

**Lectures:** Tues/Thurs 12:30-1:45am, Location TBD

**Instructors**

**Lecture and Lab Instructor:** Prof. Jennifer Glass

**Email:** jennifer.glass@eas.gatech.edu

**Office hours:** TBD

**Office:** Ford Environmental Science and Technology (ES&T) room 1234

**Pronouns:** she/her

**Lecture TA:** TBD

**Email:** TBD

**Office hours:** TBD

**Office:** TBD

**Pronouns:** he/him

**Lab TA 1:** TBD

**Email:** TBD

**Office hours:** TBD

**Office:** TBD

**Lab TA 2:** TBD

**Email:** TBD

**Office hours:** TBD

**Office:** TBD

**Pre-requisites:** MATH 1552 and CHEM 1212K

**Course Description (EAS 4220/6200):** The objective of this course is to learn how chemical, biological, and geological processes control the distribution of chemical elements on Earth and the solar system. Geochemical processes are central to a variety of environmental issues, including the distribution of CO<sub>2</sub> on Earth and the transformation and storage of inorganic and organic contaminants. Simultaneously, geochemical processes are involved in the transformation of natural species, including nutrients, carbon, and minerals. In this course, we will study the fundamental geochemical processes regulating the distribution of chemicals on Earth. This course will also introduce stable and radiogenic isotopic techniques essential for tracing elements through biogeochemical cycles and dating the age of planetary materials. This course is designed for students interested in securing jobs in environmental agencies or consulting companies or pursuing graduate studies in the geosciences, environmental science, or environmental engineering. Through a semester-long video project, students will gain experience in scientific communication on notable topics in environmental sciences of high interest to the public.

**Learning Objectives:**

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

1. Understand the thermodynamic and kinetic principles that control chemical composition and microbial activity in waters and soils.
2. Explain how source rock mineralogy influences weathering processes and soil type.
3. Practice using chemical principles to find solutions to real-world geochemical crises, such as lead contamination in drinking water.
4. Describe how radiogenic and stable isotopes have been used to determine the timeline and nature of Earth's chemical evolution.
5. Learn practical applications of environmental geochemistry for industry positions.

**Laboratory Description (EAS 4221/6201):** The laboratory is worth 1 credit and is separate from the lecture (3 credits). ENVS majors must register for the laboratory, but the laboratory is optional for students from other majors. The laboratory component will teach you how to obtain physical and chemical measurements in the field, collect and preserve natural samples, and conduct chemical analyses of these samples in the laboratory. Several short trips will be taken to the field sites during the semester to collect samples, and each student will be responsible for analyzing a series of samples and discussing their results in class. Please refer to lab Canvas site for more info.

**Required reading:** There will be required reading each week, posted as PDFs on Canvas > Modules. Readings will primarily come from Introduction to Geochemistry by Kula C. Misra (2012; Wiley and Blackwell) and Aqueous Environmental Geochemistry by Donald Langmuir (1997; Prentice Hall). Other relevant references: Geochemistry: Pathways and Processes by Harry Y. McSween, Jr., Steven M. Richardson, and Maria E. Uhle (2003; 2<sup>nd</sup> Ed; Columbia University Press), Aquatic Chemistry by Stumm & Morgan (1996; 3<sup>rd</sup> Ed; Wiley), Environmental Chemistry by vanLoon & Duffy (2000; 3<sup>rd</sup> Ed; Oxford University Press), Physical Chemistry by Engel & Reid (2014; 3<sup>rd</sup> Ed; Pearson); and Isotopes: Principles and Applications (2005; 3<sup>rd</sup> Ed; Wiley) by Faure and Mensing. *You do not need to buy a textbook.*

**Technology policy:** You are welcome and encouraged to search the web during class for geochemistry related topics. Please bring a CHARGED tablet or laptop, and headphones in case we need to watch videos, to every class. We will often do some work on projects in the middle of class so it is essential that you bring technology you need to work on your project. Laptops and tablets are available for lending at the GT library (<https://library.gatech.edu/spaces-technology/gadgets>).

**Evaluation:**

40% Video Project

40% Homework

20% Lecture Attendance and Participation in Work Sessions

**Grading Scale:** A: 90.00-100%; B: 80.00-89.99%; C: 70.00-79.99%; D: 60.00-69.99%; F: <60.00%. The scale above *may* be curved slightly (a few %) upward depending on class performance.

**Pass/Fail:** ≥70%: Satisfactory; <70%: Unsatisfactory

**Canvas:** The course will make extensive use of Canvas (log on with your GT username and password and select “Environ Geochemistry - EAS-4220/6200”). The links on the left hand side of the page will take you to the following:

- 1) **Announcements** (also sent via email)
- 2) **Modules** (contains links to all lecture slides, readings, and assignments)
- 3) **Grades** (where all scores are posted and you can view your current grade)
- 4) **Discussions** (post here to ask questions and communicate with students and instructors)

**Grades:** Students can check current grades at any time on Canvas Gradebook. Scores will be posted within 1 week after the deadline. Requests for grade changes must be received by email to both instructors with a detailed explanation of the grading error no more than one week after the grade is posted.

**Homework:** Homework will be posted on Canvas to evaluate student learning of the key points of the lectures. Homework will be due Fridays at 11:59pm. Ten percent will be subtracted per day that the homework is late (including weekends).

**Video Project:** This is a semester-long project with weekly sub-assignments, in which you will make a 5-minute YouTube video entitled “*Where does the [element] in your phone come from?*”. The following elements will be assigned to each student: Li, Mg, Al, Si, P, K, Co, Ni, Cu, Ga, As, Br, Y, Ag, In, Sn, Sb, La, Pr, Nd, Eu, Gd, Tb, Dy, Ta, W, Au. More details will be provided in weekly assignments, which will

build up to the final project. Free video recording and editing software is available for students, including Microsoft ClipChamp, from <https://gatech.onthehub.com/>, and at the GT Multimedia Commons in the Library, which has a video recording studio and computers with Adobe Premiere Pro and iMovie. Project rubrics and further details will be posted on Canvas. Video project assignments will be due on alternate weeks as homework assignments and will be due Fridays at 11:59pm. Ten percent will be subtracted per day that the homework is late (including weekends).

**Exams:** No exams!

**ChatGPT/generative AI policy:** You *may* use ChatGPT to proofread for grammar and to find potential content. You should not use it to generate your text and you should never trust anything it tells you without double checking a reputable source.

**Extra Credit:** There may be extra credit opportunities, each worth 5 extra credit points on that week's homework, about . To receive the extra credit, you must submit a 1 paragraph summary of the seminar (or, if you cannot attend, about a paper by the seminar speaker) on Canvas within one week after the talk. The paragraph should summarize the major points of the talk or article and discuss its connection(s) to geochemistry.

Week & Topic	Reading	Assignment
1: Intro to Geochemistry & Video Project	--	--
2: Chart of the Nuclides	Misra Chp. 1, 2, 3	Video Script 1
3: Chemical Bonding & Crystal Field Theory	Misra Chp. 3	Homework 1
4: Planetary Differentiation	Misra Chp. 12	Video Script 2
5: Thermodynamics	Misra Chp. 4	Homework 2
6: Kinetics & Radiometric Dating	Misra Chp. 9, 10	Video Script 3
7: Activity & Solubility	Misra Chp. 7	Homework 3 + Video Script 4
8: Fall Break & Full Video Script	--	Full Video Script
9: pH & Carbonate Chemistry	Misra Chp. 4, 7	Homework 4
10: Aqueous Speciation	Langmuir Chp. 3	Homework 5
11: Weathering & Adsorption	Langmuir Chp. 7, 9, 10	Homework 6
12: Redox Chemistry	Misra Chp. 8	Homework 7
13: Acid Mine Drainage Activity & Work Day	Misra Chp. 8.8.1-8.8.2	Final Video Due
14: Film Festival for Video Projects	--	--

### Campus Resources for Students:

**Student accommodations:** If you have any kind of disability, whether apparent or non-apparent, learning, emotional, physical, or cognitive, and you need some accommodations or alternatives to course exercises, please contact Prof. Glass to discuss reasonable accommodations for your access needs. Students with disabilities who require reasonable accommodation to fully participate in course activities or meet course requirements must contact the Office of Disability Services <http://disabilityservices.gatech.edu/>, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter.

### Support Services and Resources

#### Academic support

- Tutoring and Academic Support <https://tutoring.gatech.edu/>
  - 1-to-1 tutoring <https://tutoring.gatech.edu/tutoring/>
  - Peer-Led Undergraduate Study (PLUS) <https://tutoring.gatech.edu/plus-sessions/>
- Advising and Transition <https://advising.gatech.edu/>
  - Academic advising for your major <https://advising.gatech.edu/find-your-advisor>

- Exploratory advising <https://advising.gatech.edu/exploratory-advising>
- Academic coaching <https://advising.gatech.edu/academic-coaching>
- OMED: Educational Services <https://omed.gatech.edu/tutor-schedule-0>
  - Group study sessions and tutoring programs
- Communication Center (<http://www.communicationcenter.gatech.edu>)
  - Individualized help with writing and multimedia projects

### Personal Support

#### Georgia Tech Resources

- The Office of the Dean of Students: <https://studentlife.gatech.edu/content/get-help-now>; 404-894-6367; Smithgall Student Services Building 2<sup>nd</sup> floor
- Center for Mental Health Care & Resources: <https://mentalhealth.gatech.edu>
  - *If you're experiencing significant mental health difficulties and need immediate support, our staff is available during business hours (8 a.m.-5 p.m.). Call 404.894.2575 or visit us in Suite 238, Smithgall Student Services Building, 353 Ferst Dr NW, Atlanta, GA 30313. After hours, call 404.894.2575 and select the option for the after-hours counselor. In an emergency, call GT Campus Police at 404.894.2500 on campus or 911 off campus.*
- Students' Temporary Assistance and Resources (STAR): <https://studentlife.gatech.edu/content/star-services>
  - Can assist with interview clothing, food, and housing needs
- Stamps Health Services: <https://health.gatech.edu>; 404-894-1420
  - Primary care, pharmacy, women's health, psychiatry, immunization and allergy, health promotion, and nutrition
- Belonging & Student Support: <https://support.belonging.gatech.edu/>
  - Smithgall Student Services Building Suites 102, 131, 140
- Georgia Tech Police: 404-894-2500; <http://www.police.gatech.edu>

#### National Resources

- The [National Suicide Prevention Lifeline](#) | 1-800-273-8255
  - Free and confidential support 24/7 to those in suicidal or emotional distress
- The [Trevor Project](#)
  - Crisis intervention and suicide prevention support to members of the LGBTQ+ community and their friends
  - Telephone | 1-866-488-7386 | 24 hours a day, 7 days a week
  - [Online chat](#) | 24 hours a day, 7 days a week
  - Text message | Text "START" to 687687 | 24hrs day, 7 days a week

**Cancellation of classes:** If classes are cancelled by Georgia Tech due to campus closing, the schedule of topics will be re-evaluated by Prof. Glass once campus has re-opened, and announcements about any changes to the schedule and assignments will be made by a Canvas announcement and email.

**Academic integrity and honor code:** Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. The instructor, teaching assistants and students in this class, as members of the Georgia Tech community, are bound by the Georgia Tech Academic Honor Code. Please see <http://www.catalog.gatech.edu/policies/honor-code/> for Georgia Tech's Academic Honor Code, which you are required to uphold. Any student suspected of plagiarizing on a quiz, lab, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations. Plagiarism is defined here as verbatim copy/paste of a sentence or more of text written by anyone other than the student.

**Student-Faculty Expectations Agreement:** To create a mutually respectful classroom environment, your instructors abide by the principles for student-faculty expectations laid out by Georgia Tech. This means that we will:

- create a positive, engaged academic environment;
- be available to meet with you (virtually) outside of class at a mutually convenient time;
- provide you in advance with all necessary materials so that you can complete all course assignments;
- make my grading criteria and rubrics available to you so that you understand how we evaluate your assignments.

In turn, instructors expect that students too will fulfill your responsibilities. Specifically, we expect that:

- you will work with us to create a respectful, engaged academic environment;
- you will attend course meetings and on time;
- you will come to class prepared, having read the required material and watched the lecture recording, and ready to engage in class discussions;
- you will adhere to the principles of Georgia Tech Student Honor Code.

You can review Georgia Tech student-faculty expectations here:

<http://catalog.gatech.edu/rules/22/>.