

CHEMICAL RESEARCH CHEM 4950 (CRN 54280)
Department of Chemistry
Georgia State University
Summer Semester 2021

Instructor: Dr. W. Crawford Elliott, Associate Professor of Geosciences (Courtesy Appointment, Department of Chemistry, GSU).

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Mode of Instruction: Blended, on-line and some face-to-face. **COVID 19 protocols in place.**

Prerequisite: Prior approval of a written program or proposed work by the Department of Chemistry.

Office Hours: by appointment. Meeting times are by arrangement, see below. Credit Hours earned: Three semester credit hours are earned on successful completion of this course.

Primary Texts. Faure and Mensing (Isotopes, Principles and Applications, 3rd Edition, Wiley; Dalrymple and Lanphere, Potassium-Argon Dating, Principles, Techniques and Applications to Geochronology, Freeman.

Objectives: The primary objective of this course is to be able to describe and to understand the uses of radioactive atoms and their radiogenic daughters to determine a numerical date of geologic materials. A second objective is to be able to understand and use the rudimentary mathematics of radioactive decay and its application to calculate the age of a rock. A third objective is to use this knowledge to understand how one geochronologic clock, K-Ar, was applied to answer select geologic questions (age of early hominid, determining a depositional age, and for hydrocarbons exploration).

Mechanism: This course is a reading (directed reading) course with visitation to laboratory to help/view mass spectrometry/atomic absorption spectrometry work being done in SP 409. The reading assignments are intended to introduce and provide the necessary background to understand the following topics: radioactivity, types of radioactive decay in geologic materials, mathematics of radioactive decay, calculation of the ages of rocks/minerals based on parent, daughter and decay constants, and application of K-Ar geochronologic technique in different geologic (and hopefully sufficiently interesting) settings.

The instructor will provide a photocopy of the reading in Faure and Mensing. The student will download the readings from the GSU Library (interlibrary loan). If student encounter difficulty in accessing these articles then please notify the instructor immediately.

The readings in Faure and Mensing will provide the necessary background to understand at a good first level geochronology using radioactive atoms. At mid-term (W/WD date), the students will complete submit a take home assignment/questionnaire. These questions will assess the comprehension of the necessary concepts in Faure and Mensing. The questions will be handed out approximately one-two weeks before the mid-term point of the course. This assignment will count 25% of the final grade.

One week before the start of final exams, the student will submit a paper covering the following topics as separate sections in that paper; Radioactive decay of potassium; the derivation of the equation to calculate the age of a rock (neatly drawn equations will suffice); and a review of the measurement of K and argon isotopes. This review should describe the methods for analyzing K, K-40, and extracting of Ar from geologic materials and measurement of Ar isotope ratios for calculating the geologic age. The conclusions or summary should detail what was learned in this reading course.

This report will follow all requirements set forth by the Department of Chemistry for this course. This paper will be graded based on: readability (grammar, sentence structure, paragraph structures), paper organization (adherence to organization), references (adherence to ACS reference style); technical content

in equal amounts. This paper is due on July 16 as a .doc file. The instructor will read promptly and return comments to the student in about 48 hours. The final paper will be due July 26.

The instructor is able to meet by email/phone/zoom periodically to discuss questions from the readings. The student will initiate these requests for discussion.

If a regular meeting makes sense, then the student and instructor will schedule a weekly meeting (via zoom) to go over important points, answer questions, and stay on track.

Accommodations for students with disabilities. Any student with a documented disability that influences their participation in this course needs to visit the Georgia State University Disabilities Services office in the Student Center-East, Suite 205. The website for GSU Disabilities Services is here: <http://disability.gsu.edu/>. In most cases, you will first need to have your disability documented by GSU Disabilities Services. Once that is complete, you can schedule a meeting with the instructor to discuss how we can accommodate your full participation in the class. That meeting should conclude with signing of some forms that are outlined at the website above. Please always communicate with me about any issues you are having so we can address them promptly.

Grading: The grade will be a composite score based on the scores of the first assignment (readings in Faure); and final paper (80%). The occurrence of plagiarism will result in a lowered grade on the assignment and the student will be reported to the University Administration if circumstances warrant it. If you have a valid reason for missing an exam or required exercise, please see me as soon as possible to reschedule the due date for that exercise. If I do not hear from the student in a reasonable period of time (3 days) from the time of the exam or due date of the exercise, then a zero will be awarded for that exam or exercise.

Important Dates

June 22:	Instructor will handout questions to be answered.
July 2:	Answers to questions from Faure/Mensing.
July 6:	Withdrawal date and possibly receive a “W”
July 16:	Paper due to instructor
July 19:	Due date for paper revisions/corrections to student.
July 26	Final Report (corrected) due to instructor.

Week	Reading	Activity*
June 7 – June 11	F&M Chapter 1, 2	Webex discussion
June 14 -June 18	F&M Chapter 3, 4	First exercise out. FtF Discussion
June 21 – June 25	F&M Chapter 6.	Webex.
June 28 – July 2	D&L Chapter 5 Argon measurement.	Complete First Exercise, FtF discussion
July 6 – July 8	D&L Chapter 6 Potassium measurements.	Independence Day Recess (M) Discussion (Webex).
July 13 – July 17	D&L Chapter 7 Precision and Accuracy	Paper Due (first draft) on July 17 no later than close of business. Discussion, FtF.
July 20 – July 24	Write paper.	Submit paper no later than close of business July 26.

Note * Webex and f-to-f meetings are Friday at 11 am.

Reading List.

a) General Reference on Radioactivity and K-Ar Geochronology.

Faure, G. and Mensing, T., 2004, *Isotopes, Principles and Applications* (3rd Edition), Wiley, 928 pp. See specific chapters on Radioactive Decay. Chapters 1-4 and 6.

Dalrymple, G.B., and Lanphere, M.A., 1969, *Principles, Techniques and Applications to Geochronology*, Freeman. Chapters 5-7.