

**The last day to audit Chem 211 is Friday, Aug. 28 (audits do not count toward full-time status). The last day to drop Chem 211 is Friday, Oct. 23.*

Prereq: CHEM 163 and CHEM 163L, CHEM 201 and CHEM 201L; or credit or enrollment in CHEM 178; and concurrent enrollment in CHEM 211L

Course Description: Theory and practice of elementary volumetric, chromatographic, electrochemical, and spectrometric methods of analysis. Chemical equilibrium, sampling, and data evaluation. Emphasis on environmental analytical chemistry; the same methods are widely used in biological and materials sciences as well.

Lecture: MW, 11:00 am -11:50 pm, 1352 Gilman Hall, **cloth face covering required**

Instructor: Dr. David Appy

Office: 3754 Gilman Hall

Email: dvappy@iastate.edu

Office Hours: MW, 12:00 pm – 1:00 pm, 3754 Gilman or by appointment. One at a time in the office please, and maintain social distancing while waiting.

Head TA: Rafael Blome-Fernández

Office: 2206 Hach Hall

Email: rblome@iastate.edu

Office Hours: TBD

Course Materials:

Textbook - “Exploring Chemical Analysis”, 5th ed. by Harris.

Scientific Calculator – eg. Texas Instruments TI-30X IIS or similar calculator. No graphing calculators (or calculators with extensive memory storage or error analysis functions).

Canvas will serve as our official electronic course interface. Please check Canvas often for important announcements, course materials, and grade information. Visit www.canvas.iastate.edu

Lecture Capture:

Lectures will be recorded automatically and posted to Canvas (screen + audio).

Laptop and cell phone policy:

NO laptops, cell phones, or other electronics may be used in class unless specified by the instructor.

Tablets may be used to take notes as long as they are flat on the desk and not used for media purposes.

Grading Structure:

Exams – 3 midterm exams (100 pts each) and 1 semi-cumulative final exam (150 points)

Homework assignments – 11 assignments @ 10 pts each = 110 pts.

Total = 560 pts

Grading Scale:

*The final grading scale is entirely at the instructor’s discretion. We will begin the semester with a straight 90-80-70-60% scale and adjust if needed. **THE GRADING SCALE IS THE INSTRUCTOR’S CONCERN, NOT YOUR CONCERN.**

*If there is an error in the gradebook (i.e. missing or incorrect score), contact the Head TA as soon as possible. Otherwise, **DO NOT CONTACT THE INSTRUCTORS ABOUT GRADES.**

Homework Details:

Written homework assignments are due each Friday at 5:00 pm CDT in Canvas in pdf form. Any method of conversion to pdf is acceptable, including the relatively easy Adobe Scan app (available free online). Homework will be graded based only on degree of completeness (which includes showing reasonable work, especially the setup of unit conversions). It is the student's responsibility to evaluate the correctness of their own work. Answer keys will be posted shortly after each due date.

Late Work and Makeup Work:

Late work is not accepted and there are no makeup exams. See below for instructions if you think you will miss an exam.

Missing Class/Exams:

You do not need to inform the instructor that you will miss lecture. If you are going to miss an exam, please contact the Head TA as far in advance as possible (preferably > 1 week in advance). Exam can be given early, but not late.

If you test positive for COVID, please inform the instructor immediately. Your identity will be held in confidence, but for contact tracing purposes we may want to inform those who sit near you (more COVID details below).

Seating Chart:

Related to the above, we will keep a seating chart for contact tracing purposes in the event a student tests positive for COVID.

Tips for success: Sleep at night and eat breakfast in the morning. Read the relevant portions of the text before class. Schedule manageable time slots to study throughout the week. The night before an exam, get some sleep, and DO NOT CRAM.

Academic Dishonesty

The class will follow Iowa State University's policy on academic dishonesty. Anyone suspected of academic dishonesty will be reported to the Dean of Students Office.

Accessibility Statement

Iowa State University is committed to assuring that all educational activities are free from discrimination and harassment based on disability status. Students requesting accommodations for a documented disability are required to work directly with staff in Student Accessibility Services (SAS) to establish eligibility and learn about related processes before accommodations will be identified. After eligibility is established, SAS staff will create and issue a Notification Letter for each course listing approved reasonable accommodations. This document will be made available to the student and instructor either electronically or in hard-copy every semester. Students and instructors are encouraged to review contents of the Notification Letters as early in the semester as possible to identify a specific, timely plan to deliver/receive the indicated accommodations. Reasonable accommodations are not retroactive in nature and are not intended to be an unfair advantage. Additional information or assistance is available online at www.sas.dso.iastate.edu, by contacting SAS staff by email at accessibility@iastate.edu, or by calling 515-294-7220. Student Accessibility Services is a unit in the Dean of Students Office located at 1076 Student Services Building.

****Present accommodation requests to the instructor at least one week before the exam for which you are requesting accommodations.**

Prep Week (formerly Dead Week)

This class follows the Iowa State University Prep Week policy as noted in section 10.6.4 of the Faculty Handbook.

COVID-19 health and safety requirements

Students are responsible for abiding by the university's [COVID-19 health and safety expectations](#). All students attending this class in-person are required to follow university [policy](#) regarding health, safety, and face coverings:

wear a cloth face covering in all university classrooms, laboratories, studios, and other in-person instructional settings and learning spaces. Cloth face coverings are additionally required to be worn indoors in all university buildings, and outdoors when other people are or may be present where physical distancing of at least 6 feet from others is not possible. Students with a documented health or medical condition that prevents them from wearing a cloth face covering should consult with [Student Accessibility Services](#) in the Dean of Students Office.

ensure that the cloth face covering completely covers the nose and mouth and fits snugly against the side of the face.

practice physical distancing to the extent possible.

assist in maintaining a clean and sanitary environment.

not attend class if you are sick or experiencing symptoms of COVID-19.

not attend class if you have been told to self-isolate or quarantine by a health official.

follow the instructor's guidance with respect to these requirements. Failure to comply constitutes disruptive classroom conduct. Faculty and teaching assistants have the authority to deny a non-compliant student entry into a classroom, laboratory, studio, conference room, office, or other learning space.

Discrimination and Harassment

Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. Veteran. Inquiries regarding non-discrimination policies may be directed to Office of Equal Opportunity, 3410 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, Tel. 515-294-7612, Hotline 515-294-1222, email eooffice@iastate.edu

Religious Accommodation

Iowa State University welcomes diversity of religious beliefs and practices, recognizing the contributions differing experiences and viewpoints can bring to the community. There may be times when an academic requirement conflicts with religious observances and practices. If that happens, students may request the reasonable accommodation for religious practices. In all cases, you must put your request in writing. The instructor will review the situation in an effort to provide a reasonable accommodation when possible to do so without fundamentally altering a course. For students, you should first discuss the conflict and your requested accommodation with your professor at the earliest possible time. You or your instructor may also seek assistance from the Dean of Students Office at 515-294-1020 or the Office of Equal Opportunity at 515-294-7612.

Contact Information for Academic Issues

If you are experiencing, or have experienced, a problem with any of the above issues, email academicissues@iastate.edu

Learning Outcomes and Objectives:

Upon successful completion of this course, students will have mastered fundamental concepts in quantitative analysis (analytical chemistry).

Students will be able to:

Chapter 0 – Describe the general steps in chemical analysis and explain why each is important

Chapter 1 – Perform calculations and report results with correct units and convert between different types of units as required; Describe the procedure for preparing a solution and calculate quantities required to achieve the desired concentration of reagents

Chapter 2 – Select the correct laboratory equipment to complete a task and describe best practices

Chapter 3 – Represent accuracy and precision in raw data and derived quantities through the correct usage of significant figures and statements of uncertainty

Chapter 4 – Describe the characteristics of data sets that relate to their significance and spread (variance) and learn to correctly identify an outlier

Chapter 5 – Describe the steps to validate an analytical procedure and incorporate measures to ensure accuracy when analyzing a sample

Chapter 6 – Calculate the concentration of an unknown sample using titration – the addition of exact volumes of a reagent of known concentration until the two react fully

Chapter 7 – Utilize the mass of a precipitate or the products of combustion to ascertain the composition or amount of an unknown sample

Chapter 8 – Describe the relationship between the concentrations of protons, hydroxide, and pH and the difference between strong and weak acids and bases; Calculate the concentration of each species present in solution for a weak acid or base

Chapter 9 – Use the Henderson-Hasselbach equation to calculate the pH of a solution given the concentration of a weak acid (base) and its conjugate base (acid); Describe how a buffer works, how it is prepared, and how an indicator aids in measuring pH

Chapter 10 – Describe how acid-base titrations work and calculate the concentrations of both strong and weak acids or bases based on titration data

Chapter 11 – Calculate pH and conduct titration analysis in polyprotic solutions

Chapter 12 – Systematically treat equilibria, taking into account the effect of ionic strength on activity coefficients, charge and mass balance, and fractional composition

Chapter 13 – Describe how metal contents of a solution can be quantified using titration with a chelating agent and calculate the metal concentration from titration data

Chapter 14 – Describe reactions involving electron transfer to a conductor (e.g., a metal electrode) and calculate concentrations of each oxidation state of an analyte using an equilibrium statement

Chapter 15 – Describe how electrochemical potential can be utilized to measure ion concentration at liquid-liquid junctions and at membranes; Calculate ion concentration given a junction potential

Chapter 16 – Describe how redox titrations work and calculate the concentrations of redox active species based on titration data

Chapter 17 – Describe how electrochemical instrumentation can be used to measure current or charge as a function of time or electrical potential; Understand the significance of these measurements in clinical and environmental sensing

Chapter 18 – Describe the properties of light and describe how it interacts with matter; Using Beer's Law, calculate the concentration of a solute based on the light it absorbs

Chapter 19 – Describe how the intensity of light emitted from a sample is collected and how fluorescence or luminescence can be utilized for quantitative analysis

Chapter 20 – Determine the atomic composition of a sample utilizing atomic spectroscopy; Describe the working principles of instrumentation used for atomic spectroscopy including atomic emission and ion coupled plasma coupled to mass spectrometry

Chapter 21 – Describe the working principles of both chromatography and mass spectrometry; Interpret chromatograms, describing their quality, and extract information from a mass spectrum

Chapter 22 – Describe the working principles of gas and liquid chromatography, the advantages of utilizing high pressure for liquid chromatography, and how to prepare a sample for chromatography

Chapter 23 – Explain the fundamental underpinnings and relative advantages of ion, molecular exclusion, and affinity chromatography and capillary electrophoresis

Tentative Schedule for Chem211 (Fall 2020) – **WORKING DOCUMENT******

Week	Dates	Chapter/Topic	HW Problems (pdf due each Friday by 5 pm in Canvas)
1	M 8/17	Introductions/Syllabus Ch. 0 – The Analytical Process	HW#1 Ch.0 - 1, 3, 4
	W 8/19	Ch. 1 – Chemical Measurements	Ch.1 - 2, 3, 4, 5(b), 8, 9, 14, 15, 21, 28, 30, 31
2	M 8/24	Ch. 2 – Tools of the Trade	
	W 8/26	Ch. 3 – Math Toolkit	
3	M 8/31	Ch. 4 - Statistics	
	W 9/2	Ch. 4 - Statistics	
4	M 9/7	Review/Flex Day	No HW this week.
	W 9/9	Exam 1 – in class	
5	M 9/14	Ch. 5 – Quality Assurance and Calibration Methods	
	W 9/16		
6	M 9/21		
	W 9/23		

7	M 9/28		
	W 9/30		
8	M 10/5		
	W 10/7	Exam 2	
9	M 10/12		
	W 10/14		
10	M 10/19		
	W 10/21		
11	M 10/26		
	W 10/28		
12	T 11/2		

	R 11/4	Exam 3	
13	M 11/9		
	W 11/11		
14	M 11/16		
	W 11/18		
FINAL EXAM – Wednesday, Nov. 25 at 9:45 am in 1352 Gilman			

*ISU Final examinations policy will be followed absolutely (<http://www.registrar.iastate.edu/exams/>).