

CHMB16H3

TECHNIQUES IN ANALYTICAL CHEMISTRY

FALL 2012 COURSE SYLLABUS

Course Instructors

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Required Text: Students are strongly encouraged to follow the lectures and the notes of the instructor for guidance in readings and problems from the following textbook:

Quantitative Chemical Analysis, Daniel C. Harris, 7th or 8th Edition, Publisher: W. H. Freeman

*Please note that the 8th edition is also available electronically as a subscription-based web resource (i.e. accessible on-line for a specified time period). Please see the note below for further details.

Strongly Recommended: *Student solutions manual for Quantitative Chemical Analysis*

Note: Lecture topics include suggested review problems from the text. Such material may be included on tests, tutorials, and exams. Quantitative Chemical Analysis is available online (described below) and in the UTSC Bookstore or the Reserves section of the UTSC Library.

Electronic On-line Text: An electronic on-line version of the text is available both directly from the publisher and through a US publisher consortium. This entails purchasing a subscription to a web-based version of the text, which can be searched, annotated, etc. The text is the same from both sources, but the publisher's representative claims that their web interface is easier to use. Both versions allow a trial subscription or chapter preview, so you can try both versions before spending your money!

To purchase:

- Publisher's version using an e-book card from the U of T Campus Bookstore (cheapest option preview the text on-line at the url below before contacting the bookstore for availability of the subscription card)
- Direct from the publisher (Freeman) web site at <http://ebooks.bfwpub.com/qca8e.php>
Through the CourseSmart publisher consortium at <http://www.coursesmart.com/9781429269117>

Course Topics

Sept. 11 **Introduction to Analytical Chemistry**

Learning objectives: *Qualitative and Quantitative Analytical Chemistry*

QCA 8th Edition Chapter 0, Sections 0-2 and 0-3

QCA 7th Edition, Chapter 0, Sections 0-1 and 0-2

Problems: 0-1, 0-2, 0-3, 0-4, 0-5 (same in the 8th and 7th Editions)

Sept. 12 **Chemical measurements**

Learning objectives: *GLP and SOPs*

QCA 8th Edition, Chapter 1, Sections 1-2, 1-3 and 1-5

QCA 7th Edition, Chapter 1, Sections 1-1, 1-2, 1-3 and 1-4

Problems: 1-15, 1-18, 1-19, 1-21, 1-32, 1-33 (same in the 8th and 7th Editions)

Sept. 18 **Experimental Error**

Learning objectives: *Significant figures, random and systematic errors, uncertainties, confidence intervals*

QCA 8th Edition Chapter 3, Section 3-3, 3-5

QCA 7th Edition, Chapter 3, Sections 3-4, 3-5

Problems: 3-1, 3-2, 3-3, 3-5, 3-10, 3-13 (same in the 8th and 7th Editions)

Reading: *Chapter 2 Tools of the Trade* is important for your practicals. Please, read it carefully!

Sept. 19 **Statistics**

Learning objectives: *Regression coefficient, method of least squares, t Test, F Test, Q Test, precision and accuracy*

QCA 8th Edition Chapter 4, Sections 4-1, 4-2, 4-3, 4-4, 4-6, 4-7, 4-8

QCA 7th Edition, Chapter 4, Sections 4-1, 4-2, 4-3, 4-4, 4-6, 4-7, 4-8

Problems: 4-3, 4-13, 4-14, 4-21, 4-22, 4-23 (same in the 8th and 7th Editions)

Sept. 20 **Tutorial-1** 7-8 pm in room HW214 (Attendance is voluntary, but will worth 0.5% bonus mark. Tutorials will not be videotaped. Example problems will be solved together with the students, and topics of the lectures will be discussed.)

Sept. 25 **Sample Preparation**

Learning objectives: *Statistics of sampling, sample preparation techniques*

QCA 8th Edition Chapter 27, Sections 27-1 (27-2 Reading only), 27-3

QCA 7th Edition, Chapter 28, Sections 28-1 (28-2 Reading only), 28-3

No recommended problems!

Sept. 26 **Quality Assurance and Calibration Methods**

Learning objectives: *Standard addition, calibration curves, validation*

QCA 8th Edition Chapter 5, Sections 5-1, 5-2, 5-3, 5-4

QCA 7th Edition, Chapter 5, Sections 5-1, 5-2, 5-3, 5-4

Problems: 5-6, 5-8, 5-18, 5-19, 5-24, 5-30 (same in the 8th and 7th Editions)

Oct. 2 **Acid-Base Titrations-1**

Learning objectives: *Volumetric titrations between acids and bases*

QCA 8th Edition Chapter 10, Sections 10-1, 10-2, 10-3, 10-4, 10-5, 10-6

QCA 7th Edition, Chapter 11, Sections 11-1, 11-2, 11-3, 11-4, 11-5, 11-6

Problems: 10-11, 10-18, 10-24, 10-29, 10-47, 10-73, 10-74 in the 8th Edition (or 11-11, 11-18, 11-24, 11-29, 11-47, 11-70, 11-71 in the 7th Edition)

Oct. 3 **Acid-Base Titrations-2**

Learning objectives: *Volumetric titrations between acids and bases*

QCA 8th Edition Chapter 10, Sections 10-1, 10-2, 10-3, 10-4, 10-5, 10-6

QCA 7th Edition, Chapter 11, Sections 11-1, 11-2, 11-3, 11-4, 11-5, 11-6

Problems: 10-11, 10-18, 10-24, 10-29, 10-47, 10-73, 10-74 in the 8th Edition (or 11-11, 11-18, 11-24, 11-29, 11-47, 11-70, 11-71 in the 7th Edition)

Oct. 4 **Tutorial-2** 7-8 pm in room HW214 (Attendance is voluntary, but will worth 0.5% bonus mark. Tutorials will not be videotaped. Example problems will be solved together with the students, and topics of the lectures will be discussed.)

Oct. 9 **Fundamentals of Electrochemistry**

Learning objectives: *Nernst Equation*

QCA 8th Edition Chapter 13, Sections 13-4, 13-5, 13-7

QCA 7th Edition, Chapter 14, Sections 14-4, 14-5, 14-7

Problems: 13-25, 13-26, 13-30 in the 8th Edition (or 14-25, 14-26, 14-30 in the 7th Edition)

Oct. 10 **Electrodes and Potentiometry**

Learning objectives: *Reference electrodes, indicator electrodes, pH measurement with a glass electrode*

QCA 8th Edition, Chapter 14, 14-1, 14-2, 14-3, 14-4, 14-5

QCA 7th Edition, Chapter 15, Sections 15-1, 15-2, 15-3, 15-4, 15-5

No recommended problems!

Oct. 16 Review and Discussion before the Mid-Term (Poll results will be announced!)

Oct. 17 Mid-Term-1 (Mid-term will be in the class for 90 min. Please, follow further instructions and announcements on the Blackboard)

Oct. 18 **Tutorial-3** 7-8 pm in room HW214 (Attendance is voluntary, but will worth 0.5% bonus mark. Tutorials will not be videotaped. Mid-term-1 questions will be solved together with the students 😊)

Oct. 23 **Redox Titrations-1**

Learning objectives: *Potentiometric titrations*

QCA 8th Edition Chapter 15, Sections 15-1, 15-2

QCA 7th Edition, Chapter 16, Sections 16-1, 16-2

Problems: 15-2, 15-6 in the 8th Edition (or 16-2, 16-6 in the 7th Edition)

Oct. 24 Redox Titrations-2

Learning objectives: Iodometric titrations

QCA 8th Edition Chapter 15, Section 15-7

QCA 7th Edition, Chapter 16, Section 16-7

Problems: 15-24, 15-25 in the 8th Edition (or 16-24, 16-25 in the 7th Edition)

Oct. 30 EDTA Titrations-1

Learning objectives: Metal-chelate complexes, EDTA

QCA 8th Edition Chapter 11, Sections 11-1, 11-2, 11-3, 11-5, 11-6, 11-7

QCA 7th Edition, Chapter 12, Section 12-1, 12-2, 12-3, 12-5, 12-6, 12-7

Problems: 11-3, 11-6, 11-10, 11-33, 11-35, 11-36 in the 8th Edition (or 12-3, 12-6, 12-10, 12-33, 12-35, 12-36 in the 7th Edition)

Oct. 31 EDTA Titrations-2

Learning objectives: EDTA titration techniques

QCA 8th Edition Chapter 11, Sections 11-5, 11-6, 11-7

QCA 7th Edition, Chapter 12, Section 12-5, 12-6, 12-7

Problems: 11-3, 11-6, 11-10, 11-33, 11-35, 11-36 in the 8th Edition (or 12-3, 12-6, 12-10, 12-33, 12-35, 12-36 in the 7th Edition)

Nov. 1 **Tutorial-4** 7-8 pm in room HW214 (Attendance is voluntary, but will worth 0.5% bonus mark. Tutorials will not be videotaped. Example problems will be solved together with the students, and topics of the lectures will be discussed.)

Nov. 6 Fundamentals of Spectrophotometry-1

Learning objectives: Beer's Law, UV-vis spectrophotometry

QCA 8th Edition Chapter 17, Sections 17-1, 17-2, 17-3, 17-4 and 17-5

QCA 7th Edition Chapter 18, Sections 18-1, 18-2, 18-3, 18-4 and 18-5

Problems: 17-11, 17-16, 17-19 in the 8th Edition (or 18-10, 18-16, 18-19 in the 7th Edition)

Nov. 7 Fundamentals of Spectrophotometry-2

Learning objectives: Fluorescence, IR spectrophotometry

QCA 8th Edition Chapter 17, Sections 17-1, 17-2, 17-3, 17-4 and 17-5

QCA 7th Edition Chapter 18, Sections 18-1, 18-2, 18-3, 18-4 and 18-5

Problems: 17-11, 17-16, 17-19 in the 8th Edition (or 18-10, 18-16, 18-19 in the 7th Edition)

Nov. 13 Atomic Spectroscopy

Learning objectives: Atomization and trace metal analysis

QCA 8th Edition Chapter 20, Sections 20-1, 20-2, 20-3

QCA 7th Edition, Chapter 21, Sections 21-1, 21-2, 21-3

No recommended problems!

Nov. 14 Introduction to Analytical Separations-1

Learning objectives: Solvent extraction, fundamentals of chromatography

QCA 8th Edition Chapter 22, Sections 22-1, 22-2, 22-3

QCA 7th Edition, Chapter 23, Sections 23-1, 23-2, 23-3
No recommended problems!

Nov. 20 **Review and Discussion before the Mid-Term (Poll results will be announced!)**

Nov. 21 **Mid-Term-2 (Mid-term test will be in the class for 90 min. Please, follow further instructions and announcements on the Blackboard)**

Nov. 22 **Tutorial-5** 7-8 pm in room HW214 (Attendance is voluntary, but will worth 0.5% bonus mark. Tutorials will not be videotaped. Mid-term-2 questions will be solved together with the students 😊)

Nov. 27 **Introduction to Analytical Separations-2**
Learning objectives: Solvent extraction, fundamentals of chromatography
QCA 8th Edition Chapter 22, Sections 22-1, 22-2, 22-3
QCA 7th Edition, Chapter 23, Sections 23-1, 23-2, 23-3
No recommended problems!

Nov. 28 **Review and Discussion before the Final Exam (Poll results will be announced!)**

Nov. 30 **Deadline for the submission of the Assignment**

Evaluation:

Mid-term Exam-1	10%
Mid-term Exam-2	10%
Labs	40%
Assignment	5%
Final Exam	35%
Tutorial (Bonus)	2.5%

Total **102.5%**

Course Policies and General Information:

Course Announcements: Announcements, updates to readings, assignment topics, requirements, and evaluation, etc. will be posted to the course site. Students are responsible for checking the course website regularly. **Please, arrange your UTORONTO emails to accept the course announcements.**

Lecture/Lab/Tutorial Attendance: Attendance at lectures and labs is expected. Attendance is taken in labs and tutorials. If you need to miss a laboratory period for any *valid* reason, you must contact Dr. Sauer either by phone (416-287-7209) or by e-mail (esauer@utsc.utoronto.ca) *before* your next scheduled lab period. If the reason for your absence is medical, you must download a UTSC Medical Certificate and have it completed by your doctor (download at:

http://www.utsc.utoronto.ca/~registrar/resources/pdf_general/UTSCmedicalcertificate.pdf

The completed note must contain the following information:

- Verification that you were examined on or before the day of your missed lab
- The nature of your illness
- A statement indicating the physician's professional opinion as to whether you should receive special consideration on medical grounds

Submit your completed medical note to Dr. Sauer within one week of your absence. A make-up lab will be rescheduled provided that space and time permits. If a make-up lab is not possible, the marks from the other labs will be re-weighted to make up for the missed lab.

Given the importance of the lab component of this course, any labs missed in excess of one will receive a mark of zero, **regardless of the reason**, and no re-weighting will occur. Labs missed without adequate documentation will also receive a mark of zero.

Ancillary Fees: The Department of Physical and Environmental Sciences at UTSC provides state-of-the-art education in chemistry. Chemistry being an experimental science makes learning in a laboratory setting critical. In order to provide the latest technology to enhance the student learning experience, UTSC will be charging ancillary fees for all chemistry courses that have a laboratory component. Those fees are used to recover the cost of materials and services used during the lab and to maintain and upgrade the equipment used by students. To view a complete list of those fees, students are encouraged to visit the following link:

[http://www.planningandbudget.utoronto.ca/Assets/Academic+Operations+Digital+Assets/Planning+\\$!26+Budget/2012-13+Category+5+Ancillary+Fees.pdf](http://www.planningandbudget.utoronto.ca/Assets/Academic+Operations+Digital+Assets/Planning+$!26+Budget/2012-13+Category+5+Ancillary+Fees.pdf)

Office Hours: Students are welcome to ask questions or resolve course-related problems by contacting the Course Instructor either by dropping in during scheduled office hours or by making an appointment. Students are responsible for work missed as a result of absence; the Course Instructors will not re-teach material covered in the lectures and lab sessions.

e-mail Communication: The Course Instructors may be contacted via the course e-mail addresses to get clarification on course-related issues, or to ask brief questions. The Course Instructor will endeavour to provide responses to emails within 48 h. Urgent issues must be communicated in person or by telephone (with a follow up email message).

Missed Mid-term Test: The exact dates of the mid-term tests are provided in the Course Topics schedule. Students who miss the term test will be assigned a mark of zero for the test, unless they can document a compelling reason for missing it. Students in that position must submit a written request to the Course Instructor with appropriate documentation. If a request is accepted for the mid-term test, the weighting of the mid-term will be included to the final exam. There will be no make-up mid-term tests.

Final Examination: The final examination will take place during the UTSC examination period in December following the end of the course. The exact date will be provided when the examination is scheduled.

AccessAbility: Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services Office as soon as possible. The UTSC AccessAbility Services staff (located in **S302**) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416) 287-7560 or ability@utsc.utoronto.ca. The sooner you let us know your needs the quicker, we can assist you in achieving your learning goals in this course.

Cell Phones: During lectures and labs please put your cell phones in silent mode to avoid disruption of the class. If circumstances warrant use of your cell phone and you must receive an emergency call, please inform the Course Instructor at the beginning of the session in advance and then excuse yourself from the session to respond to the call outside the lecture hall or laboratory.

Academic Calendar: Further information about academic regulations and course withdrawal deadlines can be found in the UTSC Calendar. You are encouraged to read this material.

Centre for Teaching and Learning: If you need assistance with effective writing skills, study skills, exam preparation, note taking, or time management, free workshops and advice are available from the Centre for Teaching and Learning, which can be reached at:

http://www.utsc.utoronto.ca/~ctl/Student_Support/index.html

Math & Statistics Learning Centre is now offering students help with any sort of questions they may have related to mathematics and statistics. Our course components involve advanced math skills. If the students are struggling, they are encouraged to drop in at AC312 and use the available general help hours. The schedule can be viewed at the link:

<http://ctl.utsc.utoronto.ca/mslc/>

Computer Use: Ethical use of University computers is expected at the University of Toronto Scarborough. Guidelines are set out in the UTSC Calendar. It is expected that the equipment and/or resources accessed in the UTSC Library and the computer labs are to be used for academic research, assignments, and course activities only.

Academic Integrity: Honesty and fairness are considered fundamental to the University's mission, and, as a result, all those who violate those principles are dealt with as if they were damaging the integrity of the University itself. When students are suspected of cheating or a similar academic offence, they are typically surprised at how formally and seriously the matter is dealt with - and how severe the consequences can be if it is determined

that cheating did occur. The University of Toronto treats cases of cheating and plagiarism very seriously.

Examples of offences for which you will be penalized include (but are not limited to):

- Using any unauthorized aids on an exam or test (e.g., "cheat sheets")
- Representing someone else's work or words as your own - plagiarism (see web document "How not to plagiarize" available online at <http://www.utoronto.ca/writing/plagsep.html>)
- Falsifying documents or grades
- Purchasing an essay
- Submitting someone else's work as your own
- Submitting the same essay or report in more than one course (without permission)
- Looking at someone else's answers during an exam or test
- Impersonating another person at an exam or test or having someone else impersonate you
- Making up sources or facts for an essay or report.

As a student it is your responsibility to ensure the integrity of your work and to understand what constitutes an academic offence. If you have any concerns that you may be crossing the line, please, read from the website

<http://www.utoronto.ca/academicintegrity/resourcesforstudents.html>

and always consult your instructor. Your instructor can explain, for example, the nuances of plagiarism and how to use secondary sources appropriately; he or she will also tell you what kinds of aids - calculators, dictionaries, etc. - are permitted in a test or exam. Ignorance of the rules does not excuse cheating or plagiarism. Students agree that by taking this course all required papers may be subject to submission for textual similarity review to **Turnitin.com** for the detection of plagiarism. All submitted papers will be included as source documents in the **Turnitin.com** reference database solely for the purpose of detecting plagiarism of such papers. The terms that apply to the University's use of the **Turnitin.com** service are described on the **Turnitin.com** web site.

This information is taken from the brochure, "*Academic Integrity*" and website, part of a series of UT publications to help students understand the University's rules and decision making structures. For copies, visit the Office of the Registrar at UTSC. All of the policies and procedures surrounding academic offences are dealt with in one policy: "*The Code of Behaviour on Academic Matters*". The full text is located in the back of the UTSC Calendar.