



COURSE OUTLINE

1. **Course:** CHEM 371, Physical Chemistry: Thermodynamics Chemistry - Winter 2024

Coordinator(s)

Name	Email	Phone	Office	Hours
Dr. Peter Kusalik	pkusalik@ucalgary.ca (email preferred)		SB 331	see drop-in help times; by appointment otherwise

Section(s)

Lecture 01 : MWF 14:00 - 14:50 in ENA 103

Instructor	Email	Phone	Office	Hours
Dr. Peter Kusalik	pkusalik@ucalgary.ca (email preferred)		SB 331	see drop-in help times; by appointment otherwise

Email: email inquiries must be sent from University of Calgary accounts and the subject line must start with CHEM 371. Responses to email inquiries about the course can be expected within 24 hours, except on weekends and holidays.

To account for any necessary transition to remote learning for the current semester, courses with in-person lectures, labs, or tutorials may be shifted to remote delivery for a certain period of time. In addition, adjustments may be made to the modality and format of assessments and deadlines, as well as to other course components and/or requirements, so that all coursework tasks are in line with the necessary and evolving health precautions for all involved (students and staff).

In Person Delivery Details:

Lectures:

All lectures will be in-person during the scheduled MWF 2:00 - 2:50 PM class times. Attendance is expected and these lectures will not be recorded. Some *supplementary* videos will be on D2L. Further details about lectures (structure and content) will be provided during the first class meeting and on D2L.

Lecture quizzes will occur during lectures and will typically be announced at least one class in advance. Students should be in attendance to participate in lecture quizzes. These quizzes will usually consist of a few short questions and will focus primarily on understanding of the most recent lecture material and will help to build conceptual problem solving skills. Experience with lecture quizzes will be critical preparation for examinations. Lecture quizzes will be hosted on Top Hat, where question scoring will include a participation component. Grading for lecture quizzes will include a small buffer and there will be at least two bonus quizzes to accommodate for missed quizzes. Further details about these quizzes and accessing Top Hat will be provided during the first class meeting and on D2L.

Labs:

All labs will be delivered in-person, and students are required to attend their scheduled lab section. The lab component is integral to the design of the course and its learning outcomes. Prior to their scheduled lab students must read the appropriate section of the lab manual, and will frequently need to watch a short lab video and complete a pre-lab quiz on D2L. Further details about labs will be provided during the first class meeting, on D2L, and in the lab manual (posted on D2L).

There will be limited availability of students to make up labs (*only* during the same week), and students missing their scheduled lab must contact their lab TA **promptly**. Accommodations for missed labs will be made on a case-by-case basis (also see sections 3 & 4).

Tutorials:

All tutorials will be delivered in-person, and students are required to attend their scheduled tutorial section. The tutorial component is integral to the design of the course and its learning outcomes. Tutorials will generally operate on a biweekly cycle, where during the first week tutorial students will work in small groups to review their attempts at solving the assigned exercise problems, and during the second week students will write a tutorial quiz based on these problems. Tutorials will primarily focus on building understanding of course material and problem solving skills, which will be critical preparation for examinations. Further details about tutorials will be provided during the first class meeting and on D2L.

There will be limited availability of students to make up tutorials (*only* during the same cycle week), and students missing their scheduled tutorial must contact the course instructor **promptly**. Accommodations for missed tutorials will be made on a case-by-case basis (also see sections 3 & 4).

Course Site:

Note: Students must use their U of C account for all course correspondence.

In addition to lectures, D2L will be a primary information source for the course. A course calendar will be maintained on D2L for course activities, including labs and tutorials.

Equity Diversity & Inclusion:

The University of Calgary is committed to creating an equitable, diverse and inclusive campus, and condemns harm and discrimination of any form. We value all persons regardless of their race, gender, ethnicity, age, LGBTQIA2S+ identity and expression, disability, religion, spirituality, and socioeconomic status. The Faculty of Science strives to extend these values in every aspect of our courses, research, and teachings to better promote academic excellence and foster belonging for all.

The Chemistry EDI Committee acknowledges there are persistent barriers that prevent such accessibility and hinder our progress towards EDI. Our representatives (faculty, postdocs, graduate and undergraduate students) are committed to addressing any concerns and work towards proactive solutions that enact necessary change within the department. To submit anonymous questions, comments or concerns regarding EDI related issues, please reach out to our Associate Head EDI, Belinda Heyne (bjmheyne@ucalgary.ca)

2. Requisites:

See section [3.5.C](#) in the Faculty of Science section of the online Calendar.

Prerequisite(s):

Chemistry 201 or 211; and 203 or 213; Physics 223 or admission to a Major program offered by the Department of Physics and Astronomy and 6 units of Physics; and Mathematics 267 or 277.

Antirequisite(s):

Credit for Chemistry 371 and any of Physics 347, 349, or 447 will not be allowed.

3. Grading:

The University policy on grading and related matters is described in [F.1](#) and [F.2](#) of the online University Calendar.

In determining the overall grade in the course the following weights will be used:

Course Component	Weight	Due Date (duration for exams)	Modality for exams	Location for exams
Laboratory (8 labs) ¹	25%	Ongoing		
Tutorials and Lecture Quizzes ²	15%	Ongoing		
Midterm ³	20%	Mar 06 2024 at 07:00 pm (2 Hours)	in-person	TBD
Registrar Scheduled Final Exam	40%	Will be available when the final exam schedule is released by the Registrar	in person	Will be available when the final exam schedule is released by the Registrar

¹ details of the lab schedule can be found in the lab manual available on D2L

² There will be 4 tutorial cycles during the term. The lecture quiz score can be used to replace a student's lowest (non-zero) tutorial quiz score. See also section 13.

³ note that there will not be a make-up or deferred midterm (see also section 4)

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

The conversion between a percentage grade and letter grade is as follows.

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum % Required	93 %	88 %	83 %	78%	73%	68 %	64 %	60%	55%	50 %	45 %

This course will have a Registrar Scheduled Final exam that will be delivered in-person and on campus. [The Final Examination Schedule](#) will be published by the Registrar's Office approximately one month after the start of the term. The final exam for this course will be designed to be completed within 3 hours.

Notes:

Students will be expected at every stage to understand the material covered in all components of the course. The midterm and

final exams are comprehensive, examining all material taught (in lectures, labs and tutorials) until the date of the respective exam.

All submitted work must be a student's original work or a grade of zero will be awarded.

In order to obtain a grade of C- or higher (necessary to satisfy the prerequisite requirements for further Chemistry courses), a student must meet the following requirements: (1) achieve a minimum 50% in the laboratory and have completed a minimum of 6 labs, and (2) achieve a minimum 50% weighted average on the Midterm and Final examinations. If conditions (1) and (2) are not both satisfied, then the maximum course letter grade a student can obtain in CHEM 371 is a D+.

It is will not be possible to alter the course component weightings for individual students.

The University of Calgary offers a [flexible grade option](#), Credit Granted (CG) to support student's breadth of learning and student wellness. Faculty units may have additional requirements or restrictions for the use of the CG grade at the faculty, degree or program level. To see the full list of Faculty of Science courses where CG is not eligible, please visit the following website: <https://science.ucalgary.ca/current-students/undergraduate/program-advising/flexible-grading-option-cg-grade>

4. Missed Components Of Term Work:

In the event that a student legitimately fails to submit any online or in-person assessment on time (e.g. due to illness, domestic affliction, etc...), please contact the course coordinator, or the course instructor if this course does not have a coordinator to arrange for a re-adjustment of a submission date, or possible exemption and reweighing of components. Absences not reported within 48 hours will not be accommodated. Students may be asked to provide supporting documentation ([Section M.1](#)) for an excused absence, See [FAQ](#).

If an excused absence is approved, options for how the missed assessment is dealt with is at the discretion of the coordinator or course instructor. Some options such as an exemption and pro-rating among the components of the course may not be a viable option based on the design of this course.

Any absences **must** be reported promptly reported, particularly if the student would like option for a make-up lab or tutorial.

If a student has missed a lab or tutorial for legitimate reasons and the absence is approved, the student may be allowed to complete the lab or tutorial at another time if this can be reasonably arranged, or if this can not be arranged the weights of the remaining labs or tutorials may be adjusted. These options are at the discretion of the coordinator. It should be note that students must complete at least 6 labs (see section 3). If students miss more than 1 tutorial quiz, the corresponding weight of the additional missed tutorial quiz(zes) will transfer to the final exam.

Absences due to activities in other courses (e.g. exams) will generally not be approved.

If an absence is not approved, the contribution of that specific component item in the final course grade will be zero.

Students who miss the midterm exam and have their absence approved will have the corresponding percentage weight transferred to the final exam.

5. Scheduled Out-of-Class Activities:

The following out of class activities are scheduled for this course.

Activity	Location	Date and Time	Duration
Midterm Exam	On Campus, Room TBD	Wednesday, March 6, 2024 at 7:00 pm	2 Hours

REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY. If you have a conflict with the out-of-class-time-activity, please contact your course coordinator/instructor no later than **14 days prior** to the date of the out-of-class activity so that alternative arrangements may be made.

6. Course Materials:

Recommended Textbook(s):

Thomas Engel and Philip Reid, *Physical Chemistry, 4th Edition*: Pearson.

Required: Chemistry 371 Laboratory Manual (available online from the course website on D2L)

Required: Excel computer software for analysis of lab data (available free to University of Calgary students)

Students should arrange access to Top Hat for lecture quizzes. Top Hat is free for University of Calgary students. Further details will be provided on the first day of class and on D2L.

Suggested practice resources :

Mastering Chemistry – available through the textbook publisher website. Provides additional practice for students on course related material. Further details will be provided on the first day of class and on D2L.

Additional textbook resources can be found on D2L under My Tools / Reading List.

In order to successfully engage in their learning experiences at the University of Calgary, students taking online, remote and blended courses are required to have reliable access to the following technology:

- A computer with a supported operating system, as well as the latest security, and malware updates;
- A current and updated web browser;
- Webcam/Camera (built-in or external);
- Microphone and speaker (built-in or external), or headset with microphone;
- Current antivirus and/or firewall software enabled;
- Stable internet connection.

For more information please refer to the UofC [ELearning](#) online website.

7. Examination Policy:

All examinations and tutorial quizzes will be closed book and no aids are allowed. Only non-programmable scientific calculators are permitted for use during these course components. If in doubt, check your calculator with your instructor prior to the exam.

Students requiring accommodation for a disability or medical condition must be registered with Student Accessibility Services (see Section 12(e) below) providing at least 7-days advance notice to arrange for the booking. They must also identify themselves to the instructor as soon as possible, and no later than 7 days before any assessment for which they are seeking accommodation.

Students should also read the Calendar, [Section G](#), on Examinations.

8. Approved Mandatory And Optional Course Supplemental Fees:

There are no mandatory or optional course supplemental fees for this course.

9. Writing Across The Curriculum Statement:

For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of the work. See also Section [E.2](#) of the University Calendar.

In this course, the quality of the student's writing in laboratory reports and in written responses for appropriate quiz and exam questions will be a factor in their evaluation.

10. Human Studies Statement:

Students will not participate as subjects or researchers in human studies.

See also [Section E.5](#) of the University Calendar.

11. Reappraisal Of Grades:

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See [Section I.3](#) of the University Calendar.

- a. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **ten business days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall submit the Reappraisal of Graded Term work [form](#) to the department in which the course is offered within 2 business days of receiving the decision from the instructor. The Department will arrange for a reappraisal of the work within the next ten business days. The reappraisal will only be considered if the student provides a detailed rationale that outlines where and for what reason an error is suspected. See sections [1.1](#) and [1.2](#) of the University Calendar
- b. **Final Exam:** The student shall submit the request to Enrolment Services. See [Section 1.3](#) of the University Calendar.

12. Other Important Information For Students:

- a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, [Mental Health Services Website](#)) and the Campus Mental Health Strategy website ([Mental Health](#)).
- b. **SU Wellness Services:** For more information, see their [website](#) or call [403-210-9355](#).
- c. **Sexual Violence:** The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email (svsa@ucalgary.ca) or phone at [403-220-2208](#). The complete University of Calgary policy on sexual violence can be viewed [here](#).
- d. **Student Ombuds Office:** A safe place for all students of the University of Calgary to discuss student related issues, interpersonal conflict, academic and non-academic concerns, and many other problems.
- e. **Student Union Information:** [SU contact](#), Email your SU Science Reps: science1@su.ucalgary.ca, science2@su.ucalgary.ca, science3@su.ucalgary.ca,
- f. **Academic Accommodation Policy:**

It is the student's responsibility to request academic accommodations according to the University policies and procedures listed below. The student accommodation policy can be found at: <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Student-Accommodation-Policy.pdf>

Students needing an accommodation because of a disability or medical condition should communicate this need to Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities: <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Accommodation-for-Students-with-Disabilities-Procedure.pdf>.

Students needing an accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, by filling out the [Request for Academic Accommodation Form](#) and sending it to Associate Head, Undergraduate by email ahugchem@ucalgary.ca preferably 10 business days before the due date of an assessment or scheduled absence.

- g. **Misconduct:** Academic integrity is the foundation of the development and acquisition of knowledge and is based on values of honesty, trust, responsibility, and respect. We expect members of our community to act with integrity. Research integrity, ethics, and principles of conduct are key to academic integrity. Members of our campus community are required to abide by our institutional [Code of Conduct](#) and promote academic integrity in upholding the University of Calgary's reputation of excellence. Some examples of academic misconduct include but are not limited to: posting course material to online platforms or file sharing without the course instructor's consent; submitting or presenting work as if it were the student's own work; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; borrowing experimental values from others without the instructor's approval; falsification/fabrication of experimental values in a report. Please read the following to inform yourself more on academic integrity:

[Student Handbook on Academic Integrity](#)
[Student Academic Misconduct Policy](#) and [Procedure](#)
[Faculty of Science Academic Misconduct Process](#)
[Research Integrity Policy](#)

Additional information is available on the [Student Success Centre Academic Integrity page](#)

- h. **Copyright of Course Materials:** All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students

registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of student academic or [non-academic misconduct](#), in addition to any other remedies available at law.

- i. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see [Legal Services](#) website.
- j. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction ([USRI](#)) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.

13. Laboratory and Tutorial Information

Laboratory activities will begin the week of [Jan. 15, 2024](#) (with a required introductory lab). It is mandatory that students attend their scheduled lab section. The lab manual can be found on the course D2L site and you must read the appropriate portions of this laboratory manual prior to attending any of your scheduled lab periods. Additionally, there will frequently be a lab video to watch and a pre-lab quiz to complete prior to each lab.

Intentional breakage of lab equipment will be reported to the Student Conduct Office. <https://www.ucalgary.ca/student-services/student-conduct>

Laboratory Safety Course: All undergraduate students taking chemistry laboratories are required to complete an introductory course (approx. 50 minutes) on laboratory safety. This course is presented in an online format. The Safety Course must be completed before the first laboratory experiment. Students who do not complete the safety lessons will subsequently be denied admission to the laboratories. While it will not count directly to the final grade, the material is considered to be part of the course and is therefore appropriate for inclusion into laboratory prelabs and exams. Students who have previously completed the Chemistry Safety Course at the University of Calgary in the past five years are NOT required to repeat it.

Lab exemptions. Students repeating the course within the last three years can be exempted from the Laboratory Component of the course if a grade of 75% or higher was obtained on the lab portion. Students choosing to exempt from the lab should be aware that,

- any labs previously conducted online may be significantly different from the labs in this course;
- the material covered in labs will be integrated into other course assessments;
- students will still be evaluated on other course components, including tutorials; and,
- the lab grade achieved on the previous attempt will be carried forward.

Prior to applying for an exemption, students are encouraged to connect with their course instructor or coordinator to better understand the risks and benefits in their specific course, particularly if these labs are not in the same format (online vs in-person) this semester. Instructors can tell you what access you will have (or not have) to lab materials as an exempt student, and how the lab materials may be integrated.

Applications for lab exemptions must be emailed to the Undergraduate Science Center (science.advising@ucalgary.ca) **no later than Monday January 15th, 2024**. Students who register in the course after this date should contact the USC as soon as possible if they wish to apply for an exemption.

Tutorials. Tutorial activities will begin the week of [Jan. 8, 2024](#). During the first week of each tutorial cycle students will work on and review exercise problems in small groups; for the first two cycles, there will be a second week for exercise problem review in order to help hone problem solving skills. Students will write a quiz based on these exercise problems during the subsequent week of each tutorial cycle, a total of 4 in the term. Marks will be assigned for participation (*which includes any meaningful activities directly related to the CHEM 371 exercises during tutorial and providing evidence for having meaningfully attempted the exercises*) for the first part of each cycle; details will be provided on the first day of class.

Course Outcomes:

- Demonstrate an understanding of the principles and laws of thermodynamics and their applications to chemical and physical systems and their equilibria.
- Describe phase behaviour and changes of state for both pure and mixed systems, relate these to appropriate phase diagrams, and distinguish between real and ideal behaviour.
- Explain the roles of free energy and chemical potential in chemical reactions and physical changes.
- Strengthen problem-solving skills, particularly when applying the principles and concepts of physical chemistry to appropriate systems and conditions; analyze problems and work independently.
- Set up and perform physical chemical experiments, using standard instrumentation and employing all appropriate experimental and safety best practices; collect data through a computer interface (LabView).
- Analyze and interpret experimental data, evaluate and identify trends and anomalies, identify appropriate literature sources

and assess reliability of values, and generate appropriate conclusions from an experiment.

- Strengthen team-work and scientific communication skills, including the ability to communicate clearly and effectively with people, and respecting both yourself and others.

Electronically Approved - Dec 19 2023 15:06

Department Approval

Electronically Approved - Dec 21 2023 13:25

Associate Dean's Approval