

Fall 2014**Chemistry 521 Radiochemistry and Radiotracers****2 credits**

Lectures: MW 09:10-10:00; Todd 303 **Instructors:** Profs. Nathalie A. Wall/ Donald E. Wall
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 OFFICE: Fulmer 628A
 OFFICE HOURS: by appointment only

Prerequisite: General Chemistry, Calculus I

Student Learning Outcome: At the end of this course the student should be able to understand and apply basic radiochemistry, including, but not limited to, concepts on nuclear stability, decay modes and kinetics, interactions of radiation with matter, radioanalytical instrumentation, health physics, radiolysis, neutron activation, and chemistry at tracer levels.

Course Website: ANGEL (<https://lms.wsu.edu>) will be used for course announcements and postings. Use your net ID and password to log in. It is your responsibility to check this site regularly.

Text: → Radiochemistry and Nuclear Chemistry. Choppin, Rydberg, Liljenzin. Butterworth-Heinemann Pub. 3rd Edition, 2001. ISBN-10: 0750674636 --- ISBN-13: 978-0750674638
 → Chart of nuclides (for example Knolls' can be found at <http://www.nuclidechart.com>)
Chart of nuclides will be needed in lecture.

Grading:	Exam 1: 300 points	GRADE RANGES: (guaranteed minimum grade)			
	Exam 2: 300 points	90% A	87% A-	83% B+	80% B
	Final: 400 points	77% B-	73% C+	70% C	67% C-
		63% D+	60% D	below 60% F	

Exams: Full credit will be given only when the work is shown. Final numerical results or final equations are not sufficient. You will be penalized for showing final numerical results shown without appropriate units. All rules for significant figures apply and points will be removed for incorrect significant figures.

Exam 1: 09/27/2014
 Exam 2: 11/01/2014
 Final Exam: 12/13/2014

Calculators: Students are expected to have and to be able to use a scientific calculator. Graphing calculators are allowed by not required. The use of any stored information/programs in a programmable calculator will be considered cheating (See ACADEMIC INTEGRITY section). Calculators with a full QWERTY keyboard (such as TI-92), PDAs, palmtop and handheld computers, and cell phone/calculator combinations may not be used during examinations. Students are responsible for bringing calculator in classes and during exams.

Students with Disabilities: Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; 509-335-3417) to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center. For more information contact a Disability Specialist

Academic Integrity We encourage you to work with classmates on assignments. However, each student must turn in original work. No copying will be accepted. Students who violate WSU's Standards of Conduct for Students will receive an F as a final grade in this course, will not have the option to withdraw from the course and will be reported to the Office Student Standards and Accountability. Cheating is defined in the Standards for Student Conduct WAC 504-26-010 (3). It is strongly suggested that you read and understand these definitions.

Safety and Emergency Notification: Washington State University is committed to enhancing the safety of the students, faculty, staff, and visitors. It is highly recommended that you review the Campus Safety Plan (<http://safetyplan.wsu.edu/>) and visit the Office of Emergency Management web site (<http://oem.wsu.edu/>) for a comprehensive listing of university policies, procedures, statistics, and information related to campus safety, emergency management, and the health and welfare of the campus community.

COURSE OUTLINE:

1. Brief history of radiochemistry
2. Basics of nuclear chemistry
 - 1) Introduction
 - 2) Nuclear stability
 - 3) Nuclear energetic
 - 4) Binding Energy
3. General principles of radioactivity
 - 1) Decay modes
 - 2) Chart of nuclides
 - 3) Rate of nuclear decay
 - 4) Naturally occurring radiation
4. Interaction of radiation with matter
 - 1) Introduction
 - 2) Heavy charged particles interaction with matter
 - 3) Electron interaction with matter
 - 4) Electromagnetic interaction with matter
 - 5) Neutron interaction with matter
5. Methods of detection of radioisotopes
 - 1) Introduction: Different types of detectors
 - 2) How detectors work and how to use them
 - 3) Gas filled detectors
 - 4) Scintillation detectors
 - 5) Semi conductor detectors
6. Counting Statistics
7. Health physics
 - 1) Fundamental objectives and concepts of radioprotection
 - 2) Methodology
8. Ionizing radiation chemical reactions
 - 1) Introduction
 - 2) Physical effects
 - 3) Chemical effects
 - 4) Radiations in organic media
9. Activation analysis
 - 1) Introduction
 - 2) Irradiation tools
 - 3) Activation analysis generalities
 - 4) Activation with thermal neutrons
 - 5) Charged particles activation analysis
10. Chemistry at tracer level
 - 1) Introduction
 - 2) From macro-concentrations to micro-concentrations
 - 3) Chemistry at tracer levels
 - 4) Principles of radiochemistry methods
 - 5) Radioactive indicator
11. General chemical facts regarding radioactive elements
 - 1) Natural radioelements
 - 2) Artificial radioelements
 - 3) Essential chemical properties of natural radioelements
 - 4) Chemical properties of artificial radioelements: Tc and Pm
 - 5) Chemical properties of transuranic radioelements
12. End of nuclear fuel cycle: nuclear waste management
 - 1) The Nuclear Fuel Cycle
 - 2) Classification of nuclear wastes
 - 3) Storage of nuclear wastes
 - 4) Types of geological waste repository
 - 5) Examples