UNIVERSITY of GUELPH

Department of Chemistry

CHEM*1040 General Chemistry I

Fall 2020 Student Course Information

Course Description: CHEM*1040 General Chemistry I offered Fall & Winter [Credit Wt. = 0.50]
This course introduces concepts of chemistry, the central link between the physical and biological sciences. Principles discussed include chemical bonding, simple reactions and stoichiometry, chemical equilibria and solution equilibria (acids, bases, and buffers), and introductory organic chemistry.

Prerequisite(s): 4U Chemistry, (or equivalent grade 12 chemistry) or CHEM*1060

Course Co-ordinator: L. Jones (lojones@uoguelph.ca)

Instructors: F.-I. Auzanneau (fauzanne@uoguelph.ca)
R. de Laat (rdelaat@uoguelph.ca)

Virtual Zoom Meetings:
Sections 0101 – 0109 MWF 11:30 AM – 12:20 PM (R. de Laat)
Sections 0110 – 0118 MWF 2:30 – 3:20 PM (F.-I. Auzanneau)
Sections 0119 – 0123 TTh 5:30 – 6:50 PM (R. de Laat)

A list of Teaching Assistants (TAs) assigned to specific lab sections is posted on CourseLink, under Content >> Laboratory Activities >> Hayden-McNeil Online Course >> F20 TA List

1. COURSE MATERIALS

(a) **Textbook:** D. Ebbing and S. Gammon, General Chemistry (Cengage Canada). Students can use the 10th, 9th or 8th edition. The same text is also used in CHEM*1050. The publisher provides 10th ed. options, e.g., textbook and/or OWL v2 resources (including e-book) through both of our campus bookstores: University Bookstore (*https://bookstore.uoguelph.ca/courselistbuilder.aspx;* $120/$112.50) and Co-op Bookstore (https://bookstore.coop/textbooks/order-online; $110.95/$99.95). The Co-op Bookstore also offers a hard cover textbook plus soft cover student solutions manual with no OWL v2 resources. Note: OWL v2 is simply additional resources provided by the publisher and are not required.

(b) **Pearson Mastering Chemistry** (required) – to complete the assigned online homework one must purchase access to a Mastering Chemistry account. A 12-month access code can be purchased from the University Bookstore ($56.25), the Co-op Bookstore ($49.99) or directly online from the Mastering Chemistry site ($49.99). W'21 CHEM*1050 will also assign online homework, so your access covers both courses. A grace period of two weeks is provided, so one can access the site prior to paying. To set-up an account, please follow the registration instructions provided on CourseLink under *Content >> Course Resources >> Pearson Mastering Chemistry Info*.

(c) **Scientific calculator** with ln, e^x, $\log_{10}$ and 10^x functions is required. Calculators or notebook computers capable of storing information are **NOT** allowed during tests/exams, *e.g.,* graphing calculators. It is your responsibility to have a properly working calculator and know how to use it.

(d) **Organic/Inorganic Molecular Model Kit** is optional. The kit will assist in visualising molecular shapes, organic chemistry structures, as well as the assigned Aspects of Organic Chemistry lab exercises. A kit can be purchased from either the University Bookstore ($15.25) or the Co-op Bookstore ($14.99).

(e) **System/Software Requirements:** To ensure you have the best learning experience possible, please review: https://opened.uoguelph.ca/student-resources/system-and-software-requirements

2. FALL 2020 CHEM*1040 LABORATORY SCHEDULE

DATE	Activities	Assessments	Deadline
Week 1 **Sept. 14 – 18**	**Hayden-McNeil Online Course:** Laboratory Skills	Laboratory Skills Post-Lab Activity	5 PM on Fri., Sept. 18
Week 2 **Sept. 21 – 25**	**CourseLink Lab Activities:** Atomic Spectroscopy Lab Simulation	Marking Module for Atomic Spectroscopy Lab Activity	5 PM on Fri., Sept. 25
Week 3 **Sept. 28 – Oct. 2**	**CourseLink Lab Activities:** Bonding and Molecular Structure Lab Activity	Marking Module for Bonding and Molecular Structure Lab Activity	5 PM on Fri., Oct. 2
Week 4 **Oct. 5 – 9**	**Hayden-McNeil Online Course:** Chemical Reaction Types and Their Equations	Chemical Reaction Types and Their Equations Post-Lab Activity	5 PM on Fri., Oct. 9
Week 5 **Oct. 12 – 16** **(No classes Oct. 12 & 13)**	**Student Science Safety I (F20) Course** Note: This course is separate from the CHEM*1040 CourseLink site	Final Assessment quiz on CourseLink Note: This is accessed via the Student Science Safety I (F20) CourseLink site	5 PM on Fri., Oct. 16
Week 6 **Oct. 19 – 23**	**CourseLink Lab Activities:** Volumetric Analysis Lab Simulation	Marking Module for Volumetric Analysis Lab Activity	5 PM on Fri., Oct. 23
Week 7 **Oct. 26 – 30**	**Hayden-McNeil Online Course:** Standardization of an NaOH Solution	Standardization of an NaOH Solution Post-Lab Activity	5 PM on Fri., Oct. 30
Week 8 **Nov. 2 – 6**	**CourseLink Lab Activities:** Gaseous Equilibria Lab Simulation	Marking Module for Gaseous Equilibria Lab Activity	5 PM on Fri., Nov. 6
Week 9 **Nov. 9 – 13**	**Hayden-McNeil Online Course:** Titration of Strong and Weak Acids	Titration of Strong and Weak Acids Post-Lab Activity	5 PM on Fri., Nov. 13
Week 10 **Nov. 16 – 20**	**Hayden-McNeil Online Course:** Buffers, Titration Curves, and Indicators	Buffers, Titration Curves, and Indicators Smart Worksheet	5 PM on Fri., Nov. 20
Week 11 **Nov. 23 – 27**	**Hayden-McNeil Online Course:** Synthesis of Aspirin	Synthesis of Aspirin Post-Lab Activity	5 PM on Fri., Nov. 27
Week 12 **Nov. 30 – Dec. 4**	**CourseLink Lab Activities:** Aspects of Organic Chemistry	Marking Module for Aspects of Organic Chemistry Lab Activity	5 PM on Fri., Dec. 4

Note: Although the Hayden-McNeil Introduction to Lab Simulations Post-Lab Activity will not contribute to your final lab grade, it must be completed to gain access to all other post-lab activities within the Hayden-McNeil Online Course. Similarly, the Introduction to Smart Worksheets activity will not contribute to your final lab grade, but it must be completed to gain access to the Buffers, Titration Curves, and Indicators Smart Worksheet.

3. EVALUATION

Your final course grade will be based on the following components:

Mastering Chemistry Online Homework Assignments (best 10 out of 11)	10%
CourseLink Online Lab Work (5 lab activities)	10%
Hayden-McNeil Lab Work (6 lab activities)	14.5%
CourseLink Student Science Safety I (F20) Course (1st grade attempt)	0.5%
Midterm Test 1 (Wed., Oct. 14, 5:30 PM)	14%
Midterm Test 2 (Mon., Nov. 9, 5:30 PM)	18%
Final Examination (Thurs., Dec. 10, 8:30 AM)	33%

Note: To obtain credit, a minimum of 50% in the overall course **AND** at least seven out of the eleven lab activities must have been completed, else a maximum final grade of 49% is assigned.

(a) **Mastering Chemistry Online Homework (required):** Chemistry is not a subject that can be easily learned by simply reading a book. To consolidate your understanding, one must work with the course concepts on a regular basis. Interactive homework is one way to keep up and test your understanding. 12-month access to a Mastering Chemistry account can be purchased direction online from the Mastering Chemistry site, or by way of an access code purchased from one of the campus bookstores. Your account can be used to add the W'21 CHEM*1050 Mastering Chemistry course site next semester.

Follow the instructions provided on CourseLink (*Content >> Course Resources >> Pearson Mastering Chemistry Info*) to set-up your account. Complete the "Intro to MasteringChemistry" to familiarize yourself with the system. This site is linked to the CHEM*1040 CourseLink site, and can be accessed through the **Pearson MyLab and Mastering link**, located on the course home page.

There are 11 graded assignments. Each is comprised of a quiz (weighted 50%; 2 attempts/question) and adaptive follow-up questions (50%; multiple attempts), generated once the quiz questions have been submitted. Your worst assignment will be dropped prior to calculating your final grade out of 10. Quizzes are due **Thursday 11:59 PM, starting Sept. 24**, and the adaptive follow-ups are due by the following **Sunday 11:59 PM**. If an assignment is not attempted, a grade of zero is assigned.

(b) **CourseLink Online Lab Activities (required):** Five of the eleven CHEM*1040 laboratory activities can be found on the CHEM*1040 CourseLink site (Content >> Laboratory Activities >> CourseLink Lab Activities). Each activity consists of 2 parts: simulated experiment or a set of lab activities and a marking module. Background info and worksheets to help you record your work are provided for each activity. The marking module's link is released after you have visited the simulation and/or lab notes/worksheets.

The simulated experiments can be done as many times as you wish however, some labs assign a new "unknown" number with each attempt. Make sure to record this number for grading purposes.

Once you have completed all activities and calculations, **only then** open the marking module to evaluate your work. You have one attempt and 60 minutes to enter your answers – which is more than ample time for all. **Marking modules are due Fridays at 5 PM** (refer to Laboratory Schedule – page 2). If an assigned marking module is not submitted by the deadline, a grade of zero is assigned.

Submitted marking modules can be reviewed starting the Monday following the due date and for a two-week period. You will be able to review your answers, the correct answers and any feedback provided.

(c) **Hayden-McNeil Online Course (required):** The remaining six lab activities can be found on the Hayden-McNeil online course site. A link to the site is provided on the CHEM*1040 CourseLink site, under Content >> Laboratory Activities >> Hayden-McNeil Online Course. Follow the instructions provided on how to register. This site provides background info, lab procedures and a virtual lab environment to conduct experiments and collect data. Introduction to Lab Simulations will familiarize you with the site and grant access to the other lab activities. Each lab is assessed through a **post-lab activity or smart worksheet** that is **due Fridays at 5 PM** (refer to Lab Schedule – page 2). If an attempt is not submitted by the assigned deadline, a grade of zero is assigned.

(d) **CourseLink Lab Safety Course (required)**: You must complete the course entitled "*Student Science Safety I (F20)*" by **Friday, October 16, 5 PM** (refer to Laboratory Schedule – page 2). It takes 2-3 hours to complete. You have unlimited attempts to achieve a grade of 90% or better on the final assessment, however the grade on your first attempt is worth 0.5% of your final grade in the course. If an attempt is not submitted by the assigned deadline, a grade of zero is assigned.

(e) **Practice Online Quizzes (optional)** – see *CourseLink >> Content >> Week #*
A *Self-Assessment Quiz* is available until Sept. 27, 11:59 PM and can be accessed twice. Find out what you know! There are also topic specific practice quizzes posted under each Week's module. These quizzes can be attempted multiple times to help you test your knowledge.

(f) **Midterm Tests (required):** Test#1: Wed., Oct. 14, 5:30 PM, CourseLink
Test#2: Mon., Nov. 9, 5:30 PM, CourseLink

The midterm tests are designed to test your knowledge of the course material up to and including Weeks 4 and 8 lectures, corresponding text references and laboratories. Test#2 will have a heavier emphasis on the material since Test#1.

Each test consists of multiple choice and short answer questions to be completed individually within 60 minutes. Using Universal Design principles, **everyone will be given up to time and a half (90 minutes) to complete these tests**. Past written midterms, designed for 80 minutes, can be found under Content >> Course Resources >> Tests & Exam Resources. Students having a conflict with a scheduled test and another course or lab, must e-mail Prof. Jones (lojones@uoguelph.ca) at least one week in advance of the test.

(g) **Final Examination (required): Thurs., Dec. 10, 8:30 – 10:30 AM, CourseLink**
The online 2-hour exam evaluates the entire course via multiple choice and short answer questions.

(h) **Midterm Tests and Final Examination Info:** Midterm tests and the final examination are common to all sections, delivered through CourseLink and are closed book. Notes, printed material of any kind, any communication with other students or any other aids are <u>not</u> permitted. Calculators capable of storing text information or formulas are **not permitted**.

You are required to use Respondus LockDown Browser and Monitor (webcam) to proctor your online midterm tests and final exam. Download and install LockDown Browser and Monitor (https://download.respondus.com/lockdown/download.php?id=273932365) prior to the first midterm test. A practice test is provided (see Content >> Course Resources >> Tests & Exam Resources >> Instructions and Links) to ensure Respondus LockDown Browser and Monitor is set up properly and that you are comfortable using the software prior to your first test. If you encounter any technical issues during the practice test, midterm tests or final exam, please contact CourseLink Support at courselink@uoguelph.ca or 519-824-4120 ext. 56939.

Note: If you have any concerns about meeting system requirements, contact CourseLink Support (http://spaces.uoguelph.ca/ed/contact-us/). They canl work with you to find alternative solutions.

4. LECTURE SCHEDULE

Week	Dates	Topics	CourseLink Resources (see Content tab)	Text Reference
Week 0	Sept. 10 to Sept. 11	Measurement Significant figures Atoms, molecules & ions	Review Video Lessons Self-Assessment Quiz	*Review: Ch. 1, 1.4 – 1.8 Ch. 2, 2.3 – 2.10
Week 1–2	Sept. 14 to Sept. 25	Atomic structure Periodic trends Lewis structures VSEPR & bonding	Periodic Tables (Week 1) Atomic Structure Practice Quiz (Week 1) VSEPR Interactive Tutorial (Week 2) Molecular Structure Practice Quiz (Week 2) Questions of the Week (Weeks 1 and 2)	*Review: 7.1 – 7.4 Ch. 7, 7.5 Ch. 8, 8.1 – 8.7 Ch. 9, 9.2 – 9.9 Ch. 10, 10.1 – 10.4
Week 3–4	Sept. 28 to Oct. 9	The Mole Stoichiometry & Chemical Rxns	Stoichiometry Video Lessons (Week 3) Nomenclature Practice (Week 3) Stoich. & Rxns Practice Quizzes (Weeks 3-4) Questions of the Week (Weeks 3 & 4) Titration and Analysis Problem (Week 4) Midterm Prep Quiz (Week 4)	*Review 3.1 – 3.5 Ch. 3, 3.6 – 3.8 Ch. 4, 4.1 – 4.4, 4.7 – 4.10 *Review 5.1 – 5.4

Fall Study Break – From end of classes on Oct. 9 to beginning of classes Wednesday, Oct. 14

Midterm Test#1: Wednesday, October 14, 5:30 PM, CourseLink

Week 5	Oct. 14 to Oct. 16	Chemical Equilibrium	Questions of the Week (Week 5) Equilibrium Practice Quiz	Ch. 14, 14.1 – 14.8
Week 6–8	Oct. 19 to Nov. 6	Acids, bases and salts	Acids and Bases Video Lessons (Weeks 6 & 7) Acids and Bases Practice Quiz (Week 7) Salts Video Lessons (Week 8) Salts Practice Quiz (Week 8) Questions of the Week (Weeks 6-8)	Ch. 15, 15.1 – 15.8 Ch. 16, 16.1 Ch. 16, 16.3 – 16.4

Midterm Test#2: Monday, November 9, 5:30 PM, CourseLink

Week 9	Nov. 9 to Nov. 13	Buffers and titration curves	Buffers Video Lessons (Week 9) Buffers Practice Quiz (Week 9) Titration Curve Animation (Week 9) Titration Curves Practice Quiz (Week 9) Questions of the Week (Week 9)	Ch. 16, 16.5 – 16.7
Week 10–12	Nov. 16 to Dec. 4	Organic chemistry Intermolecular forces Final exam review	Organic nomenclature quizzes (Week 10) Structural isomer tutorial (Week 10) Stereoisomers (Week 10) Organic Chem Practice Quizzes (Weeks 10 & 11) The Macrogalleria (Week 12) Questions of the Week (Weeks 10 - 12)	Ch. 11, 11.5 Ch. 23, 23.1 – 23.7 Ch. 24, 24.1 Organic Chemistry Notes – all questions

Final Examination: Thursday, December 10, 8:30 AM

Note: You are responsible for the topics marked with an asterisk (*) as they are assigned as review and may not be explicitly addressed within the posted video lessons or virtual sessions.

On CourseLink, under Content >> Week, you will find course notes, videos and follow-up activities to help you prepare each week. You are strongly encouraged to review the relevant material prior to your scheduled Zoom meetings, where problems and questions will be addressed. You can only attend the session for which you are registered. Instructors will cover basically the same material but may do so in a different order.

Zoom Meetings: To join the scheduled virtual session, download a free copy of Zoom from www.zoom.us. The virtual meetings will be recorded and made available on CourseLink. By joining, you are giving consent for the session to be recorded. You do not need a webcam or mic to participate in these sessions. Questions are asked using the chat function.

POLICY ON MISSED WORK

(a) **Missed Midterm Tests:** If you do not write one of the midterm tests, you must e-mail Prof. Jones via your U of G account. Include your full name, student ID number and an explanation. If a valid excuse is received, the percentage value of the midterm test is added to the percentage value of the final exam. Otherwise, a grade of zero will be assigned. **No make-up tests will be provided.**

(b) **Missed Final Examination:** If you miss a final exam, contact your Program Counsellor as soon as possible (refer to *www.uoguelph.ca/uaic/programcounsellors* for contact info). An official request must be made within **five working days** of the missed examination. Consult the Undergraduate Calendar for further details: *https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml*

(c) **Other Work:** When you find yourself unable to meet an in-course requirement, due to illness or compassionate reasons, e-mail Prof. Jones via your U of G account. Include your full name and student ID number. If a valid excuse is received, your work will be re-evaluated; otherwise, a grade of zero is assigned. Regulations and procedures for Academic Consideration are found in the Undergraduate Calendar (*https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml*)

(d) The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.

5. EXPECTATIONS

The course website and virtual class meetings are considered our classroom and the same protections, expectations, guidelines, and regulations used in face-to-face settings apply, plus other policies and considerations that come into play specifically because this course is delivered online. Inappropriate online behaviour will not be tolerated, where examples include:

- Posting inflammatory messages about your instructor or fellow students;
- Using obscene or offensive language online;
- Copying or presenting someone else's work as your own;
- Adapting information from the Internet without using proper citations or references
- Buying/selling lab reports or assignments;
- Posting or selling course materials to course notes websites;
- Recording lectures without the permission of the instructor;
- Having someone else complete your quiz or completing a quiz for/with another student
- Stating false claims about lost quiz answers or other assignment submissions
- Threatening or harassing a student or instructor online;
- Discriminating against fellow students, instructors, and/or TAs;
- Using the course website to promote profit-driven products or services;
- Attempting to compromise the security/functionality of CourseLink; and
- Sharing your username and password.

6. ACADEMIC ETHICS

Original work performed in good faith is assumed with all course components. University of Guelph students have the responsibility of abiding by the University's policy on academic integrity, which prohibits several forms of academic offences, including cheating; falsification; plagiarism; unauthorized collaboration; or recording and/or dissemination of instructional content without express permission of the instructor.

Your graded submissions for online assignments, tests and exam should be your own, individual work. You may not share content from any assignments, tests, exams, etc. with 3rd-parties such as Chegg, CourseHero, Reddit, or any other non-UoG course content repositories. If found guilty of academic misconduct, a grade of zero is a common penalty on such course components, as well as a letter documented the offence being placed in your official student file.

It is also presumed that the data you collect, all data analysis and written/typed calculations and responses that you submit for grading is yours alone. We often find examples of plagiarism in which lab reports are copied from someone else, or from a previous semester. In short, if you have not done something yourself, do not attempt to pass it off as original work.

Further academic misconduct information can be found in the Undergraduate calendar: https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml
If you have any questions about what might cross the line, please do not hesitate to ask your lab TA or Instructor prior to submitting your work.

7. EQUAL OPPORTUNITY AND EVALUATION POLICY

The University is committed to academic integrity and has high ethical and moral standards. All students will be treated equally and evaluated using the criteria presented in this outline. Evaluation criteria are based strictly on achievement and not effort. There is no extra work for extra credit or to "make up" a grade. The need to obtain a higher grade for various reasons is not grounds for increasing your grade. If your grade were "bumped" (*i.e*. you received a grade you did not legitimately earn), it would be unfair to all the other students in the course.

8. COURSE RESOURCES

(a) **CHEM*1040 Website –** access through portal *http://www.uoguelph.ca/courselink/*
Your **Username** is the part of your U of G e-mail address before the "@" sign. Your **password** is the same as your University e-mail. The course website provides a wealth of resources *(i.e.,* video lessons, animations, questions of the week, and previous midterms, *etc*.), practice quizzes and a discussion board to post your course questions. Weekly announcements are posted on the course homepage to help you stay up-to-date and form the main mode of communication regarding the course. **It is your responsibility to access this site on a regular basis and read all posted announcements.**
CourseLink Student Support page: https://spaces.uoguelph.ca/ed/students/

(b) **Instructors –** will be available at certain times for consultation and assistance. Virtual office hours will be arranged at the beginning of the semester and posted on CourseLink.

(c) **Chemistry Learning Centre** – Get Ready for First-year Chem Resource site
Teaching Assistants (TAs) are available to answer questions and assist you with both the lecture and laboratory material online. Virtual hours will be posted on CourseLink under "Announcements". The sessions can be accessed through the Virtual Classroom on the Get Ready for First-year Chem site.

(d) **Supported Learning Groups** (SLGs) – link located on CHEM*1040 homepage
SLGs are regularly scheduled, small group study sessions, held virtually this semester. Attendance is voluntary and open to all students in the course. SLGs are facilitated by students who have successfully completed the course. SLG leaders work with faculty/staff to create study activities that integrate course content with effective approaches to learning. They are not tutors. The peer-supported group study format exposes students to various approaches to learning, problem solving, and exam prep. Use the link on the CHEM*1040 homepage to enroll, view the schedule and join a virtual SLG session.

9. END OF CHAPTER PROBLEMS

There is a good correlation between mastering the course concepts on a week-by-week basis and performance in the course. Problems are assigned to provide additional reinforcement of the principles covered in the course, to allow you to practice problem-solving techniques and to check your own knowledge before the midterm tests and final exam. For the end-of-chapter problems, answers are provided at the back of your textbook. For full solutions, consult the textbook's Student Solutions Manual, provided online if you have purchased access to OWL v2.

Work the problems in the week the material is covered in lectures. A common reason why students are unsuccessful in CHEM*1040 is that they fall so far behind with the material that they never catch up. Lectures become harder to comprehend without the reinforcement effect of constant practice. If you have difficulties, **seek help early**!

The questions within the text are organised according to categories (*e.g.*, Review, Concept and Cumulative-Skills Problems). If you find the early review questions unchallenging, move on to the other sections. Additional "Questions of the Week" are provided on CourseLink under each week, which represent types of questions that may appear on tests or the final examination.

Review:

Chapter 1: 1.35, 1.41, 1.81, 1.83, 1.127.

Chapter 2: 2.43, 2.65, 2.75, 2.77, 2.79, 2.83, 2.85, 2.91, 2.93, 2.99, 2.101, 2.109, 2.119, 2.123.

Chapter 3: 3.37, 3.39, 3.45, 3.61, 3.65, 3.67, 3.73.

Atomic structure, periodic trends, molecular structure and bonding (Week 1 – 2):

Chapter 7: 7.25, 7.33, 7.37, 7.45, 7.69, 7.87, 7.97, 7.114, 7.117.

Chapter 8: 8.39, 8.43, 8.49, 8.61, 8.63, 8.65.

Chapter 9: 9.43, 9.45, 9.49, 9.57, 9.59, 9.63, 9.65, 9.69, 9.71, 9.77, 9.93, 9.97, 9.99, 9.128, 9.139.

Chapter 10: 10.31, 10.33, 10.35, 10.39, 10.41, 10.45, 10.49, 10.53, 10.65, 10.69, 10.73, 10.100.

Stoichiometry and Reactions (Week 3 – 4)

Chapter 3: 3.24, 3.81, 3.83, 3.89, 3.91, 3.93, 3.97, 3.103, 3.105, 3.117, 3.119, 3.135, 3.137.

Chapter 4: 4.31, 4.35, 4.37, 4.39, 4.41, 4.43, 4.51, 4.69, 4.71, 4.77, 4.81, 4.85, 4.87, 4.89, 4.93, 4.107, 4.109, 4.111, 4.115, 4.119, 4.123, 4.127, 4.141, 4.151.

Chapter 5: 5.75, 5.77, 5.79, 5.119, 5.137, 5.143.

Acid-Base Equilibrium (Week 5 – 8)

Chapter 14: 14.23, 14.25, 14.35, 14.37, 14.39, 14.41, 14.43, 14.55, 14.57, 14.59, 14.61, 14.63, 14.73, 14.75, 14.83, 14.87, 14.121, 14.123.

Chapter 15: 15.27, 15.29, 15.31, 15.33, 15.35, 15.41, 15.53, 15.57, 15.59, 15.61, 15.67, 15.71, 15.85, 15.99.

Chapter 16 (Weak Acids/Bases): 16.1, 16.9, 16.23, 16.25, 16.35, 16.39, 16.41, 16.45, 16.51, 16.53, 16.55, 16.57, 16.101, 16.111, 16.115.

Chapter 16 (Salts): 16.27, 16.59, 16.63, 16.65.

Buffers and Titration Curves (Week 9)

Chapter 16 (Buffers): 16.29, 16.71, 16.73, 16.75, 16.77, 16.81, 16.83, 16.113, 16.121, 16.141.

Chapter 16 (Titration Curves): 16.15, 16.31, 16.85, 16.87, 16.89, 16.93, 16.107, 16.109, 16.119, 16.135, 16.143.

Organic Chemistry & Intermolecular Forces: (Week 10 – 12)

Chapter 11: 11.63, 11.69, 11.71, 11.105, 11.109 b & d.

Organic Chemistry Notes for CHEM*1040: All study questions from each section.

Chapter 23: 23.14, 23.25, 23.29, 23.35, 23.39, 23.41, 23.53, 23.55, 23.65, 23.75.

Chapter 24: 24.29, 24.53, 24.55.

10. CHEM*1040 EXPECTATIONS AND LEARNING OBJECTIVES

The pre-requisite for CHEM*1040 is two full high school chemistry courses (*e.g.*, 3U and 4U or grade 11 and 12 chemistry). In reviewing the course content of CHEM*1040 you may feel you know most of the material already. **Don't be misled!** The topics may be familiar, but we will be providing a deeper understanding of the fundamental concepts within chemistry.

The purpose of CHEM*1040 (and CHEM*1050) is to build upon your previous exposure to the subject. You will need to move away from just memorization terms and definitions and spend more time thinking about the processes and concepts within chemistry. This will lay the foundation for more advanced courses such as analytical chemistry (*i.e.*, CHEM*2400 or CHEM*2480), biochemistry (*i.e.*, BIOC*2580), organic chemistry (*i.e.*, CHEM*2700), inorganic chemistry and physical chemistry (*i.e.*, CHEM*2060, CHEM*2880 and CHEM*2820). **Note that the course is not designed to "teach" you chemistry. It is, however, constructed to help you <u>learn</u> chemistry.**

For some, it may have been more than a year since you last took a chemistry course and it is not unrealistic to assume that you have forgotten some of what you have already learned. We will review some basic concepts, <u>but</u> this will not be a comprehensive review. **You must review carefully the sections of the textbook that have been assigned as review on your own.**

(a) What We Expect You Already Know/Understand:

- classifications of matter and terms associated with its physical properties (e.g., temperature; density, homogeneous vs. heterogeneous mixtures). (Refer to Sections 1.4 and 1.7)
- how to report the number of significant figures in each quantity and **how to round off the result of a calculation to the correct number of significant figures**. (Refer to section 1.5 in text as well as the introductory notes within your laboratory manual.)
- SI base units, SI prefixes (from *tera* through to *femto*) and converting between units. (Sections 1.6 & 1.8)
- basic concepts and terminology associated with atoms and atomic structure (*e.g.*, electron, proton, neutron, atomic number, mass number, atomic mass unit, isotope, natural abundance, mole, molar mass) (Section 2.3–2.4)
- information provided by any periodic table (e.g., atomic symbols and names, period versus group), and be familiar with the overall structure and organization of the modern periodic table. (Sect. 2.5)
- names of groups 1, 2, 17 and 18; how to classify an element as a metal, non-metal or metalloid based on its position in the periodic table; the common forms of the most common non-metals: H_2, F_2, Cl_2, Br_2, I_2, N_2, O_2, P_4, S_8. (Section 2.5)
- names and formulas of simple inorganic and organic compounds. Familiarise yourself with Tables 2.4 to 2.6. Sections 2.6–2.8 and pages 1–26 in the Organic Notes.
- how to write and balance simple chemical equations by inspection. (Sections 2.9–2.10)
- concepts and calculations that involve quantities of atoms, ions or molecules, Avogadro's number, molar mass and molecular formula. (Sections 3.1–3 .2)
- to use % composition & molar mass to determine empirical and molecular weights. (Sect's 3.3–3.5)

- how to use a balanced chemical equation to relate masses and moles of reactants and products. (Sections 3.6–3.7)
- meaning of terms such as empirical formula, molecular formula; structural formula; anion; cation; oxidation state; limiting reagent; excess reagent; actual, theoretical and percent yields; molarity (Sections 3.8, 4.7)
- units of pressure used for gas law problems and be able to convert between them. (Section 5.1)
- concepts and terminology associated with the ideal gas law (PV=nRT) (Sections 5.3–5.4)
- difference between wavelength and frequency and are familiar with the electromagnetic spectra and the different regions of the spectra (X-ray, UV, visible, IR, Microwave, radio). (Section 7.1)
- concept of a photon and how the energy of a photon is directly proportional to the frequency and inversely related to wavelength. (Section 7.2)
- when and why the Bohr Theory of the atom is useful, and as well as its limitations, and why it is not correct. (Section 7.3)
- how to work with exponential (i.e., scientific) notation, logarithms (*e.g.,* log & ln), exponentials (i.e., 10^x and e^x) and the quadratic formula. Practice: *https://atrium.lib.uoguelph.ca/xmlui/handle/10214/1755*
- how to solve for an unknown within a linear equation. In some instances, it may be helpful if you can solve for two unknowns using two linear equations.
- how to use a table of (x,y)-data pairs to construct a plot. For straight line plots, you will be expected to calculate slope.

(b) **CHEM*1040 Learning Objectives** – the course can be subdivided into six sub-sections and the learning objectives for each are as follows:

Atomic structure and Periodic Table (Sections 7.4 – 8.7 & 9.2-9.3)

1. Understand the significance of the quantum numbers, understand how they can be used to code for the electron energy levels within atoms and know the shapes of the boundary surfaces of *s*, *p* and *d* orbitals. (Sections 7.4–7.5)
2. Understand the organization of the periodic table in terms of the types of orbitals being filled; be able to apply the Pauli Exclusion Principle and Hund's Rule. (Sections 8.1–8.2 & 8.4)
3. Predict the magnetic behaviour of an atom or ion. (Section 8.4)
4. Write ground-state electron configurations for any atom or ion using only the Periodic Table. (Sections 8.3 & 9.2)
5. Know periodic trends such as atomic dimensions and how atomic dimensions change as a function of position in the Periodic Table; compare the sizes of two atoms, two ions, or an atom and ion. (Sections 8.6 and 9.3)
6. Define ionization energy, electron affinity and electronegativity. Know how these parameters change as a function of position in the Periodic Table. (Section 8.6)

Lewis structures, VSEPR & bonding (Sections 9.4 –9. 9 & 10.1 – 4)

1. Apply the Octet Rule to the construction of Lewis structures for multi-atom, multi-element molecules. Be able to recognize violations of the rule. (Sections 9.4–9.6 and 9.8)
2. Know what resonance is and be able to draw resonance structures. (Section 9.7)
3. Show how formal charges can facilitate the generation of "better" Lewis structures. (Section 9.9)
4. Apply VSEPR Theory to Lewis structures to determine approximate molecular geometries. (Section 10.1)
5. Understand the significance of electronegativity and use it to identify polar bonds; use geometry to identify polar molecules. (Sections 9.5 & 10.2)

6. Understand the logic behind the need to invoke hybridization of atomic orbitals; use number of electron pair locations to determine hybridization used by the central atom. (Section 10.3)
7. Describe single, double or triple bonds in terms of the overlap of hybrid or pure atomic orbitals. (Section 10.4)

Stoichiometry (Sections 3.6 – 3.8, 4.1 – 4.4, 4.7 – 4.10)

1. Relate quantities in chemical equations (*e.g*., single & multi-stepped reactions) (Sect's 3.6–3.7)
2. Connect the concepts of limiting reagent (or reactant), theoretical yield, actual yield and percentage yield. Be able to work problems related to these concepts. (Section 3.8)
3. Perform calculations involving molarity. Be able to determine solution concentration, prepare a solution or interconvert units. (Sections 1.8 & 4.7 – 4.8, 4.10)
4. Apply the solubility rules in Table 4.1 to either compounds or reactions. (Sections 4.2–4.3)
5. Differentiate between molecular and net ionic equations. Be able to write either. (Section 4.2)
6. Write precipitation and neutralization reactions. (Section 4.3 – 4.4)
7. Understand the logic behind both gravimetric and volumetric analyses, and be able to perform stoichiometric calculations involving solids, solutions or gases. (Sections 4.9–4.10 and 5.3–5.5)

Chemical Equilibrium (Chapter 14)

1. Describe the characteristics of dynamic equilibrium. (Section 14.1)
2. Connect the dependence of K on the way the balanced equation is written. What happens to K if the reaction is reversed? (Sect. 14.2)
3. Write a K expression for homogenous or heterogeneous equilibrium. (Sect's 14.2–14.3)
4. Relate K to ***extent of reaction***, relative amount of reactant/product at equilibrium. (Sect. 14.4)
5. Relate Q value to ***direction of reaction***, forward or reverse, to reach equilibrium. (Sect. 14.5)
6. Be able to solve an equilibrium problem. (Sect. 14.6)
7. Use Le Chatelier's principle to describe the effect of a stress on equilibrium position, equilibrium constant K and equilibrium concentrations or pressures. Stresses include adding or removing a reagent, a temperature change, or a change in overall volume or pressure. (Sect. 14.7)

Acids, bases, salts, buffers and titration curves (Chapters 15 & 16):

1. Differentiate between the three definitions of acids and bases (*i.e.,* Arrhenius, Brønsted-Lowry and Lewis). Identify examples of each. (Sections 15.1–15.3)
2. Identify the six common strong acids (see Table 15.1).
3. Identify strong bases (group I and II hydroxides and oxides) (see Table 15.1)
4. Identify conjugate acid/base pairs in an acid/base reaction. (Section 15.2)
5. Write an equation for the auto-ionization of water and its K expression. (Section 15.6)
6. Recognize strong acid and base aqueous solutions and determine the pH and equilibrium concentrations. (Sections 15.7–15.8)
7. Calculate pH from $[H^+]$ or $[H^+]$ from pH; relate $[OH^-]$ and $[H^+]$ using K_w. (Section 15.8)
8. Recognize weak acids and weak bases, write an equation for the dissociation of an acid or base in water, identify the substances acting as the acid and base on either side. (Sections 16.1 & 16.3)
9. Write the equilibrium constant expression for a weak acid or weak base dissociation, determine pH and equilibrium concentrations. (Sections 16.1 & 16.3)
10. Relate K_a and K_b using K_w. (Section 16.4)

11. Classify salts as producing neutral, acidic or basic solutions in water; determine the pH of a salt solution (Sections 16.4–16.5).
12. Recognize and determine the pH of buffer solutions; suggest a reasonable buffer solution to maintain a certain pH. (Section 16.6)
13. Understand how and why an indicator changes color (Section 15.8 & 16.7).
14. Know the difference between equivalence point (or stoichiometric point), endpoint, and midpoint (or half equivalence/half stoichiometric point).
15. Evaluate the reaction between a strong acid and strong base, a weak acid and strong base or a strong acid and weak base to determine the pH at various points including: (1) before titration, (2) before equivalence point, (3) at equivalence point & (4) after equivalence point. (Section 16.7)
16. Write an equation for an acid/base reaction and determine the direction from acid/base strengths.

Organic chemistry (Organic Notes; Sections 11.5, 23.1 – 23.7 & 24.1 – 2)

1. Identify and name the various functional groups. (Organic Notes (ON) pp. 1–22)
2. Identify and relate the different types of isomers. (ON pp. 23–30)
3. Identify types of intermolecular forces present between molecule (Section 11.5, ON pp. 31-32)
4. Compare and contrast boiling points, melting points and water solubility based on intermolecular forces. (ON pp. 32–34)
5. Identify chemically reactive centres (electrophiles, nucleophiles and free radicals), reaction intermediates and intermediates stability. (ON pages 35–36)
6. Know the following representative organic reactions:
   (a) *Alkanes* – substitution reaction through halogenation (ON pp. 36–38)
   (b) *Alkenes* – addition of acid or hydrogen & polymerisation (ON pp. 39–42)
   (c) *Alkyl Halides* – nucleophilic substitution reactions (ON pp. 42–43)
   (d) *Alcohols* – oxidation with dichromate and acid (ON pp. 44–45)
   (e) *Aldehydes/Ketone*s – addition of H_2 & nucleophilic attack of H_2O & alcohol (ON pp. 45–47)
   (f) *Carboxylic Acids* – formation of esters and polyesters (ON pp. 47; 49–50)
   (g) *Esters* – formation of amides and polyamides (ON pp. 48, 50–52)
7. Differentiate between addition and condensation polymers (ON pp. 40–42; 49–52).
8. Recognise the acid & base properties of organic compounds and their salts. (ON pp. 52–53)

(c) **CHEM*1040 Learning Outcomes**

On successful completion of this course, students should be able to:

1. Demonstrate knowledge and understanding of atomic structure, periodic trends, Lewis structures, VSEPR and bonding.
2. Understand and apply the concepts of chemical equilibrium, especially in associating with acids, bases, salts, buffers and titration curves.
3. Solve quantitative problems (stoichiometric) involving chemical formulas and equations which include solids, liquids, solutions or gases.
4. Demonstrate knowledge and understanding of physical and chemical aspects of organic molecules and their reactions.
5. Perform laboratory experiments demonstrating safe and proper use of standard chemical glassware and equipment.
6. Record, graph, chart and interpret data obtained from experiments through working co-operatively with others or independently.

11. ADVICE FROM STUDENTS ON HOW TO DO WELL IN CHEM*1040

- "Be sure to mark down all your deadlines."
- "Read a bit ahead in the text. The lectures make much more sense..."
- "Keep on top of the lecture material and textbook reading/question assignments... the midterm and final will not seem half as difficult!"
- "Try to understand what you are doing, not just know how to do it."
- "KNOW your material and be able to explain it well to someone else with little difficulty."
- "Ask questions if you don't understand … it will not get better with time."
- "… read textbook, pay attention in lecture, ask questions, visit your Prof., go to SLG's, go to the Chem Learning Centre, whatever you need to do, do it. Resources are there, you just need to go get them."

12. UNIVERSITY POLICIES & INFORMATION

(a) **Academic Advisors** – If you are concerned about any aspect of your academic program, make an appointment with a Program Counsellor within your degree program. For contact info, please refer to: *https://www.uoguelph.ca/uaic/programcounsellors*

(b) **Academic Assistance** – If you are struggling to succeed academically, the Learning Commons (*https://www.lib.uoguelph.ca/*) offers numerous academic resources, including workshops related to time management, taking multiple choice exams and general study skills. You can also set up individualized appointments with a learning specialist.

(c) **Academic Integrity** – The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all of us to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. Note: Whether one intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse you from the responsibility of verifying the academic integrity of your work before submission. If you are in any doubt as to whether an action on your part could be construed as an academic offence, consult your Instructor or a Faculty Advisor. Refer to the Undergraduate Calendar for more detailed information about the Academic Misconduct Policy:
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

(d) **Accessibility** – The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student. When accommodations are needed, students are required to register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway. Accommodations are available for both permanent and temporary disabilities. Note that common illnesses, such as a cold or the flu, do not constitute a disability. For more info, go to the SAS website: *www.uoguelph.ca/sas*

(e) **Copies of out-of-class assignments –** Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

(f) **Copyright of Course Materials** – All course materials are copyrighted by the Department of Chemistry, the instructor who prepared the materials or the publisher who provided the materials.

These materials can only be reproduced with permission and in conjunction with associated copyright rules. **Note**: Lectures and laboratories **cannot** be recorded or copied without the permission of the presenter. Material recorded with permission is restricted to personal use for that course, unless further permission is granted.

(g) **Course Evaluation** (CEVAL) – Students will be invited to complete a short online evaluation of their TA**,** as well as their Instructor and the course, near the end of the semester. The department regards this information as important in evaluating the course, as well as your TA and Instructor's performances. All comments are reviewed, and suggestions are followed whenever possible. To access the online evaluation, go to *https://courseeval.uoguelph.ca/*.

(h) **Communication** – As per university regulations, all students are required to check their <uoguelph.ca> e-mail account **regularly**: e-mail is the official route of communication between the University and its students. In this course, students are required to regularly read the posted announcements on the CHEM*1040 course home page.

(i) **Use of Personal Information** – Personal information is used by University officials to carry out their authorized academic and administrative responsibilities and to establish a relationship for alumni and development purposes. The University of Guelph's policy on the Collection, Use and Disclosure of Personal Information can be found in the Undergraduate Calendar: *https://www.uoguelph.ca/registrar/calendars/undergraduate/current/intro/index.shtml*

(j) **Resources** – Academic Calendars provide information about the University of Guelph's procedures, policies and regulations: *www.uoguelph.ca/registrar/calendars/index.cfm?index*

i. **Drop Date**: Courses that are one semester long must be dropped by the last day of classes to have the course removed from your transcript. Evaluate your performance regularly. If you find you are not doing well, seek advice from your Instructor. Regulations and procedures for dropping courses can be found in the Undergraduate Calendar: *https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml*

ii. **Schedule of Dates**:
www.uoguelph.ca/registrar/calendars/undergraduate/current/c03/index.shtml
e.g., Th., Dec. 3 – classes rescheduled from Tue., Oct. 13; Tuesday schedule in effect
Fri., Dec. 4 – classes rescheduled from Mon., Oct. 12; Monday schedule in effect.

(k) **Wellness** – If you are struggling with personal or health issues:

- **Counselling Services** (*https://wellness.uoguelph.ca/counselling/*) offers individualized appointments to help students work through personal struggles that may be impacting their academic performance.
- **Student Health Services** (*https://wellness.uoguelph.ca/health/*) provides medical attention.
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers offers workshops and sessions related to stress management and high-performance situations (https://www.selfregulationskills.ca/)