CHE 220: Introduction to Environmental Analytical Chemistry
Spring 2015
(TR 9:40-10:55/Little Open Tutoring Room)

INSTRUCTOR INFORMATION:

Dr. Cindy DeForest Hauser
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Phone: 894-2302
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Office Hours: Wednesdays 10:30 – 11:30 and by appointment
Problem Solving Session: Tuesdays 4:15-5:15, Martin 328

COURSE DESCRIPTION:

In this course, we will explore inorganic aqueous chemical equilibrium with applications in environmental chemistry. Laboratory experiments include quantitative environmental analysis using volumetric, spectroscopic, chromatographic and potentiometric methods. This course fulfills Chemistry and Environmental Studies Major Requirements.

EQUILIBRIUM	ANALYTICAL	ENVIRONMENTAL
SOLUBILITY	SAMPLING	CLIMATE CHANGE
ACID/BASE	STATISTICS	AIR POLLUTION
COMPLEX ION	QUANTITATIVE ANALYSIS	WATER POLLUTION
ELECTROCHEMISTRY	TITRATIONS	FOOD AND SUSTAINABILITY
NUCLEAR CHEMISTRY	SPECTROSCOPY	ENERGY
	CHROMATOGRAPHY	
	ELECTROANALYTICAL	

REQUIRED RESOURCES:

Daniel Harris, Quantitative Chemical Analysis 8e, Freeman, etext available through Sapling

Bound Laboratory Notebook

Sapling Online Homework Module

CHE115 or equivalent General Chemistry text.

COURSE REQUIREMENTS:

ATTENDANCE POLICY: Attendance at lectures and scheduled laboratory sessions is mandatory; a record of attendance will be kept. A student who misses in excess of 25% of lectures will not receive a passing grade. If illness or some other factor outside your control causes you to miss a lecture, review or laboratory session, you must **notify me as soon as possible**. Do not assume that you will be permitted to reschedule reviews or laboratory sessions without prior notification. Missed reviews due to illness will require documentation from student health or a doctor. Make up reviews will be rescheduled at the discretion of the instructor. There will not be any make up laboratory sessions unless we are able to schedule into a section that has yet to complete that experiment. Alternative assignments may be used in the event of missed laboratory periods.

ASSIGNED READING AND PROBLEMS: Daily readings and/or problems are indicated on the lecture schedule. You are expected to be an active learner in this course. This means that you should do the reading before coming to class and come prepared with a calculator to engage in problem solving. The reading will focus on what we are going to cover in class that day. Most of the learning in this course occurs through problem solving. The most successful students work with the material each day and are active participants in working through the problems in class. Problems will be assigned through Sapling Online Homework and Hardcopy Problem Sets. Sapling Online Homework assignments are due by 9:30 AM on the day indicated in the Lecture/Lab Schedule. A hardcopy (no spirals) of the Problem Sets is due to the labelled folder outside my office door by 3:30 PM the day indicated.

LABORATORY (Martin B50): The laboratory is designed to complement and reinforce concepts in class. Laboratory experiments focus on quantitative techniques while exploring environmental issues. The laboratory notebook includes the experimental description, procedure and recording pages. Report sheets will be posted to moodle or made available on the bookshelf outside my office door. You are to report on time for lab (1:30 Wednesday and 1:40 Thursday) with safety glasses, closed toed shoes, a calculator, lab notebook and writing implement. Prelabs will be due as soon as you enter the lab and will not be accepted once the prelab instruction has begun. The laboratory protocol MUST be read in its entirety prior to coming to lab. Laboratory reports will either be due before you leave lab or on the day indicated in the Lecture/Lab Schedule.

PROBLEM SOLVING SESSIONS: Optional, but strongly encouraged. We will work through recommended problems, which will be very helpful in completing required problems. Past experience indicates that students who work problems are more successful in the course. Students will work through problems with the course instructor facilitating. Group work will be encouraged. Mohamed Munye will serving as a TA for this course and will similarly be holding problem solving sessions.

COURSE EVALUATION:

Problem Sets/Sapling Assignments	100
Four Reviews (120 pts each)	480
Cumulative *MCAT* Final	120
Laboratory	250
In Class Exercises	50
Total Points	1000

MATH & SCIENCE CENTER:

The Math & Science Center (MSC) offers free assistance to students in all areas of math and science, with a focus on the introductory courses. Trained and highly qualified peers hold one-on-one and small-group tutoring sessions on a drop-in basis or by appointment, as well as timely recap sessions ahead of scheduled reviews. Emphasis is placed on thinking critically, understanding concepts, making connections, and communicating effectively, not just getting correct answers. In addition, students can start or join a study group and use the MSC as a group or individual study space. Located in the Center for Teaching & Learning (CTL) on the first floor of the College Library, drop-in hours are Sunday through Thursday, 8-11 PM, and Sunday, Tuesday, Thursday, 4-6 PM, beginning Tuesday, January 20. Appointments are available at other times. For more information, visit http://sites.davidson.edu/ctl, or contact Dr. Mark Barsoum (mabarsoum or ext. 2796).

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES:

Full accommodations are the legal right of students with all kinds of disabilities, whether learning disabilities or physical disabilities. I am happy to provide these accommodations. If you are a student with a learning disability documented by Davidson College who might need accommodations, please identify yourself to me within the first week or two of class, so that I can learn from you as early as possible how to best work with your learning style. Students with other disabilities are also encouraged to self-identify if there is any way in which I can make accommodations that will enhance your learning experience. All such discussions will be fully confidential unless you otherwise stipulate.

EXCUSED ABSENCES:

Should there be a conflict between any class or laboratory session and a religious holiday or observance, the student should let the instructor know of his or her personal need. Religious observance warrants a legitimately excused absence with prior approval by the faculty.

HONOR CODE:

"*Every student shall be honor bound to refrain from cheating (including plagiarism). Every student shall be honor bound to refrain from stealing. Every student shall be honor bound to refrain from lying about official College business. Every student shall be honor bound to report immediately all violations of the Honor Code, which come under his or her observation; failure to do so shall be a violation of the Honor Code. Every student found guilty of a violation of the Honor Code shall ordinarily be dismissed from the College for a period. Every member of the College community is expected to be familiar with the operation of the Honor Code.*"

"All course work submitted for evaluation is pledged with the student's signature: *On my honor, I pledge that I have neither given nor received help on this work, nor am I aware of any violation on the part of others*. In pledging, his or her work, the student affirms that any significant learning must be done within the boundaries of the pledge, that any knowledge falsely represented as one's own is hollow and without merit." (excerpted from the current College catalog announcements)

You are encouraged to work together on recommended problems. Problem sets, prelabs and laboratory reports must be your own work. True collaborative efforts on problem sets and laboratory reports are permitted. Indicate who you worked with and extent of collaboration or assistance in the pledge. Using reviews or laboratory reports from previous classes will be considered a violation of the honor code.

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Lecture Schedule, Lab Schedule and Assignments Due
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Week of	Environmental Context	Equilibrium	Analytical Application	Recommended Reading & Assignments Due
Jan 12	*Equilibrium Chemistry of Natural Waters* Role of coal in water quality Carbon Dioxide/Climate change & Dissolved Oxygen	Introduction to the Course Distribution of iPads Environmental Sampling *Introduction to Chemical Equilibria* Henry's Law	Water Sampling Units of Concentration, Sig Figs & Error Statistical Analysis of Data Read pp 13-20, Chapters 3 and 4	Read Case 1, Environmental Sampling, Chpt 0, and 699-705. See Moodle, Read pp 117-121 and CNW pp 409-413
Jan 19	Combustion Reactions: Acid Deposition from NOx and SO_2	*Acid-Base Equilibria* Strengths of Acids and Bases Weak Acids and Bases Polyprotic Acids and Bases	Water Quality Analysis *Water Quality Report Due*	Read pp 126-136, 150-155 and Chpt 8 *Sapling I* Read Chpt 9 *Problem Set I*
Jan 26	Ocean Acidification	Buffers *Titrimetric Analysis* Titration Calculations Primary and Secondary Standards Indicators	Lab Check In Read Chapter 2 Calibration of Glassware *Calibration Report Due*	Read pp 172-181, 193-194 *Sapling II* Read pp 22-24 *Problem Set II*
Feb 2	Alkalinity	Acid/Base Titrations **Review I** (*ENV201 Atmos Chem*)	Alkalinity/Buffering Capacity Titrations *Alkalinity report due* *Dry KHP*	Read Chpt 10, CNW 430-432
Feb 9	Metals in water; Salinity, TDS, Acid Mine Drainage, Coal Ash Disposal	*Solubility Equilibria* Solubility Products Relative Solubility Common Ion Effect Selective Separation	Quantitative Analysis of Environmental Samples and the use of Reference Materials through the Titrimetric Determination of KHP *KHP Report Due*	Read pp 121-124 and Moodle Read CNW: pp 432-448

Feb 16	Weathering and Solubilization Effects of Acidification	pH and solubility Precipitation Titrations Chloride Analysis	Identification of Unknown Acid Contaminant in Natural Water Samples using Potentiometric Titration *Prepare Coal Samples for Heating in Furnace*	Read pp 155-158, 265-270, CNW 449-450 *Sapling III* Read pp 685-693 *Problem Set III*
Feb 23	*Food and Sustainability* Soil Chemistry	*Transition Metals and Complexation Equilibria* Coordination Chemistry Complex Ions and Solubility Food and Sustainability Intro Jeff and Theresa (Farm Tour)	Excel Calculation of Theoretical Curves and Identification of Unknown Field Trip to Davidson Farm	Read pp 124-126 *Sapling IV* See Moodle for Reading *Problem Set IV*
Mar 2	*Spring Break*			

Week of	**Environmental Context**	**Equilibrium**	**Analytical Application**	**Recommended Reading & Assignments Due**
Mar 9	Water Hardness Analysis	*Transition Metals and Complexation Equilibria* Coordination Chemistry Complex Ions and Solubility Complexometric Titrations	Scientific Writing Article deconstruction Creating a grading rubric Plotting theoretical curves Outline results and discussion Prepare $BaSO_4$ precipitate	Read pp 124-126 Read Chpt 11, CNW 448-449 **Review II (Take Home)**
Mar 16		*Fundamentals of Chromatography* *Fundamentals of Spectroscopy* *Analytical parameters and calibration*	Sulfur Content in Coal; Complexometric Titration	Read Chpt 17 Read Chpt 22 *Unknown Results and Discussion Due*
Mar 23	*Redox Chemistry of Natural Waters & Soils* Dissolved Oxygen, BOD, COD	*Fundamentals of Electrochemistry*		*Sapling V* Read Appendix D and Chpt 13 Read CNW 559-578

	pE, Eh Metal Speciation		Soil Sampling/pH/Eh/Soil Drying	*Problem Set V*
Mar 30		*ENV201 Climate Change* Chemistry of Natural Waters In Class Exercise **Review III** *ENV201 Climate Change (45 min)*	Crushing/Sieving/Extraction	*Sapling VI*
Apr 6		*Easter Break* Electroanalytical Methods Redox Titrations Electrochemical Sensors: Ion Selective Electrodes	Macronutrients in soil Atomic Absorption Spectroscopy and Colorimetry	Read Chpt 15
Apr 13		Electrolysis and Electrochemical Remediation Methods *ENV201 Energy* Project Day: Data analysis and sharing of data. Exercise: What makes a good and bad poster?	Fertilizer runoff and water eutrophication; nitrates and phosphates in natural water systems by Ion Chromatography	Read Chpt 14 and pp 361-369
Apr 20	*Energy*	ENV201 Energy Batteries and Fuel Cells	Eutrophication and water quality: dissolved oxygen in natural water systems using redox titrations Electrochemical Remediation of contaminated soil	*Problem Set VI* See Moodle for Reading
Apr 27		*Nuclear Chemistry*	Check Out and Course Evaluations	See Moodle for Reading
May 4		**Review IV**	*No Laboratory Sessions*	*Sapling VII*