Introduction to Chemical Analysis
CHEM/ENCH 213
Fall 2020

Instructor: Zhe She
Office: Chernoff 307
Phone: 613-533-2790
E-mail: zhe.she@queensu.ca
Questions: Virtual office hours.

LECTURES: No synchronized lectures. Virtual office hours will be announced on OnQ.

TUTORIALS: Weekly 1-hour tutorial will be held. Each student will be assigned to a tutorial group.


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

Lab Room: Remote access labs
Lab Timetable: See onQ course site for lab scheduling details

Week 1 (Sept. 10-12): Introductory Labs (~ 1.0 hrs) – remote lab rules and expectations, lab administration; assignment to lab teams – remote attendance mandatory (the details of remote introductory meetings for each lab section will be announced via the onQ course site.

Weeks 2-11, students rotate between the following four experiments:
   1. UV-VIS Spectrophotometry with Multi-wavelength Detection
   2. Analytical Techniques based on Fluorescence Spectroscopy
   3. Absorption and Emission Flame Atomic Spectrometry
   4. 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 lecture-related material (i.e. syllabus, slides and practice problems)
- a week-by-week calendar of the topics/tests
- Laboratory Information Section, including lab report guidelines, report grading outlines, links to video material and lab-specific data files, which the students will have to use to process pre-recorded analytical data and to compile the corresponding lab reports.
- 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:
♦ Follow instructions and study lab materials on-line.
♦ Submit lab reports on time.
♦ Attend every lecture and participate in the learning activities.
♦ Do the (unmarked) assignments and the (marked) on-line tests.
♦ Be valued members of their team during weekly tutorial group.
♦ 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, pipets, buret and volumetric flask.
♦ 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)

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

ASSESSMENT AND COURSE POLICIES

Lab reports (4): 30%
Open book on-line tests* (5): 36%
Open book final exam: 34%

* There is no make-up test if you miss one. Flexibility was built in to facilitate academic consideration:
  • The best 3 out of 5 on-line tests will be used to calculate the overall test mark. (12% x 3 tests)

Students must pass BOTH the lecture and the laboratory components to pass the course. Fail one of the lab (30%) and lecture (70%) components will result in an overall fail for the course. 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:

Queen’s Official Grade Conversion Scale

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<th>Grade</th>
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<td>B+</td>
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<td>C+</td>
<td>67-69</td>
<td>D+</td>
<td>57-59</td>
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<td>85-89</td>
<td>B</td>
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Location and Timing of Final Examinations

(2020 Fall Exam will be on-line remotely.)

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 Thanks-giving 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.

Remote Exams

For exams being offered remotely, Regulation 7.2.3. Restrictions on Assessment is waived. Remote exams will be allowed in the last two weeks of classes and in the study period designated by Senate prior to the examination period in order to accommodate the limited number of online proctoring seats available.

Statement on Academic Integrity

The following statement on academic integrity builds on a definition approved by Senate and is designed to make students aware of the importance of the concept and the potential consequences of departing from the core values of academic integrity. It is highly recommended that this statement be included on all course syllabi. Instructors may also consider including this statement with each assignment.

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). 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).

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), on the Arts and Science website (see 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.

It is recommended that instructors add a paragraph here to explain issues of academic integrity that are particularly relevant to the course. E.g.

- Plagiarism –including guides on how to use sources correctly. Possible example:
Please note that we have had issues in the past with unintended plagiarism in this course. Regardless of how and where you retrieve information, the principles of academic integrity apply. Please visit these helpful websites to help you make sure that you are able to write things in your own words:

- [https://www.queensu.ca/academicintegrity/students/avoiding-plagiarismcheating](https://www.queensu.ca/academicintegrity/students/avoiding-plagiarismcheating)
- [https://integrity.mit.edu/handbook/academic-writing/avoiding-plagiarism-paraphrasing](https://integrity.mit.edu/handbook/academic-writing/avoiding-plagiarism-paraphrasing)

- Groupwork-What level of collaboration is acceptable? Clearly state if there are things students must do alone. Possible example:
  
  - You are permitted to work with a partner or in groups of 3 to encourage collaboration, cooperation, and collective learning on lab assignments. You are not permitted to share answers among large groups or as a tutorial group. You must work independently on quizzes and 'pop questions'.

**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.”

**Technology**

The statement below outlines general course technology requirements. If your course requires specific software or hardware, the Technology Requirements statement can help further define what available resources the students have access to. For example, if you require students to participate in synchronous sessions, they may need access to a webcam and headset.

Students should be encouraged when possible to work with the most recent versions of software including web browsers, Java, Flash and Adobe Reader.

**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 wired internet connection is encouraged, we recognize that students may be relying on a wireless connection. A minimum download speed of 10 Mbps and up to 20 Mbps for multimedia is recommended. To test your internet speed, [https://www.speedtest.net/](https://www.speedtest.net/)

For technology support ranging from setting up your device, issues with onQ to installing software, contact ITS Support Centre [https://www.queensu.ca/its/itsc](https://www.queensu.ca/its/itsc)

**Turnitin Statement**

A statement regarding use of Turnitin is preloaded into courses created on OnQ within a module on
academic integrity. Please make sure to make that module visible to students if you choose to use Turnitin.

Copyright of Course Materials
All CHEM/ENCH 213 course materials created by Zhe She, including all slides, presentations, handouts, tests, exams, syllabus, and other similar course materials, are the intellectual property of Zhe She. It is a departure from academic integrity to distribute, publicly post, sell or otherwise disseminate Zhe She’s course materials or to provide them to anyone else for distribution, posting, sale or other means of dissemination, without Zhe She’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.

Recording Synchronous (Live) Tutorials
Be mindful that while many devices allow for enabling video, some students may prefer to participate using voice only, or to obscure the background of their meeting space. Students should not be required to turn on their webcam unless there is a demonstrated need to do so (e.g., for assessment purposes). A Fact sheet on Privacy and Remote Teaching and Learning may be found at https://www.queensu.ca/accessandprivacy/Privacy-and-Remote-Teaching-and-Learning. Contained within the Fact Sheet is a link to a set of FAQs on Recording online classes and meetings to show how to use Zoom and Teams/MS Stream in a privacy-protective way: https://www.queensu.ca/accessandprivacy/faqs

Notice of Recording
Synchronous (live) classes will be delivered in this course through a video conferencing platform supported by the University [MS Teams, Zoom]. Steps have been taken by the University to configure these platforms in a secure manner. Classes will be recorded with video and audio (and in some cases transcription) and will be made available to students in the course for the duration of the term. The recordings may capture your name, image or voice through the video and audio recordings. By attending these live classes, you are consenting to the collection of this information for the purposes of administering the class and associated coursework. If you are concerned about the collection of your name and other personal information in the class, please contact the course instructor to identify possible alternatives.
To learn more about how your personal information is collected, used and disclosed by Queen’s University, please see the general Notice of Collection, Use and Disclosure of Personal Information.

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/
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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: Zhe She
Instructor email address: zhe.she@queensu.ca