

WESTERN UNIVERSITY  
DEPARTMENT OF CHEMISTRY

CHEM 274A t Physical Chemistry Thermodynamics & Kinetics

COURSE OUTLINE 274

Welcome to CHEM 274A!

## 1. Course Information

Lecture hours:

Location:

Labs: Thursday 2:30 to 5:30 pm and Friday 2:30 to 3:30 pm See separate document with detailed lab schedule on experiments and location. The labs start on the week of September 16. The

Delivery Mode In-person

Brief course description Foundations of classical physical chemistry. Topics include chemical thermodynamics, quantitative description of phase transitions and chemical equilibrium, chemical kinetics, reaction dynamics, diffusion and transport processes.

Prerequisites Chemistry 1301A/B, Chemistry 1302A/B, 0.5 course from Calculus 1000 A/B, Calculus 1500A/B, Numerical and Mathematical Methods 1412A/B, and any other 0.5 course at the 1000 level from Calculus, Applied Mathematics, Mathematics, or Numerical and Mathematical Methods. Integrated Science 1001X may be used as a substitute for the combination of Chemistry 1302A/B and Calculus 1301A/B

Anti-requisites



### 3. Course Syllabus

#### Learning Outcomes

1. Knowledge of Scientific Principles Be able to describe the fundamental scientific principles of thermodynamics and kinetics and apply these principles in assignments, discussions on/off and new problems
2. Knowledge of Methods Obtain problem-solving skills in physical chemistry by solving assignments, quizzes and on/off-line discussions and lecture material.
3. Application of Knowledge Be able to apply the knowledge in order to predict and rationalize the physical and chemical properties of systems, the direction in which chemical and physical processes proceed, transport properties of materials and rate laws
4. Communication Be able to prepare logical and concise written reports via training in quizzes and assignments.
5. Awareness of Knowledge Limits Recognize assumptions and limitations in the scientific models and their possible impact on the results by training on case studies, lecture assignments, quizzes.
6. Autonomy and Professional Capacity (i) Be able to work productively and collaboratively as a team member by solving problems with other students (ii) Evaluate the potential impact thermodynamics and kinetics may have in society, health and environment.

#### Course website

All course material will be posted <https://westernu.brightspace.com/>  
Students are responsible for checking the course OWBrightspace site (<https://westernu.brightspace.com/>) regularly for news and updates. This is



- The assignment will be released at the beginning of the lectures that are covered; thus, the problems are to be done gradually and be completed as the material progresses.
- The assignments may be solved in collaboration with your peers. Usage of any AI software to provide solutions is NOT RECOMMENDED. It is important to understand the solution weaknesses in understanding of the solutions will manifest in the quizzes, midterms and final exams.
- For the date of assignment release and the material covered (tentative) please see table that follows.

6 Quizzes out of which the **best 4 Quiz marks** will be counted toward the course grade. 4X2.5% each = 10% of the course grade.

To receive the bonus of having **the best 4 quiz marks** counted toward the course grade **the student should write at least 5 quizzes**

#### What is the content of the quiz and how is to be done?

- Each quiz may have true/false questions and/or multiple choice questions or problems and/or problems to solve explicitly in OWL Brightspace. The questions may or may not be like that of the corresponding assignment, but the examinable material is the same.
- Each quiz corresponds to the material of one assignment
- The quizzes are to be done individually. Collaborations with others, GPT or AI usage, searching for the answers online, or any other means of obtaining the answer apart from individual effort are not allowed.
- The quiz is open book. During the quiz, you can use your own notes and/or lecture notes and/or textbooks

- The instructor reserves the right to randomize or modify the questions of the quiz delivered to each student.
- The quiz can be submitted multiple times **OWL** Only the grade of the final submission will be recorded, NOT the highest grade of all the attempts.
- At the end of the examination the answers of each student will be

#### Where?

- The quizzes will be done **online** on **OWL** and they last for 20 min. The 20 min period will be preset on **OWL**

#### When?

- A student may start the quiz any time once the quiz opens. The time of the quiz will terminate at the beginning of the 20th minute from the starting time. For example, if one starts the quiz at 10:5 am the time will end at the beginning of the 5th minute at 11:25 am, NOT WHEN THE 2th minute is completed (this is how **OWL** manages the time) It is strongly recommended to do the quiz during the work hours so you can be helped by **OWL Brightspace** support if you have any technical issues The instructor and TA cannot help with **OWL Brightspace** technical problems.

#### Missed quiz?

There are 6 quizzes in the course. The quizzes are set in certain days to provide self • • • u v š } ( š Z • š μ before midterms and final. It is noted that the quizzes are open for more than one days they have built-in flexibility. If there is a valid reason (e.g. illness, other serious circumstances, varsity competition) for missing a quiz the instructor may offer accommodation U • Œ ] ] v ^ } u u } š ] } v v • • Section. Please contact the TA to report that you miss the quiz the information is entered to the gradebook.

Mid-terms: 17% each X 2 = 34% of the course grade.

- The duration of each midterm is 45 min. and takes place **IN-CLASS**
- The dates and the examinable material of the midterms are presented in the table that follows.
- Allowed electronic devices during the midterms and final: Only basic scientific non-programmable calculators are permitted on tests and exams. All other electronic devices (cell phones, laptops, tablets, cameras, etc.) are prohibited. Students found in possession of

prohibited devices will receive a mark of ZERO for the entire test or exam.

- Aid-sheet In all the exams an aid-sheet will be provided by the instructor. The aid-sheet is posted on OWL Brightspace at the beginning of the course.

Final 40 % of the course grade.

- The duration of the final exam will be 3 hours and the date will be
- The exams cumulative on the entire course material
- Allowed electronic devices during the midterms and final Only basic scientific non-programmable calculators are permitted on tests and exams. All other electronic devices (cell phones, laptops, tablets, cameras, etc.) are prohibited. Students found in possession of prohibited devices will receive a mark of ZERO for the entire test or exam.
- Aid-sheet In all the exams an aid-sheet will be provided by the instructor. The aid-sheet is posted on OWL Brightspace at the beginning of the course.

To pass the course you must obtain a minimum of 50% in the average of the quizzes, lab reports, midterms and final. Obtaining a good average grade in the quizzes, midterms & lab reports is not sufficient to pass the course. The final exam MUST be written.

The quizzes, labs and exams are essential components of the course. The minimal number of assessments to pass the course are the following

- at least one midterm test;
- perform the experiments and provide lab reports for 3 out of the 4 labs
- write the final exam

A student who fails to submit the required minimum number of these assessments and is granted academic consideration will have to apply for a grade of incomplete (INC) at the Dean's Office and submit them the next time the course is offered. Students who submit fewer than the minimum required number of assessments and do not obtain an INC will receive a course grade of greater than 40%, even









	UNIT 2: FIRST LAW AND ENTHALPY		
Friday, September 20	work, different types of work, volume change work, surface tension work heat internal energy molecular interpretation of internal energy	APK Focus 2, pp.33-38	QUIZ 1 Covers the same material as Assignment 1, i.e. Sept. 9-Sept. 18, inclusive  The quiz opens Sept. 20 00:01 am at Monday, Sept. 23, 11:55 pm
Monday, September 23	Heat and work are not state functions First law of thermodynamics Reversible vs irreversible processes	APK Focus 2, pp.38-43	Assignment 2 is released it covers material from Sept. 20-Sept 27, inclusive
Wednesday, September 25	Estimating work, heat internal energy for Isothermal and Isobaric processes Maximum work	APK Focus 2 38-43	
Friday, September 27	Heat Capacity Enthalpy Thermochemistry	APK: Focus, pp. 41-57	Solutions to Assignment 2 are released
Monday, September 30	National Day for Truth and Reconciliation (observed at Western). No classes		



from Sept.9  
to Sept.  
27th,  
inclusive

			Assignment 4 released. It covers Oct. 21-Oct. 30 inclusive.
Friday, October 25	Problems solving Clausius Clapeyron equation		
Monday, October 28	The thermodynamic description of mixtures Partial molar quantities Chemical potential Chemical potential of an ideal gas and mixture of ideal gases  Chemical potential of liquids	APK: Focus, pp. 143-151	
Wednesday, October 30	Colligative properties $\Delta T_f$ Lowering of the freezing point and elevation of the boiling point Osmotic pressure	APK: Focus, pp. 152-162; 162-164	Solutions of Assignment 4 are released.
Friday, November 1	Activity and Activity coefficients	APK: Focus, pp. 186-190	<b>QUIZ 4</b> Covers the same material as Assignment 4, i.e. Oct.

<p>Monday, November 4</p>	<p>Chemical Equilibrium Relation of Equilibrium constant and change in free energy of the reaction</p>	<p>APK: Focus, pp. 206-209</p>	<p>21-Oct. 30 inclusive</p> <p>The quiz is open Nov 1, 00:01 am to Nov. 4, 11:55 pm</p> <p>Assignment 5 is released. it covers material</p>
-------------------------------	--	------------------------------------	---

	Determination of equilibrium constants		Time 4:00 pm. Location: TBA.
UNIT 5: CHEMICAL KINETICS			
Wednesday, November 3	Experimental methods in chemical kinetics Rate laws and rate constants	APK: Focus 17, pp. 269-276	
Friday, November 5	Integrated rate law Arrhenius equation	APK: Focus 17, pp. 277-282; 287-291	Solutions of Assignment 5 are released.



	UNIT 6:TRANSPORT PROCESSES		

Friday,  
November 2

Diffusion

Date to be  
determined  
by the  
registrar

All Academic Consideration requests must include supporting documentation; however, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make Academic Consideration requests without supporting documentation in this course. However, the following assessments are excluded from this and therefore always require formal supporting documentation

Examinations scheduled during official examination periods (Defined by policy)

Practical laboratory (Defined by policy)

Midterms

When a student mistakenly submits their one allowed Academic Consideration request without supporting documentation for the assessments listed above or those in the Coursework with Assessment Flexibility section below, the request cannot be recalled and reapplied. This privilege is forfeited.

## Coursework with Assessment Flexibility

### Flexible Completion

Quizzes. This course has 6 quizzes, out of which 4 quizzes with the highest marks are counted towards your final grade. If you miss any of the two quizzes, there are no consequences in the grades and no Academic Consideration is needed since only 4 quizzes out of the 6 will count toward the final grade. If the student still wants to write the missed quiz, Academic Consideration may be requested. In this case a make-up quiz may be written only if this is before the solutions of the specific quiz is released to the students.

Should extenuating circumstances arise, students may request Academic Consideration for the third, fourth, fifth, or sixth missed quiz and the weight of the missed quizzes will be reweighted to the final exam

### Deadline with a No Late Penalty Period

Lab reports Students are expected to submit each of the reports by the deadline listed in the lab schedule. Should extenuating circumstances arise, students do not need to request Academic Consideration and they are permitted to submit their lab report up to 48 hours past the deadline without a late penalty. Should students submit their assessment beyond 48 hours past the deadline, a late penalty of 8% per day will be applied. Academic Consideration requests may be granted only for extenuating circumstances that started before the deadline and lasted longer than the No Late Penalty Period (48 hours).



Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at

[http://academicsupport.uwo.ca/accessible\\_education/index.html](http://academicsupport.uwo.ca/accessible_education/index.html)

if you have any questions regarding accommodations.





## 8. Tips for studyingfor the course

Before the class





