Chemistry 202: Analytical Chemistry

Term 2, 2019-2020

Instructors:

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Office Hours:

At least one of the instructors will be available from 11 am to noon and from 3 to 4 pm each weekday.

Introduction:

Analytical chemistry can be divided into two branches: qualitative analysis and quantitative analysis. Qualitative analysis deals with finding what constituents are in an analytical sample, and quantitative analysis deals with determining how much of a given constituent is in the sample. This course deals primarily with quantitative analysis.

Learning Objectives: Students will…

1. Determine the error associated with chemical measurements and apply statistical methods to analyze data; predict the concentrations of reactants and products using concepts of chemical equilibrium; explain the theoretical and experimental basis of potentiometric and spectrochemical methods; utilize concepts in analytical separations to design a separation method. (Knowledge).
2. Apply concepts of analytical chemistry to solve conceptual and practical problems (Inquiry, Reasoning).
3. Develop and demonstrate precise lab technique; accurately collect, record, analyze, and interpret data; operate a variety of analytical instruments; and calculate the error associated with results (Inquiry, Reasoning, Ethical Behavior).
4. Work effectively with others in the lab and communicate lab results clearly, both in writing and verbally (Communication, Ethical Behavior).

This course supports the Educational Priorities and Outcomes of Cornell College with emphases on knowledge, inquiry, reasoning, communication, and ethical behavior.

Course Materials:

The text for the course is ***Quantitative Chemical Analysis***, Ninth Edition, by Daniel C. Harris. You also need to purchase access to the Sapling Learning system. In addition you will need a carbonless-copy laboratory notebook with numbered pages, safety goggles, and a scientific calculator (not your phone).

Course Schedule:

The class will meet on Monday through Friday from 9 to 11 am for the first week. After the first week, class meetings will be on Monday, Wednesday, and Friday mornings.

The laboratory, which is a major part of this course, will meet from 12:30 to 3 pm each day. After the first week, lab will meet Tuesday and Thursday mornings as well, beginning with a

pre-lab meeting at 8:45 am. If you prepare for lab, arrive promptly, and work efficiently, you will be able to complete your lab work by 3 pm.

Grading:

Your grade for the course will be based on your scores on a midterm exam, a comprehensive final exam, problem sets, and laboratory work, with a total of 1000 points possible:

Homework problems	100 pts
Laboratory	500
Midterm exam	175
Final exam	225

Your laboratory work will be graded on the basis of precision, accuracy, and the organization and completeness of your report. Be sure to read the section on the laboratory notebook before you begin your lab work. Homework problems will be completed through the Sapling Learning system.

Grading brackets are 11% wide. Cutoffs will be no higher than:

A-/B+	89%
B-/C+	78%
C-/D+	67%
D-/F	56%

Cutoffs may be lower depending on the difficulty of the exams.

Disabilities and accommodations policy:

Cornell College makes reasonable accommodations for persons with disabilities. Students should notify the Office of Academic Support and Advising and their course instructor of any disability related accommodations within the first three days of the term for which the accommodations are required, due to the fast pace of the block format. For more information on the documentation required to establish the need for accommodations and the process of requesting the accommodations, see
http://www.cornellcollege.edu/academic-support-and-advising/disabilities/index.shtml.

Academic honesty:

Cornell College expects all members of the Cornell community to act with academic integrity. An important aspect of academic integrity is respecting the work of others. A student is expected to explicitly acknowledge ideas, claims, observations, or data of others, unless generally known. When a piece of work is submitted for credit, a student is asserting that the submission is her or his work unless there is a citation of a specific source. If there is no appropriate acknowledgement of sources, whether intended or not, this may constitute a violation of the College's requirement for honesty in academic work and may be treated as a case of academic dishonesty. The procedures regarding how the College deals with cases of academic dishonesty appear in The Catalogue, under the heading "Academic Honesty."

DAILY SCHEDULE

	Day	Instr.	Morning (9:00-11:00 am unless noted)	Afternoon (12:30-3:00 pm unless noted)	Assignment due (5:00 pm unless noted)
Week 1	M	CT	Ch 0-4[1]	Pre-lab; check-in; begin Exp 1; Excel	
	T	CS	Ch 4, 6	Pre-lab at 12:45 pm Exp 1	
	W	CT	Ch 6-8	Exp 2	Exp 1 report PS 1
	Th	CT	Ch 8 Data workup	Exp 3	PS 2
	F	CS	Ch 9	Pre-lab Exp 4	Exp 2 and 3 report PS 3
Week 2	M	CS	Ch 10	Exp 4	PS 4
	T		Pre-lab at 8:45 am Exp 5	Exp 5	PS 5
	W		Review	Midterm exam	PS 6 (12:30 pm)
	Th		Pre-lab at 8:45 am Rotation lab[2]	Pre-lab Rotation lab	Exp 4 oral report
	F	CT	Ch 18, 20	Pre-lab Rotation lab	Exp 5 report
Week 3	M	CS	Ch 21-26	Prelab Rotation lab	PS 7
	T		Pre-lab at 8:45 am Rotation lab	Rotation lab	One lab report (your choice)
	W	CT	Ch 14	Rotation lab	One lab report (your choice) PS 8
	Th		Rotation lab	Rotation lab	
	F	CS	Ch 15, 17	Rotation lab	One lab report (your choice) PS 9
Week 4	M		Review	Catch-up in lab Work on reports and PS	Two lab reports (your choice) Exp 12 oral report
	T		Catch-up in lab; debrief Work on reports and PS	Work on reports and PS Check out of lab by 3:00 pm	PS 10
	W		**Final exam (comprehensive)**	You're done!	One lab report; lab notebook (all by 1:00 pm)

[1]We will not cover all of each chapter; details will be distributed.

[2]We will distribute a lab rotation schedule during Week 2.

LAB EXPERIMENTS AND POLICIES

1. (20) Preparation of 0.1 M Solutions of Hydrochloric Acid and Sodium Hydroxide; Acid Base Ratio
2. (20) Standardization of Sodium Hydroxide Solution with Potassium Hydrogen Phthalate
3. (20) Standardization of Hydrochloric Acid Solution with Sodium Carbonate
4. (40) Column Chromatography
5. (50) Analysis of Calcium in Milk by EDTA Titration
6. (50) Spectrophotometric Determination of the pK_a of an Acid Base Indicator
7. (50) Determination of Iron in Breakfast Cereals
8. (40) Analysis of Metal Ions in Food
9. (65) Titration of an Amino Acid
10. (40) Blood Alcohol Analysis by Gas Chromatography/Mass Spectrometry
11. (40) HPLC Determination of Caffeine in Beverages
12. (35) Optimization of a Gas Chromatography Method.

Numbers in parentheses are points. The overall quality of your lab notebook will also be assessed, with a maximum score of 30 points, to give a total of 500 points possible for the lab portion of the course. If you have extra time at the end of the course, you may attempt to improve your score on a lab by repeating it. Speak with one of the instructors before you repeat any experiment.

Lab reports are to be turned in by 5 pm on the dates indicated above for grading of Experiments 1 through 5. As you complete other experiments, turn in your reports in a timely fashion, following the due dates listed above. It will be to your advantage to complete each report promptly, while the work is still fresh in your mind. ***Late reports will be assessed a penalty of up to 10% per day.***

For each pre-lab lecture missed, 5 points will be deducted from your total score. Point deductions for being late to a pre-lab can be up to 5 points.

No listening devices (except hearing aids) are allowed in the lab or during exams.

When you work with a partner on an experiment, both partners must be present and participating throughout the experiment.

On Tuesday, Day 17, all laboratory work will end by 11:00 am and all drawers will be checked in by 3:00 pm. All remaining reports and your notebooks for final grading are due no later than 1 pm on Wednesday, Day 18.