permission to write a deferred final exam will be expected to write their exam during the Faculty of Arts and Science deferred exam period [January 12 to 16, 2023] with exact time, date, and location to be announced. Requests for individualized deferred exam dates will not be accommodated. The deferred exam is considered an official exam to which all the exam regulations apply.