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CHEM 360-001:Environmental Chemistry

Alexei Khalizov

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CHEM 360, Environmental Chemistry *Fall 2024 Course Syllabus*

MW, 11:30 AM - 12:50 PM, CULM LECT 2

Instructor: Dr. Alexei Khalizov

Office: Tiernan 356, Zoom

Phone: 973-596-3583

Email: khalizov@njit.edu

Office hours: Wednesday 2:30-3:30 pm (location 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 with emphasis on the atmosphere. Included are an introduction to the composition and chemistry of the natural and polluted atmosphere, thermodynamics and kinetics of atmospheric reactions, indoor and outdoor air pollution, air quality and its impact on human health, air quality regulations, and climate change. Examples of specific environmental issues covered in this course are the global stratospheric ozone depletion and Polar ozone holes, classical and photochemical smog, acid rain, and climate warming.

Number of Credits: 3

Prerequisites: CHEM 126 or CHEM 122, or CHEM 124 with a grade of C or better. CHEM 360 is a prerequisite for CHEM 361.

Course-Section and Instructors

Course-Section	Instructor
001	Alexei Khalizov

Required Textbook:

Title	Atmospheric Chemistry (From the Surface to the Stratosphere)
Author	Grant Ritchie
Edition	1st
Publisher	Oxford
ISBN #	978-1-78634-176-1

Supplementary textbook (not required, but highly recommended): Elements of Environmental Chemistry by Ronald A. Hites, 2nd Edition (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, November 14, 2022. It will be strictly enforced.

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

- 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
- name criteria pollutants and justify their selection by the EPA
- calculate pH of rainwater under natural and polluted conditions
- describe pollution control methods, regulations, and policies
- assess impacts of air pollution on the environment, human health, and climate
- explain the major differences between the successive layers of the earth's atmosphere
- describe and explain the major photochemical reactions taking place in the stratosphere
- list the photochemical reactions leading to the ozone depletion
- list the chemical reactions forming photochemical smog
- describe the greenhouse effect and its connection to global warming
- explain the phenomena behind the formation of acid rain

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%
Homework	10%
In-class quizzes	10%
Take-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”.

Homework & In-Class Quiz Policy: Homework assignments will be given regularly and they must be completed by set due dates. No late homework will be accepted. The assignments are accessed via Canvas and graded automatically. Multiple attempts are allowed in homework assignments to help students learn the relevant material. Most homework assignments are typically followed by a quiz. All in-class quizzes are closed notes and closed book, and allow only one attempt. The quiz with the lowest grade will not be counted towards the total.

Home quizzes are to help refresh knowledge of pre-requisite freshman chemistry. The problems must be completed by the posted deadlines. The assignments are accessed via Canvas and graded automatically. Details are provided on CHEM360 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 October
Final Exam Period	December 17 - 23, 2023

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

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 instructor that the exam will be missed so that appropriate steps can be taken to make up the grade.

When there is a “COVID-related” issue: (a) If medically related (e.g., I got exposed to COVID yesterday and I am not sure if I should be attending class), contact the Office of the Dean of Students.

Cellular Phones: All cellular phones and other electronic devices must be in a quiet mode during all class times, unless permitted by the instructor during certain in-class work. Such devices must be stowed away during exams or quizzes, unless explicitly permitted by the instructor.

Class project: several topics will be identified by the students via the in-class discussion and groups will be formed, one group per topic. There will be several students per group and each student will be responsible for a certain aspect of the bigger topic and must research an original scientific article published in a peer-reviewed journal. The article must cover the identified topic and cannot be a magazine article or a review article. The article must be submitted (as PDF file) for approval by the instructor by date #1 (will be announced). Each student will write and submit a 2-page article summary by date #2. The summary must be single-spaced, submitted electronically via Canvas, and will be checked for plagiarism using Turnitin. Finally, students will make group presentations of their topics, where each member covers specific subtopic (date #3).

ADDITIONAL RESOURCES

Chemistry Tutoring Center: Located in the Central King Building, Lower Level, Rm. G12. Hours of operation are Monday - Friday 10:00 am - 6:00 pm. For 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**. The office is located in Fenster Hall Room 260. 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:

<http://www5.njit.edu/studentsuccess/disability-support-services/>

Important Dates See: Fall 2024 Academic Calendar, Registrar
<https://www.njit.edu/registrar/fall-2024-academic-calendar>

Sept	2	Labor Day. University Closed
Sept	3	First Day of Classes
Sept	9	Last Day to Add/Drop a Class
Sept	9	Last Day for 100% Refund, Full or Partial Withdrawal
Sept	10	W Grades Posted for Course Withdrawals
Sept	16	Last Day for 90% Refund, Full or Partial Withdrawal - No Refund for Partial Withdrawal after this date
Sept	30	Last Day for 50% Refund, Full Withdrawal

Oct	21	Last Day for 25% Refund, Full Withdrawal
Nov	11	Last Day to Withdraw from Classes
Nov	26	Thursday Classes Meet
Nov	27	Friday Classes Meet
Nov	28	Thanksgiving Recess Begins. No Classes
Dec	1	Thanksgiving Recess Ends
Dec	11	Last Day of Classes
Dec	12	Reading Day 1
Dec	13	Reading Day 2
Dec	14	Saturday Classes Meet
Dec	15	Final Exams Begin
Dec	21	Final Exams End
Dec	23	Final Grades Due

Course Outline

Lecture	Topic	Assignment
1	Introduction: environment; course logistics; Earth as a closed system (lithosphere, atmosphere, and hydrosphere); life and ecosystem; global biogeochemical cycles	RAH 1.2 (Elements of Environmental Chemistry by Ronald A. Hites)
2	Review of fundamental concepts #1: concentration units for gas mixtures and aqueous solutions; unit conversions; peer reviewed journal articles and literature search	RAH 1
3	Earth's atmosphere: major and minor constituents; atmospheric structure; energy balance; global circulation; sources, sinks, transport, and lifetimes of chemicals	GR 2.1, 2.3.1, Appendix A; RAH 3.1 (Atmospheric Chemistry by Grant Ritchie)
4	Review of fundamental concepts #2: atoms and molecules; structure and reactivity; thermochemistry; equilibria; reaction rates; pH of strong and weak acids; photochemistry; heterogeneous reactions	GR 1.6, 5.5; RAH 2.3, 3.2, 5.1, Appendix A
5	Atmospheric aerosols: physical properties and chemical composition; sources and sinks; interaction with sunlight; aerosol-cloud interaction	GR 5.1-5.4

6	Climate change: radiative balance; greenhouse gases; signs of climate change; radiative forcing; global warming and its impacts	GR 2.3, 2.4; RAH 4
7	Stratospheric chemistry - ozone chemistry: Chapman model of stratospheric ozone; catalytic ozone destruction; global stratospheric ozone reduction; Montreal protocol; Antarctic ozone hole	GR 3; RAH 3.4, 3.5
8	Tropospheric chemistry: the hydroxyl radical; oxidation of methane and carbon monoxide; the role of nitrogen oxides and organic compounds in the formation of tropospheric ozone and secondary organic aerosols; oxidation of sulfur dioxide; nighttime chemistry	GR 4; RAH 3.6
9	Air quality: indoor and outdoor air pollution; classical and photochemical smog; primary and secondary pollutants; criteria pollutants; monitoring of air pollutants; emission control; health impacts of air pollution; air pollution regulations; acid rain	GR 4.7, 5.6; RAH 3.6, 5.1, 5.2

*Updated by Alexei Khalizov - 2024
Department of Chemistry & Environmental Science
Course Syllabus, Fall 2024*