

CHEM 212 Analytical Chemistry for Biologist – Winter 2023 (3 credits)

1. General Information:

Instructor:	Melissa K. Passarelli, Ph.D.
Office hours (SP 275.33) :	Tues. & Fri. 13 :30-14 :30
Email :	melissa.passarelli@concordia.ca
Lectures :	Wednesday and Friday 11:45 – 13:00
Course Management :	Moodle

Students are expected to attend the lectures in-person, held in HC 157 Loyola Campus. In the event of a campus shut down, a zoom link will be provided on the Moodle page for a remote synchronous lecture.

2. Resources for CHEM 212

Required:

- Textbook: Daniel C. Harris Exploring Chemical Analysis 5th edition. W.H. Freeman and Company. (Paper text available in the bookstore)
- Analytical Chemistry for Biologist Laboratory Manual (Course pack)

Optional:

- Solutions Manual for Exploring Chemical Analysis 5th Edition. W. H. Freeman and Company

3. Course Description:

This course introduces the basic concepts of analytical chemistry to students in the biological sciences. Topics include treatment of analytical data; chemical equilibria and titrations; introduction to spectroscopy; separation science; electrochemistry. lectures and laboratory. Prerequisite: CHEM 205, 206; PHYS 204, 206, 224, 226; MATH 205; or equivalents for all prerequisite courses. *Note: This course may not be taken for credit by students registered in a Chemistry or Biochemistry program.*

4. Schedule

Week #	Lecture #	Date	Topic
1	1,	11 Jan 2023	Welcome to CHEM212
	2	13 Jan 2023	0-1 The analytical chemist's Job 0-2 General steps in a chemical analysis 1-1 SI Units 1-2 Conversion between units 1-3 Chemical concentrations 1-4 Preparing solutions
2	3,	18 Jan 2023	3-1 Sig figs
	4	20 Jan 2023	3-2 Sig fig in Arithmetic 3-3 Types of Error 3-4 Propagation of Uncertainty

			6-1 Principles of volumetric analysis (endpoint / equivalence point) 6-2 Stoichiometry calc.
23 Jan 2023			DNE deadline
3	5, 6	25 Jan 2023 27 Jan 2023	7-1 Gravimetric analysis 7-3 Stoichiometry calc. 1-5 Equilibrium constants 8-1 What are Acids and Bases 8-2 Relation Between $[H^+]$, $[OH^-]$, and pH 8-3 Strengths of Acids and Bases 8-4 Introducing acids and bases 11-1 Polyprotic acids and Bases 8-5 Tools for dealing w/ weak acids and bases 8-6 Weak-acid equilibrium 8-7 Weak-bases equilibrium
4	7, 8, Q1	1 Feb 2023 3 Feb 2023	9-1 What you mix is what you get 9-2 Henderson-Hasselbalch Equation 9-3 A buffer in action 9-4 Preparing buffers 9-5 buffer capacity 9-6 How acid-base indicators work Quiz Friday (in-class)
5	9, 10	8 Feb 2023 10 Feb 2023	10-1 Titration of strong base with strong acid 10-2 Titration of weak acid with strong base 10-3 Titration of weak base with strong acid 10-4 Finding the end point 10-5 Practical Notes 11-1 Amino acids are polyprotic 11-2 finding the pH in Diprotic systems 11-3 which is the principal species? 11-4 titrations in polyprotic systems
6	11, 12	15 Feb 2023 17 Feb 2023	13-1 Metal-chelate Complexes 13-2 EDTA 13-3 Metal ion indicators 13-4 EDTA titration techniques 13-5 The pH-dependent Metal-EDTA equilibrium 13-6 EDTA titration curves
7	13, Midterm Exam	22 Feb 2023 24 Feb 2023	14-1 Redox chemistry and electricity 14-2 galvanic cells 14-3 standard potential 14-4 the Nerst Equation 14-5 E and Equilibrium Constant 14-6 Reference electrode Midterm (Friday in-class)
Mid-term break (27 Feb- 5 Mar 2023)			

8	15, 16	8 Mar 2023 10 Mar 2023	15-1 The silver indicator electrode 15-2 what is a junction potential? 15-3 How ion-selective electrodes work 15-4 pH measurements with a glass electrode 15-5 Ion-selective Electrodes 16-1 Theory of redox titrations 16-2 redox indicators
9	17, 18	15 Mar 2023 17 Mar 2023	18-1 Properties of light 18-2 Absorption of light
10	19, 20	22 Mar 2023 24 Mar 2023	18-3 Measuring absorbance 18-4 Using beers law 18-6 Fluorescence and phosphorescence 19-4 what happens when a molecule absorbs light 19-5 luminescence in AC
11	21 22, Q2	29 Mar 2023 31 Mar 2023	19-1 The Spectrophotometer 19-2 Analysis of a Mixture Quiz 2 (Friday in class)
12	23	5 Apr 2023	21-4 Mass Spectrometry 21-5 information in a MS
Easter Break (7 Apr – 10 Apr 2023)			
13	24, 25	12 Apr 2023 14 Apr 2023	22-1 Gas Chromatography Van Demeter Equation 21-1 What is Chromatography 21-2 a chromatograph 21-3 Why do bands spread? 22-2 Classical LC 22-3 HPLC
	26	18 Apr 2023	Make-up day for 7 Apr 2023 class
Cumulative Final Exam (20 Apr -2 May 2023) TBA by the exam office			

5. Grades

Letter grades: F: 0 – 49.9; D-: 50-52.9; D: 53-56.9; D+: 57-59.9; C-: 60-62.9; C: 63-66.9; C+: 67-69.9; B-: 70-72.9; B: 73-76.9; B+: 77-79.9; A-: 80- 84.9; A: 85-89.9; and A+: 90+.

Grading: Laboratory = 25%; Quizzes (2 x 10%) = 20 %; Midterm exams = 25%; and Final exam = 30%.

Minimum grade: A minimum of 50 % is required to pass the lecture portion of the course. In addition, you MUST score 60% the laboratory section to pass the course. Grades below the minimum will result in an "R" grade indicating that you must repeat the course.

The lab section will be divided into two groups. Each group will have a lab session every other week. Please consult the CHEM 212 lab Moodle site to find your group assignment.

Lab exemptions: Students who are repeating the course and have passed the lab component within the past two (2) years, may request a lab exemption.

<https://www.concordia.ca/content/dam/artsci/chemistry/docs/labexempt.pdf>

Please print, fill out, sign and return the lab exemption form to elizabeth.montesano@concordia.ca by Friday, January 13th at noon (the end of the first week of term before the start of the labs). Late applications will not be accepted.

6. CHEM 101 Seminar and Quiz

“CHEM 101”: The Academic Code of Conduct: Ethical Use of Information Sources

MANDATORY QUIZ AND SEMINAR

As part of your CHEM course, you are **required** to i) attend a Chemistry and Biochemistry Departmental Seminar on the academic conduct code and the appropriate use of information sources and ii) pass the online quiz associated with this seminar (the passing grade for the quiz is 100%). (**Note:** this quiz is graded by the Department of Chemistry and Biochemistry, and you do not have access to it until after you have attended the seminar. Therefore, any other quiz you may have taken on the academic code of conduct does not count toward the CHEM 101 requirement.) The aim of this seminar and quiz is to clarify the academic conduct code in terms of which practices will be considered unacceptable with regards to work submitted for grading in your CHEM course. **You are only exempt from repeating the seminar and the quiz if you have done both in Winter 2018 or more recently,*** otherwise you are required to repeat both this term. This short seminar (1 hour) will be held at the following times (note that you will not be given credit if you join too late and/or leave too early):

Date (Winter 2023)	Time (EST)	Mode	Registration link
Jan. 24 (Tuesday)	21:00- 22:00	Zoom	https://concordia-ca.zoom.us/meeting/register/tZUrcemqrj4tHNYUyp-gnOR8uREtmKGlyU9u
Jan.26 (Thursday)	21:00- 22:00	Zoom	https://concordia-ca.zoom.us/meeting/register/tZckf-GhqDkuHNA4TuWQ5yWQqBPGD_Ai27-l

As space for each of the Zoom seminars is limited, please **register early** for your preferred slot (copy the corresponding link above into your browser). You will **receive** a notice from Zoom with the link to the actual seminar. Then do not forget to **attend** that seminar slot on the date above!

We will take attendance at the Zoom seminar.

If you do not complete this course requirement, your final grade for the course may be lowered by one full letter grade with an incomplete (INC) notation until such time as this requirement is completed. Please refer to the undergraduate calendar (section 16.3.5) for details on removal of an incomplete notation.

* You are exempt if you can locate your ID in the pdf file located on the Departmental web site (<http://www.concordia.ca/content/dam/artsci/chemistry/docs/Compliance-list.pdf>) and if there is no entry in the “quiz” column for you.

PLAGIARISM AND OTHER FORMS OF ACADEMIC DISHONESTY

The Academic Code of Conduct can be found in section 17.10 of the academic calendar (<http://www.concordia.ca/academics/undergraduate/calendar/current/17-10.html>). Any form of unauthorized collaboration, cheating, copying or plagiarism found in this course will be reported and the appropriate sanctions applied. The mandatory seminar is a clear and fair opportunity to learn what our

faculty regards as academic misconduct. Failure to take part in this learning opportunity and thus ignorance of these regulations is no excuse and will not result in a reduced sanction in any case where academic misconduct is observed.

7. List of student services

Accessibility: If you have accessibility needs that require academic accommodations, please meet with an advisor from the Access Centre for Students with Disabilities (ACSD) as soon as possible to set up an accommodation plan. <https://www.concordia.ca/students/accessibility.html>

Additional resources:

1. Student Success Centre: concordia.ca/students/success
 2. Chemistry and Biochemistry Academic Advisor: greg.kos@concordia.ca
 3. Counselling and Psychological Services: concordia.ca/students/counselling-life-skills
 4. Concordia Library Citation and Style Guides: <https://library.concordia.ca/help/citing>
 5. Health Services: concordia.ca/students/health
 6. Financial Aid and Awards: concordia.ca/offices/faao
 7. Academic Integrity: concordia.ca/students/academic-integrity
 8. Dean of Students Office: concordia.ca/offices/dean-students
 9. International Students Office: concordia.ca/students/international
 10. Student Hub: concordia.ca/students
 11. Sexual Assault Resource Centre: concordia.ca/students/sexual-assault
 12. As a Concordia student, you are a member of the Concordia Student Union and have many resources available to you including:
 - a. HOJO (Off Campus Housing and Job Bank): csu.qc.ca/services/housing-and-job-bank-hojo/
 - b. CSU Advocacy Centre: csu.qc.ca/services/advocacy-centre/
 13. Aboriginal Student Resource Centre: concordia.ca/students/aboriginal
8. **Covid-19 disclaimer:** In the event of circumstances beyond the control of the University, the delivery mode, content, location, and evaluation scheme in this course are subject to change. Students will be informed of the changes prior to implementation