

CE 5390 – Environmental Engineering Chemistry – Fall 2017

The University of Texas at El Paso
Civil Engineering
Class: Tue/Thur 4:30-5:50pm, Class. Bld. 204
CRN: 18577
Prerequisites: CE 4342

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Office hours: Tues/Thur, 1:30-2:30pm

Required Text: Chemistry for Environmental Engineering and Science, (2003), Sawyer *et al.*

Supplemental Texts: Aquatic Chemistry, (1996), Stumm and Morgan; Water Chemistry, (1980), Snoeyink and Jenkins; Water Chemistry, 2nd Ed. (2014), Benjamin

Description and Objectives

This course involves a study of theory and analysis of chemistry in environmental systems: thermodynamic equilibrium, reaction kinetics, acid/base, complexation/solubility, and oxidation/reduction.

Expectations

Participation: More than simply attending class, you are invited to *think*, and *participate* in the lectures and discussions. I encourage you to be curious and inquisitive during lectures and discussions.

Preparedness: I recommend that you bring the textbook, a personal course notebook, a pen or pencil, a calculator, completed homework assignments, and questions from the homework and assigned reading.

Punctuality: You are expected to be on time to class, laboratory exercises, and tours. Assignments submitted late will not be graded and will receive no credit.

Ethics: In engineering, personal integrity is of utmost importance, especially in the assessment and reporting of environmental conditions. Also, in most cases, it is necessary to work in teams to develop and design optimal solutions to problems and challenges, and it is essential that each team member contribute to the productivity of the team. In this course, I strongly recommend that you complete homework assignments in teams; in many cases, you will help each other through the solution of difficult problems. My goal for the homework is for you to develop proficiency in the theory and calculation of aqueous chemical systems. Thus, every student is accountable for *understanding* the concepts, analysis, and solution. Any student committing plagiarism (*e.g.*, copying another's work) or any other form of academic dishonesty will be reported to the Office of Student Conduct and Conflict Resolution for disciplinary action (which may include expulsion from the University). For a concise summary of engineering ethics, I have provided here the Fundamental Canons within the [Code of Ethics](#) of the American Society of Civil Engineers (ASCE):

1. *Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties.*
2. *Engineers shall perform services only in areas of their competence.*
3. *Engineers shall issue public statements only in an objective and truthful manner.*
4. *Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.*
5. *Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.*
6. *Engineers shall act in such a manner as to uphold and enhance the honor, integrity, and dignity of the engineering profession and shall act with zero-tolerance for bribery, fraud, and corruption.*
7. *Engineers shall continue their professional development throughout their careers, and shall provide opportunities for the professional development of those engineers under their supervision.*
8. *Engineers shall, in all matters related to their profession, treat all persons fairly and encourage equitable participation without regard to gender or gender identity, race, national origin, ethnicity, religion, age, sexual orientation, disability, political affiliation, or family, marital, or economic status.*

Quizzes

I will be using a cloud-based student response software by iClicker in class this semester for quizzing and polling. You will need to create an iClicker Reef Student account to participate in class using your laptop, smart phone, or tablet connected to the university’s Wi-Fi (UTEPSecure) or to your mobile data plan. Sign in to Blackboard (available from <https://my.utep.edu/>) and click the link for this course. Search for the iClicker REEF icon on the Home Page. Click this link to launch a special instance of REEF, then log in, or create a new REEF account if you don’t already have one. **When creating your account, use your university email address** (username@miners.utep.edu). You will not need to purchase a subscription to use iClicker REEF this semester because it is provided to you for free. Signing into REEF through the link in Blackboard will automatically add you to my course. When asked to register a remote device, choose “not at this time”. Note: submitting votes for a fellow student is considered cheating and a violation of the University Honor Code and the Civil Engineering Honor Code. If you are caught voting for another student or have votes in a class that you did not attend, you will be referred to OSCCR for disciplinary action.

Homework

Some homework assignments will be completed through the UTEP Blackboard website (available through <https://my.utep.edu/>), and some homework assignments will be completed through Quest Learning and Assessment, a web-based content and homework delivery system maintained by The University of Texas at Austin. This homework service will require a **\$30 charge per student** for its use, which goes toward the maintenance and operation of the resource. Please go to <https://quest.cns.utexas.edu> to log in to the Quest system for this class. During the beginning of this course, when you log into Quest, you will be asked to pay via credit card on a secure payment site. You have the option to wait up to 14 days to pay while continuing to use Quest for your assignments. If you are taking more than one course using Quest, you will not be charged more than \$60/semester. For payment questions, email questhelp@austin.utexas.edu.

Evaluation

Assessment of your performance in this course will be determined by class attendance and participation, homework quizzes, and exams. (No makeup exams will be offered.) The total course average will be computed by the following:

Evaluation	Contribution (%)
Homework	30
Quizzes	20
Midterm Exams	30
Final Exam	20
Total	100

The final course grade will be determined according to the following:

Average (%)	Grade
≥ 90	A
80-89	B
70-79	C
60-69	D
< 60	F

I reserve the right to modify or augment this grading scheme for the sake of improving the educational effectiveness of this course.

Special Accommodations

The University of Texas at El Paso provides, upon request, appropriate academic accommodation for students with disabilities. For more information, contact the Center for Accommodations and Support Services (<http://sa.utep.edu/cass/>).

Tentative Course Schedule

Class	Day	Date	Topics	Reading Assignment
1	T	AUG	29 Documentary: <i>Frontline: Poisoned Waters</i> (2009)	-
2	R		31 General Chemistry	Ch. 1-2
3	T	SEP	5 Thermodynamics: Free Energy and Equilibrium	§3.1-2
4	R		7 Physical Chemistry	§3.3, 6, 7, 9
5	T		12 Kinetics	§3.10
6	R		14 Adsorption	§3.12
7	T		19 Equilibrium and activity coefficients	§4.1-3
8	R		21 Conservation of mass and charge: monoprotic	§4.4
9	T		26 pH and ionization fractions	§4.5 (p. 121f)
10	R		28 Polyprotic acids/bases and exact solutions	§4.5 (p. 124f)
11	T	OCT	3 Exam I	Ch. 1-3, 4.1-3
12	R		5 Approximate solutions	§4.5 (p. 129f)
13	T		10 Graphical solutions with pC-pH diagrams	§4.5 (p. 136f)
14	R		Graphical solutions with pC-pH diagrams	§4.5 (p. 136f)
15	T		17 <i>Tour EPWU Water Quality Laboratory</i>	-
16	R		Open and closed systems	§4.5 (p. 143f)
17	T		24 Titrations	§4.5 (p. 147f)
18	R		Alkalinity and Buffering	§4.6-7
19	T		31 Alkalinity, open and closed	§4.5-7
20	R	NOV	2 Complex Formation	§4.8
21	T		7 Solubility	§4.9
22	R		9 Equilibrium Software	-
23	T		14 <i>Tour Freeport McMoRan's Copper Refinery in El Paso</i>	-
24	R		16 Exam II	§4.4-9
25	T		21 Oxidation-Reduction Equilibrium	§3.9, 4.10
-	R		23 <i>Thanksgiving Holiday (no class)</i>	-
26	T		28 Oxidation-Reduction Equilibrium	§4.10
27	R		30 Redox – pE-pH (Pourbaix) diagrams	§4.10
28	T	DEC	5 Redox – pE-pH (Pourbaix) diagrams	§4.10
29	R		7 <i>Tour EPWU Upper Valley Water Treatment Plant</i>	
30	T		12 Final Exam, 4:00pm-6:45pm	(comprehensive)