

# COURSE SYLLABUS



COURSE TITLE: CHEM-224: Analytical Chemistry

CLASS SECTION: 001

TERM: Fall 2022

COURSE CREDITS: 4

DELIVERY METHOD(S):

Camosun College campuses are located on the traditional territories of the Lək̓ʷəŋən and W̱SÁNEĆ peoples. We acknowledge their welcome and graciousness to the students who seek knowledge here.

Learn more about Camosun's [Territorial Acknowledgement](#).

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*Camosun College requires mandatory attendance for the first class meeting of each course. If you do not attend, and do not provide your instructor with a reasonable explanation in advance, you will be removed from the course and the space offered to the next waitlisted student.*

## INSTRUCTOR DETAILS

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NAME: Blair Surridge <http://camosun.ca/learn/school/arts-science/bios/surridge-chem-bio.html>

EMAIL: [SurridgeB@camosun.bc.ca](mailto:SurridgeB@camosun.bc.ca)

OFFICE: F348 C

HOURS: Tuesday 12:30 – 1:30pm & Thursday 12:30 – 1:30pm

*As your course instructor, I endeavour to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me. Camosun College is committed to identifying and removing institutional and social barriers that prevent access and impede success.*

## CALENDAR DESCRIPTION

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This course provides an introduction to the theory and practice of chemical separation and identification. The major techniques are examined including chromatography, solvent extraction, spectroscopy and electrochemistry. The problems associated with data acquisition and the statistics of sampling are stressed throughout.

### PREREQUISITE(S):

All of:

- C in CHEM 121

### CO-REQUISITE(S):

### EXCLUSION(S):

## COURSE LEARNING OUTCOMES / OBJECTIVES

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Upon completion of this course a student will be able to:

1. Define and calculate the mean, median, mode, variance and standard deviation for a series of replicate analyses. Estimate the population mean from analysis of a small number of trials. Test for the rejection or retention of suspect data. Explain and use the least squares procedure to graph experimental data.
2. Describe and explain the procedures for gravimetric and titrimetric analyses: obtain data that falls within the established margins of error for the methods.
3. Derive and apply the Beer-Lambert law and use internal and external standards to ensure the validity of the analysis. Distinguish between absorption, emission, fluorescence and phosphorescence. Obtain absorption and emission spectra from various sources and perform a complete quantitative analysis on the samples provided. Explain and use light scattering techniques to estimate the turbidity of solutions.
4. Distinguish between the major modes of radioactive decay and between the activity of the sample and the dose received by the absorber. Estimate the age of fossils and artifacts via carbon and argon dating techniques and the concentrations of trace materials using neutron activation and isotope dilution techniques.
5. Identify and describe the mode of operation for the four major types of electrode. Distinguish between constant current and constant potential coulometry and use them to estimate the concentrations of particular ions in solution. Distinguish between normal and pulsed polarography and analyze polarograms obtained from mixtures of metal ions.
6. Describe, explain and apply the techniques of solvent extraction, distillation, sublimation, and the major forms of chromatography to the separation of a mixture.
7. Discuss the basis for improvements in the signal to noise ratio of a measurement. Distinguish between the Fourier transform and continuous wave methods of recording data. Explain the process of analogue to digital conversion.
8. Construct a null point hypothesis; use one or two tailed significance tests to reject or retain the hypothesis. Use a paired t test to compare two different methods of analysis for the same sample.

## REQUIRED MATERIALS & RECOMMENDED PREPARATION / INFORMATION

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|                       |   |
|-----------------------|---|
| Lecture               | <ul style="list-style-type: none"> <li>• Chem 224 Lecture Note Package</li> <li>• E-Text "Quantitative Chemical Analysis" 10th Edition, by Daniel C. Harris and Charles A. Lucy (Macmillan Learning)</li> </ul> <p>E-text is purchased at the bookstore and includes access to Achieve Homework</p> |
| Laboratory            | <ul style="list-style-type: none"> <li>• Chem 224 Lab Manual</li> <li>• Safety glasses</li> <li>• Lab coat</li> <li>• A small hard covered laboratory notebook</li> </ul>   |
| In Library On Reserve | <ul style="list-style-type: none"> <li>• "Fundamentals of Analytical Chemistry" 8<sup>th</sup> addition, by Skoog, West, Holler, and Crouch</li> </ul>  |

## COURSE SCHEDULE, TOPICS, AND ASSOCIATED PREPARATION / ACTIVITY / EVALUATION

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**Lecture Times: Monday 2:30 to 3:50 in E344 Wednesday 2:30 to 3:50 in E344**

The following schedule and course components are subject to change with reasonable advance notice, as deemed appropriate by the instructor.

| WEEK  | ACTIVITY or TOPIC   | eBook Reference                                      |
|-------|---|--|
| 1-3   | Analytical process, measurement, experimental error, and statistics | Ch. 0, 1, 3, and 4                                   |
| 4     | Classical methods (Gravimetric and Titration) & Quality Assurance   | Ch. 5 & 27   |
| 5-6   | Electrochemical Methods   | Ch. 14 and 15  |
| 7-9   | Spectrochemical Methods   | Ch. 18, 19, 20, and 21                               |
| 10-13 | Methods of Separation   | Ch. 23, 24, and 25 (parts of 22)                     |
| na    | Methods of Calibration and Quality Assurance                        | Ch.5 Covered in the Lab #2 and throughout the course |

Students registered with the Centre for Accessible Learning (CAL) who complete quizzes, tests, and exams with academic accommodations have booking procedures and deadlines with CAL where advanced notice is required. Deadlines can be reviewed on the [CAL exams page](http://camosun.ca/services/accessible-learning/exams.html). <http://camosun.ca/services/accessible-learning/exams.html>

## Chem. 224 Lab Schedule Thursday 9:30 to 12:20pm

(note: your lab group must consist of no more than 2 students to maximize time on lab instrumentation and equipment)

| Week | Lab Date              | Lab No. / Experiment  |
|------|-----------------------|---|
| I    | Sept 8 <sup>th</sup>  | Lab #1: Introduction and skills assessment:                 |
| II   | Sept 15 <sup>th</sup> | Lab #2: External Standard Calibration and Isotopic Dilution |
| III  | Sept 22 <sup>th</sup> | Lab #3: Analysis of Halide Ions Using Silver Nitrate:       |
| IV   | Sept 29 <sup>th</sup> | <b>Statistics Tutorial</b>                                  |
| V    | Oct 6 <sup>th</sup>   | Lab #4: Part B Ion Selective Electrodes                     |
| VI   | Oct 13 <sup>th</sup>  | Lab #5: UV/Vis Spectroscopy:                                |
| VII  | Oct 20 <sup>nd</sup>  | Lab #6: Flame Atomic Absorption Spectroscopy                |
| VIII | Oct 27 <sup>th</sup>  | <b>Midterm</b>  |
| IX   | Nov 3 <sup>rd</sup>   | <b>GC and HPLC Tutorial</b>                                 |
| X    | Nov 10 <sup>th</sup>  | Lab #7: Chromatography Part 1                               |
| XI   | Nov 17 <sup>th</sup>  | Lab #7: Chromatography Part 1                               |
| XII  | Nov 24 <sup>th</sup>  | Lab #7: Chromatography Part 2                               |
| XIII | Dec 1 <sup>st</sup>   | Lab #7: Chromatography Part 2                               |
| XIV  | Dec 8 <sup>th</sup>   | Lecture Wrap-up plus Final Exam Review (Room TBA)           |

## EVALUATION OF LEARNING

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| DESCRIPTION   | WEIGHTING    |
|---|--------------|
| Labs  | 20           |
| Achieve Homework <sup>1</sup>                               | 20           |
| Quizzes   | 15           |
| Midterm <sup>2</sup> (up to and including electrochemistry) | 15           |
| Final Exam (comprehensive)                                  | 30           |
|   | <b>TOTAL</b> |
|   | 100%         |

If you have a concern about a grade you have received for an evaluation, please come and see me as soon as possible. Refer to the [Grade Review and Appeals](http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf) policy for more information.  
<http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf>

1. This online homework software will provide practice questions, which are interactive and are not meant to replace the more traditional end of chapter homework questions. Marks are given for correctness and completing each assignment. Achieve Learning comes with the ebook can be purchased from Camosun College bookstore online. See D2L for more instructions. Due dates for each assignment will be provided by your instructor and can be found on the Achieve Learning website.
2. Expected to cover units 1-3; note an outline will be provided ahead of time for the midterm and the final exam.

## COURSE GUIDELINES & EXPECTATIONS

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- (1) Student must pass the lab and lecture component of the course to obtain credit for Chem 224. All labs are to be attended, individual lab reports completed following your instructor's guidelines, and the report format provided in the lab manual.
- (2) Immediate contact must be made with instructor for missed labs due to illness or family emergencies for arrangements to be made. This should be done by email. For more information, see lab manual.
- (3) A test score that is not as high as that of the December final exam will be dropped automatically and its weight redistributed to the final exam. For example, if a low score is obtained on your midterm then your final exam will then be 45% of the course grade!
- (4) This will be written in one of the classes. No one is allowed to write exams late and there will be no exceptions. Early exam is a privilege and not a right; thus, at full discretion of the instructor. In the event that the midterm is missed the marks will be weighted to the final exam as per point 3) above.

## SCHOOL OR DEPARTMENTAL INFORMATION

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### IMPORTANT DATES

#### Week

|     |   |
|-----|---|
| IV  | Sept. 30 <sup>th</sup> : National Day for Truth and Reconciliation-College Closed |
| VI  | Oct.10: Thanksgiving Monday-College Closed  |
| XI  | Nov. 11: Remembrance Day – College Closed   |
| XIV | Exam Period for Fall 2022 begins  |

## STUDENT RESPONSIBILITY

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Enrolment at Camosun assumes that the student will become a responsible member of the College community. As such, each student will display a positive work ethic, assist in the preservation of College property, and assume responsibility for their education by researching academic requirements and policies; demonstrating courtesy and respect toward others; and respecting expectations concerning attendance, assignments, deadlines, and appointments.

## SUPPORTS AND SERVICES FOR STUDENTS

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Camosun College offers a number of services to help you succeed in and out of the classroom. For a detailed overview of the supports and services visit <http://camosun.ca/students/>.

|                                     |   |
|-------------------------------------|---|
| Academic Advising                   | <a href="http://camosun.ca/advising">http://camosun.ca/advising</a>                       |
| Accessible Learning                 | <a href="http://camosun.ca/accessible-learning">http://camosun.ca/accessible-learning</a> |
| Counselling                         | <a href="http://camosun.ca/counselling">http://camosun.ca/counselling</a>                 |
| Career Services                     | <a href="http://camosun.ca/coop">http://camosun.ca/coop</a>                               |
| Financial Aid and Awards            | <a href="http://camosun.ca/financialaid">http://camosun.ca/financialaid</a>               |
| Help Centres (Math/English/Science) | <a href="http://camosun.ca/help-centres">http://camosun.ca/help-centres</a>               |
| Indigenous Student Support          | <a href="http://camosun.ca/indigenous">http://camosun.ca/indigenous</a>                   |
| International Student Support       | <a href="http://camosun.ca/international/">http://camosun.ca/international/</a>           |
| Learning Skills                     | <a href="http://camosun.ca/learningskills">http://camosun.ca/learningskills</a>           |
| Library                             | <a href="http://camosun.ca/services/library/">http://camosun.ca/services/library/</a>     |
| Office of Student Support           | <a href="http://camosun.ca/oss">http://camosun.ca/oss</a>                                 |
| Ombudsperson                        | <a href="http://camosun.ca/ombuds">http://camosun.ca/ombuds</a>                           |
| Registration                        | <a href="http://camosun.ca/registration">http://camosun.ca/registration</a>               |
| Technology Support                  | <a href="http://camosun.ca/its">http://camosun.ca/its</a>                                 |
| Writing Centre                      | <a href="http://camosun.ca/writing-centre">http://camosun.ca/writing-centre</a>           |

If you have a mental health concern, please contact Counselling to arrange an appointment as soon as possible. Counselling sessions are available at both campuses during business hours. If you need urgent support after-hours, please contact the Vancouver Island Crisis Line at 1-888-494-3888 or call 911.

## COLLEGE-WIDE POLICIES, PROCEDURES, REQUIREMENTS, AND STANDARDS

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### Academic Accommodations for Students with Disabilities

The College is committed to providing appropriate and reasonable academic accommodations to students with disabilities (i.e. physical, depression, learning, etc). If you have a disability, the [Centre for Accessible Learning](http://camosun.ca/services/accessible-learning/) (CAL) can help you document your needs, and where disability-related barriers to access in your courses exist, create an accommodation plan. By making a plan through CAL, you can ensure you have the appropriate academic accommodations you need without disclosing your diagnosis or condition to course instructors. Please visit the CAL website for contacts and to learn how to get started:

<http://camosun.ca/services/accessible-learning/>

### Academic Integrity

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.13.pdf> for policy regarding academic expectations and details for addressing and resolving matters of academic misconduct.

### Academic Progress

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.1.pdf> for further details on how Camosun College monitors students' academic progress and what steps can be taken if a student is at risk of not meeting the College's academic progress standards.

### Course Withdrawals Policy

Please visit <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.2.pdf> for further details about course withdrawals. For deadline for fees, course drop dates, and tuition refund, please visit <http://camosun.ca/learn/fees/#deadlines>.

### Grading Policy

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf> for further details about grading.

### Grade Review and Appeals

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf> for policy relating to requests for review and appeal of grades.

### Mandatory Attendance for First Class Meeting of Each Course

Camosun College requires mandatory attendance for the first class meeting of each course. If you do not attend, and do not provide your instructor with a reasonable reason in advance, you will be removed from the course and the space offered to the next waitlisted student. For more information, please see the "Attendance" section under "Registration Policies and Procedures" (<http://camosun.ca/learn/calendar/current/procedures.html>) and the Grading Policy at <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf>.

### Medical / Compassionate Withdrawals

Students who are incapacitated and unable to complete or succeed in their studies by virtue of serious and demonstrated exceptional circumstances may be eligible for a medical/compassionate withdrawal. Please visit <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.8.pdf> to learn more about the process involved in a medical/compassionate withdrawal.

### Sexual Violence and Misconduct

Camosun is committed to creating a campus culture of safety, respect, and consent. Camosun's Office of Student Support is responsible for offering support to students impacted by sexual violence. Regardless of when or where the sexual violence or misconduct occurred, students can access support at Camosun. The Office of Student Support will make sure students have a safe and private place to talk and will help them understand what supports are available and their options for next steps. The Office of Student Support respects a student's right to choose what is right for them. For more information see Camosun's Sexualized Violence and Misconduct Policy: <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.9.pdf> and [camosun.ca/sexual-violence](http://camosun.ca/sexual-violence). To contact the Office of Student Support: [oss@camosun.ca](mailto:oss@camosun.ca) or by phone: 250-370-3046 or 250-3703841

### Student Misconduct (Non-Academic)

Camosun College is committed to building the academic competency of all students, seeks to empower students to become agents of their own learning, and promotes academic belonging for everyone. Camosun also expects that all students to conduct themselves in a manner that contributes to a positive, supportive, and safe learning environment. Please review Camosun College's Student Misconduct Policy at <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.5.pdf> to understand the College's expectations of academic integrity and student behavioural conduct.

**Changes to this syllabus:** Every effort has been made to ensure that information in this syllabus is accurate at the time of publication. The College reserves the right to change courses if it becomes necessary so that course content remains relevant. In such cases, the instructor will give the students clear and timely notice of the changes.