# Concordia University
# Chemistry 235 – Kinetics of chemical reactions
# Syllabus for Fall 2018– Section 01

**GENERAL INFORMATION**
This 3-credit course introduces students to the theory and measurement of chemical reaction rates.
Pre-requisite: CHEM 234 (Physical Chemistry I),

**Course format:** Lectures and laboratories

**Instructor:** Dr. Guy Paquette
Office: SP-201.14
Office hours: Tuesday and Thursday: 12h30 to 14h00
Email : guy.paquette@concordia.ca

**Lectures:** Tuesday and Thursday: 08h45 to 10h00
Location: CC-321

**Lab Coordinator**: Alain Tessier
Office: SP-S175.21
Office hours : by appointment
Email : Alain.Tessier@concordia.ca

**Laboratories:**
Section 0101: Monday: 13h30 - 17h30 in **SP-220**
Section 0151: Thursday: 18h30 - 22h30 in **SP-220**
Section 0156: lab exempt

**Recommended Textbook:**
Physical Chemistry : Thermodynamics, Structure and Change. 10th Edition, by Peter Atkins & Julio de Paula, W.H Freeman and Company, 2014.
Volume 1 or total.
Note: the 8th and 9th editions are also perfectly adequate

or

Physical Chemistry,11th Edition, by Peter Atkins, Julio de Paula and James Keeler, Oxford University Press, 2018

**COURSE OUTLINE:**
The following topics will be covered: mathematical treatment of experimental results; theories of reaction rates; unimolecular reactions; the steady-state approximation; factors influencing rates of reactions in solution; acid-base catalysis; enzyme catalysis and the Michaelis-Menten mechanism; free-radical reactions; photochemical reactions; experimental methods and techniques.

**COURSE GRADE**
The final mark is based on: 35% for the 2 midterm exams (17.5% each), 40% for the final, and 25% for laboratories. The grade for laboratories includes pre-lab, lab performance, lab reports and lab exam; the lab exam will be written in class, will last 30 minutes and will be worth 5% of the final mark. See the lab Moodle webpage for details.

Bonus points: a few unannounced in-class quizzes will allow for a total of up to 6 bonus points.

**In order to pass the course, a minimum of at least 60% (15/25) on the lab component, and of at least 50% (37.5/75) on the theory component are required (bonus points are not counted into theory component).**

If a student is absent from a midterm exam, an official written justification must be provided, (i.e. an appropriately signed doctor's note). This justification should be delivered to the instructor **no later than one week after the exam**. If there is no valid justification, the student will receive a mark of zero for the exam. If the reason for absence is valid, the value of the missed midterm exam will be added to that of the final exam.

**Grade equivalence:**

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|---|---|---|---|---|---|
| 90 – 100 | **A+** | 85 – 89.9 | **A** | 80 – 84.9 | **A-** |
| 76 – 79.9 | **B+** | 73 – 75.9 | **B** | 70 – 72.9 | **B-** |
| 66 – 69.9 | **C+** | 63 – 65.9 | **C** | 60 – 62,9 | **C-** |
| 56 – 59.9 | **D+** | 53 – 59.9 | **D** | 50 – 52.9 | **D-** |
| 40 – 49.9 | **F** | 0 – 39.9 | **R** | | |

**IMPORTANT DATES**
**- Lectures for CHEM 235/2, section 01, begin Tuesday Sept. 4th**
**- Laboratories begin during the week of Sept. 10th**
**- Deadline to withdraw with tuition refund (DNE) is Monday, Sept. 17th**

**- Mid-term exams: Thursday Oct. 4th, and Thursday, Nov. 1st (subject to change)**

**- Last day to withdraw (DISC) is Monday, Nov. 5th.**
**- Lectures end Monday Dec. 3rd.**
**- Final exam period is from Dec. 5th to Dec. 19th.**

**(In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change)**

## LECTURE MATERIAL AND PRACTICE PROBLEMS

All concepts related to the course material will be covered in the lectures. The students are expected to read the appropriate sections of the textbook. There are no formal assignments for this course, but a list of suggested practice problems from the book will be provided with each section. It is the student's responsibility to use these problems to practice in applying the course material.

## LABORATORY INFORMATION

All questions on matters related to the labs should be addressed to the Lab Instructor. **Laboratories start on the week of September 10$^{th}$.** Labs will be performed on a rotation basis, so that students will be performing one lab experiment every other week.

Although lab experiments are done with a lab partner, each student must submit an individual lab report for all experiments. Joint lab reports are not acceptable. Do not expect any particular lab experiment to be directly related to the material covered in lectures of the preceding week; consider the laboratory work as additional, independent learning experience.

## LABORATORY MANUAL AND MATERIALS

The lab manual for the five experiments can be found online from the CHEM 235 Moodle website. You do not need to purchase the lab manual, but should print out the necessary pages form the website. Other items such as lab coats, hardcover notebook and safety glasses (mandatory) are available at the bookstore.

## LABORATORY EXEMPTION

Students who are repeating the course, having passed the lab component within the past 2 years, may request a lab exemption. A student who is eligible for a lab exemption **must apply for it before the end of the first week of the term, i.e. prior to the start of the laboratory experiments (forms available in SP-201.01 and on the departmental website).** Once accepted, students must register for the appropriate lab exemption section (Section 0156); students registered in the other lab sections will be required to complete the lab portion of the course. Students who withdraw from the course (DISC) are not eligible for a lab exemption based on labs completed in the term for which there is a DISC notation.

## CALENDAR FOR LECTURES

Please note that this calendar may be changed as the term proceeds. The chapter numbers indicated relate to the 10$^{th}$ edition of the textbook.(Physical Chemistry, by Atkins & de Paula)

Introduction & syllabus

Chemical Kinetics

- Reaction rates, definitions (Chap. 20A)
- Simple rate laws (Chap. 20B)
- Rate determination and analysis (Chap. 20B)
- Temperature dependence and activation energy (Chap. 20D)
- Complicated rate equations (Chap. 20E)
- The steady-state approximation (Chap. 20E)

**Mid-term Exam I**

Kinetics of complex reactions
- Rate laws of complex reactions (Chap. 20E)
- Chain reactions, Polymerization reactions (Chap. 20F)
- Homogenous catalysis (Chap. 20H)

**Mid-term Exam II**

Theory of reaction rates
- The Arrhenius Equation (Chap. 20D)
- Collision theory and the pre-exponential factor (Chap. 21A)
- Transition-state theory (Chap. 21C)
- Reactions in solution (Chap. 19A,B,C; Chap 21B)
- Unimolecular reaction rate theory (Chap. 20F)
- Potential energy surfaces and reaction dynamics (Chap. 21D)
- Kinetic isotope effects (Chap. 21C)

**Final Exam date TBA**

**PROPER ACADEMIC CONDUCT:**

The academic code of conduct can be found in section 17.10 of the academic calendar (http://registrar.concordia.ca/calendar/pdf/sec17.pdf).

The Department of Chemistry and Biochemistry offers a seminar (CHEM 101) on the academic code of conduct, and the appropriate use of information sources which aims to clarify what practices will be considered unacceptable with regards to work submitted for grading in Chemistry and Biochemistry courses. Attendance at this seminar is **recommended** and represents a clear and fair opportunity to learn what our faculty regards as academic misconduct.

Any form of cheating, copying/plagiarism found in this course will be reported, and the appropriate sanctions applied.

Failure to take part in this learning opportunity and thus ignorance of these regulations is no excuse, and will not result in a reduced sanction in any case where academic misconduct is observed. This short seminar (1 hour) will be held numerous times (note that late-comers will not be admitted)
As space for each of the seminars is limited by the room size, please sign up to your preferred time. Sign-up sheets are available outside SP 201.01 (Departmental office).