

**SYLLABUS 2021 CHEM/ENCH 212:
Principles of Chemical Reactivity**

Course instructor: Dr Avena Ross
CHE 407, Chernoff Hall
phone: 613-533-2618
email: avena.ross@queensu.ca

Lab instructor: Dr Igor Kozin
CHE 124, Chernoff Hall
phone : 613-533-6000 ext 74665
email : igor.kozin@chem.queensu.ca

CHEM/ENCH 212 is a Hybrid course with parts taught in person and parts using OnQ

Lectures: Will be asynchronous recordings posted in OnQ each week

Tutorials: Will be in person (except section 11, which will be remote) and offered at several different times

Labs: Will be in person and offered at several different times

Office Hours: Will be in person in rm 515 in Chernoff Hall and offered during several of the official “class times”, Tuesday 10:30-11:30 am and Thursday 9:30-10:30 am

Each week a new module of the course will be released through OnQ, it will consist of a guided combination of textbook readings, video mini-lectures and knowledge checking. Most weeks you will also have a tutorial and there will be 6 labs during the course of the semester.

Learning goals: (i) understanding the essence of the reactivity of organic molecules and (ii) being able to relate it to kinetic studies and parameters; (iii) understanding solvent and electronic effects on reactivity. At the end of the course, students should be able to anticipate the reactivity of nearly any reactive partners.

Learning outcomes:

At the end of CHEM/ENCH 212, students should be able to.....

- (i) Identify and characterize reactive sites on organic molecules
- (ii) Predict and illustrate the pathway of a reaction using curly arrows to represent electron flow
- (iii) Determine and derive rate law expressions for Substitution and Elimination reactions
- (iv) Articulate the meaning of transition state parameters and use them to infer class of chemical reaction
- (v) Predict and justify the impact of solvent and electronic effects on reactivity
- (vi) Use experimental data obtained in the laboratory to evaluate reaction kinetics, and critically analyze and communicate scientific results.

Assessment of Learning outcomes:

Tutorials will assess outcomes (i), (ii), (iii), (iv) and (v)

Quizzes and the Mid Term Exam will assess outcomes (i), (ii), (iii) and (v)

Final Exam will assess outcomes (i), (ii), (iii), (iv) and (v)

Labs will assess outcome (vi)

Assessment Timing and Weights:

- OnQ Quizzes **10%** (Two quizzes will be held, one in Week 4 and one in Week 10, each is worth 5%)
- Tutorials **10%** (Nine tutorials held during the semester, your lowest grade will be dropped and the average of the remaining 8 used to determine this mark)
- Mid term **20%** (Take home exam held during Week 8)
- Final **35%** (In person, Timing to be announced, 3 h).
- Labs **25%**

Grading Method:

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)
A+	90-100
A	85-89
A-	80-84
B+	77-79
B	73-76
B-	70-72
C+	67-69
C	63-66
C-	60-62
D+	57-59
D	53-56
D-	50-52
F	49 and below

IMPORTANT:

- 1) The lecture material is composed of the **video lectures**; they take priority over the textbook/external online material. In the exams, you will be judged on your understanding of the **lecture material**.
- 2) Students must pass BOTH the lecture and the laboratory components to pass the course. If a student does not pass both the laboratory and lecture components of a course, they will fail the entire course and be allocated a mark of 47% or their actual mark, whichever is lower.

Required textbook: - **Organic Chemistry**, Jonathan Clayden, Nick Greeves and Stuart Warren, Oxford University Press, 2nd edition

Note: older editions are also accepted (just make sure that there is no ambiguity on the assigned reading, either with your fellow students or with the instructor)

Readings from Clayden will be posted in OnQ each week

Course Outline

Week 1	Organic Chemistry Basics and Intro to Substitution Reactions
Week 2	Orbitals and Reactivity in Substitution Reactions
Week 3	Distinguishing Between Substitution Mechanisms, Focus on SN1
Week 4	Distinguishing Between Substitution Mechanisms, Focus on SN2
Week 5	Leaving Groups in Substitution Reactions, Solvent effects on SN1
Week 6	Solvents Effects on SN2, Effects of Nucleophilicity on Substitution Reactions, Reaction Kinetics
Week 7	Introduction to Elimination Reactions and distinguishing them from Substitution Reactions
Week 8	Distinguishing Substitution and Elimination Reactions Part 2
Week 9	Distinguishing Substitution and Elimination Reactions Part 3
Week 10	Electrophilic Aromatic Substitution Reactions Part 1
Week 11	Electrophilic Aromatic Substitution Reactions Part 2
Week 12	Reaction Dynamics: Collision and Transition State Theories

Useful software: - free online testing and learning tools are available from the RSC website:

<http://www.rsc.org/learn-chemistry/resources/mechanism-inspector/>

- Several tutorials and exercises are mentioned in class as well as in the individual problem sets.

Please take the time to study them: they are very useful.

- Free online reaction animations (as well as orbitals animations) are available at the following website: <http://www.chemtube3d.com/>

- Data processing requires Microsoft Excel

Problem sets: Practice problems and solutions will be posted on the CHEM/ENCH 212 OnQ site.

These are not marked, but are recommended, as they will help you practice applying concepts from the course and will help you prepare for the mid-term and final exams.

Tutorials: There are 9 x 1 hour tutorials throughout the semester and the dates are listed below. Please attend the time and section you selected upon enrolling. Note: Each week there will be a pre-tutorial assignment posted in onQ that you will work on in a small group. Although these will not be graded they must be submitted to your TA before the start of the tutorial to receive participation credit. The tutorial itself will include a discussion of the assignment with an opportunity to ask questions and clarify challenging concepts. The TA will then administer a short quiz that you must complete and submit individually during the tutorial. Tutorials are worth 10% of your final grade and only your 8 highest grades will count towards this 10%.

Tutorial 1: Week 2 September 13-17th

Tutorial 2: Week 3 September 20-24th

Tutorial 3: Week 5 October 4-8th

Tutorial 4 (Practice Midterm): Week 6 Thursday October 18-22nd

Tutorial 5: Week 7 October 25-29th

Tutorial 6: Week 9 November 8-12th

Tutorial 7: Week 10 November 15-19th

Tutorial 8: Week 11 November 22nd-26th

Tutorial 9: Week 12 November 29th-December 3rd

Labs: All labs must be attended as scheduled

All students must attend the introductory lab (lab group assignment, lab safety, lab quiz) in week 2 (Sept. 13-16th) (~1 h)

Regular 3 h labs will be held on alternate weeks (See Schedule in onQ), in room CHE210 on the 2nd floor of Chernoff Hall.

In weeks 3-12 students will rotate between the following six experiments:

Experiment 1: Kinetics of Nucleophilic Substitution (SN1 Reaction Kinetics)

Experiment 2: Alkaline hydrolysis of Ethyl Acetate (SN2 Reaction Kinetics)

Experiment 3: Photo-isomerization Kinetics of 4-Hydroxyazobenzene

Experiment 4: Stop-Flow Kinetics - Reaction of Fe³⁺ and SCN⁻ Ions

Experiment 5: Enzyme Catalyzed Oxidation of DOPA

Experiment 6: Gas Viscosity – Determination of Collision Cross Section for Gases

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 section 11 tutorials in this course will consist of synchronous sessions hosted through zoom, you will get the best experience if you have access to a webcam and headset. **Note all other tutorial sections will be in person.**

Students are 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/>

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>

Notice of Recording

Synchronous (live) tutorials for section 11 will be delivered in this course through video conferencing platforms supported by the University [Zoom]. **(Note all other tutorial sections will be in person.)** 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](#).

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). 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.

- *In this course you are permitted to work with a partner or in groups of up to 4 to encourage collaboration, cooperation, and collective learning on lab/tutorial assignments that are designated as “group work”. You are not permitted to share answers among large groups or as a tutorial group. You must work independently on all assignments, exams, quizzes and ‘pop questions’ designated as “individual work”.*

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 intellectual property of the instructor. 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, 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.

This course makes use of Turnitin for submitting lab reports. Be aware that by logging into the site, you will be leaving onQ, and accessing Turnitin’s website. Your independent use of that site, *beyond what is required for the course (for example, purchasing the company’s products)*, is subject to Turnitin’s terms of use and privacy policy. You are encouraged to review these documents, using the link below, before using the site.

- Turnitin - http://turnitin.com/en_us/about-us/privacy

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 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 in 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/senatandtrustees/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/Coordinator Name: Avena Ross

Instructor/Coordinator email address: avena.ross@queensu.ca

Statement of the 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.**

Discussion Guidelines

University is a place to share, question and challenge ideas. Each student brings a different lived experience from which to draw upon. To help one another learn the most we can from this experience please consider 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 the lives of other people 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 ok to disagree with ideas, but do not make personal attacks.
7. Be open to being challenged or confronted on your ideas and to challenging others with the intent of facilitating growth. Do not demean or embarrass others.
8. Encourage others to develop and share their ideas.