

# Instrumental Analytical Methods

## CHEM 412 Fall 2008

Theory, capabilities, and limitations associated with identifying the differentiating characteristic of a chemical. Emphasis is on developing an understanding of how to separate, detect, identify, and quantify a chemical substance using instruments in chemical analysis.

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Office hours: Tuesday and Thursday 2pm - 4pm; Friday 11am - 12pm

### Course objectives:

The main objective of the course is to develop an understanding of the chemical principles upon which modern instrumentation is based, including the development of:

- Skills of **effective experimental planning**.
- Skills in **critically evaluating** observations and data.
- **Written communication skills** in the context of chemical science.

### Course overview:

This course is a continuation of CHEM212, thus all students should have completed CHEM212 before taking CHEM412. The lectures presuppose a certain level of understanding in the theory of instrumental analytical chemistry, although we will review much of this earlier material. The emphasis of this course is to develop your instrumental intuition with respect to chemical analysis, by helping you to better identify the *differentiating characteristic* of a chemical of interest. The main goals are related to quantifying, identifying, detecting and separating the chemical. Ideally, this understanding will be applied to assessing relevant and timely chemical issues that rely on the effective use of modern analytical instrumentation, which will be explored through the preparation of a research paper and presentation.

### Evaluation and grading

Quizzes & Assignments	15 %
Mid-term exam	15 %
Final exam	25 %
Term paper	20 %
Draft paper	5 %
Presentation	10 %
Participation	10 %

Total 100

Final grades will be based on the students earned percentage of the total possible points, using the University's plus/minus grading scale (90.0 – 100 = A; 87.0 – 89.9 = A-; 83.0 – 86.9 = B+; 80.0 – 82.9 = B; 77.0 – 79.9 = B-; 73.0 -76.9 = C+, and so on).

## Textbook

The Art and Science of Chemical Analysis by Enke.

## How the course works

### Lectures & Labs

Lectures: 🕒 Mondays, Wednesdays, Fridays; 1 pm – 2 pm REIC 204

Lectures will provide a review of material covered in CHEM212 as well as introduce you to new concepts, including instruction on experimental design, QA/QC, data analysis, and report writing. Handouts of journal articles and the textbook will complement the lecture material. In-class demonstrations will complement the material covered in the lecture, and will require student participation.

### Course Policies

CHEM412 is governed by the academic regulations at UAF, found in the 2008-2009 Academic Calendar (pp. 78-84). Some additional policies are specific to CHEM412, and are listed below:

#### Assignments:

- Assignments are to be submitted by the assigned date during class time (lecture or lab), or before the assigned date via email. Please do not submit assignments under my office door.
- Your graded assignments will normally be returned the week following the assignment's due date.
- If you feel that any assignment has been incorrectly or unfairly graded, please put your argument in writing (Note: no written argument, no regrade), attach it to the original assignment, and deliver it to me. I will then remark the *entire* assignment. The new mark, which could be either higher or lower than the original mark, will be your grade.
- If you are late on an assignment, **a penalty of 5% per day is applied up to 5 calendar days**, and after then it will not be marked. An extension may be granted under exceptional circumstances (e.g., medical condition, family emergency).
- The lectures are an essential part of the course and **attendance is required. Absences and lateness will affect the Participation component of your grade.** You simply cannot learn nor contribute to others' learning when you are not in class or disrupt it by arriving late.
- I encourage you to make use of the Writing Center (8th floor, Gruening Building) where you can take a draft of any writing for assistance. Drafts of your projects will be graded, and I will provide feedback. Thus, the more substantial your draft, the more substantial the feedback.

A note about first drafts: First drafts must be original student products. The draft provides an indication of the writing style of each student, how much progress the student has made in the assignment or project, and demonstrates the student's ability to write independently using resources (journal articles, textbooks, lecture notes, etc.). The amount of work and attention to detail students put into the draft will vary, depending upon aptitude, initiative, and motivation of the student.

**Referencing your work & plagiarism:**

Where applicable, you are expected to provide references for all of your assignments. References serve three purposes: (1) to credit others for their ideas; (2) to demonstrate your understanding of the literature; and (3) to allow the reader to refer to the original reference for further detail or interpretation. Detailed references should follow the citation conventions of one of the following: Nature, Environmental Science & Technology.

Plagiarism is an extremely serious academic offense as outlined in the University Calendar and carries penalties varying from failure in an assignment to suspension from the University. Plagiarism is defined as appropriating passages or ideas from another person's work and using them as one's own. Lifting passages of text from the Web is also plagiarism and will not be accepted.

**Students with documented disabilities:** Students with a physical or learning disability, who may need academic accommodations, should contact the Disability Services office (203 WHIT, 474-7043). Disability Services will then notify the instructor of special arrangements for course work.

**Computer Lab:** Your enrollment in CHEM412 gives you user privileges in the department's computer lab. Information and policies are available at [www.uaf.edu/chem/NewNetwork.html](http://www.uaf.edu/chem/NewNetwork.html).

**CHEM412 Syllabus page 4 of 5 Tentative Course Schedule & Readings**

Dates	Topic	Reading	Activity
	Introduction to course		
September 5	Chemical Analysis overview	Chapter 1	
September 8	Measurement and statistics in chemical analysis	Chapter 2	
September 10	Measurement (continued)	Chapter 2	
September 12	Acids and bases (review)	Chapter 3	
September 15	Acids and bases (continued)	Chapter 3 & 4	
September 17	Titrations	Chapter 4	
September 19	TBA		
September 22	Analysis by absorption of light	Chapter 5	
September 24	Absorption (continued)	Chapter 5	
September 26	Analysis by photon emission	Chapter 6	Assignment 1 due
September 29	Photon emission (continued)	Chapter 6	
October 01	TBA		
October 03	Analysis by complexation reactivity	Chapter 7	
October 06	Complexation (continued)	Chapter 7	
October 08	Analysis by precipitation reactivity	Chapter 8	
October 10	Precipitation (continued)	Chapter 8	
October 13	TBA		
October 15	TBA		Assignment 2 due
October 17	Review for mid-term		
October 20	<b>Mid-term exam (Chapters 1-8)</b>		
October 22	Analysis by electrode potential	Chapter 9	
October 24	Electrodes (continued)	Chapter 9	
October 27	Analysis by oxidation-reduction reactivity	Chapter 10	
October 29	Red-ox (continued)	Chapter 10	
October 31	TBA		
November 03	TBA		
November 05	Analysis by interphase partition	Chapter 11	
November 07	Partitioning (continued)	Chapter 11	
November 10	Partitioning (continued)	Chapter 11	
November 12	TBA		Assignment 3 due

November 14	TBA		
November 17	TBA		
November 19	TBA		
November 21	Informal term paper discussion		
November 24	TBA		Draft papers due
November 26	TBA		
November 28	no class		
December 01	In class presentations		
December 05	In class presentations (continued)		
December 08	TBA		
December 10	TBA		
December 12	Final papers due		