Winter 2016 Student Course Information
CHEM*1040 General Chemistry I
Department of Chemistry
University of Guelph

Course Description: CHEM*1040 General Chemistry I F,W (3-3) [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

Instructor: Prof. Adrian Schwan (schwan@uoguelph.ca; MACN 336 West Wing; Ext. 58781)
The email is provided for logistic communication only, not scientific communication. I only answer scientific questions in live, personal face-to-face mode.

Schwan Availability: *After Class*
Open Tutorial: Wed. 8:30 to 9:30 am; Thurs. 9:00 to 10:00 am, LIB 360.
Office Hours: Mondays 3:00 – 6:00 pm; Tuesdays 9:30 – 11:30 am
Wednesdays 9:30 - 10:30; 1:30 – 3:00 pm; Fridays 9:30 - 11:30 am

Lecture: Tues., Thurs. 4:00-5:20 in War Memorial Hall

Laboratory: Times and locations are listed on WebAdvisor (*http://webadvisor.uoguelph.ca/*). Refer frequently to the tabulated schedule of particular labs and assignments in this document.

1. COURSE MATERIALS

(a) **Textbook:** D. Ebbing and S. Gammon, General Chemistry. Students can use the 11th, 10th, 9th or 8th ed. The publisher provides a 10th ed. textbook package including the Student Solutions Manual. This package can be purchased from one of the campus bookstores. **Note:** 10th edition copies of text and solutions manual are on Library Course Reserve.

(b) **Laboratory Manual** ($20) and **Organic Chemistry Notes** ($10) are purchased from the Chemistry Dept. Jan. 11-15, 2016, 9:30 AM – 3:30 PM in SSC 2101. CASH ONLY

(c) **Lab coats** and **safety goggles** (not safety glasses) are required and can be purchased from the University Bookstore.

(d) **Scientific calculator** with ln, e^x, $\log_{10}$ and 10^x functions. Note: Calculators or notebook computers capable of storing text information are **NOT** allowed in examinations.

(e) **Cochrane Molecular Model Kits** are available at the campus bookstores. This kit will assist you in visualising material on molecular shapes, organic chem. and Dry Lab D.

(f) **Sapling Learning Access** (optional) – to complete the optional online homework assignments one needs to purchase access to a Sapling Learning account. A grace period on payment is until Jan. 25, so one can explore the site prior to paying for access. Semester access ($32 USD) is purchased online (credit card, pre-paid credit card or Paypal account). Alternatively, the campus bookstores also have one semester access cards for purchase. **Use the link on the course website** "*Content – Logistics and Accesses - Sapling*" **to set-up an account.** That link also describes how to re-enter Sapling for W2016, if you already paid for F2015.

2. "WET" LABORATORY – Begins Monday, January 11! Bring your lab manual.

The laboratory is a required component of CHEM*1040. A schedule is provided on the next page. Students attend their chemistry labs according to their lab section number. For example, CHEM*1040*0104 has the section number 0104, where the first two numbers represent the lecture (*i.e.*, 01, T, Th 4:00 PM) and the last two are the lab section (*i.e.*, 04, Mondays 7:00 PM). If your lab section ends with an **odd** number (*i.e.*, 1, 3, 5, 7 or 9), then you follow the "**Week Acid Schedule**". If your lab section ends with an even number (*i.e.*, 2, 4, 6, 8 or 0), then you follow the "**Week Base Schedule**".

(a) **Mandatory First Lab Meetings – Monday, January 11 to Thursday January 14**

Students must attend their first lab to receive mandatory safety training required by law. This safety lab is a pre-requisite for all subsequent labs. As proof of your registration, you must bring a computer print-out dated **Jan. 1, 2016 or later** of WebAdvisor's "*My Class Schedule*" or a device that can display it electronically. You do not need a lab coat or googles for this first lab meeting, but you do need your CHEM*1040 lab manual.

(b) **Online "Wet" Pre-lab Quizzes – CHEM*1040 CourseLink site – Starts Jan. 14**

Pre-lab quizzes are worth 3% of your final grade and are based on the "wet" lab activities that you are about to perform **– refer to the Laboratory Schedule**. To prepare for these quizzes, review the material provided in your lab manual. Pre-lab quizzes open the Thursday before your particular "wet" lab week and closes 60 minutes prior to the start of your lab period. You have two attempts at each quiz. If a quiz is not attempted, a grade of zero is assigned. To access, go to "*Content – Links to Pre-Lab Quizzes*".

(c) **Laboratory Reports – submitted electronically online**

Lab reports are submitted through Chemistry's online General Lab Marker System. During your lab period, you collect your data and submit a copy to your TA before leaving the lab. You then complete your lab report and submit it online for grading. Lab reports are normally due one week after your lab period and by 11:55 PM. Marks are deducted for lateness. Further info and the link to access the site is provided on CourseLink, under "*Content – Lab Resources*".

(d) **Missed Laboratory**

Refer to the "*Purple Page for Lab Absences in First-Year Chemistry*" posted on the CHEM*1040 course, under "*Content – Lab Resources*".

(e) **Week 8 (preceding Midterm) and Week 12 (Last Week of Classes)**

To help you prepare for the midterm and final exam, separate Midterm and Final Exam Preparation Problems Labs periods will be provided. The Problems Lab questions will be posted on CourseLink under "*Content – Lab Resources*". Attempt the questions prior to your lab period to gain the most benefit. Answers are only provided within the scheduled 90 minute labs.

(f) **Student Science Safety:** You are required to complete the Lab Safety Course online. You will find the course in your list of CourseLink courses and it is entitled "Student Science Safety". You must complete this course with a grade of 90% or better before you undertake any labs in the course. When you complete it, you will receive an electronic badge in CourseLink which can be shown to your T.A. You will have an unlimited number of attempts to complete the safety course to obtain the passing grade.

(g) Laboratory Exemptions for students who are repeating CHEM*1040

DEADLINE: WEDNESDAY JAN. 13, 2016 → *http://www.chemistry.uoguelph.ca/cgi-bin/ulabexemption.exe*

Students who obtained a "wet" lab grade of **at least 60%,** but who failed the course as a whole, may apply for a lab exemption. The lab work must have been completed during one of the three preceding semesters in which the course was offered (*i.e.*, F'14, W'15 or F'15).

NOTE: Students repeating CHEM*1040 who are granted a "wet" lab exemption **must complete the online "dry" computer labs** and can attend any Problems Lab session during weeks 8 and 12.

WINTER 2016 CHEM*1040 LABORATORY SCHEDULE

DATE	"WEEK ACID" Schedule (Sections ending with **ODD** number)	Activity	"WEEK BASE" Schedule (Sections ending with **EVEN** number)	Activity
Week 1 Jan. 11-15	**Arrive for regular starting time.** Sign-in & safety training. Safety training is mandatory and a legal requirement.	Bring Class Schedule & Lab Manual	**Arrive 90 min after regular starting time** (*i.e.*, for 10 AM, 4 PM or 8:30 PM). Sign-in & safety training. Safety training is mandatory and a legal requirement.	Bring Class Schedule & Lab Manual
Week 2 Jan. 18-22	**Arrive for regular starting time.** Experiment 1: Introduction to Laboratory Equipment	**Pre-lab quiz on Safety & Exp't 1**	**Arrive 90 min after regular starting time.** Experiment 1: Introduction to Laboratory Equipment	**Pre-lab quiz on Safety & Exp't 1**
Week 3 Jan. 25-29	**Arrive for regular starting time.** Experiment 2: Chemical Reactions in Aqueous Solution	**Pre-lab Quiz on Exp't 2**	**Do not go to lab room this week.** *Online Computer Lab: Dry Lab A: Atomic Spectroscopy*	*Dry Lab A Marking Module*
Week 4 Feb. 1-5	**Do not go to lab room this week.** *Online Computer Lab: Dry Lab A: Atomic Spectroscopy*	*Dry Lab A Marking Module*	**Arrive at regular starting time.** Experiment 2: Chemical Reactions in Aqueous Solution	**Pre-lab Quiz on Exp't 2**
Atomic Spectroscopy Marking Module DEADLINE: Sunday, February 7, 11:55 PM				
Semester Test Wednesday Feb 10, 2016 ⇓ ROZH 104 5:45-6:45 pm				
Week 5 Feb. 8-12	**Arrive for regular starting time.** Experiment 3: Standardization of Sodium Hydroxide	**Pre-lab Quiz on Exp't 3**	**Do not go to lab room this week.** *Online Computer Lab: Dry Lab B: Volumetric Analysis*	*Dry Lab B Marking Module*
Feb. 15-19 READING WEEK No classes or labs				
Week 6 Feb. 22-26	**Do not go to lab room this week.** *Online Computer Lab: Dry Lab B: Volumetric Analysis*	*Dry Lab B Marking Module*	**Arrive at regular starting time.** Experiment 3: Standardization of Sodium Hydroxide	**Pre-lab Quiz on Exp't 3**
Volumetric Analysis Marking Module DEADLINE: Sunday, Feb. 28, 11:55 PM				
Week 7 Feb. 29- Mar. 4	**Arrive at regular starting time.** Experiment 4: Synthesis of Aspirin **Online report due 11:55 PM NEXT day**	**Pre-lab Quiz on Exp't 4**	**Do not go to lab room this week.** *Online Dry Lab C: Gaseous Equilibria*	*Dry Lab C Marking Module*
Week 8 Mar. 7 - 11	**Arrive for regular starting time.** Midterm Prep – Problems Lab Attendance will be taken.	Attempt problems (posted on CourseLink) ***prior*** to lab.	**Arrive 90 min after regular starting time.** Midterm Prep – Problems Lab Attendance will be taken.	Attempt problems (posted on CourseLink) ***prior*** to lab.
Midterm Fri Mar. 11, 2016 ROZH 104 6:30 to 8:30 pm				
Week 9 Mar. 14-18	**Do not go to lab room this week.** *Online Dry Lab C: Gaseous Equilibria*	*Dry Lab C Marking Module*	**Arrive at regular starting time.** **Experiment 5:** Buffers, Titration Curves and Indicators	**Pre-lab Quiz on Exp't 5**
	For any valid Expt. 1, 2 & 3 lab absence(s), apply online to submit your excuse by the end of this week.			
Gaseous Equilibria Marking Module DEADLINE: Sunday, March 20, 11:55 PM				
Week 10 Mar. 21-24	**Arrive at regular starting time.** Experiment 5: Buffers, Titration Curves and Indicators	**Pre-lab Quiz on Exp't 5**	**Do not go to lab room this week.** *Online Dry Lab D: Aspects of Organic Chemistry*	*Dry Lab D Marking Module*
Week 11 Mar. 28- Apr. 1.	**Do not go to lab room this week.** *Online Dry Lab D: Aspects of Organic Chemistry*	*Dry Lab D Marking Module*	**Arrive at regular starting time.** Experiment 4: Synthesis of Aspirin **Online report due 11:55 PM NEXT day.**	**Pre-lab Quiz on Exp't 4**
Organic Chemistry Marking Module DEADLINE: Sunday, April 3, 11:55 PM				
Week 12 Apr. 4 – 8	**Arrive at regular starting time.** Clean-up & Final Exam Problems Lab Attendance will be taken.	Attempt problems (posted on CourseLink) ***prior*** to lab.	**Arrive 90 min after regular starting time.** Clean-up & Final Exam Problems Lab Attendance will be taken.	Attempt problems (posted on CourseLink) ***prior*** to lab.
	Any remaining lab excuses must be submitted online by **Friday Apr. 8**, else a grade of zero is assigned.			

3. EVALUATION

(a) The final course grade will be calculated based on the scheme that produces the highest grade:

Course Components	*Scheme #1:*	*Scheme #2:*
Optional Online Homework (Sapling Learning)	10%	0%
Online "Wet" Pre-lab Quizzes (CourseLink)	3%	3%
Online "Dry" Lab Work (CourseLink)	10%	10%
"Wet" Lab Reports (General Lab Marker System)	12%	12%
Semester Test (Wednesday, Feb. 10)	11%	13%
Midterm (Friday March 11)	22%	26%
Final Examination (Apr. 15, 2016)	32%	36%

The final exam will be cumulative. NOTE: If your final exam grade (as a %) exceeds one or both of your semester test or midterm, that final exam grade (as a %) will be substituted for the lower of your two in-semester assessments.

(b) **Optional Online Homework** (*www.saplinglearning.ca*)
Chemistry is not a subject that can be easily learned by simply reading a book. To consolidate your understanding, one must work with and use the concepts discussed in the course on a regular basis. Interactive homework is a way to keep up with the course and test your understanding. If you choose to complete the online assignments, your midterm and final exam weights are reduced (see Scheme #1 above). Access is purchased either online or through the campus bookstores. Sapling Learning provides a grace period on payment up to Jan. 25th, so one can try the system prior to paying for access. If an assignment is not attempted, a grade of zero will be assigned. Assignments are **due 11:55 PM on Wednesdays**, starting Jan. 20. There are 11 assignments and the worst score will be dropped prior to calculating your final homework grade.

(c) **Practice Online Quizzes** – not for credit (*courselink.uoguelph.ca → Content → Week #*)
A Self-Assessment Quiz is available until Jan. 24, 11:30 PM and can only be accessed once (see "*Week 0*"). Find out what you know! Also located under the other weeks within the Content tab, you will find topic specific practice quizzes, which you can attempt as many times as you wish.

(d) **Online "Dry" Laboratory Work** (*courselink.uoguelph.ca – see "Content" → "Week #"*)
Each online lab consists of 2 parts: the *experiment* and the *marking module*. Both are delivered through the course website. Background info and worksheets are provided in the CHEM*1040 Laboratory Manual. 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 calculations, **only then** open the marking module to evaluate your work. You have only one attempt and 60 minutes to enter your answers. If a marking module is not attempted, a grade of zero is assigned. The Lab Schedule includes suggested dates and deadlines for these activities.

1. *Dry Lab A: Atomic Spectroscopy* – explore energy levels in atoms & "fireworks" colours. Results submitted through Marking Module by **Sunday, February 7, 11:55 PM**, else a zero grade is assigned.
2. *Dry Lab B: Volumetric Analysis* – test your understanding of stoichiometric concepts and analyses skills. Marking Module due before **Sunday, Feb. 29, 11:55 PM**, else a zero is assigned.
3. *Dry Lab C: Gaseous Equilibria* – study factors that influence chemical equilibria.
   Marking Module due before **Sunday, March 13, 11:55 PM**, else a grade of zero is assigned.
4. *Dry Lab D: Aspects of Organic Chemistry* – investigate the molecular structure of organic molecules. Marking Module due before **Sunday, April 3, 11:55 PM**, else a grade of zero is assigned.

NOTE: Results are made available for review only after the class deadline and for two weeks.

(e) **Midterm Assessments** There will be two examinations during the term. The Semester Test will be one hour in duration and will cover the first two chapters, lectures 1-9 and the corresponding text material. This test will be made up of multiple choice questions. The Midterm will cover lectures 1-16 and the corresponding text material and will have a duration of 2 hours. The Midterm will consist of multiple choice, short answer questions and problems.

Semester Test Conflict: If you have a legitimate conflict, you may request to write the alternate semester test on Tues. Feb. 9 from 6:00 – 7:00 PM. Apply on-line at *www.chemistry.uoguelph.ca/alternateexam* by Feb 3/16. Return to the site to check the status of your request. A similar opportunity will be available for any Midterm conflicts (Mar. 11/16) and will be introduced later in the course.

(f) Final Examination: Friday, April 15, 08:30 AM - 10:30 AM, location(s) TBA
For room assignments, refer to *www.uoguelph.ca/registrar/scheduling/index.cfm?exam_fall* prior to the final exam period. The final examination evaluates the entire course.

All examinations will be closed book. Notes, printed material of any kind, any communication with other students or any other aids are <u>not</u> permitted. Computers or calculators capable of storing text information or formulas are not permitted.

4. POLICY ON MISSED WORK

a) **Missed Term Assessment:**
If you do not write the semester text and/or exam, documentation must be e-mailed or given to your Instructor. Doctor's notes are always acceptable, should be sought, but not required. If a valid excuse is received, the percentage value of the midterm will be added to the percentage value of the final exam. Otherwise, a grade of zero will be assigned. **No make-up semester text or exam will be given.**

b) **Missed Final Examination:**
If you miss a final exam, contact your Program Counsellor as soon as possible (for the list of Program Counsellors see *www.uoguelph.ca/uaic/programcounsellors*). Official documentation is required within ***five working days*** of the missed examination/course work deadline. Consult the Undergraduate Calendar (Section VIII, under Academic Consideration).

c) **Other Missed Work** (with the exception of missed "wet" labs – see section 2 d)
Contact Prof. Schwan using your U of G e-mail account, with your name and student ID#. If a valid excuse is received, your work will be re-evaluated. Otherwise, a grade of zero is assigned. See the Undergraduate Calendar for information on regulations and procedures for Academic Consideration: *www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml*

5. COURSE RESOURCES

(a) **CHEM*1040 Website -** access through portal ***http://www.uoguelph.ca/courselink/***
Your **Username** is your Central Login ID (that part of your University of Guelph e-mail address before the "@" sign). Your **password** is your Central Login Account Password. The course website provides a wealth of resources *(i.e.*, e-lectures, animations, and sample midterms, *etc*.), practice quizzes and a discussion board to post your course questions. Weekly announcements are posted under "*News*". It is your responsibility to check this site on a regular basis.

(b) **Schwan office hours including 2 hours in Science Commons** (LIB 360)
See office hours posted near the top of this document.

(c) **Chemistry Learning Centre** (3rd Floor Library – Science Commons – LIB 360)
Chemistry Graduate Teaching Assistants (TAs) are available to answer questions and assist you with the lecture and laboratory material. Hours are posted on the course website under "*News*".

(d) **Supported Learning Groups** (SLGs) – *www.lib.uoguelph.ca/get-assistance/studying/slgs*

SLGs are regularly scheduled small group study sessions. Attendance is voluntary and open to all students enrolled in the course. SLGs are facilitated by successful students who have recently completed the course. SLG leaders attend all lectures and work with faculty and 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 preparation. Session time(s), location(s) and further information are available on the SLG website.

For this course offering your SLG leaders will be
Kaleigh Johnson-Cover kjohns26@mail.uoguelph.ca
Brittany King bking03@mail.uoguelph.ca

(e) **Mastering Chemistry** Pearson, a different publisher from Sapling and from your Ebbings and Gammon text has requested that I make available to you several self-study modules/quizzes related to the content of CHEM*1040 and I have agreed to their request. This study opportunity is available to you free of charge, for you to use as an additional study resource at your own leisure. The link for access and instruction are at "*Content – Logistics and Accesses - Mastering Chemistry Additional Homework*". Please if you end up being a frequent user of this service, please provide me with some comments, as the Department would like to know the strengths and weaknesses of this homework sources.

6. ANTICIPATED LECTURE SCHEDULE

Review the appropriate sections in the text **before** lectures. Topics marked with an asterisk (*) are not covered in class but can be examined.

Anticipated Lecture Content	Approx. Dates	Topics	*Online CourseLink Resources	Text Reference
Lecture 0	--	Measurement Significant figures Atoms, molecules & ions	Self-Assessment Quiz (Content tab – Week 0) Stoichiometry e-lectures (Resources tab): *Review topics 1-3 and 7	*Review: Ch 1, 1.4 – 1.8 Ch 2, 2.3 – 2.10
Lectures 1-5	Jan. 12-26	Atomic structure Periodic trends Lewis structures VSEPR & bonding Hybridization	Review Course outline Periodic Tables (Resources) VSEPR tutorial (Resources) Questions of the Week (Resources) Atomic & Molecular Structure Practice Quiz (Content – Week 1 & 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
Lectures 6-9	Jan. 28-Feb. 9	The Mole, Stoichiometry, Chemical Rxns And Review	Stoichiometry e-lectures: topics 4-6 (Resources) Nomenclature Practice (Resources) Titration & Analysis Problem (Resources) Questions of the Week (Resources) Stoichiometry & Rxns Practice Quiz A & B (Content – Week 3 & 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
Semester Test (Wednesday, Feb. 10): ROZH 104 5:45-6:45 pm				
Lectures 10-16	Feb. 11 - Mar. 10	Equilibrium Acids and bases Salts and buffers Review Period	Equilibrium simulation (Resources) Equilibrium Practice Quiz (Content – Week 5) Acid-Base e-lectures, topics 1-7 (Resources) Acids & Bases Practice Quiz (Content – Week 7) *Salts* e-lectures, topics 1-3 (Resources) *Buffers* e-lectures, topics 1-2 (Resources) Salts & Buffers Practice Quiz (Content – Week 8) Questions of the Week (Resources)	Ch 14, 14.1 – 14.8 Ch 15, 15.1 – 15.8 Ch 16, 16.1 Ch 16, 16.3 – 16.6
Midterm (Friday March 11): ROZH 104 6:30-8:30 pm				
Lectures 17-18	Mar. 15-17	Buffer utility Titration curves	Titration Curves Practice Quiz (Content – Week 9)	Ch 16, 16.6 – 16.7
Lectures 19-24	Mar. 22-Apr. 7	Organic chemistry Intermolecular forces Final exam review	Structural isomer tutorial (Resources) *Organic nomenclature quizzes (Resources) Stereoisomers (Resources) The Macrogalleria (Resources) Organic Chemistry Practice Quiz (Content – Week 10) Questions of the Week (Resources)	Ch 11, 11.5 Ch 23, 23.1 – 23.7 Ch 24, 24.1 Organic Chemistry Notes – all questions
FINAL EXAMINATION: Friday April 15 8:30-10:30 AM				

7. END OF CHAPTER PROBLEMS

There is a good correlation between mastering the concepts within the course on a week-by-week basis and performance in the course as a whole. Problems are assigned to provide reinforcement of the principles covered in lectures, to allow you to practice problem-solving techniques and to check your own knowledge before tests and the 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. Copies are available in the Chemistry Learning Centre and on Course Reserve at the library.

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 are provided under "*Resources*" on the course website as "*Questions of the Week*", which represent the types of questions that may appear on examinations.

Review:

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

Chapter 2: 2.43, 2.51, 2.65, 2.67, 2.75, 2.77, 2.79, 2.83, 2.85, 2.87, 2.91, 2.93, 2.99, 2.101, 2.109, 2.111, 2.119, 2.123, 2.127.

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

Atomic structure, periodic trends, molecular structure and bonding:

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

Chapter 8: 8.16, 8.21, 8.24, 8.39, 8.43, 8.49, 8.61, 8.63, 8.65, 8.81.

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: 10.27, 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:

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, 4.105, 4.107, 4.109, 4.111, 4.115, 4.119, 4.123, 4.127, 4.141, 4.143, 4.151.

Chapter 5: 5.75, 5.77, 5.87, 5.119, 5.137, 5.143.

Chemical Equilibrium, Acids & Bases:

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, 15.28, 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, 15.127.

Acid-Base Equilibria, Buffers, Titrations:

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, 16.59, 16.63, 16.65, 16.101, 16.111, 16.115.

Salts & Buffers: 16.27, 16.29, 16.71, 16.73, 16.75, 16.77, 16.81, 16.83, 16.113, 16.141.

Titration Curves: 16.15, 16.31, 16.85, 16.87, 16.89, 16.93, 16.107, 16.109, 16.119, 16.121, 16.135, 16.143.

Organic Chemistry & Intermolecular Forces:

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.

Chapter 24: 24.29, 24.53, 24.55.

8. 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 learn chemistry.**

For some of you, 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 but 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:

- the 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 a given 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.)
- the SI base units and SI prefixes (from *tera* through to *femto*) and are able to convert between units. (Section 1.6 & 1.8)
- the 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)
- the 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. (Section 2.5)
- the 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)
- and are familiar with the 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)
- the 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)
- the 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)
- the units of pressure used for gas law problems and be able to convert between them. (Section 5.1)
- the concepts and terminology associated with the ideal gas law (PV=nRT) (Sections 5.3–5.4)

- the 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)
- the 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 really 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: *www.uoguelph.ca/numeracy/repository/index.cfm*
- 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 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 within a 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 attach 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.

9. 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 the 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. The resources are here, you just need to go get them."

10. UNIVERSITY POLICIES

a) **E-mail Communication** – As per university regulations, all students are required to check their official University e-mail account (username@mail.uoguelph.ca) regularly. E-mail is the official route of communication between the University and its students.

b) **Accessibility** – The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Centre for Students with Disabilities (soon to be re-named Student Accessibility Services) as soon as possible. For more information, contact CSD at 519-824-4120 ext. 56208, or e-mail csd@uoguelph.ca or refer to the website *www.csd.uoguelph.ca/csd/*

c) **Academic Misconduct Policy** –The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. Note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor. The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

d) **Recording of Materials** – Presentations which are made in relation to course work – including lectures – cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

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

i. **Drop Date**: The last date to drop one-semester courses, without academic penalty, is **Friday, Mar. 11/16**. For regulations and procedures for dropping courses, refer to the Undergraduate Calendar:
www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml