

Chemistry 2260

Introduction to Spectroscopy

Fall 2020 –remote delivery

In Chemistry 2260, we will study how spectroscopy is used to understand the chemical and physical properties of matter on the microscopic scale. In order to describe these principles, a good command of mathematics is essential!

Instructor: Dr. Jennifer van Wijngaarden (she/her/hers)
vanwijng@cc.umanitoba.ca

Website: Please check the UMLearn site frequently for class announcements, important dates and updated course content.

This course is being run as a “flipped” classroom which means that learning is student-driven and primarily occurs at home through assigned readings and videos. Class time (MWF 9:30) in Cisco Webex will be used to work on sample problems together, conduct group discussions and answer student questions (not to deliver a traditional lecture). Note that these online sessions replace traditional office hours.

For a better idea of what to expect, please watch the video on “Course logistics” under Lecture 1 (UMLearn)

As this course is being delivered and assessed remotely, it is essential that you have access to a computer with
 i) **webcam and microphone**
 ii) **reliable internet connection** capable of streaming videos

Texts: The following **e-books** (available for *free* through the UManitoba library) will be used in the course. Links are also provided in UMLearn.

1. *Physical Chemistry for the Chemical Sciences*, Chang and Thoman, <http://bit.ly/ChangThoman>

2. *Basic Atomic and Molecular Spectroscopy*, J. M. Hollas, <http://bit.ly/JMHollas>

---Please note that each student can save a personal copy of individual chapters on their computer and print them. Students cannot share files or print them for others. Please respect the licensing agreement with the publisher so that we do not lose this privilege of using a free textbook!!!

Grading:

Participation	5%
Quizzes (best 4 of 5)	20%
Midterm exam	25%
Final exam	30%
Laboratory	20%

--- To pass the course, you must obtain a grade of 50% in the lab and a grade of 50% in the lecture material (quizzes, midterm, final exam)

The conversion to final letter grades will be as follows:

A+ >90%	B+ 75-79%	C+ 64-69%	D 50-56%
A 80-89%	B 70-74%	C 57-63%	F <50%

Important Dates:

Quiz 0	September 14
Labs start	September 15, 16, 17
Quiz 1	September 21
Quiz 2	October 5
Quiz 3	October 19
Midterm	November 2
Quiz 4	November 16
Quiz 5	November 30

Academic Integrity:

There is zero tolerance for academic integrity offences such as using unauthorized materials during quizzes/exams, plagiarism in lab reports and inappropriate collaboration (group work). All suspected academic misconduct will be reported to the Department of Chemistry and the Faculty of Science. For more information on how to avoid breaching academic integrity bylaws, please visit this site:

<https://www.sci.umanitoba.ca/students/undergraduate-students/academic-resources/academic-integrity-2/>

The standard penalties imposed by the Department and Faculty of Science for acts of academic dishonesty are attached to this document on page 4. Please review them.

Professional Conduct

When participating in online classes and discussion, students are expected to behave professionally and follow the same basic norms as they would in person, such as being clothed, not being impaired, and treating others with respect. Essentially, if you wouldn't do it in an in-person class, don't do it in a virtual setting.

Labs:

The lab is run by **Dr. Carl Bartels**. You will be conducting a mix of 'in person' and online labs which start during the week of **September 14**. There is a [separate UMLearn page for the lab](#) where the schedule and manual are posted.

Homework:

Practice exercises are provided in each lecture and will help you improve your understanding of core concepts. Final answers to numerical problems (not solutions) will be posted. Dr. vW will often solve 1-2 problems during class but it is important that you also attempt these on your own to prepare for quizzes and exams. Assigned problems give you practice with routine calculations (units, solving equations with algebra, etc.) and also challenge you to apply the core concepts in new situations.

Quizzes:

Online quizzes are held every two weeks in UMLearn during the regular class time. There is a **test quiz** (Quiz 0) worth no marks on **September 14** to get comfortable with the online settings. Note that we will be using the Respondus Lockdown Browser and Monitor software in UMLearn for quizzes and exams which requires that you show ID before starting and that you have both your webcam and microphone turned on. See page 6 of this document for more information. Note that "Brightspace" = UMLearn in this document.

Quizzes are **not cumulative** and will cover only assigned lecture material (readings, videos, homework problems) since the previous (graded) quiz. Your lowest quiz grade will be dropped so students missing one quiz do not need to contact Dr. vW. Students missing more than one quiz should contact Dr. vW within 24 h to arrange an **oral quiz** with Dr. vW via Zoom.

Midterm exam:

The midterm exam on Monday November 2nd (6-8 pm) is **cumulative** and based on all assigned lecture material (readings, videos, homework problems). Like the quizzes, it will be electronically monitored and recorded using UMLearn and/or Zoom and requires that your webcam and microphone be turned on throughout the exam. Students missing the midterm due to illness or internet issues should notify Dr. vW within 24 h. The deferred midterm will be run as an **oral exam** one-on-one with Dr. vW via Zoom.

Final Exam:

The final exam is **cumulative** and will be based on all assigned lecture material (readings, videos, homework problems). This is scheduled by the Registrar's office during the final exam period in December and the format will be discussed later in the term.

2020 Course Outline:**1. Basis of Spectroscopy**

Overview of quantum chemistry including: Planck's Law, blackbody radiation, wave-particle duality, deBroglie wavelengths, Heisenberg uncertainty principle, Schrödinger equation, operators, wavefunctions, Particle in a 1D box

2. Atomic Spectroscopy

Interpretation of atomic energy levels and atomic absorption/emission spectra including: Bohr model, Rydberg model, QM solution of H atom, multi-electron atoms, photoelectron spectroscopy

3. Vibrational Spectroscopy

Discussion of molecular vibration and interpretation of infrared and Raman spectra of linear and nonlinear molecules including: Hooke's law, QM solution of vibration (harmonic oscillator), effect of anharmonicity, selection rules

4. Rotational Spectroscopy

Understanding molecular rotation and interpretation of microwave and infrared spectra of various tops including: classical description of rotation, QM solution of molecular rotation (linear rigid rotor), Boltzmann populations and degeneracies, effect of molecular non-rigidity and multiple moments of inertia, rovibrational spectra (diatomic)

5. Electronic Spectroscopy

Relating electronic structure of molecules to ultraviolet/visible and X-ray spectra including: discussion of molecular orbitals and energy levels starting with H_2^+ and extending to C_{60} , vibrational (and rotational) structure of electronic spectra, Franck-Condon principle, photoelectron spectroscopy, Koopman's theorem



Suggested minimum penalties for common acts of academic dishonesty and violation of other university policies under the Student Discipline Bylaw

Act of Academic Dishonesty	Minimum penalty given by the Department Head (or designate). <i>Note: This applies to first offenses only. Subsequent offenses must be referred to the Dean (or designate); see third column.</i>	Minimum penalty given by Associate Dean of Science (as the Dean's designate). (See Notes i and ii below)
Possession/use of unauthorized material or Copying in a quiz, test, or midterm.	Grade of zero on quiz, test, or midterm; DISC designation and notation on transcript; penalty may include a proportion of the course greater than the value given to the quiz or a grade of F in the course.	F-DISC in course, notation on transcript; may include suspension from all Faculty of Science courses for a minimum of one year.
Copying, Inappropriate Collaboration, or Plagiarism in a laboratory report or assignment.	Grade of zero on report or assignment; DISC designation and notation on transcript; Extent of plagiarism may invoke a more severe penalty. Penalty may include a proportion of the course greater than the value given to the assignment, project or laboratory report.	F-DISC in course, notation on transcript; may include suspension from all Faculty of Science courses for a minimum of one year.
Inappropriate communication during a quiz, test, or midterm.	Grade of zero on quiz or test; DISC designation and notation on transcript; penalty may include a proportion of the course greater than the value given to the quiz or test.	F-DISC in course, notation on transcript; may include suspension from all Faculty of Science courses for a minimum of one year.
Possession/use of unauthorized material, Copying, or Inappropriate communication during a final examination.	Investigation is referred to the Dean.	F-DISC in course, notation on transcript, and suspension from all Faculty of Science courses for a minimum of one year.
Fabrication of data in a lab report, project, or Honours thesis.	Investigation is referred to the Dean.	F-DISC in course, notation on transcript, and suspension from all Faculty of Science courses for a minimum of one year. May involve more severe penalties and suspension from the Faculty of Science.
Forged documents of any kind.	Investigation is referred to the Dean.	Suspension from the Faculty of Science.
Personation in an assignment, lab report, quiz, test, midterm, or final examination.	Reprimand; other penalties under the authority of the Head. Investigation is normally referred to the Dean.	Suspension from the Faculty of Science.
Inappropriate or disruptive behaviour (http://umanitoba.ca/admin/governance/governing_documents/students/279.html)	Reprimand; other penalties under the authority of the Head.	Reprimand; may include DISC designation and notation on transcript; suspension from all Faculty of Science courses for a minimum of one year; suspension from the Faculty of Science; or it may be referred to the President's Office for more severe penalties.



Definitions:

Possession of unauthorized material: possession of cell phone, calculator, cheat sheet, etc.

Possession of unauthorized material is assessed as dishonest behaviour, regardless of whether the material was actually used in the event.

Copy: deliberately copying from another person or website with or without the other person's knowledge. Allowing another person to copy from you is also dishonest.

Plagiarism: According to the Student Discipline Bylaw (<http://webapps.cc.umanitoba.ca/calendar09/regulations/plagiarism.asp>) plagiarism is "to take ideas or words of another person and pass them off as one's own".

Inappropriate collaboration: working together and copying each other's answers or ideas on an assignment or report.

Inappropriate communication: communication (verbal, written, or other) during a quiz, test, or an exam that is required to be completed alone.

Forged documentation: use of forged application materials, forged identification, forged signature, or an attempt to change information from a course.

Personation: use of another person's identification card, use of a signature other than your own, your presence in an exam of a course or course section in which you are not registered with intent to write or read the exam, or any implication that you are someone else.

F-DISC stands for F in the course with disciplinary action imposed due to academic dishonesty.

Notes:

i) Penalties for Non-Science students found guilty of academic dishonesty in Faculty of Science courses will be decided after consultation with their Registration Faculty (e.g. penalties for an Engineering student taking a Mathematics course will be selected by the Department of Mathematics or the Associate Dean of Science, with an opportunity for the Dean of Engineering to attend the hearing and recommend further penalties).

ii) An educational component to the disciplinary action may be implemented to avoid future acts of academic dishonesty. Therefore, penalties may also be accompanied with other requirements to be met before permission will be given to the student to continue in the program. For example, an acceptable letter of apology, a properly written essay on a disciplinary or other topic, or attendance at specified workshops may be required before a suspension or penalty is lifted.

iii) Contravention of other exam regulations such as not submitting a written exam paper, submitting exams from two different course sections, etc. may also be subject to disciplinary action.

iv) Department Heads are required to report all offenses to the dean's office.

v) The department Head (or designate) must check with the dean's office for previous offenses prior to meeting with the student.

Student Quick Start Guide

LockDown Browser® and Respondus Monitor®

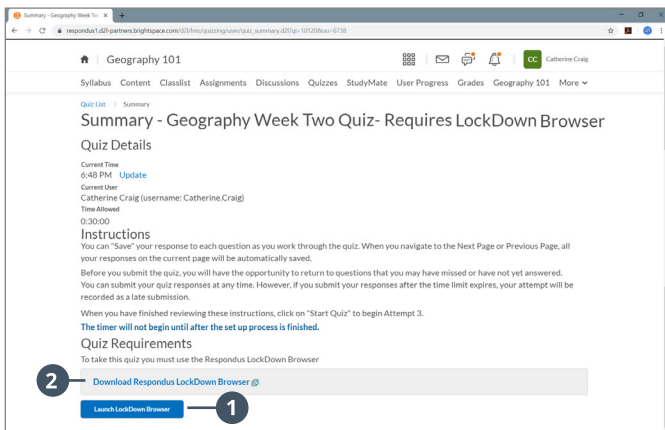
WHAT IS RESPONDUS LOCKDOWN BROWSER?

LockDown Browser is a locked browser for taking quizzes in Brightspace. It prevents you from printing, copying, going to another URL, or accessing other applications during a test. If a Brightspace test requires that LockDown Browser be used, you will not be able to take the quiz with a standard web browser.

LockDown Browser should only be used for taking Brightspace quizzes. It should not be used in other areas of Brightspace.

TAKING A QUIZ

1. Close all programs, unless one is used to connect you to the Internet.
2. Log into Brightspace with a regular browser, select the course and navigate to the quiz.
3. From this screen, either install LockDown Browser or launch it to take the quiz.



1. If the computer already has LockDown Browser installed, simply click the "Launch LockDown Browser" button.
2. If the computer does not have LockDown Browser installed, this link will enable you to install LockDown Browser to the computer.
4. If prompted to close a blocked program (e.g. screen capture, instant messaging), choose **Yes**.
5. The test will then start. (Note, once a test has been started with LockDown Browser, you cannot exit the quiz until the **Submit** button is clicked.)

USING WITH A WEBCAM (Respondus Monitor)

You may be required to use LockDown Browser with a webcam, which will record you during an online, nonproctored exam. (The webcam feature is sometimes referred to as "Respondus Monitor.")

Your computer must have a functioning webcam and microphone. A broadband connection is also required.

If a quiz requires LockDown Browser **and** a webcam, follow steps 1-5 in the previous "Taking A Quiz" section. At this point the Startup Sequence for the webcam begins.

- You will first need to review and agree to the Terms of Use.
- The **Webcam Check** will confirm that your webcam and microphone are working properly.
- The remaining steps of the Startup Sequence will depend on settings chosen by your instructor. Follow the instructions and note your progress along the left side of the screen.
- If you encounter a problem, select the **It's not working** link for troubleshooting tips.

The quiz will begin after the Startup Sequence is complete. You cannot exit LockDown Browser until the quiz is submitted for grading.

PROBLEMS?

If you have problems downloading, installing, or taking an assessment with Respondus LockDown Browser, contact your instructor or your institution's help desk.

Respondus, LockDown Browser and Respondus Monitor are registered trademarks of Respondus, Inc. All other trademarks are the property of their respective owners. Copyright © 2019 Respondus.