Chem 4:176 – Radiochemistry: Energy, Medicine, and the Environment (3 s.h.)
Fall 2015

Lecture times: 9:30-10:20, Mon/Wed/Fri (E215 CB)

Course Administrators: Prof. Michael Schultz e-mail: michael-schultz@uiowa.edu Phone: 319-335-8017
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Andy Nelson email: andrew-w-nelson@uiowa.edu

Office hours for Eric Eitrheim or Andy Nelson will be from 3:00 – 4:30 PM Mon. & Thurs. in office E359 CB. If these times do not work for your schedule, times are available outside office hours by appointment by emailing Eric Eitrheim or Andy Nelson. If you would like to schedule a time to meet with other lecturers please email or call to set up a time (information provided on ICON).

Course philosophy
This course is designed to provide fundamental theoretical concepts and calculations that are core to all aspects of radiochemistry within a framework of real-world applications. Students will be introduced to the chemical and physical phenomena that describe nuclear interaction, decay modes, isotope effects, and radioanalytical measurement technologies and gain insights into the impact these phenomena have for applications of radiochemistry and nuclear science in medicine, energy, industry, natural sciences, government, and for society.

Course Materials
Required text: Text (PDF’s) will be provided to you on ICON when needed and are references in the tentative schedule.


An interactive chart of the nuclides will be posted on ICON under “links”.

Course web site: (https://icon.uiowa.edu/) This site has the course syllabus, announcements, class handouts, problem set assignments, and grades.

Grading:
1) 7 Problem sets @ 40 points each (Due at beginning of class period) = 280 points (28%)
2) Midterm Exam = 360 (36%)
5) Comprehensive final exam = 360 points (36 %)

Total = 1000 points

The final grade distribution will approximately follow that recommended by the College of Liberal Arts and Sciences for an advanced level course: A’s (22 %), B’s (38 %), C’s (36 %), D’s (3 %), F’s (1 %). Within each grade level, +/- letter grades will be given.

Notes on independent work and grading
General discussion with classmates on the inorganic concepts being tested in problem set exercises is encouraged, but each student must submit independent work in your own words. All in-class exams must be completed alone. Cheating will not be tolerated.

Any questions about grades and scores received for course assignments should be directed to Prof. Schultz. Federal privacy rules mandate that individual scores and grades cannot be publicly posted. Grades will be posted on ICON after each exam and individual cumulative scores and an estimated midterm grades may be obtained from Prof. Schultz.

Electronic Communication
University policy specifies that students are responsible for all official correspondences sent to their University of Iowa e-mail address (@uiowa.edu). Faculty and students should use this account for correspondences
Collegiate Guidelines.

Your responsibilities to this class, and to your education as a whole, include attendance and participation. You are also expected to be honest and honorable in your fulfillment of assignments and in test-taking situations (the College's policy on plagiarism and cheating is on-line in the College's Student Academic Handbook http://www.clas.uiowa.edu/students/academic_handbook/). You have a responsibility to the rest of the class-and to the instructor-to help create a classroom environment where all may learn. At the most basic level, this means that you will respect the other members of the class and the instructor, and treat them with the courtesy you hope to receive in turn. All students in the College have specific rights and responsibilities. You have the right to adjudication of any complaints you have about classroom activities or instructor actions. Information on these procedures is available in the Schedule of Courses and on-line in the College's Student Academic Handbook. Any complaints with the operation of this course should be initially directed to Prof. Schultz. Department of Chemistry Contact Information: Students in need of additional information may contact staff in the Chemistry Center (231 CB or at 335-1341) during normal business hours.

Administrative Home of the Course

The College of Liberal Arts and Sciences is the administrative home of this course and governs such academic matters as the add/drop deadlines, the second-grade-only option, issues concerning academic fraud or academic probation, and how credits are applied for various graduation requirements. Different colleges may have different policies. Students with questions about these or other CLAS policies should speak with an academic advisor or with the staff in 120 Schaeffer Hall. Also see the CLAS Academic Handbook: www.clas.uiowa.edu/students/academic_handbook/index.shtml

CLAS Final Exam Policies

The final examination schedule for each class is announced around the fifth week of the semester by the Registrar. Final exams are offered only during the official final examination period. No exams of any kind are allowed during the last week of classes. All students should plan on being at the UI through the final examination period. Once the Registrar has announced the dates and times of each final exam, the complete schedule will be published on the Registrar's web site.

Academic Fraud

Plagiarism and any other activities that result in a student presenting work that is not his or her own are academic fraud. Academic fraud is reported to the departmental DEO and then to the Associate Dean for Academic Programs and Services in the College of Liberal Arts and Sciences who deals with academic fraud according to these guidelines: www.clas.uiowa.edu/students/academic_handbook/ix.shtml

Making a Suggestion or a Complaint

Students have the right to make suggestions or complaints and should first visit with the instructor, then with the course supervisor if appropriate, and next with the departmental DEO. All complaints must be made within six months of the incident. www.clas.uiowa.edu/students/academic_handbook/ix.shtml#5

Accommodations for Disabilities

A student seeking academic accommodations should first register with Student Disability Services and then meet with a SDS counselor who determines eligibility for services. A student approved for accommodations should meet privately with the course instructor to arrange particular accommodations. See www.uiowa.edu/~sds/

Understanding Sexual Harassment

Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community have a responsibility to uphold this mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. See the UI Comprehensive Guide on Sexual Harassment for assistance, definitions, and the full University policy.

Reacting Safely to Severe Weather

If severe weather is indicated by the UI outdoor warning system, class members will seek shelter in the innermost part of the building, if possible at the lowest level, staying clear of windows and of free-standing expanses which might prove unstable. The class will resume after the severe weather has ended.
<table>
<thead>
<tr>
<th>Dates</th>
<th>General topics</th>
<th>Relevant Text Sections</th>
</tr>
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<tbody>
<tr>
<td>Aug. 24</td>
<td><strong>Course intro</strong> <em>(Forbes, Schultz)</em></td>
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| Aug. 26-Sept. 11            | **Introductory Material**  
Atoms, Isotopes, nuclear stability, radioactive decay (α, β, γ),  
parent/daughter and introduction to radiochemistry careers and  
applications. Radioactive Ingrowth & Equilibriums.  
*(Eitrheim)*  
**Radiation Detectors & Interactions with matter**  
Principles of α, β, γ interactions with matter, decay detection.  
Biological Interactions. *(Nelson)*  
*Homework 1 Due Sept 11*  
*Chapter 8*  
*Homework 2 Due Sept 25*  
*Chapter 8* |                                          |
| Sept. 14 - 25               | **Environmental Radiochemistry**  
Introduction to environmental radiochemistry of actinides,  
radiometals, and radon. *(Nelson)*  
**MIDTERM EXAM**  
**The Nuclear Fuel Cycle**  
Introduction to nuclear power generation from uranium ore to  
energy production and waste. *(Forbes)*  
*Chapter 5*  
*Homework 3 Due Oct 9*  
*Homework 4 Due Oct. 23* |                                          |
| Sept. 28 - Oct. 14          | **Separations & Geochronology**  
Introduction to fabrication of nuclear weapons-grade materials,  
chemical separations technologies, and geochronology.  
*(Eitrheim/Peate)*  
*Chapter 7, 15-16*  
*Homework 6 Due Nov. 20* |                                          |
| Oct. 16                     | **Accelerators and reactors for isotope production.**  
Introduction to production reactors, accelerators, reactions, cross  
sections, targets. *(Sunderland/Dick)*  
**FALL BREAK** | **Chapter 12-13**  
*(HW #7)* |
| Oct. 19 – Nov. 2             | **Radiopharmaceuticals**  
Introduction to radiochemistry for radiopharmaceuticals  
*(Schultz)* | **Chapter 18**  
*Homework 7 Due Dec. 9* |
| Nov. 4 - Nov. 13            | **Separations & Geochronology**  
Introduction to fabrication of nuclear weapons-grade materials,  
chemical separations technologies, and geochronology.  
*(Eitrheim/Peate)*  
*Chapter 7, 15-16*  
*Homework 6 Due Nov. 20* |                                          |
| Nov. 16 – Nov. 20 & Nov. 30 – Dec. 4 | **Accelerators and reactors for isotope production.**  
Introduction to production reactors, accelerators, reactions, cross  
sections, targets. *(Sunderland/Dick)* | **Chapter 12-13**  
*(HW #7)* |
| Nov. 23 – Nov. 27           | **FALL BREAK**                                                               | **Chapter 18**  
*Homework 7 Due Dec. 9* |
| Dec. 7 – Dec. 11            | **Radiopharmaceuticals**  
Introduction to radiochemistry for radiopharmaceuticals  
*(Schultz)* | **Chapter 18**  
*Homework 7 Due Dec. 9* |
| **Dec. 14-18**              | **FINAL EXAM PERIOD**                                                       | **Chapter 18**  
*Homework 7 Due Dec. 9* |