Winter 2017 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: R. de Laat (SSC 2506)
EMAIL: rdelaat@uoguelph.ca
Lectures: Tues, Thur 04:00PM - 05:20PM ROZH 104
Laboratory: Times and locations are listed on WebAdvisor (*http://webadvisor.uoguelph.ca/*).

1. COURSE MATERIALS

(a) **Textbook:** D. Ebbing and S. Gammon, General Chemistry. Students can use the 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) **CHEM*1040 Laboratory Manual & Organic Chemistry Notes** can only be purchased from the Chemistry Department. Mon, Jan. 9 to Fri. Jan. 13 9:30 AM to 3:30 PM in SSC 2106.

(c) **Safety Goggles** (not safety glasses) and a **Lab coat** are **required**.
Goggles can be purchased from the Chem. Department or 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) **Organic/Inorganic Molecular Model Kit** will assist in visualising molecular shapes, organic chemistry structures and Dry Lab D exercises. A kit can be purchased from one of the bookstores.

(f) **MasteringChemistry** (optional) – to complete the optional online homework assignments one must purchase access to a MasteringChemistry account. There is a grace period on payment of two weeks, so one can explore the site prior to paying. A 36-month access card can be purchased through one of the campus bookstores or you can purchase access online through the MasteringChemistry site with either a credit card or PayPal account. To set-up an account, follow the registration instructions provided on CourseLink under Content >> Main Course Resources>>Mastering Chemistry.

2. "WET" LABORATORY – Begins the week of Monday, Jan. 9! Bring your lab manual.

The laboratory is a required component of CHEM*1040. A schedule is provided on page 3. Students attend their labs according to their lab section number. For example, CHEM*1040*0125 has the section number 0125, where the last two numbers represent the lab section . If your lab section ends with an **odd** number (*i.e.*, 1, 3, 5, 7 or 9), you follow the "**Week Acid Schedule**". If it ends in an even number (*i.e.*, 2, 4, 6, 8 or 0), you follow the "Week Base Schedule".

(a) **Mandatory First Lab Meetings – Monday, January 9 to Friday, January 13.**

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. 01, 2017 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) **Mandatory Online Lab Safety Course**: You must complete the CourseLink course entitled "*Student Science Safety*" with a grade of 90% or better before you can undertake any labs. It takes 2-3 hours to complete. You have unlimited attempts to obtain the passing grade. Upon successful completion, you receive an electronic badge that you will need to show your T.A. (print or electronic form), as proof of completion, prior to being allowed to participate in Experiment #1.

(c) **Online "Wet" Pre-lab Quizzes – CHEM*1040 CourseLink site**

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 Lab Schedule**. To prepare for these quizzes, review the material in your lab manual. You have two attempts at each quiz. If a quiz is not attempted, a grade of zero is assigned. To access, go to *Quizzes* on the Main CourseLink page. NOTE: Each quiz is available for review after the deadline and for a two week period.

Everyone has the same due date for the Pre-Lab Quizzes. The experiments will be discussed in class after the pre-lab quiz is due:

Pre-lab Quiz#1 (Safety & Expt#1)	due	Jan 12, 2017 3:00 PM
Pre-lab Quiz#2 (Expt#2)	due	Jan 19, 2017 3:00 PM
Pre-lab Quiz#3 (Expt#3)	due	Feb 2, 2017 3:00 PM
Pre-lab Quiz#4 (Expt#4)	due	Feb 16, 2017 3:00 PM
Pre-lab Quiz#5 (Expt#5)	due	Mar 9, 2017 3:00 PM

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

Lab reports are submitted through Chemistry's online General Lab Marker System (ULAB). 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 (If your lab was Monday your report is due the next Monday by 11:55 PM unless indicated otherwise on the lab schedule). Marks are deducted for lateness. Further info and the link to the site are provided on CourseLink, under *Content >> Lab Resources*. Additional information can be found in the Introduction section of your lab manual.

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

DEADLINE: TUESDAY, JANUARY 10 → *www.chemistry.uoguelph.ca/labexemption*

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'15, W'16 or F'16).

NOTE: Students granted a "wet" lab exemption **must** still complete the online "dry" labs.

Winter 2017 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. 9 - 13	**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. 16 - 20	**Arrive for regular starting time.** **Experiment 1:** Introduction to Laboratory Equipment **Report due in 1 week by 11:55 PM**	**Pre-lab quiz on Safety & Exp't 1**	**Arrive 90 min after regular starting time.** **Experiment 1:** Introduction to Laboratory Equipment **Report due in 1 week by 11:55 PM**	**Pre-lab quiz on Safety & Exp't 1**
Week 3 Jan. 23 - 27	**Arrive for regular starting time.** **Experiment 2:** Chemical Reactions in Aqueous Solution **Report due in 1 week by 11:55 PM**	**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 Jan. 30 – Feb. 3	**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 **Report due in 1 week by 11:55 PM**	**Pre-lab Quiz on Exp't 2**
Atomic Spectroscopy Marking Module DEADLINE: Sunday, Feb. 5 , 11:55 PM				
Week 5 Feb. 6 - 10	**Arrive for regular starting time.** **Experiment 3:** Standardization of Sodium Hydroxide **Report due in 1 week by 11:55 PM**	**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*
Week 6 Feb. 13 - 17	**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 **Report due in 1 week by 11:55 PM**	**Pre-lab Quiz on Exp't 3**
Winter Break Feb. 20 – 24 – No Classes – No Labs				
Volumetric Analysis Marking Module DEADLINE: Sunday, Feb. 26 , 11:55 PM				
Week 7 Feb. 27 – Mar. 3	**Arrive at regular starting time.** **Experiment 4:** Synthesis of Aspirin **Report due in next day by 11:55 PM**	**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. 6 - 10	**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 4:** Synthesis of Aspirin **Report due in next day by 11:55 PM**	**Pre-lab Quiz on Exp't 4**
Gaseous Equilibria Marking Module DEADLINE: Sunday, Mar. 12 , 11:55 PM				
Week 9 Mar. 13 -17	**Arrive at regular starting time.** **Experiment 5:** Buffers, Titration Curves and Indicators **Report due in 3 days by 11:55 PM**	**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*
	For any valid Expt. 1, 2 & 3 lab absence(s), apply online to submit your excuse by the end of this week.			
Week 10 Mar. 20 -24	**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 5:** Buffers, Titration Curves and Indicators **Report due in 3 days by 11:55 PM**	**Pre-lab Quiz on Exp't 5**
Organic Chemistry Marking Module DEADLINE: Sunday, Mar. 26, 11:55 PM				
Week 11 Mar. 27 - 31	**Arrive at regular starting time.** Clean-up **Attendance will be taken.**		**Arrive 90 min after regular starting time.** Clean-up **Attendance will be taken.**	
Any remaining lab excuses must be submitted online by **Friday Mar 31 at 5 PM**, else a grade of zero is assigned.				
Week 12 Feb. 3 - 7	No CHEM*1040 Labs this Week			

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 (MasteringChemistry)	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%
Midterm Examination (Tues. Feb. 14th in class)	28%	33%
Final Examination (Mon. Apr. 10th 7 – 9 PM)	37%	42%

Note: A final course grade of 50% is required to pass the course and receive credit.

(b) Optional Online Homework (MasteringChemistry)

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 a way to keep up and test your understanding. If you choose to complete the online homework, your exam weights will be reduced (see Scheme #1 above). Following the instructions provided on CourseLink under Content >> Mastering Chemistry to set-up an account. If you had a MasteringChemistry account from Fall 2016 sign on using your login and password from Fall 2016 – DO NOT create a new account. You MUST complete the "Introduction to MasteringChemistry" assignment to learn how to use the Mastering Chemistry system. There are no grades for the Introduction to MasteringChemsitry assignment. There are 11 assignments for grades. Each is comprised of two equally weighted parts: a Parent Quiz and an Adaptive Follow-up that is generated after completing the quiz. Your worst assignment score will be dropped prior to calculating your final homework grade. Quizzes are due **Fridays by 11:55 PM, starting Jan. 20**, and adaptive follow-ups are due **the following Tuesday**. If an assignment is not attempted, a grade of zero will be assigned. If you need assistance, e-mail *mstrngspprt@gmail.com*

(c) **Practice Online Quizzes** – not for credit (*CourseLink: Quizzes*)

A *Self-Assessment Quiz* is available until Jan. 13, 11:55 PM and can only be accessed once. Find out what you know! Topic specific practice quizzes are posted under particular weeks, which you can attempt multiple times, to test your knowledge throughout the semester.

(d) **Online "Dry" Laboratory Experiments** (*CourseLink: Content >> Lab Resources)*
Online "Dry" Marking Modules (*CourseLink: Quizzes)*

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 your 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 <u>all</u> calculations, **<u>only then</u>** 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 to complete these labs and the deadlines for the marking modules.

1. *Dry Lab A: Atomic Spectroscopy* – explore energy levels in atoms & "fireworks" colours. Results submitted through Marking Module by **Sunday, Feb. 5, 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 **Sun., Feb. 26, 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, Mar. 12, 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 **Sun., Mar. 26, 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.

(f) **Midterm Examination**: Tues. Feb. 14th in class

This multiple choice exam includes material up to and including week five lectures, corresponding text references and laboratories. Sample midterms can be found on CourseLink, under "A+ *Resources*".

Final Examination: Mon. Apr. 10th 7 – 9 PM
This multiple choice exam evaluates the entire course.

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

4. POLICY ON MISSED WORK

a) **Missed Midterm Examination:**
If you do not write the midterm, documentation must be e-mailed or given to your Instructor. Doctor's notes are always acceptable, 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 midterm examination 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. Consult the Undergraduate Calendar: *https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml*

c) **Other Missed Work** (with the exception of missed "wet" labs – see section 2 d)
Contact R. de Laat via your University of Guelph e-mail account, including your full 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: *https://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 the part of your University of Guelph 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 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) **Your Instructor**
Your instructor will be available at certain times for consultation and assistance. Office hours will be arranged at the first class meeting and posted on CourseLink.

(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.

6. LECTURE SCHEDULE

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

Week	Dates	Topics	*Online CourseLink Resources	Text Reference
Week 0		Measurement Significant figures Atoms, molecules & ions	Self-Assessment Quiz Stoichiometry Video Lessons	*Review: Ch 1, 1.4 – 1.8 Ch 2, 2.3 – 2.10
Week 1–2	Jan. 9 to Jan. 20	Atomic structure Periodic trends Lewis structures VSEPR & bonding	Periodic Tables VSEPR tutorial Questions of the Week Atomic & Molecular Structure Practice Quiz	*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	Jan. 23 To Feb. 3	The Mole Stoichiometry & Chemical Rxns	Stoichiometry Video Lessons Nomenclature Practice Titration & Analysis Problem Questions of the Week Stoichiometry & Rxns Practice Quiz A & B	*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
Week 5	Feb. 6 to Feb. 10	Equilibrium	Equilibrium Practice Quiz	Ch 14, 14.1 – 14.8
MIDTERM EXAMINATION: Tues. Feb. 14th in class				
Week 6–9	Feb. 13 to Mar. 17	Acids and bases Salts and buffers Titration curves	Acid-Base Video Lessons Acids & Bases Practice Quiz *Salts* Video Lessons *Buffers* Video Lessons Salts & Buffers Practice Quiz Titration Curves Practice Quiz) Questions of the Week	Ch 15, 15.1 – 15.8 Ch 16, 16.1 Ch 16, 16.3 – 16.7
Week 10–12	Mar. 20 to Apr. 7	Organic chemistry Intermolecular forces Final exam review	Structural isomer tutorial *Organic nomenclature quizzes Stereoisomers The Macrogalleria Organic Chemistry Practice Quiz Questions of the Week	Ch 11, 11.5 Ch 23, 23.1 – 23.7 Ch 24, 24.1 Organic Chemistry Notes – all questions
FINAL EXAMINATION: Mon. Apr. 10th 7 – 9 PM				

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 the midterm 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. 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 (Weeks 1 – 2):

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

Chapter 8: 8.16, 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 (Weeks 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, 4.105, 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 (Weeks 5 – 6)

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 (Weeks 7 – 9)

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: (Weeks 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.

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, 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 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 <mail.uoguelph.ca> e-mail account 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 ***Student Accessibility Services*** as soon as possible. For more information, contact SAS 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 – faculty, staff, and students - 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. 10**. For regulations and procedures for dropping courses, see 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*