

## Chemistry 9604: Radiation Induced Chemistry

Instructor: J. Clara Wren, [jcwren@uwo.ca](mailto:jcwren@uwo.ca), ChB. 019

### Course Description:

This course covers the chemical effects produced in a system by the absorption of ionizing radiation, alpha-, and beta-particles and gamma- and x-rays from decay of radioactive isotopes, and high energy ions and electrons from accelerators. The course topics include sources of radiation, collision of high energy radiation with electrons in matter, differences between photochemistry (solute-oriented) and radiation chemistry (solvent-oriented), the formation of ions and free radicals along the radiation tracks, the diffusion and chemical reaction kinetics of ions and free radicals, and the application of water radiolysis to interfacial chemical and materials research.

### Outline:

1. Review on Ionizing Radiation
  - Radioactive decay, half-life, first order reaction, source strength
  - Alpha, beta, gamma-radiation, x-rays, high-energy particles
  - Accelerators, Synchrotron
  - Nuclear systems chemistry and materials
2. Interaction of Radiation Particles/Photons with Matters
  - Charged particles ( $\alpha$ ,  $\beta$ , etc) vs. photons
  - Bremsstrahlung radiation, inelastic and elastic collision vs. photoelectric effect, Compton scattering, coherent scattering and pair production
  - Rate of energy loss, penetration length, linear energy transfer (LET)
3. Radiolysis Kinetics
  - Radiolysis products along the radiation tracks, g-values, dosimetry
  - Solvated electrons, and free radicals
  - Effect of solvent properties, liquid water vs supercritical water, organic solvents, ionic liquids
4. Interfacial Mass and Charge Transfer Processes in the Presence of Ionizing Radiation
  - Energy absorption by solid vs liquid medium
  - Chemical potentials in solid vs liquid medium
  - Radiation induced metal oxide nanoparticles
  - Radiation induced corrosion

### Lectures and Schedule: Tues and Thurs: 1:30 to 3:00 pm

<b>Evaluation:</b>	Literature review + Presentation	70 %
	Two Problem Sets	2 × 15 %
<b>Approximate Due Dates:</b>	Problem Set Assignments: Feb. 10 and Mar 24, 2022	
	Literature review + Presentation: throughout the course	

### **Course attendance and missed/late assignments**

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed.

### **Notes on Academic Honesty**

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

[www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_grad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf)

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

### **Health and Wellness**

As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Western provides several on campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western's Campus Recreation Centre.

Numerous cultural events are offered throughout the year. For example, please check out the Faculty of Music web page <http://www.music.uwo.ca/>, and our own McIntosh Gallery <http://www.mcintoshgallery.ca/>. Information regarding health- and wellness-related services available to students may be found at <http://www.health.uwo.ca/>. Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate chair), or other relevant administrators in their unit. Campus mental health resources may be found at [http://www.health.uwo.ca/mental\\_health/resources.html](http://www.health.uwo.ca/mental_health/resources.html)