

**CHE 591
Chemistry of the Environment
Summer 2021**

Instructor

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Office Hours

M 12:30-1:30 pm; W 1:30-2:30 pm; Th 10-11 am

These office hours are the blocks of time that I am reserving to be available to meet with students **virtually**. The link for my Zoom office hours is <https://stonybrook.zoom.us/j/4854399090>. Though you can “drop in”, it would probably be good idea to schedule a meeting by sending me an email, that way you won’t be in the Zoom “waiting room” if I am already meeting with another student. I will have availability at times in addition to these three reserved hours, but the times will vary from week to week.

You can access Zoom office hours either by using Zoom on your computer or phone, or you can call in to 1 646 867 9923 and then entering the meeting ID number (485 439 9090) followed by the “#” sign.

Course Description

This course focuses on the chemistry of environmental processes, environmental degradation, remediation and abatement processes, energy production, and some connections between chemistry-related and non-chemistry-related aspects of sustainability.

Course Learning Objectives

Upon completion of the course, students will be able to:

- Explain major processes in the chemistry of: photochemical smog, stratospheric ozone, greenhouse and enhanced greenhouse effect, acid rain, carbonate buffer system, environmentally relevant oxidation and reduction reactions, energy from fossil fuel combustion, energy from nuclear fission, persistent organic pollutants.
- Analyze the role of the chemical enterprise in both exacerbating and addressing the challenges of anthropogenic environmental degradation.
- Appraise the effectiveness of a book written for a general audience addressing issues of sustainability that have chemical or other technical aspects.
- Apply concepts and tools drawn from any field of study in order to understand the links between science or technology and the arts, humanities or social sciences.
- Synthesize quantitative and/or technical information and qualitative information to make informed judgments about the reciprocal relationship between science or technology and the arts, humanities, or social sciences.
- Work effectively in teams to learn course content and further develop process skills

Synchronous Meeting Times

Mon and Wed 9:30-11 am EST; students are required to attend these sessions

Prerequisite

CHE 132 or CHE 152

General Education Requirements

Stony Brook Curriculum (SBC): STAS- Understand relationships between science or technology and the arts, humanities, or social sciences

Diversified Education Curriculum (DEC): H- Implications of science and technology

Required Text

Spiro, T. G.; Purvis-Roberts, K. L.; Stigliani, W. M. (2012) *Chemistry of the Environment*, 3rd ed. (ISBN 978-1891389702)

And one book from the following list:

Ehrenreich, Ben (2020) *Desert Notebooks: A Roadmap for the End of Time* (ISBN 13: 9781640093539)

Goodell, J. (2018) *The Water Will Come: Rising Seas, Sinking Cities, and the Remaking of the Civilized World* (ISBN 13: 978-0316260206)

Jahren, Hope (2020) *The Story of More: How We Got to Climate Change and Where to Go From Here* (ISBN 13: 9780525563389)

Kolbert, Elizabeth (2021) *Under a White Sky: The Nature of the Future* (ISBN 13: 978-0593136270)

MacKay, D. J. C. (2009) *Sustainable Energy without the Hot Air* (ISBN 13: 978-0954452933), also available as a free download (<http://www.withouthotair.com/>)

McKibben, B. (2011) *Eaarth: Making a Life on a Tough New Planet* (ISBN 13: 978-0312541194)

Smith, L. C. (2011) *The World in 2050* (ISBN 13: 978-0452297470)

Course Delivery Mode and Structure

This is an online course, which will be delivered both asynchronously in the Blackboard learning management system and the Perusall platform and synchronously through the Zoom platform. Course modules, consisting of recorded lectures, reading assignments, problem sets, and surveys will be posted on the course Blackboard site. Deadlines for all assignments will be indicated in the Blackboard modules.

Students must be mindful of all course expectations, assignments, and due dates, especially because the online portion of the course requires significant time management. All assignments and course interactions will utilize internet technologies. See “Technical Requirements” section for more information

This course has a collaborative learning aspect. We will meet synchronously on Monday and Wednesday mornings from 9:30-11:00 am EST. The Zoom link for synchronous class sessions is: <https://stonybrook.zoom.us/j/91977221759?pwd=ditVUU9sS1ZlUktlRWFsMmhwMm5lUT09>

Students are expected to be present for all synchronous sessions for the entire session and to participate in group discussion and problem solving. If a student is not able to participate in a given session, they should contact the instructor, preferably in advance of the session.

We will use the online platform Perusall for asynchronous book discussions. A Perusall account can be set up (for free) at <https://perusall.com/>. The course code is AUBRECHT-24ETT. Perusall can be used with a computer or a smartphone.

How We Will Communicate:

Course-related questions should be posted in the General Questions Forum on Blackboard. For personal/private issues, email me directly. Please allow between 24-48 hours for an email reply. Your Stony Brook University email must be used for all University-related communications. All instructor correspondence will be sent to your SBU email account. **Plan on checking your SBU email account regularly for course-related messages.** To log in to Stony Brook Google Mail, go to <http://www.stonybrook.edu/mycloud> and sign in with your NetID and password. Regular communication is essential in online classes. Students working in asynchronous collaborative groups should plan to log in once a day. Students working in synchronous collaborative groups should plan to log in at least twice per week.

Technical Requirements:

All students will need access to Blackboard, Zoom, and Perusall. The Blackboard course site can be accessed at <https://blackboard.stonybrook.edu>

SBU students have access to Zoom. To set up an account follow

<https://it.stonybrook.edu/help/kb/getting-started-with-your-stony-brook-zoom-account>

The Zoom link for the class is

<https://stonybrook.zoom.us/j/91977221759?pwd=ditVUU9sS1ZlUktlRWFsMmhwMm5lUT09>

A Perusall account can be set up (for free) at <https://perusall.com/>. The course code is AUBRECHT-24ETT. Perusall can be used with a computer or a smartphone.

Students can participate in Zoom sessions using a computer with a microphone or with a smartphone. Instructions for using zoom on a smartphone are at <https://it.stonybrook.edu/help/kb/using-zoom-on-an-android-or-ios-mobile-device>

You will need a computer, either Windows (version 10) or Macintosh (OS X 10.11 or higher), and a reliable internet connection that is capable of streaming video. Chrome browser seems to be the best for connecting to Blackboard. You will be at a significant disadvantage if you try to complete all coursework on a tablet or phone. You will need headphones/earbuds, a microphone, and a webcam. Course exams will be given through Blackboard.

Technical Assistance:

If you need technical assistance at any time during the course or to report a problem with Blackboard you can:

- Phone: 631-632-9800 (client support, Wi-Fi, software and hardware)
- Submit a help request ticket: <https://it.stonybrook.edu/services/itsm>
- If you are on campus, visit the Walk-Up Tech Support Station in the Educational Communications Center (ECC) building.

Assignments

Course modules will include reading assignments from the textbook, journal articles, or other sources. Problem sets will be due weekly on Thursdays at 11:55 pm; short surveys will be due weekly on Friday at 11:55 pm. Problem sets will be accepted up to 48 hours late (with a small point penalty), after which solutions will be made available and late assignments will no longer be accepted.

You will be asked to write a critical review (1500-2000 words) of one of the books suggested (Ehrenreich, Goodell, Jahren, Kolbert, MacKay, McKibben, or Smith). A complete description of the critical book review assignment will be provided in a separate document. The review is due on July 3 at 11:55 pm.

Exam Schedule

Exams will be given in Blackboard.

Exam 1 Available from 9:00 am on Thurs 6/10 through 11:55 pm on Fri 6/11. Students will be allotted 120 minutes, within this window, to complete the exam.

Exam 2 Available from 9:00 am on Thurs 7/1 through 11:55 pm on Fri 7/2. Students will be allotted 120 minutes, within this window, to complete the exam.

Evaluation

Course grades will be based on the percentage of points earned out of 600 possible points distributed as:

Weekly surveys	25
Collaborative activities	75
Writing assignment and book discussions	100
Problem sets	100
Exam 1	100
Exam 2	100
CHE 591 assignment (see page 7)	100

Academic Integrity

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html

Academic dishonesty will not be tolerated. In this course, the specific standards are as follows:

- Plagiarism of the critical book review will be taken very seriously. If there is adequate evidence that a book review (or part of it) was plagiarized, the student will receive 0/100 on the writing assignment and will be reported to the Academic Judiciary.
- In any online exam, copying answers from another person or communication other than what is allowed will result in a report to the Academic Judiciary and a final grade of C- or lower in the course.
- Students may discuss problem set questions, but should not ask to be given nor give to others the solutions or responses to questions.

Student Accessibility Support Center (SASC)

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact the Student Accessibility Support Center (SASC), ECC (Educational Communications Center) Building, room 128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation are confidential.

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

Chosen Names and Personal Pronouns

Everyone has the right to be addressed by the name and pronouns that correspond to their gender identity, including non-binary pronouns, for example: they/them/theirs, ze/zir/zirs, etc. Rosters do not list gender or pronouns so you may be asked to indicate the pronouns you use so that I don't make assumptions based on your name and/or appearance/self-presentation (you are not obligated to do so). If you use a chosen name, please let me know. Chosen names and pronouns are to be respected at all times. Mistakes in addressing one another may happen, so I encourage an environment of openness to correction and learning. Chosen name and personal pronouns may evolve over time, so if at any point during the semester you would like to be addressed differently, please let me know.

Course Schedule

Detailed descriptions of the assignments for each week will be posted on Blackboard.

Week of	
5/24	What is sustainability and what does chemistry have to do with it? How can chemists make molecules and materials in ways that have less environmental impact? What is systems thinking and what insights can it provide? Note: there will be a synchronous session on Fri 5/28 from 9:30-11 am
5/31	What causes tropospheric air pollution? How are tropospheric air pollutants regulated? How can air quality be improved? No synchronous session on Mon 5/31
6/7	What causes the stratospheric ozone hole and why is it getting better? Exam 1
6/14	How does a planet's atmosphere affect its average temperature? What is changing in the composition of Earth's atmosphere and what are the (anticipated) impacts? Why are some greenhouse gases worse than others? What areas of Earth's climate system are not as well understood?
6/21	How can we meet energy needs while reducing greenhouse gas emissions? Is nuclear energy a good option? What would it take to reach the goals of the Paris Accord?
6/28	What oxidation and reduction processes occur in natural waters and how are they perturbed? What acid-base processes occur in natural waters and how are they perturbed? Exam 2, critical book review due

CHE 591 -Chemistry of the Environment Assignments

Students enrolled in CHE 591 are expected to complete all coursework (reading, problems, writing assignment, exams) for CHE 310/ENV 320. CHE 591 is a graduate level course; accordingly, students are expected complete **one** of the following additional assignments.

Option 1: develop lesson plans

Develop lesson plans for four class sessions (45-minute sessions) for a course for students in grades 7-12 focused on material from CHE 591. Three of the lesson plans should be for class sessions that teach topics that are required by the relevant standards for the course but do so using topics of environmental or sustainable chemistry. One of the lesson plans can be for "enrichment" class sessions that do not have a requirement of addressing content standards. Identify what course the lesson plans are intended for and what are the relevant standards (NY State P-12 Science Learning Standards, IB Chemistry, IB Environmental Systems and Societies, AP chemistry, AP Environmental Science). Some potentially useful resources for this assignment include:

- Environmental Literacy Council (<http://www.enviroliteracy.org/teachers-index.php>)
- AP Environmental Science Course (<https://apcentral.collegeboard.org/pdf/ap-environmental-science-course-description.pdf>)
- Beyond Benign (<http://www.beyondbenign.org/>)
- Climate Literacy and Energy Awareness Network (CLEAN, <http://cleanet.org/index.htm>)
- National Science Digital Library (<https://nsdl.oercommons.org/>)
- ACS Chemical Education Resources (<http://www.acs.org>), click on students and educators, educational resources
- The Wonder of Science (<https://thewonderofscience.com/model-course-maps>)
- PhET Interactive Simulations (<https://phet.colorado.edu/>)
- Journal of Chemical Education (<https://pubs.acs.org/journal/jceda8>)

If you modify a lesson plan that you found from another source, you must cite your source and include a description of the modifications that you made.

A Learning-Teaching Plan Format, modified slightly from the one developed by the Institute for STEM Education (I-STEM) at SBU, is included in the appendix.

Option 2: write a short review article

Chose a topic related to environmental, sustainable, or green chemistry of interest to you and research it in the peer-reviewed literature. Your topic should be focused narrowly enough that you can present and fully discuss it in 10-12 pages. You should have at least 15 peer-reviewed sources for your review. Your review should include a bibliography in ACS format.

(<https://libguides.usc.edu/c.php?g=235076&p=1561830>)

There are many resources available from the Stony Brook Library to access and search the peer-reviewed literature (<http://www.library.stonybrook.edu/>). The University pays for access to these resources- you will be prompted for your SBU NetID if you are not on a University network. Many full-text articles are available online through the Stony Brook University Libraries.

Stony Brook Library Sustainability and Environmental Studies Guide
<http://guides.library.stonybrook.edu/sustainability>

Stony Brook Library Chemistry Guide
<http://guides.library.stonybrook.edu/chemistry>

Web of Science

Select "Web of Science" from this list of databases available through the Stony Brook library. Search chemical literature by topic, author or subject. Structure and reaction searching are not available in this database. Web of Science is good for citation searching, which is finding papers that cite a certain paper. Citation searching is useful for going forward chronologically in the literature.

Reaxys

Reaxys is the electronic versions of the Beilstein and Gmelin databases. Beilstein covers organic literature and the Gmelin database covers the inorganic and organometallic literature. Users can search the chemical literature via chemical name, structure, reaction or topic.

SciFinder

SciFinder is the electronic version of Chemical Abstracts, which is the world's most comprehensive database of chemical literature and patents. A limited number of simultaneous users of SciFinder at SBU is permitted. Users will need to register for an account using a valid **Stony Brook email address (do not register with a non-SBU email address)**. SciFinder can be searched by topic, author or subject (like Web of Science), but also by chemical name, structure, or substructure (like Reaxys)

Option 3: write an analysis of how environmental challenges and potential solutions are presented in popular culture

Explore how issues of environmental degradation, climate change, and sustainability are portrayed in popular culture (fiction- including science fiction, movies, television, and new media). This assignment is less instructor-defined than the preceding two, though it is not intended to involve less work than the other two options. **Please submit a short (one page or less) written description of your plan for my approval before you start working on the assignment, though no later than Sat June 12.**

Deadlines

First draft (email as a word attachment to instructor): **Sat June 26** by 11:55 p.m. Comments will be returned to you by June 28. (30% of grade)

Final draft (email as a word attachment to instructor): **Sat July 3** by 11:55 p.m. (70% of grade)

Lesson Plan Format for Option 1

Name _____ Date _____ Lesson # _____

Course this lesson is intended for _____

Learning – Teaching Plan _____ *Title of Lesson*

The following items are to be included when preparing a Lesson Plan. All text in italics is to be removed from the lesson plan before it is submitted

Lesson Overview *(Summarize the lesson in a few sentences. Include a brief description of how the lesson is connected to a real-world phenomenon).*

Standards Table

Drawn from _____ *(give name of the New York State Core Document). If lesson is for a set of standards other than NY State Standards, modify the sections in blue text as needed.*

(See Resource Guides at: <http://www.nysed.gov/curriculum-instruction/science-learning-standards> – use only 1 resource guide/lesson)

Content <i>(include number and full text of each standard, PI, MU)</i>	
Standard 4 Key Idea	
Performance Indicator(s)	
Major Understanding(s)	
Process Skills <i>(include number and full text of each that applies for your discipline)</i>	
Chemistry	<i>Process Skills Based on Standards 1,2,6,7 p. 5-11 Process Skills Based on Standard 4 p. 12-15</i>
Physics	<i>Process Skills Based on Standards 1,2,6,7 p. 6-11 Process Skills Based on Standard 4 p. 12-15</i>
Earth Science	<i>Process Skills Based on Standards 1,2,6,7 p. 4-7 Intermediate Core: Process Skills Based on Standard 4 General Skills p. 10, Physical Setting Skills p. 11</i>
Living Environment	<i>Intermediate Core: Standards 1, 2, 6,7: Expanded Process Skills p. 4-9 Process Skills Based on Standard 4 General Skills p. 10, Living Environment Skills p. 10 LE Core Appendix A: Laboratory Check List p 21</i>
Reference Table <i>(for Chem, ES, and Physics) Give page number</i>	

Title: (e.g., Life Science, Structure and Function)		
Performance Expectation(s) Targeted (Include numeric identifier, i.e., PE code - HS-LS1-1: Genes, Proteins, and Tissues) <i>Select the DCI, Scientific Practice and Crosscutting Concept for this PE that are addressed in the lesson.</i>		
Scientific Practice(s) Targeted in this PE	DCIs Targeted in this PE	Cross Cutting Concept(s) Targeted

Student Preconceptions/ Misconception about the topic	Scientific Understanding
Reference(s)	
Prior learning and prerequisite skills (that students will need to know in order to be successful in this lesson, include lab skills)	

Learning Objectives			
Students will be able to (SWBAT): (What do you want the students to be able to do at the end of this lesson? These must be measurable as per Bloom’s Taxonomy and assessable both during and at the end of the lesson.		Evaluation Criteria: (Specific evidence that every student meets the learning objectives. It can be in the form of an educational technology tool, a rubric, an answer to a question etc. Does it tell you which students “get it” and which ones do not?) How will students communicate what they learned about the Phenomenon?	
1.			
2.			
Learning and Teaching Experiences – Engage, Explore, Explain, Elaborate, Evaluate (With time frame for each element, describe what will occur during the lesson. Within the lesson, include key questions and where they will be asked.) Note: You do not have to include Explore, Explain, and Elaborate in every lesson.			
Time	Teacher Does	Students Do	Notes to Self
Phenomenon used to Engage students in thinking about the PE (Describe phenomenon and include link if available)			

	Engage: Opening Activity- <i>Access Prior Learning/ Stimulate Interest/ Generate Questions</i>		
	Explore: <i>What Scientific Practice(s) will students use to GATHER information about the Phenomenon?</i>	<i>How will students use the scientific practices?</i>	<i>Probing or Clarifying Questions:</i>
	Explain: <i>Concepts explained and Vocabulary defined:</i>		
	Elaborate: <i>Expand and solidify students' understanding of the concept and/or apply it to a real- world situation.</i>	<i>How will the students connect the Crosscutting Concepts to the DCI and Scientific Practice(s)?</i>	
	Evaluate: (See Learning Objectives above)		
	Lesson Closure (<i>How will the lesson end?</i>)		
Academic Language Demands/ Vocabulary/Symbols (<i>new terms introduced in this lesson - give a brief definition of each term</i>)			
Scientific vocabulary			
Non-scientific vocabulary			

Materials: <i>e.g., power point slides, demonstration materials, laboratory supplies, visual and/or technology aids (smart board, projector etc.), graphic organizers, etc.</i>	Supplementary Materials: <i>Attach all supplementary materials (handouts) to your lesson plan, including all assessment materials, scoring guides, and rubrics.</i>

Safety concerns and Disposal (<i>If using lab equipment, include safety precautions and information about disposal of waste.</i>)

Management plan *(If this is a lab or some other hands-on activity, describe your management plan for distributing and collecting materials to/from your students.)*

Homework *(that is appropriate for this lesson; not a set of questions from a textbook)*

References and Acknowledgements