



**CHEMISTRY 2240-1 (Lecture)  
INTRODUCTION TO ENVIRONMENTAL CHEMISTRY  
SPRING 2019**

**Instructor:** Dr. Michael E. Ketterer

**Office:** SGM Room 111

**Phone and email:** (303) 871-2254 (Department office); (928) 853-7188 (mobile). Calls or voicemails to my mobile phone are OK but please minimize sending text messages; email is preferred: [michael.ketterer@du.edu](mailto:michael.ketterer@du.edu) *For emails, please only use your DU address.*

**Class Meets:** MWF 0900-0950 AM in Boettcher Center Auditorium 102

**Office Hours and Contact:** MWF 1000-1100 AM, or by appointment

**Graduate TA (Laboratory):** Heather Runberg [Heather.Runberg@du.edu](mailto:Heather.Runberg@du.edu)

**Text:** James E. Girard, Principles of Environmental Chemistry, Third Edition, 2014, Jones and Bartlett Learning, ISBN 978-1-4496-9352-7. The text is strongly recommended, but I would stop short of saying it is absolutely required. We will be following a treatment that parallels the book to a large extent, and so reading the book will be helpful for obtaining a separate perspective. Nevertheless, the Internet-savvy person can easily find excellent sources, for all lecture topics, to use as supplementary resources. At times, you will benefit from looking at materials on the Internet, but please consider their credibility/veracity. The first edition of Girard from 2005 or the second edition from 2010 may be available for sale online very cheaply, and these earlier editions should be useable.

**Other Required Resources:** You will need an inexpensive calculator that has the capability for performing square roots, logarithms, and exponents. It is your obligation to understand these operations, and please bring your calculator to class, and of course, in-class exams. No use of a mobile phone-based calculator will be permitted during in-class exams.

**Course Description:** This course in environmental chemistry Introduction to Environmental Chemistry is designed as the third of three core chemistry requirements for environmental science majors, although it is expected that a handful of other chemistry majors and students from other disciplines may be enrolled. The course is designed as a “survey” of topics in environmental chemistry; as such, we will not go into extreme detail on any one topic. The aim of the course is to introduce students to environmental chemistry issues and to expose ideas that will provide a basic framework to process complex issues that will face our world today and in coming years.

The course is comprised of both lecture (CHEM 2240-1) and lab portions (CHEM 2240-2, -3). One final grade will be assigned, weighted as a mix of the two portions (60/40, lecture/lab, respectively). As a result, it is not possible to withdraw solely from lecture or lab, independent of the other.

The course is not designed to be an upper division chemistry course; however, you may encounter topics and exam questions that appear quite challenging. Students should anticipate typically spend 2-3 hours outside of class per course credit hour, which means ~ **6-9 hours outside of class per week on average**. This will not always be the case, and some weeks and topics could require more or less effort. Some topics are cumulative, and will draw from your prerequisite knowledge; hence, it is best to keep current with your work.

CHEM 2240-1 (lecture) consists of an examination of the Earth's surface (lithosphere, hydrosphere, atmosphere, and biosphere) as a chemical system with emphasis on how humans perturb the Earth's system through resource use, population impact, and introduction of pollutants. The course emphasis is both upon how the Earth surface environment works as a chemical system, and how humans alter this system. We will focus on impacts the Earth has witnessed in the *Anthropocene*. Technologies that create alterations, as well as those that attempt to alleviate human impact are discussed.

***It is assumed that you have a robust, sound knowledge of these two General Chemistry courses.*** Concepts from other specialized sub-disciplines of Chemistry will be brought in and explained as appropriate, while acknowledging that most students will not have experience beyond General Chemistry. When these topics appear, they will be explained as required by providing adequate background and context.

It is an excellent idea to have a General Chemistry textbook available. A suggested text that is open-source, and available freely online is at: <https://openstax.org/details/books/chemistry>

The use of instrumentation in chemical analysis in solving integrated field-laboratory problems will be discussed to a limited extent, and will be addressed in greater detail (and hands-on) in the accompanying laboratory sections. As environmental scientists, you can expect to encounter situations requiring monitoring/measurement of organic and inorganic constituents, ranging from major to ultra-trace levels, in many different media (water, air, soils, anthropogenic products and wastes, biota). It is advantageous for you to have some familiarity with these measurements, even if you are interfacing with laboratory specialists rather than performing them hands-on.

**Course Objective:** The primary objective of the course is to enable an understanding of the environment, its issues and challenges, from the viewpoint of chemistry. The student should complete this course having obtained an appreciation for how all natural Earth processes run on “chemicals” and “chemical reactions”; and how humans introduce abnormal amounts of naturally occurring substances as well as new substances that are wholly synthetic in origin.

**Course Structure/Approach:** CHEM 2240-1 will be conducted mainly in a lecture format during classroom meetings (75-80%). Questions, discussions, and interjections are most welcome; I will put forth topics and questions to solicit your response and participation. It is not my style to randomly call upon individuals in class, recognizing that individuals each have

different personalities, cultural perspectives, and learning styles.

The in-class materials will be presented as PowerPoint files. As I have previously developed/instructed this course in an online format, you will note that the PowerPoint files have icons to click on to hear my short audio clips (\*.wav format) associated with each slide. We will not play these during class; of course, they are available for your preview/review purposes, and in the event you must miss a class session. The order of presentation will be organized similarly to the Chapters in your text, and the materials will be posted on Blackboard during the course of the semester.

Please note regarding the PowerPoint files: there is more material here than can be completely covered during a 10-week quarter. Accordingly, I will adjust the depth and coverage of some topics, and please expect that we will skip in-class treatment for portions of what is posted in these files on Canvas. ***Nevertheless, I will not expect you to be accountable for topics not specifically addressed during class, with a few possible, forewarned, minor exceptions.***

The PowerPoint presentations will often include references or links to important supplementary materials such as suggested (ungraded) practice problems, recommended web sites, and journal articles. Some, but not necessarily all, of this content will also be posted on Canvas.

Students are expected to be familiar with the use of the Internet as an electronic resource, and will be directed occasionally to online journals that are available through the University of Denver library website. Two very useful starting points for searching the scientific literature are [scholar.google.com](http://scholar.google.com) and [sciencedirect.com](http://sciencedirect.com). That is to say, in addition to the textbook and class material I present, you will have the opportunity (and, sometimes, the expectation) to consult other resources. These will consist of websites (instrumentation manufacturers, laboratories, trade associations, government sites, user groups, and list-servers), electronically available journals, and paper-based journals. Most journal articles published in recent decades are available in electronic format and may be printed and/or stored in journal publication format as \*.pdf format.

**Class Schedule** (*approximate, and subject to changes and adjustments as announced*)

<b>Dates</b>	<b>Topics</b>	<b>Book Chapter(s)</b>
4/1	Overview of course; discussion of the Anthropocene	
4/3, 4/5, 4/8	Planet Earth: Rocks, Life and Energy	1
	Earth's Soils and Agriculture	2
4/10, 4/12, 4/15, 4/17	The Earth's Atmosphere	3
	Chemistry of the Troposphere	5
	Chemistry of the Stratosphere	6
<b>4/19</b>	<b><i>Exam #1 distributed (take-home format)</i></b>	
<b>4/26</b>	<b><i>Exam #1 due in class</i></b>	
4/19, 4/22	Water Resources	8
4/24, 4/26, 4/29	Water Pollutants	9
5/1, 5/3, 5/6, 5/8	Water Treatment	9
	Water Analysis	10
<b>5/10</b>	<b><i>Exam #2 in-person (mix of multiple choice and short answer format)</i></b>	
5/13, 5/15, 5/17	Environmental Radioactivity	12
5/20, 5/22	Hazardous Wastes	20
5/24, 5/29	Energy Resources	11, 13
<b>5/29</b>	<b><i>Exam #3 distributed (take-home format)</i></b>	
<b>6/3</b>	<b><i>Exam #1 due in class</i></b>	
6/1, 6/3, 6/5	Climate Change	4
6/7	Summary overview; review/address questions for final exam	
<b>Week of 6/10 – 6/13</b>	<b><i>Final Exam (TBA)</i></b>	

## Course Policies, Evaluation Methods, and Deadlines

\* *My guiding principles in dealing with all students are “consistency and fairness”.*

\* All rules and policies regarding drop/add, academic integrity, etc. as set forth by the University shall be in effect for this course. For more information, please consult your these documents; by inference, you are agreeing to all of these rules as a registered student. You are expected to abide by the Pioneer Pledge and the Honor Code of the University of Denver:

Pioneer Pledge: <http://www.du.edu/studentlife/ccs/pledge.html>

Honor Code Statement: [http://www.du.edu/studentlife/ccs/honor\\_code\\_2011-2012.pdf](http://www.du.edu/studentlife/ccs/honor_code_2011-2012.pdf)

\* University policy grants students excused absences from class or other organized activities for observance of religious holy days, unless the accommodation would create an undue hardship. Faculty are asked to be responsive to requests when students contact them *in advance* to request such an excused absence. Students are responsible for completing work or exams given during their absence, but should be given an opportunity to make up work missed because of religious observance. Once a student has registered for a class, the student is expected to examine the course syllabus for potential conflicts with holy days and to notify the instructor by the end of the first week of classes of any conflicts that may require an absence (including any required additional preparation/travel time). The student is also expected to remind the faculty member in advance of the missed class, and to make arrangements in advance (with the faculty member) to make up any missed work or in-class material within a reasonable amount of time.

\* University policy also grants excused absences from class or other organized activities to students participating in official, University-sanctioned activities (e.g., athletic team participants, or any other type University-sponsored activities requiring absence from campus/classes). If this applies to you, it is your responsibility to submit these requests via email, as soon as the activity's schedule is known prior to the absence, along with appropriate documentation.

\* I am obligated to make accommodations for University policy-excused in-person exams and/or adjust dates of take-home exams; however, I am unable to provide more than cursory outside-of-class recap of missed class sessions.

\* Students experiencing significant illnesses that preclude being present for an in-person exam, or submitting a take-home exam, will be excused for situations warranting such, and accommodations will be made. I reserve the right to request appropriate documentation.

\* I will make all necessary accommodations for students diagnosed with a learning disability. I will do so while maintaining complete confidentiality. Students requiring these accommodations have the responsibility of informing their instructors; please do so, in writing, during the first week of the Quarter. For further information, please see the University Disability Services' website: <http://www.du.edu/disability/dsp/index.html>.

\* You are responsible for material assigned or covered regardless of your attendance/participation. In CHEM-2240-1 (Lecture), you will be graded strictly upon exam performance regardless of your overall effort, attendance, or time expended.

\* Please be advised that there can never be an exact relationship between the effort you put in and the grade received; when asked this by students, the answer always is “it just depends”, and it is not possible for the instructor to specify what the student must do, in order to receive a predetermined outcome. Nevertheless, students with erratic or sub-par attendance cannot expect to achieve above-average grades, and therefore, you will find that regular attendance and a few hours per week of work outside class is in your best interest.

\* You are encouraged to read through the text, review the PowerPoint presentations and associated audio segments, and to review any supplementary journal articles, reports, websites and any other related materials recommended by the instructor. I am not a fan of testing people on small, trivial details; I will emphasize asking in-person exam questions that are based upon major ideas that have been well-covered in class.

\* Take-home exam questions may be more probing and lengthy; these exams may require you to do additional research; of course, you may use any/all resources. Nevertheless, you are expected to work on these take-home exams, ***completely on your own, without collaboration/assistance from classmates or others.*** If you experience difficulties, please ask questions to me, preferably at least two days before these exams are due. Please do not expect to be able to get significant assistance (e.g., detailed questions submitted *via* email) ***within the last ~ 16 hours*** before these exams are due in class.

\* Course materials will be posted and distributed through University of Denver’s Canvas system. You are responsible for securing your own software resources; I anticipate using common file formats such as PDF, XLS or XLSX, DOC or DOCX, PPT or PPTX, MP3, MP4, and WAV. The audio and video files (MP3, MP4 and WAV) should be compatible with many different media players. I cannot provide more than cursory assistance to you on IT-related issues; please seek assistance from the University of Denver IT Help Center if you require such.

\* Short emails about course content and/or administrative matters are acceptable; these should be sent from your U of Denver email account. Please include CHEM 2240 or other immediately recognizable identifiers in the subject line; an email should include your full name; please write professional-type correspondence; it is always appropriate (as is the case in any business setting) to say “Dear So and So”, “Please”, “Thank you”, “Sincerely”; be concise and organized, and use complete sentences with correct spelling, punctuation, and grammar. Important points buried in the text of lengthy messages are sometimes overlooked, so brevity is preferable. If English is not your native tongue, I owe my respect to you for learning a difficult additional language, and I will be understanding and tolerant of challenges you may experience.

\* If you write from a non-DU email address, and/or do not identify yourself, I will not feel obligated to respond.

\* Emails that convey hostility, disrespect, are argumentative, or are presenting completely

unreasonable requests and demands will not receive a response. Reciprocally, I pledge that I will never correspond with anyone in this manner, either.

\* Tardiness is disruptive; please try to arrive on time. Departing class early is also disruptive; if you must do so, please sit in the back, and exit quietly and inconspicuously.

\* I respect the need for each individual to stay in contact with family and friends. The use of mobile devices, however, is disruptive to the learning environment for others. Thus, I request that the ringers of all mobile devices be muted during class. If an emergency arises, and you need to accept/make a call on your phone, I request that you quietly leave the room and conduct your conversation out in the hallway. Sending or checking text messages during class is not encouraged, and these practices convey your lack of interest herein to everyone.

\* Please note that all exams will be posted/distributed, or held in-person on the specified dates. You will have a window of several days to submit the take-home style exams; these outside-class exams are to be submitted in-person as paper copy on or prior to the due date. If any problems arise that will lead to you being unable to submit an exam within the time window, please email me and explain the situation. Under extenuating circumstances, you may be permitted to submit a take-home exam *via* email; however, please consider this situation to be a last resort.

\* If extenuating circumstances beyond your control render you unable to fulfill a take-home exam due date or attend an in-class exam, please bring the matter to my attention via email. If you ask about these matters in person, I will still request an email be submitted. Where circumstances warrant, I will make accommodations such as a different deadline, or a makeup exam time. Please do not take advantage of these practices; I reserve the right to deny accommodations where circumstances do not warrant such. ***I am a reasonable person.***

\* All individual exams will be graded as a percentage out of 100. The point weighting of the examinations is as follows:

Exam 1 (take-home)	15 %
Exam 2 (in-person)	15 %
Exam 3 (take-home)	15 %
Final exam (in-person)	20 %
<b>Lecture total weighting</b>	<b>65 %</b>
Laboratory (refer to separate syllabus)	35%
Total	100 %

Extra credit is possible, but is not guaranteed; if given, it will amount to a modest amount (e.g., perhaps a total of 3 - 5% of the total possible grade).

\* Performance expectations are as given in the Table below. The instructor reserves the right to make downward adjustments to this scale (i.e. adjustments in the direction of leniency). In no event will the actual scale used be adjusted upward (harsher) from that above. Adjustments (if any) to this scale are not guaranteed, and will likely not be determined until the end of the semester.

A	93.0 – 100
A –	90.0 – 92.9
B +	87.0 – 89.9
B	83.0 – 86.9
B –	80.0 – 82.9
C +	75.0 – 79.9
C	69.0 – 74.9
C –	65.0 – 68.9
D +	62.0 – 64.9
D	58.0 – 61.9
D –	55.0 – 57.9
F	< 55.0