

CHEM 361-002, Environmental Chemistry of Water and Soil Pollution Spring 2025 Course Syllabus

MW, 11:30 AM - 12:50 PM, FMH 203

Instructor: Dr. Alexei Khalizov

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Office hours: TBD or by appointment

NJIT Academic Integrity Code: All Students should be aware that the Department of Chemistry & Environmental Science (CES) takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

Students are asked to pay extra attention concerning academic honesty, with the understanding that all cases of plagiarism, cheating, multiple submission, and unauthorized collaboration are subject to penalty. Students must properly cite and attribute all sources used for papers and assignments. Students may not collaborate on exams or assignments, directly or through virtual consultation, unless the instructor gives specific permission to do so.

Posting an exam, assignment, or answers to them on an online forum (before, during, or after the due date), in addition to **consulting posted materials**, **constitutes a violation of the university's honesty policy**. Likewise, **unauthorized use of live assistance websites**, including seeking "expert" help for specific questions during an exam, can be construed as a violation of the honesty policy.

COURSE INFORMATION

Course Description: Chemistry of the environment, including the hydrosphere and geosphere. Principles of physical, inorganic, and organic chemistry are applied to understand the origins of environmental pollutants, their transport, distribution, and decomposition pathways in water and soil environments.

Number of Credits: 3

Prerequisites: CHEM 360 or one of the following courses (CHEM 222, CHEM 231, CHEM 236, CHEM 243, CHEM 245) with a grade of C or better.

Course-Section and Instructors

Course-Section	Instructor
002	Alexei Khalizov

Required Textbook:

Title	Environmental Chemistry: A global perspective
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Author	Gary W. vanLoon and Stephen J. Duffy
Edition	3 rd or 2 nd
Publisher	Oxford
ISBN #	978-0199228867 or 0199228868

Supplementary textbook (not required, but highly recommended): Elements of Environmental Chemistry by Ronald A. Hites, 2nd Edition. The book is available electronically via NJIT library website at https://primo.njit.edu/permalink/01NJIT_INST/32cv1j/alma995065053705196

General Chemistry reference materials (not required): (a) ACS General Chemistry Study Guide (<http://uwm.edu/acs-exams/instructors/ordering-information/>); (b) a good freshman General Chemistry textbook, such as Chemistry: a Molecular Approach by N.J. Tro (any edition)

Calculator requirements: bring to every class scientific or engineering calculator. Advanced graphing calculators are NOT allowed during exams and quizzes (e.g., TI-30 or TI-34 are permitted, but not TI-84 or TI-Nspire)

University-wide withdrawal date: The last day to withdraw with a **W** is Monday, April 4, 2022. It will be strictly enforced.

Learning Outcomes: by the end of this course, students will be able to

- List major environmental compartments
- Identify factors that control the speciation of chemicals in different environments
- Distinguish cases where pollutant concentrations are controlled by transport or chemical transformations
- Solve problems involving flows, fluxes, and residence times of pollutants
- Present a written summary and an oral overview of an original scientific article
- calculate concentrations and mixing ratios of pollutants using different units
- describe the concepts of global cycles, sources and sinks, and lifetimes of pollutants
- calculate lifetimes and removal rates of pollutants
- identify primary and secondary pollutants
- calculate pH of rainwater under natural and polluted conditions
- describe pollution control methods, regulations, and policies
- assess impacts of air, water, and soil pollution on the environment and human health
- describe the water pollution by heavy toxic metals and their bio-geochemical cycles
- explain the phenomena behind the formation of acid rain
- identify the various types of biological and chemical water pollutants and explain their effects
- describe the water and sewage treatment process and explain the rationale for each step

POLICIES

All CES students must familiarize themselves with, and adhere to, all official university-wide student policies. CES takes these policies very seriously and enforces them strictly.

Grading Policy: The final grade in this course will be determined as follows:

In-class participation	5%
In-class quizzes	10%
Homework	10%
Home quizzes on pre-requisite material	10%
Class project	10%
Midterm exam	25%
Final exam	30%

Your final letter grade in this course will be based on the following tentative curve:

A	90+	C	70+
B+	85+	D	60+
B	80+	F	
C+	75+		

Attendance Policy: Attendance at classes will be recorded and is **mandatory**. Each class is a learning experience that cannot be replicated through simply “getting the notes”. Brief in-class participation assignments will be given and graded.

Quiz Policy: Nearly each homework assignment is followed by a quiz. The quiz with the lowest grade will not be counted towards total.

Home quizzes are to help refresh knowledge of pre-requisite freshman chemistry. The entire set must be completed by the given deadline. The problems are accessed via Canvas and graded automatically. Details are provided on CHEM361 Canvas page.

Exams: There will be one midterm exam held in class during the semester and one comprehensive final exam. The following exam periods are tentative and therefore possibly subject to change:

Midterm Exam	Mid-March
Final Exam Period	May 10 - 16, 2025

The final exam will test your knowledge of all the course material taught in the entire course.

In-class assignment policy: It is a violation of the academic integrity to access 'live' (in-class) exams and assignments when unproctored (e.g., outside of the classroom or OARS). Such cases will be reported to the Dean of Students office. Examples of such in-class assignments include midterm and final exams, in-class quizzes, and in-class participation quizzes.

Makeup Exam Policy: There will normally be **NO MAKE-UP QUIZZES OR EXAMS** during the semester. In the event that a student has a legitimate reason for missing a quiz or exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the CES Department Office/Instructor that the exam will be missed so that appropriate steps can be taken to make up the grade.

Cellular Phones: All cellular phones must be switched to silent mode during all class times. Such devices must be stowed in bags during exams or quizzes, unless permitted by the instructor during certain in-class work.

Class project: This will be a team project. We will discuss a range of topics in class and students will vote select one topic. Students will formulate project focus areas, using a template outlined in class, and will form groups, each with its own focus. Each group will formulate question(s) and then work to address those questions with support from peer-review articles (at least one journal article per student). The findings will be reflected in a 2-page summary (singly spaced, one summary per student) and presented in class (each student presents individually). It is suggested to delegate one student to guide the entire project.

Extra credits: Under no circumstances will students be given the opportunity to complete extra-credit assignments to bolster their final grades.

Note: You are encouraged to discuss with me any difficulties you may encounter during the course. Please do not let the problem linger, contact me as early as possible!

ADDITIONAL RESOURCES

Chemistry Tutoring Center: Located in the Central King Building, Lower Level, Rm. G12. For hours of operation and further information please click [here](#).

Accommodation of Disabilities: Office of Accessibility Resources and Services (**formerly known as Disability Support Services**) offers long term and temporary accommodations for undergraduate,

graduate and visiting students at NJIT.

If you are in need of accommodations due to a disability please contact the Office of Accessibility Resources and Services at **973-596-5417** or via email at oars@njit.edu. A Letter of Accommodation Eligibility from the Office of Accessibility Resources Services office authorizing your accommodations will be required.

For further information regarding self-identification, the submission of medical documentation and additional support services provided please visit the Accessibility Resources and Services (OARS) website at:
<https://www.njit.edu/accessibility/>

Important Dates (See: [Spring 2025 Academic Calendar, Registrar](#))

Date		Day	Event
January	20	Monday	Martin Luther King, Jr. Day
January	21	Tuesday	First Day of Classes
January	25	Saturday	Saturday Classes Begin
January	27	Monday	Last Day to Add/Drop a Class
January	27	Monday	Last Day for 100% Refund, Full or Partial Withdrawal
January	28	Tuesday	W Grades Posted for Course Withdrawals
February	3	Monday	Last Day for 90% Refund, Full or Partial Withdrawal, No Refund for Partial Withdrawal after this date
February	17	Monday	Last Day for 50% Refund, Full Withdrawal
March	10	Monday	Last Day for 25% Refund, Full Withdrawal
March	16	Sunday	Spring Recess Begins - No Classes Scheduled - Univ Open
March	22	Saturday	Spring Recess Ends
April	3	Thursday	Wellness Day - No Classes Scheduled - University Open
April	7	Monday	Last Day to Withdraw
April	18	Friday	Good Friday - No Classes Scheduled - University Closed
April	20	Sunday	Easter Sunday - No Classes Scheduled - University Closed
May	6	Tuesday	Thursday Classes Meet
May	7	Wednesday	Friday Classes Meet
May	7	Wednesday	Last Day of Classes
May	8	Thursday	Reading Day 1
May	9	Friday	Reading Day 2
May	10	Saturday	Final Exams Begin
May	16	Friday	Final Exams End
May	18	Sunday	Final Grades Due

Course Outline

#	Topic	Assignment
1	Introduction: environment; Earth as a closed system (lithosphere, atmosphere, and hydrosphere); life and ecosystem; global biogeochemical cycles	Reading: vL&D* 1
2	Brief review of fundamental concepts: concentration units for gas mixtures and aqueous solutions; unit conversions; reaction rates and equilibria; pH of strong and weak acids	Reading: vL&D 2.3, 9.2, 9.3, H 1
3	Sources, sinks, and mass balance: residence time, rate constant, adding flows, steady-state and non-steady state mass balance, up and down going curves, fluxes, chemical and physical lifetimes	Reading: H* 2 HW 1&2
4	Hydrosphere: water cycle; properties of water; distribution of chemical species in aquatic systems	Reading: vL&D 9, 10 HW 3
5	Chemicals in water: gases, organic chemicals, and metals; colloids and surfaces; microbiological processes	Reading: vL&D 11-15 HW 4-8
6	Water pollution and treatment: definition; water quality; primary, secondary, and tertiary methods; advanced microbiological processes	Reading: vL&D 16
7	The terrestrial environment: soil formation and properties	Reading: vL&D 17, 18
8	Soil contamination: solid, organic, and mixed urban wastes; synthetic organic chemicals	Reading: vL&D 19, 20

* textbook by van Loon and Daffy

**textbook by Hites

Updated by Alexei Khalizov - 2025
Department of Chemistry & Environmental Science
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