

**ENV 220/CHM 220 – Environmental Analysis
Spring 2010**

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Office Hours: MWH 1:00-2:00 PM

WH 9:00-10:00 AM

or by appointment

Lecture Meets: MW from 11:00-11:50 AM in Boehm 104

Laboratory Meets: M from 2:00-4:50 PM in Boehm 307

Course Supplies:

- Environmental Analytical Chemistry, Ed. F.W. Fitfield and P.J. Haines: Blackwell Science Ltd, 2000 (EAC). (*OPTIONAL*)
- Laboratory Notebook – bound, composition book (not spiral)
- Calculator with ability to perform scientific notation, natural logarithms, base 10 logarithms, and linear regressions. NOTE: Storing of text, formulas, or data during an exam is in violation of the Academic Honesty Policy (see below).
- Access to Blackboard (<http://blackboard.kutztown.edu>) where the syllabus, lecture notes, announcements, problem sets, solutions, and laboratory information will be posted.
- Access to Course Reserves in the library.

Philosophy and Expectations

ENV220/CHM220 is specifically designed to answer two fundamental questions about a sample: 1) “What is the sample composed of?” and 2) “How much of each component is present?” Inherently, in order to answer these questions, one must be well versed in the language, thinking, and procedures of *analytical chemistry* as well as the underlying *chemical principles* that have been studied in general chemistry. This course will not stand on its own – you must utilize the knowledge and skills already obtained in your other chemistry courses! You will notice an increased independence that you will be expected to assume. In addition, the laboratory is an integral part of this course, and the experiments have been selected and scheduled to closely relate to the material covered during lectures. Laboratory work in environmental science is crucial, and I strongly suggest that you take advantage of the laboratory projects and reports to increase your understanding of the field.

Overall, my philosophy on teaching and learning can be summed up by the following Chinese Proverb: “I hear, and I forget. I see, and I remember. I do, and I understand.” It is important that you as a student actively participate in creating your own knowledge. In my opinion, lectures should not simply be the instructor talking about the topic. There should be a dialogue for comments, discussions, and asking questions about concepts that may or may not be understood. There is no such thing as a dumb question! If I cannot answer your question during class, I will do so outside of class in office hours or via email.

Course Objectives

At the end of this course, you should be able:

- To understand and apply “The Analytical Method”
- To distinguish between different sampling methods

- To explain strategies of quantitative analysis including the use of calibration curves, standard addition, and internal standards
- To understand basic techniques such as volumetric and gravimetric analysis and the chemical principles in which they are grounded
- To describe chemical instrumentation such as UV/Vis spectroscopy, FTIR, atomic absorption spectroscopy, ion chromatography, gas and liquid chromatography, and mass spectrometry and how applied to environmental analysis
- To identify the strengths and limitations of various analytical techniques
- To select an appropriate analytical technique(s) for a particular sample or analyte
- To research and use standard testing methods commonly encountered in environmental analysis
- To be familiar with emerging environmental contaminants, their origins, and the techniques used for analysis, monitoring, and in some cases remediation

Tentative Course Schedule

Week	Date	Lecture Topic
1	W 1/20	The Analytical Method; Sampling Considerations
2	M 1/25	Types of Errors/Statistics/Calibration Curves, Std Addition, Internal Std
3	M 2/1	Volumetric Analysis
4	M 2/8	Gravimetric Analysis/Spectroscopy
5	M 2/15	Spectroscopy
6	M 2/22	Spectroscopy
6	W 2/24	EXAM #1
7	M 3/1	Electrochemistry <i>(Paper Topic due W 3/3)</i>
8	M 3/8	<i>Spring Break</i>
9	M 3/15	Chromatography
10	M 3/22	Chromatography/Mass Spectrometry <i>(Resubmit Paper Topic due)</i>
11	M 3/29	Mass Spectrometry/Selected Topics
12	M 4/5	Selected Topics/Review
12	W 4/7	EXAM #2
13	M 4/12	Student Presentations
14	M 4/19	Student Presentations
15	M 4/26	Student Presentations

If school is canceled on an exam day, the exam will be given the next class period.

Cumulative Final EXAM: Wednesday, May 5 @ 11:00 AM

Grading Scale

The course grade will be weighted in the following manner:

5%	Class Participation
10%	Article Summaries/Quizzes/Homework Assignments
15%	Paper and Presentation
25%	Lab
45%	Exams (including Final)

The letter grade will be assigned based on the following scale:

A	90%-100%
B	80%-89%
C	70%-79%
D	60%-69%
F	< 60%

Class Participation

Participation is expected by each of you in all class meetings. Attendance does not count as class participation. Specifically, during the class presentations, you will be expected 1) to ask questions about the presentations; and 2) to provide your peers with appropriate feedback on different aspects of their talks.

Article Summary

Throughout the semester you will be given journal articles that specifically focus on current environmental issues and the analytical techniques used to tackle them. You will read and summarize the articles using the Article Summary Sheet that will be available on Blackboard. The article summaries are worth 10 pts each (the same as a quiz score) and are due one week after they are assigned at the beginning of lecture. Article summaries turned in after the due date are considered late and a 2 pt. penalty will be applied. Anything turned in after 1 day from the due date will NOT be accepted. Reading, interpreting, and understanding what is happening in the field is a valuable skill and will be needed in your future careers as environmental scientists.

Quizzes and Exams

Quizzes will be given periodically during the lecture period. The quizzes will be announced and will take place at the beginning of class. Quizzes will concentrate heavily on material covered since the last quiz, but could also be comprehensive in nature. Exams will also be given during the lecture period. There will be two 1 hour exams during the semester (see course schedule). The Final Exam for this course will be cumulative and will be weighted the same as a regular exam.

Makeup Policy

Missed quizzes will not be rescheduled. However, I will allow a makeup quiz if you inform me at least one day in advance that you will be missing the quiz. If you miss an exam, you must have a valid excuse (accident, serious illness, death, etc.), and you must notify me within 24 hours of the missed exam in order to makeup this work. The makeup exam *will be different* from the original exam.

Paper and Presentation

The general topic of your papers will be “Emerging Environmental Contaminants”. I would like each student to select one contaminant or in some cases a class of contaminants to research. You need to focus on the analytical technique(s) and/or standard test method(s) used to analyze and/or monitor the contaminant. Additionally, I would like you to explore

- the background/history of the contaminant;
- main sources and/or origin of the contaminant;
- remediation or clean-up strategies associated with the contaminant;
- health effects/concerns or environmental effects of the contaminant;
- federal or state regulations with regard to the pollutant; etc.

The paper should be at least 8-10 pages, double-spaced, 12 pt, Times New Roman font with one inch margins. You should have at least 7 citations. A 15 minute class presentation will be required as well. Presentations will be held between April 12-28, and the dates will be assigned first by volunteer and then at random. More details about the class presentations will follow. Paper topics are due on Wednesday, March 3rd. I highly recommend beginning to think about possible ideas NOW. Please feel free to come to my office hours to discuss possible options. Your topics will be resubmitted on Monday, March 22nd with at least 3 references that you plan to use. The final draft of the paper is due one week after your class presentation. A penalty of 10 pts per day late will be applied!

The University Writing Center is located in OM 132, just down the hall from the Women's Center. The UWC is open Monday through Friday from 8:00am to 4:00pm, and Monday and Wednesday evenings from 7:00pm to 9:00pm. Make an appointment by calling 34733 or stopping in.

Academic Honesty

Academic dishonesty in this course will not be tolerated in any form. There is an absolute zero policy. Academic dishonesty is defined as, but is not limited to plagiarizing, copying from a neighbor, copying lab reports, falsifying or inventing data, using unauthorized materials/devices during an exam, altering or adding answers to an assignment after the work has been turned in, etc. The first time a student is caught, he/she will receive a zero for that assignment. If a second offense occurs, formal action will be taken. Please familiarize yourself with the following web page for the University's position on this topic, and the actions that will be taken. <http://www.kutztown.edu/divisions/student-services/departments/dsscl/acadhonesty/index.aspx>

Special Attention

Students requiring classroom accommodations due to a documented disability should contact the Office of Human Diversity (610-683-4108) at the beginning of the semester so that the instructor can be notified by letter.

Cell Phones

All cell phones, beepers, and pagers are to be turned off and put away while you are in class and lab.

ENV 221/CHM 221 – Environmental Analysis Laboratory Spring 2010

Lab Objectives

- To provide a hands-on opportunity to wrestle with the concepts and techniques discussed during lecture.
- To connect analytical techniques to prior knowledge and to make meaningful for the learning process
- To enhance problem solving skills, critical thinking, written and oral communication, and teamwork.

Lab Attendance/Makeup Policy

Attendance is mandatory. You **MUST** have a legitimate excuse (see above) in order to make-up a lab, otherwise you will receive a zero for the missed lab. Labs can only be made up within one week of the original date. If you know that you will be absent, please make arrangements with the instructor as soon as possible.

Experiments and Schedule

Lab experiments will be posted on Blackboard under Course Materials (Environmental Analysis) one week prior to the lab. The experiments must be printed out and read thoroughly before coming to lab.

Week	Date	Lab Experiment
2	M 1/25	Lab#1- Statistical Treatment of Data and Properties of Natural Water
3	M 2/1	Lab#2- Determination of the Hardness of Natural Waters by Complexometric Titration
4	M 2/8	Lab#3- The Analysis of Organic Matter in a Soil Sample
5	M 2/15	Lab#4- Simultaneous Analysis of a Mixture of Co(II) & Cr(III) using Spectrophotometry
6	M 2/22	Lab#5- Determination of Extractable Metals in Soil using Flame AA Spectrophotometry
7	M 3/1	Lab#6- FTIR Analysis of Pollutants in Automobile Exhaust (Submit Ranked Topics/Methods for the Standard Method Project)
8	M 3/8	SPRING BREAK
9	M 3/15	Lab#7- A Comparison of Methods for Analysis of Chloride Ion in Natural Waters
10	M 3/22	Lab#8- Analysis of Soil Leachate for Herbicides using High Performance Liquid Chromatography (HPLC)
11	M 3/29	Lab#9- Headspace Solid Phase Microextraction (SPME) coupled to GC-MS for Analysis of Hydrocarbons
12	M 4/5	Field Trip
13	M 4/12	Lab#10- Standard Method Project
14	M 4/19	Lab#10- Standard Method Project
15	M 4/26	Lab#10- Standard Method Project

*There is not a final for the laboratory component.

Lab Notebook

Notebooks will be evaluated at the end of the course, and you will be given a notebook grade (max 20 pts). Notebooks should contain the basics such as a Table of Contents, page numbers, and experiment titles. (See Handout on Notebook Guidelines for more details.) For each lab experiment, the goals of the experiment, acquired data, graphs, and calculations should be recorded in your bound notebook. Do not be surprised at receiving a minimum grade if you record results improperly, your calculations are incorrect, or the notebook is disorganized and hard to follow.

Lab Report Format

Lab reports are due one week after the experiment is completed (**at the beginning** of the next week's lab). For each day that a lab report is late, 2 points will be subtracted from the report grade (up to 14 points for a week late). Lab reports turned in after one week will receive a zero. Lab reports should be typed and double-spaced in complete sentences using good, standard English. Third person (passive voice) is the appropriate style for technical reports. ("The beaker was heated to 80°C.", not "I heated the beaker to 80°C.") Tables and figures should be properly labeled and incorporated within the body of the report. Most importantly, the lab report is an **INDIVIDUAL EFFORT!** You may only share **DATA** with your lab partner – all other sections must be your own work. (See Academic Honesty.) The following sections should be included for a full lab report (abbreviated reports only need Results, Discussion, and Post-Lab Questions):

Title – includes title of experiment, date, your name, and your partner's name (does NOT need to be on a separate page)

Introduction – This section gives a background into the experiment and the techniques used. It also briefly summarizes the purpose of the experiment and places it in the context of the big picture.

Experimental - The experimental (procedure) section summarizes what you did in the experiment. **DO NOT COPY** the procedure section of the experiment! Avoid including excessive detail, and do not place results or calculations in the procedure section. The length should be relatively short and the writing concise.

Results – All data should be presented here in tabulated or graphical form, clearly labeled, with units, and written to the correct number of significant figures. Graphs must be plotted in Excel with titles, labeled axes, units, the slope (linear regression), and R^2 values. The raw data should be shown first followed by sample calculations starting with the standard formula, then substituted, and finally showing the calculated result. Example calculations should be presented with "Equation Editor" in MS Word or neatly printed by hand. One should show an example of each important type of calculation (including statistical tests), but do not show detailed arithmetic. For example, the following is appropriate

$$\text{density} = \frac{\text{mass}}{\text{volume}} = \frac{24.0 \text{ g}}{6.0 \text{ mL}} = 4.0 \text{ g/mL}, \text{ but the detailed arithmetic below is unnecessary}$$

$$25.0 \text{ mL} - 19.0 \text{ mL} = 6.0 \text{ mL} \quad \text{or} \quad 6.0 \text{ mL} \overline{) 24.0 \text{ g}} \cdot \frac{4.0 \text{ g/mL}}{}$$

Discussion – This section should include 1) the meaning or interpretation of the results you obtained; and 2) possible errors associated with the measurement. “Human error” is NOT a source of uncertainty and shows your lack of thought. If the accuracy and precision are good, this should be pointed out. If outliers exist, the use of appropriate statistical tests is key.

Post-Lab Questions – Answer the questions at the very end of the lab report. It might be a good idea to complete these first because they might trigger ideas to discuss in other sections. Use calculations and equations where appropriate.

Standard Method Project

This project will be conducted during the last 3 lab periods. The main goal of the project is to select a Standard Testing Method (i.e. Method No. 340.2 (EPA-600/4-79-020)) that you will use to test 1) a known sample, and 2) an unknown sample. Several resources will be put on Course Reserves in the Rohrbach Library for you to use. You will need to initially submit your top 3 selected Methods/Topics by Monday, March 1st (please rank). Each of the submitted Methods will be reviewed to determine whether or not we have the equipment, supplies, and standards needed for the Method. There could also be some overlap in the instrumentation that everyone needs, so a schedule might be needed to accommodate everyone’s project. This project will be written up as a regular lab report, but will be worth 50 pts. Your grade will mainly be based on the quality of effort put into the assignment. You will need to use your time wisely!

Grading

The laboratory grade component is 25 % of the entire course grade. The grading will be based on the following:

- 9 Lab Reports (20 pts each)
- Standard Method Project (50 pts)
- Notebook Grade (20 pts)

Lab reports will be graded using the following rubric.

	Excellent (4) or (7-8)	Good (3) or (5-6)	Average (2) or (3-4)	Poor (1) or (1-2)	Unacceptable (0)
Introduction/ Experimental/ Results/ Discussion	Fully addresses descriptions above	Substantially addresses descriptions above	Adequately addresses descriptions above	Inadequately addresses descriptions above	Copies/absence of information
Post-Lab Questions (4 pts possible)	Points will be assigned based on number of questions.				