CHEM 235

Physical Chemistry II:

Kinetics of Chemical Reactions

A. General Information

- **Course**: CHEM 235, ***Physical Chemistry: Kinetics of Chemical Reactions***, 3 credits, Fall 2021
- **Lectures**: Tuesdays 18:00 - 20:45 (13 instances). **CC 310 LOY**
- **Laboratories**: Mondays 13:30 - 17:30 & Thursdays 18:30 - 22:30. **SP S114-01 LOY**
- **Website**: https://moodle.concordia.ca/moodle/course/view.php?id=138850, CHEM 235 51 2212.

- **Instructor**: Dr. German M. Perez, Assistant Professor (LTA),
  Department of Chemistry & Biochemistry, Faculty of Arts & Science, Concordia University
  Contact info:
  - **Email**: german.perez@concordia.ca
  - **Telephone**: 514-848-2424 ext.3338
  - **Office**: Concordia University, Loyola campus, Renaud Science Complex, SP-201.08
  - **Website**: https://www.concordia.ca/artsci/chemistry/faculty.html?fpid=german-miguel-perez-quintana
  - **Office hours:** Wednesday from 16h00 -17h00.

- **Teaching Assistant**: BSc. Zahra Alinia,
  Department of Chemistry & Biochemistry, Faculty of Arts & Science, Concordia University
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  - **Office hours:** TBA.

Online material, right to privacy and intellectual property

In order to facilitate access to this course and distance-learning, if necessary, during COVID times, these classes might be recorded by the university. If you wish to ensure that your image is not recorded, speak to the instructor as soon as possible.

Note that you may not share recordings of your classes and that the instructor will only share class recordings for the purpose of course delivery and development. Any other sharing may be in violation of the law and applicable University policies and may be subject to penalties.

Content belonging to instructors shared in online courses, including, but not limited to, online lectures, course notes, lab demonstration recordings, and video recordings of classes remain the intellectual property of the instructors. It may not be distributed, published or broadcast, in whole or in part, without the express permission of the faculty member. Students are also forbidden to use their own means of recording any elements of an online class or lecture without express permission of the instructor. Any unauthorized sharing of course content may constitute a breach of the Academic Code of Conduct and/or the Code of Rights and Responsibilities. As specified in the Policy on Intellectual Property, the University does not claim any ownership of or interest in any student IP. All university members retain copyright over their work.

Laboratory exemption

Students who are repeating the course and who have passed the lab component within the last two (2) years may be eligible for a lab exemption. Applications for the exemption must be submitted to the Department by the first week of class; late applications will not be accepted. Students MUST register for the appropriate course section; students registered in any other lab/tutorial sections by the end of the first week of class will be required to complete the entire lab portion of the course. No exception will be granted.

B. Course Description

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; catalysis by enzymes and the Michaelis-Menten mechanism; free-radical reactions; photochemical reactions; experimental methods and techniques. Lectures and laboratory.

- **Prerequisite**: CHEM 234
- **Detailed course outline**:

INTRODUCTION

1. EMPIRICAL CHEMICAL KINETICS
    - 1.1. Reaction Rates, Definitions
    - 1.2. Simple Rate Laws
    - 1.3. Rate Determination and Analysis
    - 1.4. Temperature Dependence and Activation Energy
    - 1.5. Complicated Rate Equations
    - 1.6. The Steady-State Approximation

2. KINETICS OF COMPLEX REACTIONS
    - 2.1. Rate Laws of Complex Reactions
    - 2.2. Chain Reactions
    - 2.3. Polymerization
    - 2.4. Homogeneous Catalysis

3. THEORY OF REACTION RATES
    - 3.1. The Arrhenius Equation
    - 3.2. Collision Theory and Pre-Exponential Factor
    - 3.3. Transition-State Theory
    - 3.4. Reactions in Solution
    - 3.5. Unimolecular Reaction Rate Theory
    - 3.6. Potential Energy Surfaces and Reaction Dynamics
    - 3.7. Kinetic Isotope Effects

C. Objectives

In this course, students will learn how to measure chemical kinetics, interpret kinetics of complex reactions in terms of rate laws, and compute reaction rates from theory. All concepts related to the course material will be covered in the lectures. The student is expected to read the appropriate sections of the textbook referred to by the instructor.

D. Course Materials

- Textbook: *Physical Chemistry*, 8th. edition, Atkins & de Paula, Freeman & Company (2006). The chapters discussed in the course are **available for download from the library via links on Moodle**.
- A *Student Solutions Manual to Accompany Physical Chemistry 8th. Edition* is available in the library.
- The lab manual and instructions for the five experiments is available on Moodle website.

E. Academic Assessment

- Homework (40%) – 5 time-limited assignments in weeks 3, 5, 7, 9 and 11.
- Laboratory reports (25%) – 5 experiments
- Lab exam (5%), time-limited
- Final exam (30%), time-limited
- Grading scale:

A+	90.0 - 100 %
A	85.0 - 89.9 %
A-	80.0 - 84.9 %
B+	76.7 - 79.9 %
B	73.4 - 76.6 %
B-	70.0 - 73.3 %
C+	66.7 - 69.9 %
C	63.4 - 66.6 %
C-	60.0 - 63.3 %
D+	56.7 - 59.9 %
D	53.4 - 56.7 %
D-	50.0 - 53.3 %
F	0 - 50.0 %

- Passing grades of 60% in the lab (laboratory reports and lab exam) and 50% in the theory (assignments and final exam) components of the course must be both obtained in order to pass the course. Final grades will not be rounded up or down.
- A student unable to hand in assignments/lab reports or to complete the lab/final exam by the due date with a valid excuse must produce appropriate documentation (from e.g. a doctor or an employer) to the instructor within one week of the missed deadline. The Department determines the validity of the excuse. If the excuse is deemed not valid, the student will receive a zero mark for the work not completed in time.

F. Rights and Responsibilities

All individuals participating in courses are expected to be professional and constructive throughout the course, including in their communications.
Concordia students are subject to the Code of Rights and Responsibilities which applies both when students are physically and virtually engaged in any University activity, including classes, seminars, meetings, etc. Students engaged in university activities must respect this Code when engaging with any members of the Concordia community, including faculty, staff, and students, whether such interactions are verbal or in writing, face to face or online/virtual. Failing to comply with the Code may result in charges and sanctions, as outlined in the Code.
The most common offense under the Academic Code of Conduct is plagiarism which the Code defines as **"the presentation of the work of another person as one's own or without proper acknowledgement."**
This could be material copied word for word from books, journals, internet sites, professor's course notes, etc. It could be material that is paraphrased but closely resembles the original source. It could be the work of a fellow student, for example, an answer on a quiz, data for a lab report, a paper or assignment completed by another student. It might be a paper purchased through one of the many available sources. Plagiarism does not refer to words alone - it can also refer to copying images, graphs, tables, and ideas. "Presentation" is not limited to written work. It also includes oral presentations, computer assignments and artistic works. Finally, if you translate the work of another person into French or English and do not cite the source, this is also plagiarism.
Please consult https://www.concordia.ca/conduct/academic-integrity.html for further information.

Mandatory Quiz and Seminar
CHEM 101: The Academic Code of Conduct: Ethical Use of Information Sources
As part of this course, you are **required** to i) attend a Chemistry and Biochemistry Departmental Seminar on the academic conduct code and the appropriate use of information sources and ii) pass the online quiz associated with this seminar (the passing grade for the quiz is 100%). (**Note**: This is **not** the University's quiz you may have been asked to take when you first registered and logged into the myConcordia portal; the one you must take is similar, but graded by the Department of Chemistry and Biochemistry, and you do not have access to it until after you have attended the seminar.) The aim of this seminar is to clarify the academic conduct code in terms of what practices will be considered unacceptable with regards to work submitted for grading in Chemistry and Biochemistry courses. **You are only exempt from repeating the seminar and the quiz if you have done both in Summer 2016 or more recently**, * otherwise you are required to repeat both this term. This short seminar (1 hour) will be held at the following times (note that you will not be given credit if you join too late and/or leave too early):

Date (Fall 2021)	Time	Mode
Wednesday, September 22nd	21:00 - 22:00	zoom - online
Thursday, September 23rd	21:00 - 22:00	zoom - online
Monday, September 27th	19:00 - 20:00	zoom - online

As space for each of the Zoom seminars is limited, please register for your preferred evening slot: you will receive an email invitation to do so. Then do not forget to attend that seminar slot!
Attendance at the Zoom seminar will be taken.
If you do not complete this course requirement, your final grade for the course may be lowered by one full letter grade with an incomplete (INC) notation until such time as this requirement is completed. Please refer to the undergraduate calendar (section 16.3.5) for details on the removal of an incomplete notation.

* You are exempt if you can locate your ID in the pdf file located on the Departmental web site (http://www.concordia.ca/content/dam/artsci/chemistry/docs/Compliance- list.pdf) and if there is no entry in the "quiz" column for you.

Plagiarism and Other Forms of Academic Misconduct
The Academic Code of Conduct can be found in section 17.10 of the academic calendar (http://www.concordia.ca/academics/undergraduate/calendar/current/17-10.html).
Any form of unauthorized collaboration, cheating, copying or plagiarism found in this course will be reported and the appropriate sanctions applied. The mandatory seminar is a clear and fair opportunity to learn what our faculty regards as academic misconduct. 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.

In the event of extraordinary circumstances and pursuant to the Academic Regulations the University may modify the delivery, content, structure, forum, location and/or evaluation scheme of this course. In the event of such extraordinary circumstances, students will be informed of the changes.