

**Technetium Chemistry: CHEM 793-1010
Spring 2017**

Time & Location

Tuesday, 9:00 AM– 12:00 PM
MSM 112 Lecture / MSM 173 Laboratory

Grading

Exam (70%): oral presentations (~20 min, presentation of articles given by the instructors)
Participation (30 %)

Textbook

Technetium: Chemistry and Radiopharmaceutical Applications by Schwochau, K. Wiley-VCH: Weinheim, Germany, 2000.

Note: the book will be provided in .pdf format by the instructors.

The goal of the class is to provide students with fundamental and applied chemistry of technetium and combine lectures in class with laboratory sessions. Presentations are given on the redox, coordination and synthetic chemistry of technetium complexes in all the oxidation states. The class will also focus on the application of technetium in nuclear medicine.

Course Outcomes

- Understand the role of oxidation-reduction reactions in technetium chemistry
- Ability to discuss the synthetic and coordination chemistry of technetium
- Understand the role of 4d electron in bonding and properties of technetium complexes
- Explain the applications of technetium
- Ability to work with technetium (^{99}Tc) in solution and in the solid-state
- Ability to perform the preparation of technetium complexes

The lectures in classes are based on the book *Technetium: Chemistry and Radiopharmaceutical Applications*. The lectures cover:

Introduction: discovery, isotopes and application of Tc

Analytical chemistry: identification, determination, and separation methods

Synthetic and coordination chemistry: compounds and structure

Redox chemistry: oxidation states and redox properties

Solution chemistry: Eh-pH diagram, speciation, complexation

Technetium chemistry in the fuel cycle

Medical uses: $^{99\text{m}}\text{Tc}$, radiopharmaceuticals and radioactive tracers

The laboratory classes will occur in March and April; the laboratory component focuses on developing hands-on experience with radioactive materials, handling and technetium-specific laboratory techniques. The laboratory classes cover: Preparation and characterization of ^{99}Tc compounds in the oxidation states +3 to +7. The laboratory component consists of 7 classes:

- Class 1: handling of technetium
- Class 2: preparation of KTcO_4
- Class 3: preparation of K_2TcCl_6
- Class 4: preparation of $(\text{n-Bu}_4\text{N})\text{TcO}_4$
- Class 5: preparation of $(\text{n-Bu}_4\text{N})\text{TcOCl}_4$

- Class 6: preparation of $\text{TcCl}_3(\text{PPh}_3)_3 \cdot \text{CH}_3\text{CN}$
- Class 7: preparation of $(n\text{-Bu}_4\text{N})\text{TcNCl}_4$

In those laboratory classes, students will work in the radiochemistry laboratories at the HRC under the supervision of the instructors. Prior the classes, students will be required to complete the radioprotection and protocols trainings and perform bioassay prior and after the completion of the classes.

UNLV POLICIES

Academic Misconduct — Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility and professionalism. By choosing to join the UNLV community, students accept the expectations of the Student Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling in UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's function as an educational institution. An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another, from the Internet or any source, without proper citation of the sources. See the Student Academic Misconduct Policy (approved December 9, 2005) located at: <https://www.unlv.edu/studentconduct/student-conduct>.

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Disability Resource Center (DRC) — The UNLV Disability Resource Center (SSC-A 143, <http://drc.unlv.edu/>, 702-895-0866) provides resources for students with disabilities. If you feel that you have a disability, please make an appointment with a Disabilities Specialist at the DRC to discuss what options may be available to you. If you are registered with the UNLV Disability Resource Center, bring your Academic Accommodation Plan from the DRC to the instructor during office hours so that you may work together to develop strategies for implementing the accommodations to meet both your needs and the requirements of the course. Any information you provide is private and will be treated as such. To maintain the confidentiality of your request, please do not approach the instructor in front of others to discuss your accommodation needs.

Religious Holidays Policy — Any student missing class quizzes, examinations, or any other class or lab work because of observance of religious holidays shall be given an opportunity during that semester to make up missed work. The make-up will apply to the religious holiday absence only. It shall be the responsibility of the student to notify the instructor within the first 14 calendar days of the course for fall and spring courses (excepting modular courses), or within the first 7 calendar days of the course for summer and modular courses, of his or her intention to participate in religious holidays which do not fall on state holidays or periods of class recess. For additional information, please visit: <http://catalog.unlv.edu/content.php?catoid=6&navoid=531>.

Transparency in Learning and Teaching — The University encourages application of the transparency method of constructing assignments for student success. Please see these two links for further information:

<https://www.unlv.edu/provost/teachingandlearning>

<https://www.unlv.edu/provost/transparency>

Incomplete Grades — The grade of I—Incomplete—can be granted when a student has satisfactorily completed three-fourths of course work for that semester/session but for reason(s) beyond the student’s control, and acceptable to the instructor, cannot complete the last part of the course, and the instructor believes that the student can finish the course without repeating it. The incomplete work must be made up before the end of the following regular semester for undergraduate courses. Graduate students receiving “I” grades in 500-, 600-, or 700-level courses have up to one calendar year to complete the work, at the discretion of the instructor. If course requirements are not completed within the time indicated, a grade of F will be recorded and the GPA will be adjusted accordingly. Students who are fulfilling an Incomplete do not register for the course but make individual arrangements with the instructor who assigned the I grade.

Tutoring and Coaching — The Academic Success Center (ASC) provides tutoring, academic success coaching and other academic assistance for all UNLV undergraduate students. For information regarding tutoring subjects, tutoring times, and other ASC programs and services, visit <http://www.unlv.edu/asc> or call 702-895- 3177. The ASC building is located across from the Student Services Complex (SSC). Academic success coaching is located on the second floor of the SSC (ASC Coaching Spot). Drop-in tutoring is located on the second floor of the Lied Library and College of Engineering TEB second floor.

UNLV Writing Center — One-on- one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-3-301. Although walk-in consultations are sometimes available, students with appointments will receive priority assistance. Appointments may be made in person or by calling 702-895-3908. The student’s Rebel ID Card, a copy of the assignment (if possible), and two copies of any writing to be reviewed are requested for the consultation. More information can be found at: <http://writingcenter.unlv.edu/>.

Rebelmail — By policy, faculty and staff should e-mail students’ Rebelmail accounts only. Rebelmail is UNLV’s official e-mail system for students. It is one of the primary ways students receive official university communication such as information about deadlines, major campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the university. Students’ e-mail prefixes are listed on class rosters. The suffix is always **@unlv.nevada.edu**. **Emailing within WebCampus is acceptable.**

Library Resources — Students may consult with a librarian on research needs. For this class, the subject librarian is https://www.library.unlv.edu/contact/librarians_by_subject. UNLV Libraries provides resources to support students’ access to information. Discovery, access, and use of information are vital skills for academic work and for successful post-college life. Access library resources and ask questions at <https://www.library.unlv.edu/>.

Final Examinations — The University requires that final exams given at the end of a course occur at the time and on the day specified in the final exam schedule. See the schedule at: <http://www.unlv.edu/registrar/calendars>.

CHEM 793-1010 Technetium Chemistry Course Schedule

Wk	Date	Instructor	Lecture #	Topics *
1	01/17/17	SMB	1	Instruction for the class
2	01/24/17	SMB	2	Discovery, occurrence, isotopes of Technetium
3	01/31/17	SMB	3	Fundamentals and analytical Chemistry of Technetium
4	02/07/17	SMB	4	Synthetic and coordination chemistry: Oxidation state +7 to +3
5	02/14/17	SMB	5	Synthetic and coordination chemistry: Oxidation state +3 to -1
6	02/21/17	SMB	6	Redox and Solution Chemistry
7	02/28/17	SMB	7	Technetium Chemistry in fuel Cycle
8	03/07/17	SMB	8	^{99m} Tc radiopharmaceutical applications
9	03/14/17	SMB	Tc Lab 1	Lab protocol training
10	03/21/17	SMB/FP	Tc Lab 2	Synthesis of K[TcO ₄]
11	03/28/17			SPRING BREAK
12	04/04/17	SMB/FP	Tc Lab 3	Synthesis of K ₂ [TcCl ₆]
13	04/11/17	SMB/FP	Tc Lab 4	Synthesis of <i>n</i> -NBu ₄ [TcO ₄]
14	04/18/17	SMB/FP	Tc Lab 5	Synthesis of <i>n</i> -NBu ₄ [TcOCl ₄]
15	04/25/17	SMB/FP	Tc Lab 6	Synthesis of <i>n</i> -NBu ₄ [TcNCl ₄]
16	05/02/17	SMB	Tc Lab 7	Synthesis of TcCl ₃ (PPh ₃) ₃ ·CH ₃ CN
17	05/09/17	SMB	9	EXAM