



University
of Manitoba

Faculty of Science, Department of Chemistry
CHEM 1310: Introduction to Physical Chemistry (Chemical Reactivity)
Course Syllabus, Fall 2020

Lecturer

Dr. James Xidos, James.Xidos@umanitoba.ca
Office hours: TBA

Lecture

Tues. & Thurs.: 1:00 – 2:15 PM, WebEx

Electronic Communications and Questions

All e-mail communications with university faculty and staff must be conducted using your University of Manitoba e-mail account. E-mailed questions sent from other e-mail accounts will not be answered. It is also expected that you will check your University of Manitoba e-mail account **daily** for communications sent to you by University instructors, administrators, and staff. For more information, see:

<http://intranet.umanitoba.ca/registrar/email-policy>

In all e-mail correspondence, include “CHEM 1310 lecture” or “CHEM 1310 lab” or similar in the subject line.

For general questions about the course material and administration of the lecture component (e.g. conflicts in exam times, problems regarding grades): contact James Xidos (James.Xidos@umanitoba.ca)

For questions involving the administration of the lab component (e.g. missed labs, lab grade appeals):

- Contact the lab instructor: Dr. Sarrah Vakili (Sarrah.Vakili@umanitoba.ca)

For registration and technical questions for Mastering Chemistry:

- For search, chat, or phone, 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 If you are not entitled to be in this course, you will be withdrawn, or the course may not be used in your degree program.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>

- Log in using your full UM e-mail address and corresponding password.
- There will be separate lecture and lab course sites for CHEM 1310.
- Links to live and recorded lectures will be available in Communication/Cisco WebEx
- Information posted on the UM Learn lecture site includes: course announcements, the syllabus, link for Mastering and iClicker, course-related internet and e-mail links, lecture notes, practice exams, exam keys, and marks.
- You should check UM Learn **daily** for course news and information.

Course Technological Requirements

- A computing device on which you can create and edit documents
- An internet connection capable of streaming videos, downloading software, and uploading files
- A scanner of a device with which you can take good resolution pictures of work
- Access to a webcam and microphone

Course delivery

The course will be delivered as a mix of in-class and out-of-class activities and an in-person lab program:

- Out-of-class: students are expected to complete assigned readings, videos, and problem sets.
- In-class: Classes will be conducted using Cisco WebEx and will be recorded. Dr. Xidos will cover key points, answer questions, and provide opportunities for both individual practice and group work.
- Lab program: students registered in B01 and B02 will attend five in-person experiments and complete online exercises during the term. Students registered in B82 will complete online exercises during the term and attend lab sessions in early January. Lab attendance for students in B01, B02, and B82 is mandatory.

It is appreciated that not all students can attend all classes due to technical limitations and other personal responsibilities. Nevertheless, you are strongly encouraged to attend and fully participate in classes as much as possible. When you miss one or more classes, you will need to increase your effort in learning independently.

Course materials

Textbook and online homework:

N. Tro, T.D. Fridgen, L.E. Shaw; Chemistry: A Molecular Approach, Third Canadian Edition, and Mastering Chemistry. There are three options available via the UM Bookstore:

1. Binder-ready copy of the textbook + Mastering Chemistry access code + E-text: ISBN: 9780136524175, price: \$149.99. Available at the UM Bookstore.
2. Mastering Chemistry access code + E-text: ISBN: 9780134894881, price: \$115.50.
3. Mastering Chemistry (no e-text access): ISBN: 9780134994086, price: \$50.50.

This is the first term that we are using the 3rd edition. If you previously purchased the 2nd edition (used in CHEM 1300/1310 from Fall 2018 to Summer 2020), you do not have to pay again. However, your account will need to be migrated to the new edition by our Pearson Digital Learning Manager, Dennis Guevarra. If you have not heard from him yet, you will need to contact him via e-mail at: Dennis.Guevarra@pearsoned.com

The use of both the second and third editions of the textbook will be supported.

Laboratory Program:

The lab manual will be provided electronically for free on the UM Learn CHEM 1310 lab site. Wearing safety glasses and a face mask are **required** during lab sessions. Wearing a lab coat is strongly recommended, but if you cannot get one, wearing clothes that you do not mind ruining is an acceptable alternative with suitable undergarments should they need to be removed due to a chemical spill.

Mastering Chemistry

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

- Students who purchased Mastering Chemistry since the Fall 2018 semester for CHEM 1300 or CHEM 1310 can continue using their Mastering access at no additional charge, but will need our Pearson Digital Learning Manager, Dennis Guevarra to migrate your account. Dennis has already contacted many students; if you have not received an email from Dennis, you must contact him via e-mail at: Dennis.Guevarra@pearsoned.com. In your e-mail you need to provide him with your Mastering Chemistry username and your UM e-mail address.
- For those who purchased access to Mastering Chemistry with the e-text, the e-text will be available through the Mastering Chemistry interface. If your account was migrated from the 2nd edition, you will have access to the 3rd edition of the e-text.

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

- If you have purchased an access code from the Bookstore (for any one of the three options), you must first redeem the 12-digit code using the instructions provided. This will give you a new, longer code for Mastering Chemistry. This second code you will be the one you will enter when you click on the **Access Code** option (see below).
- Log into UM Learn using your UMnetID (**must** be your account) and go to the CHEM 1310 lecture 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 can “pay” using your access code; if you are waiting for an access code from Dennis or want to purchase one later, click on the “Get temporary access without payment for 14 days” link. In either case, 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. It is a good idea to save this e-mail.
- 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.

i-Clicker

To encourage active participation in class, we will be using the i-Clicker. Downloading the software and setting up an account for i-Clicker is free. For details, see:

<https://universityofmanitoba.desire2learn.com/d2l/le/content/6606/viewContent/1432626/View>

To register for and access our i-clicker class, use the link provided in Content/i-Clicker.

University Student Services

We encourage students to use resources available at the university. If you are experiencing difficulties with your studies or assignments, have a physical or mental health problems or illnesses that may affect your course of study, or have experienced a traumatic or tragic event, please discuss these issues with a councillor in one of the following Student Affairs offices as soon as possible:

- **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-supports/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/>
- **Sexual Violence Support and Education**
Website: <http://umanitoba.ca/student-supports/sexual-violence-support-and-education>
Klinik Sexual Assault Crisis Line (for immediate 24/7 support): 1-888-292-7565

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

Sept 9	Classes begin
Sept 22	Last day to drop a course with full refund and no academic consequences.
Sept 23	Last day to add a course
Sept 27	Assignment 1 due <i>before</i> 11:00pm
Sept 30	Quiz 1, available on Mastering Chemistry between 7:00am – 11:00pm
Oct 12	Thanksgiving, no classes; Assignment 2 due <i>before</i> 11:00pm
Oct 25	Assignment 3 due <i>before</i> 11:00pm
Oct 30	Midterm examination, 6:00pm – 8:00pm
Nov 9 – 13	Midterm break, no classes
Nov 15	Assignment 4 due <i>before</i> 11:00pm
Nov 23	Last day for Voluntary Withdrawal from Fall Term 2020 courses
Nov 29	Assignment 5 due <i>before</i> 11:00pm
Dec 2	Quiz 2, available on Mastering Chemistry between 7:00am – 11:00pm
Dec 11	Classes end, Assignment 6 is due <i>before</i> 11:00pm
Dec 12 – 23	Final examination period
Jan 5 – 15	Labs for students registered in section B82

Lab schedule for sections B01-B02, B82

Exercise	B82	Rotation 1		Rotation 2	
	Friday	Monday	Friday	Monday	Friday
Expt 1: Colourimetric Analysis	Sept 25	Sept 21	Sept 25	Sept 28	Oct 2
Expt 2: Synthesis and Analysis of ASA	Oct 9	Oct 5	Oct 9	Oct 19	Oct 16
Expt 3: Solubility	Oct 23	Oct 26	Oct 23	Nov 2	Nov 6
Expt 4: Buffer Chemistry	Nov 20	Nov 16	Nov 20	Nov 23	Nov 27
Expt 5: Kinetics	Dec 4	Nov 30	Dec 4	Dec 7	Dec 11

Grading

Final grades are determined based on the following breakdown:

- Lab Program: 20%
- Assignments: 6%
- Quizzes: 14%
- Midterm Exam: 20%
- Final Exam: 40%

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 program

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

Assignments

- There are six assignments on Mastering Chemistry, 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 up to 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 up to 15% to your assignment grade, up to a maximum grade of 100% for the corresponding assignment.
- Given the opportunity for bonus marks via the adaptive follow up assignments, there is no appeals process for assignments.

Quizzes

There will be two online quizzes (7% each) that will be conducted on Mastering Chemistry

- Quiz 1: Wednesday Sept 30, will cover Chapter 11 and prerequisite knowledge
- Quiz 2: Wednesday Dec 2, will cover all material up to the end of Chapter 17, with a focus on post-midterm material.

Quizzes will be available from 7:00am – 11:00pm on the given date. These quizzes are effectively timed assignments. Unlike assignments, once you start the quiz:

- you will have 1 hour to finish the quiz,
- you will have only one opportunity to answer a question,
- you will not be able to change an answer once you have submitted it, and
- there will be no hints.

Any technical issues with the quizzes must be reported by e-mail to James Xidos in real time; no consideration for technical issues with the quizzes will be made in reported after the 11:00pm deadlines.

Completing the quizzes is **mandatory**. Alternate arrangements will be made only for students with unavoidable extenuating circumstances. Students must contact James Xidos at least one week in advance for known conflicts and no later than 48 hours afterwards for last-minute issues. The alternate arrangement may be an oral exam.

Midterm examination

- The midterm exam will be held on **Friday, October 30, 2020 at 6:00pm – 8:00pm**
- The midterm exam will cover all material up to and including section 13.3 (prerequisite knowledge, sections 11.1 – 11.12, 15.2 – 15.11, 16.1 – 16.6, 16.8, and 13.1 – 13.3)
- The format and online platform for the midterm exam will be discussed in class and posted on UM Learn before the exam date.
- The midterm exam is **mandatory**. Alternate arrangements will be made only for students with unavoidable extenuating circumstances. Students must contact James Xidos at least one week in advance for known conflicts and no later than 48 hours afterwards for last-minute issues. The alternate arrangement may be an oral exam.

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 be accumulative and will cover all CHEM 1310 material, including prerequisite knowledge, in a balanced manner.
- The format of the final exam will be posted on UM Learn before the end of the term.
- 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 with Dr. Xidos.
- No appeals of term work (laboratory, assignment, or mid-term examination grades) will be considered by Dr. Xidos and Dr. Vakili after the final examination has been written.
- If you are not satisfied with the outcome of an appeal regarding term work addressed by Dr. Xidos or Dr. Vakili, 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/>

Voluntary Withdrawal (VW), Authorised Withdrawal (AW) and Limited Access Policies

- Students have the opportunity to voluntarily withdraw (VW) from a class on or before November 23, 2020. By then, you will have received feedback so you can assess your progress. If you are not likely to pass the course, or achieve your desired grade, you should consider a VW. You may contact the instructor of the course to review your progress in more detail, or you may discuss the VW option with a Faculty academic advisor. Students enrolled in the course after the VW deadline will be assigned a final grade. Please visit http://umanitoba.ca/u1/know_yourself/573.html for more information.

- At times medical or compassionate circumstances arise that prevent a student from performing as they would under normal circumstances, you can apply for the authorised withdrawal (AW). If you are in this position you should contact a Faculty academic advisor to discuss your options. Be prepared to provide documentation supporting your situation. Please visit the following website for more information:
http://www.umanitoba.ca/student/resource/student_advocacy/authorized-withdrawal/index.html
- At present, Limited Access does not apply to students who have previously been subject to this restriction for three consecutive terms. Students will be able to register to repeat a course (or equivalent) during their initial registration time.
<https://umanitoba.ca/student/records/academicpolicychanges/limitedaccessfaq.html>

Academic integrity policies

Academic Integrity

Academic integrity is taking responsibility for and being honest with your work and respecting the work of others. Since you are a member of the university community, we want you to learn what that responsibility and honesty entails and how we respect the work of others.

The Faculty of Science continues to uphold high standards of academic integrity. We know that our students support us in this endeavour and we count on each and every one of you to do your part. Same academic standards apply online, remote learning, and in class education. We expect all students to strictly adhere to instructions from their professors regarding what resources can and cannot be used during exams, to follow all rules professors decide to set.

To aid professors in ensuring that all forms of assessments have been administered fairly, the University will be electronically monitoring tests, quizzes and examinations, included, but not limited to overseeing chat-rooms, relevant predatory web-sites and, in so doing, we will analyze scholastic evidence of individual exams. E-monitoring tools will include one of the following: Respondus Lockdown Browser & Respondus Monitor; WebEx; Zoom or Microsoft Teams.

For students, in exceptional circumstances, who cannot participate in an e-proctored exam, in-person written or oral exams may be administered. The University of Manitoba adheres to the Provincial health and safety recommendations and those will be strictly followed if an in-person examination is administered.

Academic fraud

Academic fraud is an act by a student that may result in a false evaluation (including papers, tests, examinations, etc.). It is not tolerated by the University. Any person found guilty of academic fraud will be subject to severe sanctions. *Please be particular mindful of academic integrity requirements in your courses online—if you are not sure about the expectations surrounding academic integrity, **ASK!***

Please carefully review information with regards to academic integrity: be aware; be proactive; be smart and be honest.

- Academic Integrity Message from Associate Dean Krystyna Koczanski:
<https://youtu.be/Ok-lilm4SeE>
- UM Respondus Student Guide
<https://universityofmanitoba.desire2learn.com/d2l/le/content/6606/viewContent/1463719/View>
- The Student Discipline By-Law may be accessed at:
http://umanitoba.ca/admin/governance/media/Student_Discipline_Bylaw_-_2009_01_01.pdf
- The list of suggested minimum penalties assessed by the Faculty of Science for acts of academic dishonesty is available on the Faculty of Science webpage: Faculty of Science – Suggested Minimum Penalties for Acts of Academic Dishonesty
- All Faculty members (and their teaching assistants) have been instructed to be vigilant and report every incident of academic dishonesty to the Head of the Department.
<https://universityofmanitoba.desire2learn.com/d2l/le/content/6606/viewContent/1463719/View>

Copyright and Intellectual Properties Resources

Please respect copyright. We will use copyrighted content in this course. University guidelines state that copyrighted works, including those created by instructors of the course are made available for private study and research and must not be distributed in any format without permission. Since it is illegal, do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the Copyright Act applies or written permission has been confirmed. For more information, see the University's Copyright Office website at <http://umanitoba.ca/copyright/> or contact um_copyright@umanitoba.ca

Respectful Work and Learning Environment

- You are expected to be respectful of your fellow classmates and your lecturer. We recognize that these are unusual circumstances, and that there are some adjustments needed when working virtually. At the same time, we do want to remind you that University policies, such as the Respectful Work and Learning Environment policy, still apply, as do basic expectations around how students will engage with each other, and with the University. This means that when participating in classes, online meetings, etc., 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 participating respectfully. Essentially, if you wouldn't do it in an in-person class, don't do it in virtual setting!
- Please familiarize yourself with the UM Respectful Work and Learning Environment (RWLE)

[http://umanitoba.ca/admin/governance/media/Respectful Work and Learning Environment RWLE Policy - 2016_09_01.pdf](http://umanitoba.ca/admin/governance/media/Respectful_Work_and_Learning_Environment_RWLE_Policy_-_2016_09_01.pdf)

and Section 2.5(c) of the Student Non-Academic Misconduct and Concerning Behaviour Procedure describes types of inappropriate or disruptive behaviour:

[https://umanitoba.ca/admin/governance/media/Student Non-Academic Misconduct and Concerning Behaviour Procedure - 2018_09_01.pdf](https://umanitoba.ca/admin/governance/media/Student_Non-Academic_Misconduct_and_Concerning_Behaviour_Procedure_-_2018_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)	Sept. 24

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).

Unit 2: Equilibria of Solutions (about 4 weeks), Textbook Sections:	Covered by:
Acids and Bases (Ch. 15, sections: 15.2 – 15.11) Aqueous Ionic Equilibrium (Ch. 16, sections: 16.2 – 16.6, 16.8)	Oct. 22

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.
- Understand the common ion effect.
- Understand selective precipitation.
- Understand complex-ion equilibria and K_f .

Unit 3: Kinetics (about 2 weeks), Textbook Sections:	Covered by:
Chemical Kinetics (Chapter 13: sections 13.2 – 13.7)	Nov 5

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.

Unit 4: Entropy and Gibbs Energy (about 2 weeks), Textbook Sections:	Covered by:
Gibbs Energy and Thermodynamics (Ch. 17: sections 17.1 – 17.11)	Nov. 26

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.

Unit 5: Electrochemistry (about 2 weeks), Textbook Sections:	Covered by:
Electrochemistry (Ch. 18 (sections 18.2 – 18.8))	Dec. 10

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.

Laboratory Overview

Laboratory program administrators

- Lab instructor: Dr. Sarrah Vakili (Sarrah.Vakili@umanitoba.ca)

Learning objectives

- Experience Chemistry in action!
- Operate safely in a chemical laboratory; assess hazard and environmental issues associated with chemicals, and dispose of chemicals accordingly.
- Perform standard chemistry techniques and select appropriate equipment and glassware for specific experimental procedures.
- Report on experiments, and estimate errors associated with measurements.
- Gain collaborative skills with teams based on a balance of individual traits.
- Increase your written and oral science communication skills.

Laboratory experiments and schedule for students in sections B01, B02 and B82:

Exercise	Online	Rotation 1		Rotation 2	
	B82 (Fri)	B01 (Mon)	B02 (Fri)	B01 (Mon)	B02 (Fri)
Expt 1: Colourimetric Analysis	Sept 25	Sept 21	Sept 25	Sept 28	Oct 2
Expt 2: Synthesis and Analysis of ASA	Oct 9	Oct 5	Oct 9	Oct 19	Oct 16
Expt 3: Solubility	Oct 23	Oct 26	Oct 23	Nov 2	Nov 6
Expt 4: Buffer Chemistry	Nov 20	Nov 16	Nov 20	Nov 23	Nov 27
Expt 5: Kinetics	Dec 4	Nov 30	Dec 4	Dec 7	Dec 11

Preparing for your first lab

- ✓ The CHEM 1310 laboratory program starts on Monday, Sept 21.
- ✓ Your lab rotation and room assignments will be posted on UM Learn during the first day of classes. Room assignments are non-negotiable.
- ✓ Read information about the laboratory program, safety policies, and other material in the lab manual (pages 5 – 15).
- ✓ Review the WHMIS handbook and 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.
 - Watch any relevant videos on UM Learn.
 - Show up at least 15 minutes early.
 - Bring your lab coat (highly recommended), safety glasses, and face mask 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). If you do not have a lab coat, wear clothes that you do not mind ruining with chemical burns.
 - Lockers are available in the hallway outside of the labs. Please bring a lock to protect your belongings.
 - **Theft happens!** Do not bring your valuables, including laptops, to the lab.

Attendance

- You must attend all scheduled lab sessions.
- You must be in the lab and with your safety glasses and face mask on and be ready to start at 2:30pm 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.
- Copies of the experiment will be provided in the lab.
- You can have an alternate arrangement to the lab in cases of:
 - ✓ sickness (third party verification 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)

Details of alternate arrangements are on page 5 of the CHEM 1310 lab manual. To make arrangements for an alternate lab, you must contact Dr. Sarrah Vakili (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.** Invalid excuses include:
 - ✗ I got up late or was too tired, I forgot to show up or didn't read the schedule correctly, I missed my bus or my car broke down, I need to study for an exam or finish an assignment, I had to work, I have a practice or event with a group not affiliated with the University of Manitoba, I missed my lab last week but I didn't get around to telling you, etc.

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:

○ Data sheets for Experiment 1:	2/20
○ Data sheets for Experiment 2 – 5:	12/20 total, 3/20 each
○ Cleanliness/Safety:	2/20
○ Prelab exercises for Experiments 2 – 5:	4/20 total, 1/20 each