

# Chem 2214B Course Outline (2025 Winter )

## Physical Chemistry for Life Sciences

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### *Course Description & Prerequisite Requirements*

**Calendar Description:** Basic thermodynamic concepts and relations and illustration of their relevance and applications to biological systems. In addition, some aspects of electrochemistry, and spectroscopic techniques will be introduced, again with emphasis on the role of these techniques in understanding the structure and nature of important biological molecules.

The **prerequisites** are (Chemistry 1301A/B and Chemistry 1302A/B) or (Chemistry 1301A/B and Integrated Science 1001X); 0.5 course from: Calculus 1000A/B or 1500A/B; and 0.5 course from: Applied Mathematics 1201A/B, Calculus 1301A/B, 1501A/B, Mathematics 1225A/B, 1229A/B, or 1600A/B. **Anti-requisites** are Chemistry 2374A, 2384B.

Unless you have either the prerequisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites. **Note:** Students repeating the course must repeat the lab component. There are no exemptions.

### *Instructor and Lecture Information*

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Section	Time	Room	Instructor	Office	Email
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#### **Lectures**

Lectures will be delivered in-person at scheduled lecture time and classroom. This arrangement is subject to change following Western updated regulations.

#### **Office hours**

I will host office hours at selected time by announcement. Other need for office hours will be by appointment (email).

#### **Email policy**

For your own protection, students must use only their @uwo.ca email account for all inquiries related to this course. It is very easy for anyone to set up a web-mail account with anyone else's name in the email address. All emails coming from non-uwo servers will be ignored. All emails coming to the instructor should include "**Chem 2214**" in the subject line to avoid delay in response.

# Course Materials

Lab Manual (Required): 2024-2025 Chemistry 2214 Laboratory Manual (To be purchased from Campus eBookstore. Visit [www.bookstore.uwo.ca](http://www.bookstore.uwo.ca); Cost: \$24.00. )

Text (Optional): *Physical Chemistry – Principles and Applications in Biological Sciences*, Tinoco (5th edition, Pearson). Cost: ~\$107 (used); ~\$190 (new) on Amazon.ca. Early editions are also acceptable.

Useful reference: *Elements of Physical Chemistry*, P. Atkins and J. de Paula (6th Ed. by W. H. Freeman & Company, or 5th Ed. by Oxford University Press) Cost: ~\$25 on Amazon.ca

Web-Enabled Device: A phone, tablet, laptop or other web-enabled device will be used for the iClicker component during class.

## Tentative Lecture Topics

Topics	Chapter in Tinoco
1. Introduction	Chapter 1 and 2
2. The properties of gases Ideal gas law and van der Waals equation of state	Chapter 2
3. The first law of thermodynamics Work, heat, expression of the first law, enthalpy, internal energy Thermochemistry	Chapter 2
4. The second law of thermodynamics Entropy and Gibbs free energy	Chapter 3
5. Physical equilibria Temperature and pressure dependence of Gibbs Free energy The phase diagram	Chapter 4 and 6
6. Chemical equilibrium Relation between the equilibrium constant and $\Delta G$ Electrochemistry	Chapter 4 and 7
7. The thermodynamic description of mixtures Ideal solutions, Raoult's law, Henry's law, colligative properties	Chapter 6
8. Transport processes Diffusion and diffusion coefficient Fick's first and second laws Solvation and sedimentation	Chapter 8
9. Spectroscopy Beers' Law. UV-Visible spectroscopy and fluorescence. Infrared spectroscopy. Other spectroscopic techniques.	Chapter 13 and 14

# Lab Information

You will do labs every other week - see following schedule. All 4 labs will be in-person. Be prepared for the experiment by carefully reading the specific section of lab manual before your arrival at the lab. As the starting date of the labs approaches, more information will be given in the lectures regarding the experiments and the structure of the labs.

## Lab schedule:

Labs	Section 051 Lab Friday 9:30 AM-12:30 PM	Section 051 Lab Report Due Friday 11:55 PM
Vapour pressure	Jan 24	Jan 31
Electromotive force	Feb 7	Feb 14
Diffusion	Feb 28	Mar 7
Viscosity	Mar 14	Mar 21

All labs will be in ChB Room 110 (first floor).

Lab Coordinator:



Lab TA:



**Lab safety:** Lab coat, safety glasses, proper footwear (shoes must cover the entire foot), socks, and ankle-length pants must be worn in the lab. Also refer to the laboratory guideline in Chem 2214 lab manual.

Any student who arrives after the doors to the lab have closed, when the "TA talk" begins, is considered late and will not be permitted to do the experiment. A mark of zero will be assigned for that experiment. Students must seek approval from TAs whenever they leave the laboratory during experiments. They must return within a reasonably short period. Students leaving without approval will not be allowed to return to the lab, and will receive zero on that experiment.

Due to limited resources, students are asked to work in pairs or groups of three in the lab. However, each student is expected to learn all aspects of the experiments. Likewise, each student is expected to contribute equally with their highest level of skills and effort. In the event of unequal contributions, the TAs may require the students to work individually for the remaining of the lab. Each student must write his/her own lab report *independently* and thus may receive a mark different from that of the partner(s). Lab partners who must plot or tabulate identical data should ensure that other aspects of their graphs or tables are "individualized"; for example, use different font sizes or types for the title and axes.

# Learning Outcomes

Upon successful completion of this course, the student is expected to demonstrate the ability to:

- Describe the basic principles of thermodynamics and other selected physical chemistry topics.
- Solve problems by correctly formulating the physical/chemical processes and executing calculations.
- Conduct physical chemistry laboratory experiments efficiently and with in-depth understanding.
- Compile professional standard lab reports with critical data analysis.
- Work independently and efficiently for course work and the lab.

## Course Website

Students are responsible for checking the course OWL site (<https://westernu.brightspace.com/>) regularly for news and updates. This is the primary method by which information will be disseminated to all students in the class. The missing of critical information due to your failure to check OWL cannot be used as a basis for appeal.

## Evaluation

### Components

The overall course grade, out of 100, will be calculated as listed below. Listed next to the respective components are their maximum contributions toward the course grade.

Component	Notes	Value
Laboratory (lab reports)	4 labs, 5% each	20
Homework Assignments	4 problem sets, 5% each	20
Midterm Test	February 28, 7:00-9:00 PM	25
Final Exam	Scheduled by the Registrar	35

**Conditions required to pass the course:** Labs and test are essential components of this course. Each student must attend at least 2 of the 4 labs, submit at least 2 lab reports, obtain an average mark of at least 50% on the laboratory component, write the final exam, and obtain at least 50% on either the midterm test or the final exam. Students who fail to meet any of these requirements without academic consideration for the missed work will receive a course grade of not greater than 40%, even if the calculated grade is higher. A student who, for medical or compassionate reasons, is unable to attend the requirement minimum number of labs and submit the required minimum number of lab reports, and who wishes to complete the missed work, will need to apply for Incomplete Standing (a grade of INC) by submitting a written

request to the Dean of the Faculty of Registration. If Incomplete Standing is granted, the student will be able to complete the missed items the next time the course is offered. A student who is unable to write the Final Exam must apply for permission to write a Special Final Examination (SPC Exam).

**Late submission penalty:** Students who are late in submission of homework assignment or lab report without approved academic consideration are subject to late penalty. The penalty for a late homework assignment is 25% per day late for up to two days; after third day, the assignment is no longer acceptable and you will receive zero for that assignment. The penalty for a late lab report is 10% per day for up to 5 days; after 6<sup>th</sup> day, the report is no longer acceptable and you will receive zero for that lab.

**Bonus marks:** up to 2 bonus marks will be awarded towards the overall course mark via participation of in-class iClicker activities by responding to questions, regardless correctly or incorrectly, with the following schedule:

- 1) 2 marks are awarded if you responded to  $\geq 75\%$  of the questions of the entire semester;
- 2) 1 mark is awarded if you responded to 50%-75% of the questions of the entire semester;
- 3) No mark is awarded if you responded to  $<50\%$  of the questions of the entire semester;
- 4) The bonus marks will only be added if you have achieved a passing course grade without any bonus marks. That is, the bonus marks can be applied to neither lab nor test components for passing purpose.

## Equal Opportunity and Evaluation Policy

We are here to help you achieve your goals. We want you to do well in the course. We were, at one time, students ourselves, so we understand the importance of course grades and the hard work that you will invest into this course.

Most importantly, we must be fair. The university is committed to academic integrity and has high ethical and moral standards. All students will be treated equally and evaluated using the criteria presented in this course outline and their respective weights. The evaluation criteria are based strictly on actual achievement, not on effort or how hard the student tried. Claims of an excellent academic history, of attendance in the course components, or of personal issues (family, relationship, financial, etc.) cannot be used to justify a higher grade in the course because they are not criteria for evaluation. There is no extra work available for extra credit or to “make up” another grade. We do not offer any extra assignments, essays, experiments, or other work of any kind to any student.

The requirement for a higher grade in order to, for example, maintain a scholarship, enter a program, or obtain a higher GPA for various reasons, is not a justifiable reason for increasing your grade. If we increased or “bumped” your grade (i.e. gave you a grade that you did not legitimately earn), it would be unfair to the other students and also a great disservice to the scholarships and programs who are evaluating all students on the basis of their grades. Please do not request for a grade increase.

# *Student Absences and Missed Course Components*

**Student absences and missed work.** Students who are unable to meet their academic responsibilities due to medical or compassionate reasons may submit a request for academic consideration. For each missed piece of work, *regardless of its weight in the total course grade*, you must apply for such consideration by providing valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration.

**Accommodation for students with disabilities.** Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. In cases where a student misses a piece of work for reasons related to the disability on file with Accessible Education, the student should request accommodation by contacting Accessible Education instead of the Academic Counselling Office.

If you are a Science student, the Academic Counselling Office of the Faculty of Science is located in NCB 280, and can be contacted at 519-661-3040 or through the ticketing system on their website: <https://www.uwo.ca/sci/counselling/>

If you are a student from another faculty, please contact the Academic Counselling Office of your Faculty.

Students should note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences must be submitted to the Academic Counselling unit or Dean's Office of your home faculty or affiliated college.**

For more information, please consult Western's policy on academic consideration for illness: [https://westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page\\_135](https://westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_135)

For the Student Medical Certificate (SMC), please see: [http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf)

**Religious Accommodation:** When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at <https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

**Missed lab.** If you missed a scheduled lab session with a valid reason, obtain academic consideration. Upon the approval of the academic consideration, the missed lab will be **excused**. It is not possible to make up a missed lab. If you attended a lab but missed the deadline to submit the lab report for a valid reason, also obtain academic consideration. Upon the approval of the academic consideration, proper accommodation will be made by allowing for extension

or the entire lab being excused. If a lab is excused, the lab mark will be based on the remaining labs.

**Missed homework assignment.** If you cannot submit your homework assignment by the due time for a valid reason, obtain academic consideration. Upon the approval of the academic consideration, that particular assignment will be excused, and your homework assignment mark will be based on the remaining assignments.

**Missed midterm test.** If you miss the midterm test for any reason, no academic consideration is needed. The weight of the midterm will be automatically transferred to the final exam. **There is no makeup midterm.**

**Missed final exam.** If you miss the Final Exam, obtain academic consideration. Upon the approval of the academic consideration, you will write the Special Exam (the name given by the university to a makeup Final Exam) in May of 2024.

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (see [http://www.registrar.uwo.ca/examinations/exam\\_schedule.html](http://www.registrar.uwo.ca/examinations/exam_schedule.html)).

If you miss the **Special Exam**, you will need to obtain academic consideration again. If it is granted, the date of the next Special Exam will normally be the scheduled date for the Final Exam the next time this course is offered. The maximum course load for the term in which the Special Exam is granted will be reduced accordingly. Please see the section on Special Exams in the Academic Calendar for details:

[https://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=5&SelectedCalendar=Live&ArchiveID=#Page\\_65](https://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=5&SelectedCalendar=Live&ArchiveID=#Page_65).

## *Academic Policies and Legalities*

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy, [https://www.uwo.ca/univsec/pdf/policies\\_procedures/section1/mapp113.pdf](https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf), the centrally administered e-mail account provided to students will be considered the individual’s official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

It is university policy that a regularly scheduled class (lecture, lab, or tutorial) takes precedence over tests and exams. Therefore, if another course schedules a test or exam that takes place during your lab or tutorial, the instructor for that course must accommodate you.

No electronic devices (e.g., phones, iPods, etc.) may be in your possession during tests and exams, even for timekeeping purposes. They may not be at your test/exam desk or in your pocket. Any student found in possession of these prohibited devices will receive a mark of zero

on the test or exam. Only non-programmable scientific calculators are allowed in midterm and final examinations.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at this website: [http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf).

## *Support Services*

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>.

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The university's policy on Accommodation for Students with Disabilities can be found here:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/Academic%20Accommodation\\_disabilities.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic%20Accommodation_disabilities.pdf)

The university's policy on Accommodation for Religious Holidays can be found here: [http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_religious.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf)

Learning-skills professionals at Learning Development & Success (<https://www.uwo.ca/sdc/learning>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling. Online resources are available.

Students who are in emotional/mental distress should refer to Mental Health@Western (<https://www.uwo.ca/health/>) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at [https://www.uwo.ca/health/student\\_support/survivor\\_support/get-help.html](https://www.uwo.ca/health/student_support/survivor_support/get-help.html). To connect with a case manager or set up an appointment, please contact [support@uwo.ca](mailto:support@uwo.ca).

Additional student-run support services are offered by the USC, <http://westernusc.ca/your-services/>.