

Introduction to Radiochemistry

ENU 6937

CHS5110

Course Description

3 credit hours.

This course will introduce basic concepts of the fundamental behavior of radionuclides, radioanalytical techniques, and applications to nuclear fuel cycle

Course Pre-Requisites / Co-Requisites

CHM 2046 or CHM 2096

Course Objectives

1. Provide students with an understanding of radioisotope decays and their measurements.
2. Provide students with an understanding of radioanalytical techniques.
3. Provide students with an understanding of chemical processes undergone by radioelements and their application to the nuclear fuel cycle and reactor behaviors.

Professional Component (ABET):

N/A- elective course

Relation to Program Outcomes (ABET):

N/A

Required Textbooks and Software

- Chart of nuclides
- Bechtel Marine Propulsion Corporation
- 2010, 17th edition
- ISBN 978-0-9843653-0-2

The course is developed by the instructor from various published sources, as described in the Recommended Materials section. Materials will be posted.

Recommended Materials

- Nuclear and Radiochemistry
- Jens-Volker Kratz and Karl Heinrich Lieser
- 12/04/2013 and 3rd edition
- ISBN-13 978-3527329014

- Quantitative Chemical Analysis
- Daniel C. Harris
- 05/29/2015, 9th edition
- ISBN-13 978-1464135385

Course Schedule

<u>Fundamentals</u>			
Week 1:	Radioelements and decay modes /	Quiz 1 /	
Week 2:	Decay kinetics /	Quizzes 2, 3 /	Homework 1
Week 3:	Measurements /	Quizzes 4, 5 /	Homework 2
Week 4:	Statistics /		Exam 1
<u>Analyses</u>			
Week 5:	Activation /	Quizzes 6, 7 /	Homework 3
Week 6:	Isotopic dilution /	Quizzes 8, 9 /	Homework 4

Week 7:	Chemical equilibrium /		Exam 2
Week 8:	complexation and precipitation /	Quizzes 10, 11 / Homework 5	
Week 9:	Solvent extraction /	Quizzes 12, 13 / Homework 6	
Week 10:	Electrochemistry/	Quizzes 14, 15 / Homework 7	
Week 11:	Special aspects of the chemistry of radionuclides /		Exam 3
	<u>Applications</u>		
Week 12:	Environmental radioactivity /	Quizzes 16, 17 / Homework 8	
Week 13:	Radiochemistry in nuclear reactor /	Quizzes 18, 19 / Homework 9	
Week 14:	Radiochemistry of the nuclear fuel cycle /	Quizzes 20, 21 / Homework 10	
Week 15:	Review /		

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance will not be monitored, nor will it be considered in the grade. However, quizzes will be given at the beginning of lecture and some materials covered during lecture will not be covered in the references or in the notes provided online. Students are responsible for obtaining these materials. If a student arrives late or leaves early, he/she is expected to do so with minimum level of disruption to the class in progress.

Students will take their quiz on the electronic medium of their choice, including their phone. Students can take notes on laptops. However, the use of phone is prohibited during class after the quiz is completed and phone will be muted during lecture. A student using their phone or having their phone ringing will be told to leave the room for the duration of the lecture - the same principle applies to office hours or appointments.

Students who participate in university-sponsored athletic or scholarly activities are permitted to be absent 12 scholastic days per semester without penalty. A scholastic day is any day on which regular class work is scheduled as defined in the approved university calendar. Students must inform the instructor of such university-sponsored activity, in writing and in advance.

Missed quizzes for other reasons than university-sponsored activities will receive a zero grade.

Missed homework for other reasons than university-sponsored activities, but due to professional, medical, or personal reason, as described below, will be granted extension with penalty: the grade will be reduced by 50% for homework received up to 1 day late, 75% for up to 2 days late, 100% beyond 2 days late.

Students who know in advance they will be absent for a scheduled exam, due to university-sponsored activities, professional, medical, or personal reasons, will inform the instructor in written as soon as they know about it and no later than one week before the exam. The student will take the exam in advance, no sooner than the Friday before the scheduled exam. Students missing an exam, without prior knowledge of the absence and for medical or personal reasons, will be allowed to take another version of that exam within the week of the scheduled exam; if this is not possible, that exam grade will be calculated at the end of the semester as the average of the remaining exam. Any additional missed exam that cannot be rescheduled will received a zero grade.

Professional: Reasonable extensions for job/internship interviews, technical conferences, or other professional / career development reasons should be requested. Requests are typically granted, at my discretion, unless they would grant a student or group of students an unfair advantage over their peers, cause significant disruption to the course or grading schedule, or violate some UF policy.

Medical: Extensions will also be granted for (your own) medical reasons – please do not come to class if you are ill. Per UF policy, in the case of medical absences that are frequent or suspiciously- timed (*e.g.*; repeatedly, suddenly ill at deadlines), the instructor may request a signed note from a physician or similar professional practitioner.

Personal: In addition, UF policies require accommodation for several non-academic, non- medical reasons. Extensions for these personal issues are strictly limited to those mandated by the letter of UF policies.

Pursuant to HWCOE policy, the following statements are required:

(Pertains to graduate students only) Excused absences are consistent with university policies in the graduate catalog <https://catalog.ufl.edu/graduate/regulations/> and require appropriate documentation.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (8 best of 10)	100 each	18%
Quizzes (16 best of 21)	10 each	10%
Exam 1	100	18%
Exam 2	100	18%
Exam 3	100	18%
Final Exam	100	18%
		100%

Grading Policy

Percent	Grade	Grade Points
93.0 - 100	A	4.00
90.0 - 92.9	A-	3.67
87.0 - 89.9	B+	3.33
83 - 86.9	B	3.00
80.0 - 82.9	B-	2.67
77.0 - 79.9	C+	2.33
73.0 - 76.9	C	2.00
70.0 - 72.9	C-	1.67
67.0 - 69.9	D+	1.33
63.0 - 66.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

Graduate: <http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

Grade Appeal

All appeals of grades, including those from clerical/grade-calculation errors, must be made within 1 week of return. (This may be modified for specific assignments.)

Grade appeals must be provided in the following format:

- Include the entire assignment unmodified.
- Attach (paper clip preferred) a written summary of which problem(s) or part(s) you believe were graded inaccurately. Be as specific as possible.
- Turn in your appeal to the instructor at class time or during office hours.
- Grade appeal will be reviewed and decided upon.

Appeals will be considered for clerical errors, addition errors, and inconsistent scoring.

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.ua.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their

Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.

<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.

<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.

<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.