

U of M, Faculty of Science, Dept. of Chemistry, Full Course Syllabus Winter 2019, CHEM 1310: Introduction to Physical Chemistry (Chemical Reactivity)

All Course Sections	Lecturers
A01; <u>Room:</u> 200 Armes Building Tues. & Thurs.: 8:30 – 9:45 AM	Angela Kuchison (Angela.Kuchison@umanitoba.ca)
A02; <u>Room:</u> 200 Armes Building Tues. & Thurs.: 1:00 – 2:15 PM	David Herbert (David.Herbert@umanitoba.ca)
A03; <u>Room:</u> 200 Armes Building Tues. & Thurs.: 2:30 – 3:45 PM	Sabine Kuss (Sabine.Kuss@umanitoba.ca)
A04; <u>Room:</u> 200 Armes Building Mon., Wed., & Fri.: 2:30 – 3:20 PM	Christian Kuss (Christian.Kuss@umanitoba.ca)

Electronic Communications and Questions

As per University policy (<http://intranet.umanitoba.ca/registrar/email-policy>), all e-mail communications must be conducted using your University of Manitoba e-mail account. Messages from other accounts will not be answered. You are expected to check your University of Manitoba e-mail account **daily** for communications sent to you by University instructors, administrators, and staff.

When e-mailing your lecturer, course coordinator or lab coordinator **ALWAYS include the course (CHEM 1310)** in the subject of the e-mail, and for the lab, your lab section and rotation. This allows the lecturer, course coordinator or lab coordinator to address your concerns efficiently.

For general questions about the course material contact your lecturer.

For questions involving the administration of the lecture component (e.g., conflicts in exam times, problems regarding grades):

- Contact the course coordinator, Angela Kuchison (Angela.Kuchison@umanitoba.ca).

For questions involving the lab component of the course (including missed labs and lab grade appeals):

- Contact the lab supervisor: Scott McKay (Scott.McKay@umanitoba.ca)
- Contact the lab coordinator: Krystyna Koczanski (Krystyna.Koczanski@umanitoba.ca).

For registration and technical questions for Mastering:

Visit: <https://support.pearson.com/getsupport/s/>

Prerequisites

All students entering CHEM 1310 must have successfully completed CHEM 1300 with a minimum grade of C and should also have a minimum of two years of previous chemistry study or its equivalent.

Elementary math skills, like setting up and solving linear and quadratic equations, using logarithm and exponential functions, are assumed and not explicitly taught in class. **It is your responsibility to ensure that you are entitled to be registered in this course.** This means that: you have the appropriate prerequisites, as noted in the calendar description, or have permission from the Chemistry Department to waive these prerequisites. If you are not entitled to be in this course, you will be withdrawn, or the course may not be used in your degree program. There will be no fee adjustment, and this cannot be appealed.

Role of CHEM 1310

CHEM 1310 is the second part of the fundamental chemistry courses offered to students who are planning to specialize in health, natural, or physical sciences. This course builds on the quantitative and qualitative chemistry foundation began in CHEM 1300. Many of the topics are applicable in other courses and programs. In addition to providing necessary pre-requisite knowledge, CHEM 1310 improves problem solving, analysis, and critical thinking skills. Together, CHEM 1300 and 1310 are the basic chemistry requirements of many non-chemistry programs (Microbiology, Dentistry, Medicine, Pharmacy, and Biosystems, Civil and Mechanical Engineering) and they also form the basis of a Chemistry or Biochemistry major.

Course description

Chemistry is the study of matter and its changes. CHEM 1300 introduced a basic understanding of the energetics behind atomic and macroscopic properties, leading the way to understanding reactivity. The central importance of understanding energy continues in CHEM 1310, while broadening its applications to studying matter and reactivity in greater depth. The course is divided into five units:

1. Intermolecular Forces (*atomic-level electrostatic interactions that influence physical properties and energies*)
2. Equilibria of Solutions (*important aqueous reactions involving acids, bases, complexes, and salts*)
3. Chemical Kinetics (*rates of reactions and reaction mechanisms*)
4. Entropy and Gibbs Energy (*determining reaction spontaneity*)
5. Electrochemistry (*reduction-oxidation reactions, galvanic cells, and cell potentials*)

Course website: <http://umlearn.ca>

- Your login name and password is the same as your UMnetID.
- Information posted on the UM Learn site includes: the full course syllabus, course FAQ, link for Mastering, laboratory information, course-related internet and e-mail links, lecture notes, textbook solutions manual, practice exams, exam keys, marks, and course announcements.
- You will also submit lab reports and receive feedback for them on UM Learn.
- You should check UM Learn **daily** for course news and information.

Resources for those with special needs

- Academic Learning Center, 201 Tier Building, (204)480-1481.
Website: <http://umanitoba.ca/student/academiclearning/>
- Student Accessibility Services, 155 University Center, (204)474-6213, (204)474-9790 (TTY).
Website: <http://umanitoba.ca/student/saa/accessibility/>
- Student Counselling, 474 University Center, (204)474-8592.
Website: <http://umanitoba.ca/student/counselling/>
- University Health Services, 104 University Centre, (204)474-8411
Website: <http://umanitoba.ca/student/health/>

Expectations

- ✓ You are required to attend **all** classes.
- ✓ You are expected to be respectful of your fellow classmates and your lecturer. Please refrain from making noise during lectures and turn off your cell phone.
- ✓ You are responsible for **all** course material, whether or not it is explicitly covered in class. It is a good idea to read ahead.
- ✓ It is in your best interests to complete all on-line assignments. You are encouraged to also complete the suggested end-of-chapter questions.
- ✓ Laboratory attendance is **mandatory**. You must earn a passing grade of at least 50% in the laboratory program to pass the course.

Supplementary Instruction (SI) Schedule

Section	SI Leader	Times	Room
A01	Jayden Park	Tuesday & Thursday, 10:00 AM-11:00 AM	124 Machray Hall
A02	Cynthia James	Tuesday & Thursday, 2:30-3:30 PM	312 Tier
A03	Oreofe Okunnu	Tuesday, 1:00-2:00 PM & Thursday, 4:00-5:00 PM	115 Armes 111 Armes
A04	Tyler Szun	Wednesday & Friday, 3:30-4:30 PM	115 Armes

What is SI? Supplemental Instruction sessions are voluntary weekly review sessions that are available to students who want to improve their understanding of course content. They offer an opportunity to interact on an informal basis to ask questions, compare notes, discuss course content, solve practice problems, and develop study strategies under the guidance of a Supplemental Instruction leader.

What is an SI leader? SI leaders are experienced students who can help you by sharing their own study strategies and techniques. They are familiar with the course material, and usually they have already taken the course. They are not there to lecture or re-teach course materials; their job is to help you think about your learning and provide you with opportunities to review with other students in an organized setting.

Why should you come? If you attend SI regularly, you will gain a better understanding of course content, get a better grade, and you might also learn some useful study strategies for future courses. While you are encouraged to attend the SI session for your class section, you are welcome to attend the SI sessions for *any* section. See

http://umanitoba.ca/student/academiclearning/services/supplemental_instruction.html

Required Course Materials

Note: the textbook is the same as that used in CHEM 1300 in Fall 2018. If you purchased this last term, there is no further cost to use e-text and Mastering Chemistry for CHEM 1310.

- 1. Textbook and online homework: N. Tro, T.D. Fridgen, L.E. Shaw; Chemistry: A Molecular Approach, Second Canadian Edition, and Mastering Chemistry. There are four options:**
 - E-text with Mastering Chemistry: ISBN: 9780134381954, price: \$115.00. Available in the Bookstore or online at: <http://bookstore.umanitoba.ca/SiteText.aspx?id=8773>
 - E-text with Mastering Chemistry bundled with a binder-ready copy of the textbook: ISBN: 9780134628592, price: \$130.00. Available in the Bookstore.
 - Access to Mastering Chemistry without the e-text: can be purchased for \$75 during Mastering Chemistry registration (see below).
 - Students that have completed CHEM 1310 (i.e. have received a grade) during the Winter 2017 semester or later and had purchased access to Sapling Learning can get free access to Mastering Chemistry without the e-text for free. To do so, please fill out the survey on UM Learn in Content / Repeating Student Information.
- 2. CHEM 1310 Laboratory Manual, Winter-Summer 2019:** ISBN 9780100000438. Bookstore price: \$15.95
- 3. Laboratory coat and safety glasses** are *required* in the CHEM 1310 Laboratory Program. The Chemistry Graduate Student Association sells new lab coats and safety glasses; location and times of these sales will be announced in class. Lab coats and safety glasses are also available in the Bookstore.

Things to do in preparation for CHEM 1310, and Expectations

- ✓ Register for Mastering Chemistry. A 14-day free trial is available.
 - **The only way to register for Mastering Chemistry is via the link provided on UM Learn in Content / Mastering Chemistry.** You will not require a course id. You can continue to use this link to access Mastering Chemistry throughout the term.
- ✓ You are required to attend *all* classes in the class section that you are registered in.
- ✓ You are required to attend *all* lab sessions you are scheduled to participate in. You must come to the lab on time, in proper attire, with your lab manual, lab coat and safety glasses, and prepared to work efficiently.

Mastering Chemistry

Mastering Chemistry is the online homework system in which you will complete six assignments. Thus, purchasing access to Mastering Chemistry is mandatory for CHEM 1310.

- Students who purchased Mastering Chemistry in the Fall 2018 semester for CHEM 1300 can continue using their Mastering access at no additional charge.
- For those who purchased access to Mastering Chemistry with the e-text, the e-text will be available through the Mastering Chemistry interface.

In addition to the for-credit exercises on Mastering Chemistry, there are many review and practice exercises available (no credit). We encourage you to at least review the first three practice exercises:

- “Introduction to Mastering Chemistry” provides you with an overview of how different types of answers are entered in Mastering Chemistry. ***It is strongly recommended that all students complete this exercise before attempting for-credit work.*** No concessions will be made for incorrect input of answers in for-credit exercises.
- “Chemistry Primer Semester 1” reviews the math skills and chemistry skills you will require to succeed in CHEM 1310
- “Chemistry Primer Semester 2” reviews many chemistry skills you will require and introduces some of the topics you will see in CHEM 1310.
- The many Dynamic Study Modules are meant to guide your practice in a variety of Chemistry topics that cover both High School review and CHEM 1300 course material.

Registering for Mastering Chemistry

- Log into UM Learn using your UMnetID (**must** be your account) and go to the CHEM 1310 course site.
- Click on **Resources / Content / Mastering Chemistry / MyLab & Mastering Links launch**. For initial registration, your Mastering Chemistry account **must** be accessed through this link.
- Click on “Pearson MyLab and Mastering” in the new page.
- Enter your information and click on Next
- At this point, you have three options:
 - If you want to purchase access to Mastering Chemistry without access to the e-text, click on **\$75.00 CAD** option and follow the instructions.
 - If you haven’t paid for an access code yet or want to pay later, click on the “Get temporary access without payment for 14 days” link and follow the instructions.

Note that you cannot use the **\$115.00 CAD** online option to pay for access to Mastering Chemistry and the e-text. You can only gain this access by purchasing an access code from the Bookstore.

- If you have purchased an access code from the Bookstore, you must first redeem the 12-digit code using the instructions provided. This will give you a new, longer code for Mastering. This second code you will be the one you will enter when you click on the **Access Code** option and follow the instructions.
 - You will be sent an e-mail from Pearson that contains a link to the course site that you need to use to complete your registration process. **Save this e-mail!**
 - This e-mail contains your Account ID and Order ID that you may need when contacting Pearson for support.
 - You can click on the registration link to upgrade your account.
- Note that you can also upgrade your account by logging into your Mastering Chemistry account, then clicking on the **My Courses** tab. There you will see an upgrade link.
- After you click on the link in your e-mail, you will be prompted to enter your 7-digit student number. Please enter this accurately! The 7-digit student number is circled in the sample student card above.
 - Once you have made it into Mastering Chemistry, you can click on “Open MyLab & Mastering”.
 - After registering, you can continue to access your Mastering Chemistry account by clicking on the link in UM Learn.



Important dates (See umanitoba.ca/student/records/deadlines/index.html)

Jan 7	Classes begin, lab rotation, lab room and bench allocations posted on UM Learn
Jan 7 - 21	Registration revision period for winter term courses
Jan 16	First update to lab rotation, lab room, and bench allocations posted on UM Learn
Jan 17/18	In-class Quiz #1
Jan 18	Last day to drop a course without financial or academic penalty
Jan 23 - Jan 31	Experiment 1: Laboratory Safety and Colourimetric Analysis
Jan 26	Assignment 2 released, Assignment 1 due <i>before</i> 11:00 PM
Feb 6 - Feb 14	Experiment 2: Synthesis and Analysis of Acetylsalicylic Acid runs
Feb 9	Assignment 3 released, Assignment 2 due <i>before</i> 11:00 PM
Feb 13/14	In-class Quiz #2
Feb 18 - 22	Louis Riel Day, Midterm break; no classes or examinations
Feb 23	Assignment 4 released, Assignment 3 due <i>before</i> 11:00 PM
Feb 25	Midterm examination, 6:00 PM – 8:00 PM
Feb 27 - Mar 7	Experiment 3: Solubility
Mar 9	Assignment 5 released, Assignment 4 due <i>before</i> 11:00 PM
Mar 13 - Mar 21	Experiment 4: Buffer Chemistry
Mar 20	Last day for voluntary withdrawal from winter term 2018 courses
Mar 21/22	In-class Quiz #3
Mar 23	Assignment 6 released, Assignment 5 due <i>before</i> 11:00 PM
Mar 27 - Apr 4	Exp. 5: Kinetics
Apr 9	Classes end, Assignment 6 and Experiment 6 are due <i>before</i> 11:00 PM
Apr 11 - Apr 26	Final examination period

Grading

Final grades are determined based on the following breakdown:

Lab Program: 20% Midterm Exam: 15% Online Assignments: 5% Quizzes: 10% Final Exam: 50%

Numerical grades will not be rounded up or scaled. A letter grade is then assigned as follows:

≥ 92.0%	A+	66.0 – 74.9%	B	50.0 – 54.9%	D
82.0 – 91.9%	A	60.0 – 65.9%	C+	< 50.0%	F
75.0 – 81.9%	B+	55.0 – 59.9%	C		

Laboratory grades

- See laboratory overview and manual for details.
- You need **at least 50%** in the lab component grade to pass CHEM 1310!

Online assignments

- There are six assignments, all having equal weight, with due dates indicated on page 5.
- You are encouraged to practice entering different types of data into Mastering.
- Begin assignments early! You should anticipate that it will take 3 hours to complete one assignment.
- No extensions or make-up options will be given for any assignment. Special cases may be considered only for documented medical or compassionate reasons.
- Any input errors will not be considered in appeals. Be cautious when entering the information – mistakes in sign, symbols, significant figures, etc. will be considered errors and no additional grades will be given.
- An adaptive follow up assignment will be made available after you complete your assignment that is due within two days of the due date of the assignment, that can add 15% to your homework grade.
- Appeal surveys are available on UM Learn for mistakes in the online homework.

Quizzes

- There are three in-class quizzes, with the dates indicated on page 5. They will be done in class and you will be given 20 minutes to complete the quiz. You must write the quiz in your registered section.
- Your best two quizzes count towards 10% of your final grade (i.e., your lowest quiz mark is dropped).
- Quizzes are short answer questions where you write the final answer in a box and it is marked as right or wrong.
- An absence will count as the lowest dropped quiz.
- There are **NO** makeup quizzes.
- If you miss more than one quiz, you must submit full documentation for your reason to the course coordinator within 24 hours of the quiz date. If the absence is considered unavoidable, the weight of the quiz will be transferred to the final exam.

Midterm examination

- The midterm exam will be held on **Monday, February 25, 2018 at 6:00 PM – 8:00 PM.**
- It will consist of a combination of multiple-choice and open answer questions.
- Be sure to bring pencils, pens, an eraser, a calculator, and Student I.D. to the exam.
- The midterm exam is **mandatory** and covers course material up to and including the end of kinetics. There is **NO** makeup midterm exam. If you miss the midterm exam your assigned grade will be zero.
- The midterm exam must be written in pen. Marks lost due to exams written in pencil with unclear markings, will be awarded a zero in an appeal.
- If you miss the exam due to any reason, detailed official documentation must be provided to the course coordinator within 48 hours. If the absence is deemed unavoidable, your final exam will be worth 65%.

Final Examination

- The final exam will be 3 hours long; the date of the final exam will be posted by the Registrar's Office.
- The final exam will consist of multiple-choice, short answer and open answer questions that will cover all course material covered during the term and will include questions on review material.
- You will need to bring pencils, pens, an eraser, a calculator, and Student I.D. to the exams.
- The final exam must be written in pen. Marks lost due to exams written in pencil with unclear markings, will be awarded a zero in an appeal.
- The writing of final exam is **mandatory**. If you miss the final exam ***you must contact your home faculty within 48 hours***. Your home faculty will decide whether or not to grant you the privilege of writing the deferred exam.
- Final examination and grades policies can be found at:
http://umanitoba.ca/admin/governance/governing_documents/academic/1299.html
- For more resources about examinations, see:
<http://umanitoba.ca/faculties/science/undergrad/resources/Academic%20Resources%20index.html>

Notice Regarding Collection, Use, and Disclosure of Personal Information by the University

Your personal information is being collected under the authority of The University of Manitoba Act. It will be used for the purposes of grading papers and providing feedback to students. Personal information will not be used or disclosed for other purposes, unless permitted by The Freedom of Information and Protection of Privacy Act (FIPPA). The University of Manitoba has taken steps to ensure that its agreement with Crowdmark, Inc. for services provided by the Crowdmark application is in compliance with FIPPA. Please be aware that information held by Crowdmark Inc. may be transmitted to and stored on servers outside of the University of Manitoba, or Canada. The University of Manitoba cannot and does not guarantee protection against the possible disclosure of your data including, without limitation, against possible secret disclosures of data to a foreign authority in accordance with the laws of another jurisdiction. If you have any questions about the collection of personal information, contact the Access and Privacy Office (tel. 204-474-9462), The University of Manitoba, 233 Elizabeth Dafoe Library, Winnipeg, Manitoba, Canada, R3T 2N2.

Appeals

- If you have concerns or questions about posted scores, examination problems, and/or answer keys, promptly consult the course coordinator: Angela Kuchison.
- For appeals of lab, quizzes, homework, and midterm marks, fill out the appropriate appeals survey on UM Learn.
- No appeals of term work (laboratory, assignment, or mid-term examination grades) will be considered by the course and laboratory coordinators after the final examination has been written.
- If you are not satisfied with the outcome of an appeal regarding term work addressed by the course coordinator or the laboratory coordinator, you can appeal a grade for term work through the Registrar's office. A fee is charged for each appeal. For more information see:
<http://umanitoba.ca/student/records/grades/690.html>
- To appeal your final grade, you can initiate the process at the Registrar's office. A fee will be charged for each appeal. For more information, see: <http://umanitoba.ca/student/records/>

Academic Policies

Plagiarism

Copying another student's examination, laboratory reports, or assignments, or an instructor's answer sheet from a previous year is plagiarism. If you quote other sources of information in a laboratory report or other assignment, you must give proper credit. Plagiarism and other forms of cheating are prohibited. The full definition of plagiarism and the possible penalties associated with it are outlined in the General Calendar of the University.

Cheating

The possession of unauthorized materials during an examination, including "crib notes" (whether hand-written or contained within a computer/calculator), is considered cheating and subject to action by the Student Disciplinary By-Law. Only calculators are permitted in an examination – no texts, notes, dictionaries, etc. Students found with cell phones, pagers, text in their calculators or other unauthorized material during a chemistry examination will be given a grade of zero (0) on that examination and further penalties may apply.

Faculty of Science statement on academic dishonesty

The Faculty of Science and The University of Manitoba regard acts of academic dishonesty in quizzes, tests, examinations, laboratory reports or assignments as serious offences and may assess a variety of penalties depending on the nature of the offence. Acts of academic dishonesty include, but are not limited to, bringing unauthorized materials into a test or exam, copying from another individual, using answers provided by tutors, plagiarism, and examination impersonation. **Cell phones, pagers, PDAs, MP3 units or electronic translators are explicitly listed as unauthorized materials, and must *not* be present during tests or examinations.** Penalties that may apply, as provided for under the University of Manitoba's Student Discipline By-Law, range from a grade of zero for the assignment or examination, failure in the course, to expulsion from the University. The Student Discipline By-Law is found at:

umanitoba.ca/admin/governance/governing_documents/students/student_discipline.html

Suggested minimum penalties assessed by the Faculty of Science for acts of academic dishonesty are available on the Faculty of Science Academic Dishonesty Guidelines and Penalties web-page:

umanitoba.ca/faculties/science/resources/Acad_Dishon_TABLE_RevCSS_AdminC_Jul2012_WEB.pdf

All Faculty members (and their teaching assistants) have been instructed to be vigilant and report all incidents of academic dishonesty to the Head of the Department. For more definitions, policy details, informative case studies, and an Academic Honesty Quiz see:

<http://umanitoba.ca/faculties/science/undergrad/resources/webdisciplinedocuments.html>

Copyright and Intellectual Properties Resources

Copyrights and intellectual property must be respected by all students. For more information, please refer to the Copyright Office: <http://umanitoba.ca/copyright/>

Limited Access and VW Resources

Students who fail or VW from a course will be subject to limited access to that course in future terms. That is, students will not be able to register for a course (for which they have VWed or failed) during the limited access registration period. For more information, please see the Repeated Course policy available at: http://www.umanitoba.ca/admin/governance/media/Repeated_Course_Policy_-_2016_09_01.pdf

Course Objectives

Prerequisite Knowledge

Before coming into CHEM 1310, you should already be able to:

- Convert between mass, volume, density and concentration for gases, liquids, solids, and solutions.
- Write balanced chemical equations and use them to carry out stoichiometry calculations, including the concept of limiting reagent.
- Name inorganic chemical compounds.
- Define acidity and basicity, use these definitions to classify reactants as acids and bases, and recognize and name common acids and bases.
- Assign oxidation states and use these to classify reactants as oxidants and reductants.
- Apply concepts learned in CHEM 1300, including thermochemistry, atomic structure, electron configurations, periodic trends, bonding models, and equilibrium.

Prerequisite knowledge is covered in the following textbook sections/chapters:

- High school review sections: 1.1 – 1.5, 2.3 – 2.7, 3.2 – 3.4, 3.6 – 3.8, 4.2 – 4.9, 5.2 – 5.7
- CHEM 1300 review chapters: 6, 7, 8, 9, 10, 14

These concepts are essential to CHEM 1310 and subsequent courses in chemistry and other subject areas, and will be assumed as background knowledge in CHEM 1310 assignments, labs, and exams.

Unit 1: Intermolecular Forces (about 2 weeks), Textbook Sections:	Covered by:
Liquids, Solids, and Intermolecular Forces (Ch. 11, sections: 11.2 – 11.12)	Jan 18

Learning objectives

- Relate properties of density, shape and volume to phase
- Describe intermolecular forces including:
 - Ion-induced dipole force
 - Dispersion force
 - Dipole-dipole force
 - Hydrogen bonding
 - Dipole-induced dipole force
 - Ion-dipole force
- Understand intermolecular forces influence on boiling point, melting point, surface tension, viscosity, capillary action.
- Understand energetics of phase changes (heat of vaporization, heat of sublimation, heat of fusion)
- Relate dynamic equilibrium to phase changes.
- Understand the relationship between vapour pressure and temperature (Clausius-Clapeyron equation)
- Sketch and understand heating curves.
- Calculate the heat of a phase transition(s) and relate to heat required for phase conversions
- Understand phase diagrams.
- Understand crystalline solid cubic unit cells and close-packing and be able to relate these to density and atomic radii.
- Identify types of solids (crystalline and atomic solids).

Suggested end-of-chapter problems

Chapter 11: Review Questions 1-45, 47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67, 69, 71, 73, 75, 77, 79, 81, 83, 85, 87, 95, 97, 99, 101, 103, 105, 107, 109, 110, 111, 113, 115, 117, 123, 125, 129, 131, 133, 135, 137, 139, 141.

Quiz 1 Material (Quiz 1 on January 17/18)

Unit 2: Equilibria of Solutions (about 4 weeks), Textbook Sections:	Covered by:
Acids and Bases (Ch. 15, sections: 15.2 – 15.11)	Feb 15
Aqueous Ionic Equilibrium (Ch. 16, sections: 16.2 – 16.6, 16.8)	

Learning objectives

- Definition of an acid and base (Arrhenius, Brønsted-Lowry, Lewis).
- Identify molecular formula and chemical structures as acids or bases.
- Relate K_a and K_b to appropriate chemical reactions in water.
- Calculate the equilibrium concentrations of ions in an aqueous solution.
- Determine the equilibrium pH or pOH of an acidic or basic solution.
- Understand the autoionization of water (K_w).
- Convert between pH, pOH, pK_a , pK_b , pK_w and $[H_3O^+]$, $[OH^-]$, K_a , K_b , and K_w , respectively.
- Calculate percent ionization of an acid.
- Calculate the ions in mixtures of acid solutions (more than one acid and polyprotic acids).
- Identify a salt as acidic, basic, or neutral.
- Relate the structure to the acidity or basicity of a given compound.
- Identify conjugate acid/base pairs.
- Definition of a buffer.
- Calculate the pH of a buffer solution.
- Calculate buffer range.
- Calculate titration curves.
- Use titration curve to identify acids and K_a .
- Choose appropriate indicators for acid/base titrations.
- Relate molar solubility to the solubility product.
- The common ion effect.
- Understand selective precipitation.
- Understand complex-ion equilibria and K_f .

Suggested end-of-chapter problems

Chapter 15: Review Questions: 1-32; 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67, 69, 71, 73, 75, 77, 79, 81, 83, 85, 87, 89, 91, 93, 95, 97, 99, 101, 103, 105, 107, 109, 111, 113, 115, 117, 119, 121, 123, 125, 127, 129, 131, 133, 135, 137, 139, 141, 143, 145, 147.

Chapter 16: Review Questions: 1-28; 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67, 69, 71, 73, 75, 77, 79, 81, 83, 85, 87, 89, 91, 93, 95, 97, 99, 101, 103, 105, 115, 117, 119, 121, 123, 125, 127, 129, 131, 133, 135, 141, 143, 147.

Quiz 2 Material: Feb. 13/14

End of Midterm Material (February 15) (Midterm date: Monday February 25)

Unit 3: Kinetics (about 2 weeks), Textbook Sections:	Covered by:
Chemical Kinetics (Chapter 13: sections 13.2 – 13.7)	Mar 8

Learning objectives

- Relate concentration and stoichiometry to observed rate.
- Understand average rate and instantaneous rate.
- Determine the rate law of a chemical reaction using initial rates.
- Determine reaction order overall and with respect to reactants.
- Identify and use the integrated rate laws.
- Determine the half-life and lifetime of a reaction.
- Understand the Arrhenius equation.
- Identify reaction mechanisms and the molecularity of each elementary step.
- Determine the rate law for an elementary step.
- Determine rate determining steps.
- Use the steady-state approximation to predict a rate law based on a mechanism.
- Understand the influence of a catalyst on a reaction.
- Know the difference between homogeneous and heterogeneous catalysis.

Suggested end-of-chapter problems

Chapter 13: Review Questions: 1-24; 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67, 69, 71, 73, 75, 77, 79, 81, 85, 87, 93, 97, 99, 101, 103, 105, 107, 109, 111, 115, 119.

Unit 4: Entropy and Gibbs Energy (about 2 weeks), Textbook Sections:	Covered by:
Gibbs Energy and Thermodynamics (Ch. 17: sections 17.1 – 17.9)	Mar 22

Learning objectives

- Identify spontaneous and nonspontaneous processes.
- Define entropy.
- Understand the second law of thermodynamics.
- Relate entropy to phase, molar mass, allotropes, and dissolution.
- Calculate the entropy of the universe, surroundings, and system.
- Determine the Gibbs energy of a reaction.
- Relate Gibbs energy change of a reaction to the enthalpy change, temperature, and entropy change.
- Relate Gibbs energy to spontaneity.
- Determine the change in entropy of a reaction.
- Understand the third law of thermodynamics.
- Relate $\Delta_r G^\circ$ to $\Delta_r G$.
- Relate Gibbs energy to reaction quotient and equilibrium constant.

Suggested end-of-chapter problems

Chapter 17: Review Questions: 1-22; 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67, 69, 71, 73, 75, 77, 79, 81, 83, 87, 89, 91, 93, 95, 97, 107.

Quiz 3: Mar 21/22

Unit 5: Electrochemistry (about 2 weeks), Textbook Sections:	Covered by:
Electrochemistry (Ch. 18 (sections 18.2 – 18.8))	Apr 9

Learning objectives

- Use oxidation numbers to identify what is oxidized and what is reduced in a redox reaction.
- Balance redox reactions using the half-reaction method.
- Describe galvanic cells.
- Calculate standard cell potentials.
- Relate cell potential to the reaction conditions.
- Relate cell potential to equilibrium constant.
- Understand electrolysis and its stoichiometry.

Suggested end-of-chapter problems

Chapter 18: Review Questions: 1-36; 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67, 69, 71, 73, 75, 77, 79, 81, 83, 85, 87, 89, 91, 95, 97, 99, 103, 105, 109, 111, 113, 115, 117, 119, 121, 123.

Laboratory Overview

Laboratory program administrators

- Laboratory coordinator: Krystyna Koczanski (Krystyna.Koczanski@umanitoba.ca)
- Laboratory supervisor: Scott McKay (209 Parker, Scott.McKay@umanitoba.ca)

Learning objectives

- Experience chemistry in action!
- Apply and test chemistry concepts covered in lectures and in the textbook.
- Perform standard chemistry techniques and select appropriate equipment and glassware for specific experimental procedures.
- Operate safely in a chemical laboratory; assess hazard and environmental issues associated with chemicals, and dispose of chemicals accordingly.
- Report on experiments, and estimate errors associated with measurements.

Laboratory experiments

Expt. 1: Laboratory Safety and Colourimetric Analysis

Expt. 2: Synthesis and Analysis of Acetylsalicylic Acid

Expt. 3: Solubility

Expt. 4: Buffer Chemistry

Expt. 5: Kinetics

Expt. 6: Computational Modelling of Substitution Reactions

Preparing for your first lab

- ✓ The CHEM 1310 laboratory program begins on Wednesday, January 23. Your lab room and bench assignments will be posted on UM Learn on the first day of classes, with the first update on Wednesday January 16, and with regular updates thereafter until the end of the drop/add period.
- ✓ Bench assignments are non-negotiable.
- ✓ Read information about the laboratory program and safety policies in the lab manual (pages 4 – 8).
- ✓ Review the WHMIS handbook and the safety presentation on UM Learn.
- ✓ Come to the lab fully prepared and ready to work:
 - Read completely and familiarize yourself with Experiment 1 before the lab.
 - Show up at least 15 minutes early.
 - Bring your **lab coat**, **lab glasses**, and **lab manual** to the lab.
 - Make sure that you are dressed appropriately (e.g. no open-toe shoes or sandals, no shorts, no short dresses, no loose clothing or jewelry, no contact lenses, tie up your hair).
 - Do not bring your valuables, including laptops, to the lab.
 - If you have a locker to store your personal belongings (assigned Parker 206, 216), you are responsible for bringing your own lock to every lab and taking your lock home after the lab

Attendance

- You must attend all scheduled lab sessions.
- You must be in the lab and with your lab glasses and lab coat on and be ready to start at 8:30 AM or 2:30 PM sharp. You can be penalized for chronic lateness. If you are more than 30 minutes late you will not be allowed to start the lab and it will be considered an inexcusable absence.
- You must bring your lab manual to the lab in order to conduct experiments. Photocopies are not acceptable. You will be provided with data sheets in the lab.

- You can make-up a lab without penalty in cases of:
 - ✓ sickness (doctor's note required)
 - ✓ undeniable and verifiable compassionate reasons (e.g. funeral, sick child)
 - ✓ University of Manitoba affiliated athletic/volunteering events (advance notice and letter from coach/mentor required)

To make arrangements for a make-up lab, you must contact Krystyna Koczanski and Scott McKay (not your TA!) by e-mail **within 24-hours** of your missed lab session.

- For inexcusable absences, no makeup lab or alternative arrangement will be considered. You will receive a grade of zero for that lab.**

Laboratory exemptions

- Students who receive a final grade in CHEM 1310 and who pass the lab component of CHEM 1310 with a minimum grade of 70% and have completed at least 5/6 experiments can apply for a lab exemption if they redo the course.
- Students who VW from the course cannot continue in the lab and are not eligible for a lab exemption.
- Students who are found guilty of academic dishonesty in CHEM 1310 are not eligible for a lab exemption.
- The lab exemption can be used only once within a two year period after the lab component has been completed.
- To apply for a laboratory exemption, go to the following website:
http://fluidsurveys.com/s/Lab_Exemption_Form/

Lab schedule, Winter 2019

Section, Time	Rotation	Expt 1	Expt 2	Expt 3	Expt 4	Expt 5
B01, Wed AM	1	Jan 23	Feb 6	Feb 27	Mar 13	Mar 27
	2	Jan 30	Feb 13	Mar 6	Mar 20	Apr 3
B02, Wed PM	1	Jan 23	Feb 6	Feb 27	Mar 13	Mar 27
	2	Jan 30	Feb 13	Mar 6	Mar 20	Apr 3
B03, Thurs AM	1	Jan 24	Feb 7	Feb 28	Mar 14	Mar 28
	2	Jan 31	Feb 14	Mar 7	Mar 21	Apr 4
B04, Thurs PM	1	Jan 24	Feb 7	Feb 28	Mar 14	Mar 28
	2	Jan 31	Feb 14	Mar 7	Mar 21	Apr 4

Marking Scheme

- The lab component is worth 20% of your final mark in CHEM 1310.
- Regardless of your total score in the course, you need a grade of at least 50.0% in the lab component to pass CHEM 1310.
- The mark breakdown for the lab is as follows:
 - Experiments 1 – 6: 17/20 total, 2.83/20 each
 - Prelab exercises for Experiments 2 – 5: 2/20 total, 0.5/20 each
 - Safety team participation: 1/20