Western Science

Department of Chemistry

# Chemistry 3372G
# Instrumental Analytical Chemistry
# Course Outline

## 1. Course Information

**Course Information**

[redacted]

**Prerequisites**
Chemistry 2272F

Unless you have either the prerequisites for this course or written special permission from your Dean's Designate (Department/Program Counsellors and Science Academic Counselling) to enroll in it, you may be removed and withdrawn from this course in accordance with university policy. This may be done after the add/drop deadline of the academic term, and the course will be marked as withdrawn (WDN) on your academic record. This decision may not be appealed.

## 2. Instructor Information

[redacted]

Students must use their Western (@uwo.ca) email addresses when contacting their instructors.

Office hours are arranged by appointment either in person or over Zoom, throughout the semester.

## 3. Course Syllabus, Schedule, Delivery Mode

### Course Description

This course provides a comprehensive introduction to modern analytical techniques used for the separation, identification, and characterization of chemical species. The course emphasizes chromatographic separations, including gas chromatography, liquid chromatography, and other separation methods, and how they are coupled with analytical instrumentation for chemical identification and quantitative analysis. These contents are accompanied with laboratory experiments

that develop practical skills in instrument operation, sample preparation, data acquisition and interpretation. The course also covers several surface analysis techniques, such as X-ray photoelectron spectroscopy, scanning electron microscopy, and scanning probe microscopy, highlighting their principles, instrumentation, and applications in materials and chemical analysis.

## Course Topics

The following chapters are intended to be covered (subject to minor revision) in this course. The chapter numbers are based on the textbook by Skoog et al, 7th Edition (See Sec 4 for Course materials).

**Chromatographic Separations (Chapters 26-30)**

- Introduction to analytical separations
- Gas Chromatography
- Liquid chromatography
- Other separation techniques

**High vacuum technology**

**Mass spectrometry (Chapters 11, 20)**

- Introduction of mass spectrometry
- Mass spectrometry for element speciation (ICP-MS)
- Mass spectrometry for structure determination

**Surface analysis techniques (Chapter 21)**

- X-ray photoelectron spectroscopy
- Auger electron spectroscopy
- Scanning electron microscopy
- Scanning probe microscopy

## Learning Outcomes

By the end of this course, students will be able to:

- gain an in-depth knowledge of the functionality of modern instrumentation that is at the heart of chemical-analytical methods.
- Understand the physical basis of chromatography-based separation techniques, such as gas chromatography and liquid chromatography, and understand how the instruments perform these tasks.
- understand the physical basis of mass spectrometry and then understand how the instruments perform these tasks.
- gain knowledge on several modern morphological characterization techniques for examining microscale substances
- realize the important of surface analysis and the difference between surface and bulk chemistry structure
- provide preliminary assessment on the choice of analytical techniques upon given an analytical task
- become aware of the fundamental importance of integrity and ethics in analytical chemistry.

By a combination of classroom learning reinforced with hands-on experiential learning using modern instrumentation in the laboratory and practices of experimental results dissemination in the forms of

analytical report and scientific manuscripts, students will become well equipped for higher level academic program (e.g. a BSc thesis project) as well as technical employment in an industrial analytical laboratory.

**Key Sessional Dates**

Classes begin: January 5, 2026
Reading Week: February 14 – 22, 2026
Presentation Day (Tentative): April 8, 1:00 pm – 4:00 pm
Classes end: April 9, 2026
Exam period: April 12 – 30, 2026

# 4. Course Materials

**Textbooks for lectures**

- Recommended

**Principles of Instrumental Analysis, 7th Ed.**
**Skoog, Holler, and Crouch**
**Cengage Learning**

This book is heavily referenced throughout the course.
An online version of this textbook is available to view through Western Library at no cost. (https://ocul-uwo.primo.exlibrisgroup.com/permalink/01OCUL_UWO/r0c2m8/alma991044668565505163)

- Suggested

**Quantitative Chemical Analysis, 10th Ed.**
**Harries and Lucy**
**Macmillan Learning**

Some of the content in the course took reference from this book (required textbook for Chem2272).

**Textbooks for laboratories**

- Required

Lab Manual (absolutely required): 2026 Chemistry 3372G Laboratory Manual (**the 2025 edition or earlier versions will not be acceptable**). $55.00
https://bookstore.uwo.ca/product/m12359

Lab Notebook: Hayden-McNeil Organic Chemistry Laboratory Notebook with carbonless copy pages. This book (available at the Bookstore and used for other Chemistry courses as well) has removable pages which will be submitted for grading with your lab reports. $16.05
https://bookstore.uwo.ca/product/1533956626

**Computer Software**:

- Microsoft Excel for data analysis

**Learning materials**

Lecture notes, additional learning resources (where applicable) will be posted on the OWL (https://westernu.brightspace.com/) course website.

**Please note that the lectures and labs run on separate OWL sites.**

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.

If students need assistance with the course OWL site, they can seek support on the OWL Brightspace Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

# 5. Methods of Evaluation

**Grading Scheme and Assessment Dates**
Students are evaluated based on their performances both in lab and in lecture.

The overall course grade will be calculated as listed below:

| | **Component** | **Weight** |
|---|---|---|
| Laboratory | Lab reports | 24% |
| | Driver's test | 10% |
| Lecture | Knowledge Exchange Workshop | 12% |
| | Mid-term Test (1) | 12% |
| | Mid-term Test (2) | 12% |
| | Final exam | 30% |
| Course Total | | 100% |

**Requirements to pass the course:**
Students must attend and complete at least FIVE laboratory sessions, complete the Driver's test, and obtain a combined mark of at least 50% on the laboratory component of the course.
Students who fail to meet any of these requirements will receive a course grade of not greater than 40%, even if the calculated grade is higher. For students with valid excuses, the only remedy against an F in such cases would be to apply for an INC grade through the Dean's Office and complete the missed work the next time the course is offered.

- **Laboratory (34%)**

You will need to submit all the required lab reports to earn your mark for the corresponding components.

***Laboratory reports are to be submitted electronically via LAB SECTION OWL site.***

Submit lab report as MS Word (.doc, .docx) or Portable Document Format (.pdf) file. You are also required to submit the files that were used when completing the lab report as supporting documents, i.e. the Excel (.xlsx) file and, if applicable, the raw chromatogram data (.pdf)."

The Driver's test: Students will be evaluated based on their knowledge on the instrumental analysis experiments they have performed in lab. The **Driver's test is mandatory.** Failed to show up at the

Driver's test will result in a fail in the lab component. Detailed instructions will appear as a separate document.

The laboratory component of this course is of particular importance. Performance in your lab work will be monitored closely by the teaching assistants, instructor, and laboratory coordinator. In mid-February, you will receive an interim progress notation on your laboratory competency (related only to your experimental techniques and the safe operation of equipment. Your lab reports are not considered as part of this evaluation). You will receive one of the following evaluations:

**Satisfactory**: you are performing your experiments in a safe and appropriate manner

**Caution**: you have some serious defects in your lab performance and you are in danger of not performing to your best potential. Some of your actions may potentially damage equipment or impede the performance of your lab partner. Remedial action is required, and you should discuss this matter with your teaching assistant.

**Unsatisfactory**: Your lab performance is very poor. You will be asked to meet with the instructor to discuss ways to improve the situation.

Students whose performance in the laboratory is consistently unsafe or destructive, in the opinion of the instructor, will be removed from the laboratory for the remainder of the lab session and reported to the Associate Chair of Chemistry. A zero mark will be assigned to the corresponding lab report. Continued unsafe or destructive performance will, on recommendation of the Department, and with the permission of the Dean of the Faculty, result in the student being excluded from further laboratory sessions in the course and the student will not be entitled to further evaluation in the course.

- **Lecture (66%)**

**Knowledge Exchange Workshop (12%)**
Students will work in pairs to research and share a topic related to the course (e.g. an advanced instrument-based characterization technique) that is not covered in lectures. The workshop is structured as an interactive learning experience in which students exchange knowledge through short explanations, discussion, and questions in small groups. Emphasis is placed on conceptual understanding, accuracy, and the ability to communicate ideas clearly, as well as on active engagement as both a presenter and a participant. The purpose of this activity is to broaden exposure to related topics while developing peer-teaching and communication skills.

**Mid-term Tests (24%)**
There are two Mid-term Tests in this course, each is worth 12% of the total course mark. Both tests will be held in class, and the test questions are in a mixed format (i.e. multiple choices and short answers). Students with accommodated education will be given extra time.
Test 1: February 5, 9:30 am – 10:20 am
Test 2: March 5, 9:30 am – 10:20 am

**Final Exam (30%)**
Date/Time scheduled by Office of Registrar.
The Final Exam will be cumulative. The format of the final exam will be a mixture of multiple choice and short answer questions.

**Use of Generative AI Tools**

The use of generative AI tools (e.g., ChatGPT, Copilot, Gemini) is permitted only as a learning assistant, such as for explaining concepts or helping you understand course material. You are responsible for verifying the correctness of any information produced by these tools.
The use of generative AI tools to create or substantially edit lab reports (including text, graphs, plots), or to create presentation content (slides or scripts), is not permitted. All submitted work must reflect your own original effort.
If you are unsure whether a specific use of generative AI is permitted, consult the instructor before using it.

**General information about missed coursework**
Students must familiarize themselves with the *University Policy on Academic Consideration – Undergraduate Students in First Entry Programs,* posted on the Academic Calendar:
https://uwo.ca/univsec//pdf/academic_policies/appeals/academic_consideration_Sep24.pdf,

This policy does not apply to requests for Academic Consideration submitted for **attempted or completed work**, whether online or in person.

The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult Accessible Education.

For procedures on how to submit Academic Consideration requests, please see the information posted on the Office of the Registrar's webpage:
https://registrar.uwo.ca/academics/academic_considerations/
All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline.

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 one Academic Consideration request **without supporting documentation** in this course. However, the Final Exam is excluded from this, and therefore always require formal supporting documentation.

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.

**Evaluation Scheme for Missed Assessments**
**Missed Labs**
Students are required to attend all the lab sessions. There are no make-up labs, and it is not possible to reschedule them. Absence from a lab session will result in a grade of zero for the missed lab. If the missed lab is due to a reason that is approved by Academic Counselling or Accessible Education, the weight of the lab will be shifted to other labs.

**Late Submission**
A No-Late-Penalty Period applies to each lab report submission. Should extenuating circumstances

arise, students do not need to request Academic Consideration, and they are permitted to submit their assignment up to 12 hours past the deadline without a late penalty. Should students submit their assessment beyond 12 hours past the deadline, a late penalty of 10% per day (since the deadline) will be applied to the total mark owned for the submitted work. Submission made after 48 hours after the original due date will be rejected.
Students with applicable accommodations recommended by Accessible Education may request a longer one-time deadline extension. To preserve the integrity of evaluation, such extension cannot exceed 7 days after the original due date.

**Missed Workshop**
Since this is an activity performed by a team of two, at least one member in the team shall attend the event. Both members shall receive the same grade. In the unlikely event that both members can't attend the presentation, the students shall contact the course instructor as soon as possible to arrange alternative assessment method.

**Missed Midterm Tests or Final Exam**
If you are unable to write a midterm test and are granted accommodation, the weight of the missed midterm will be shifted to the other midterm test. If you miss both midterm tests and are excused as well, the weight of the midterm tests will be transferred to the Final exam.
When a student misses the Final Exam and their Academic Consideration has been granted, they will be allowed to write the Special Examination (the name given by the University to a makeup Final Exam). See the Academic Calendar for details (under Special Examinations), especially for those who miss multiple final exams within one examination period.

# 6. Additional Statements

### 6.1 Religious Accommodation
When a recognized religious holiday or observance conflicts with an examination, test, or other scheduled academic obligation, students must request accommodation via the University's Student Absence Portal (SAP). This request should identify the conflict and specify which course component(s) (e.g. test, midterm, exam) are affected.

Students are encouraged to submit the SAP request as early as possible, but no later than two weeks before any examination, or one week before any mid-term test or quiz, to allow sufficient time for adjustment.

The SAP request serves as official notification to both the course instructor and the Academic Advising Office, in accordance with University policy:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

The Faculty of Science considers religious accommodations as scheduling conflicts. Instructors should provide either a make-up exam or an earlier sitting of the same exam to accommodate the student.

For more information on recognized religious holidays, please visit the Diversity Calendar posted on the Equity, Diversity & Inclusion website - https://www.edi.uwo.ca

### 6.2 Academic Accommodation Policies

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

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf.

### 6.3 General Academic Policies

The website for Registrar Services is https://www.registrar.uwo.ca/.

**Use of @uwo.ca email:** In accordance with policy, 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 email address. It is the responsibility of the account holder to ensure that emails received from the University at their official university address are attended to in a timely manner.

**Requests for Relief** (formally known as "appeals")

Policy on Request for Relief from Academic Decision:
https://uwo.ca/univsec//pdf/academic_policies/appeals/requests_for_relief_from_academic_decisions.pdf

Procedures on Request for Relief from Academic Decision (Undergraduate):
https://uwo.ca/univsec//pdf/academic_policies/appeals/undergrad_requests_for_relief_procedure.pdf

### 6.4 Scholastic Offences

Policy on Scholastic Offences:
https://uwo.ca/univsec//pdf/academic_policies/appeals/scholastic_offences.pdf

Procedures on Scholastic Offences (Undergraduate):
https://uwo.ca/univsec//pdf/academic_policies/appeals/undergrad_scholastic_offence_procedure.pdf

### Use of Electronic Devices During Assessments

In courses offered by the Faculty of Science, the possession of unauthorized electronic devices during any in-person assessment (such as tests, midterms, and final examinations) is strictly prohibited. This includes, but is not limited to: mobile phones, smart watches, smart glasses, and wireless earbuds or headphones.

Unless explicitly stated otherwise in advance by the instructor, the presence of any such device at your desk, on your person, or within reach during an assessment will be treated as a *scholastic offence*, even if the device is not in use.

Only devices expressly permitted by the instructor (e.g., non-programmable calculators) may be brought into the assessment room. It is your responsibility to review and comply with these expectations.

### Use of Generative AI Tools

Unless otherwise stated, the use of generative AI tools (e.g., ChatGPT, Microsoft Copilot, Google Gemini, or similar platforms) is **not permitted** in the completion of any course assessments, including but not limited to: assignments, lab reports, presentations, tests, and final examinations.

Using such tools for content generation, code writing, problem solving, translation, or summarization—when not explicitly allowed—will be treated as a **scholastic offence**.

If the use of generative AI is permitted for a particular assessment, the conditions of use will be specified by the instructor in advance. If no such permission is granted, students must assume that use is prohibited. It is your responsibility to seek clarification before using any AI tools in academic work.

**Laboratory Safety**

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 0% on their lab mark.

## 6.5 Support Services

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

Students who are in emotional/mental distress should refer to Mental Health@Western (https://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 (GBSV) and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced GBSV (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.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

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. If you have any questions regarding accommodations, you may also wish to contact Accessible Education at

http://academicsupport.uwo.ca/accessible_education/index.html

Learning-skills counsellors at Learning Development and Success (https://learning.uwo.ca) 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.

Additional student-run support services are offered by the USC, https://westernusc.ca/services/.