

Fall 2013 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

Course Co-ordinator: L. Jones (MACN 331 (West Wing); lojones@uoguelph.ca)

Instructors:

Lecture Section 01: ROZH 104 MWF 16:30 – 17:20 J. Prokipcak (SCIE 2506)
Section 02: WMEM 001 TTh 13:00 – 14:20 A. Houmam (MACN 123)
Section 03: ROZH 104 TTh 13:00 – 14:20 A. Schwan (MACN 336)
Section 04: WMEM 001 MWF 11:30 – 12:20 J. Prokipcak (SCIE 2506)
Section R5: RDC 110 MWTh 11:00 – 11:50 I. O'Halloran (Ridgetown)
Laboratory: Times and locations listed on WebAdvisor

1. COURSE MATERIALS

- (a) **Textbook:** D. Ebbing and S. Gammon, General Chemistry. Students can use the 10th, 9th or 8th ed. for CHEM*1040 (and CHEM*1050 next semester). The publisher provides a 10th ed. paperback (hybrid) textbook or e-book package that includes access to the OWL online homework system. This package can be purchased from one of the campus bookstores or online at *nelsonbrain.com*.
Note: 10th edition copies of text and solutions manual is on Library Course Reserve.
- (b) **CHEM*1040 Organic Chemistry Notes, Laboratory Manual and safety goggles** (not safety glasses) are purchased only from the Chemistry Department in SCIE 2101 Sept. 5, 6, 9, 10 & 11, 9:30 – 15:30.
- (c) **Lab coats** are required. They can be purchased from the Chemistry & Biochemistry Club in SCIE 2111 (\$18 cash sales only; Sept. 5, 9-5; Sept 6 10-5) or from the University Bookstore.
- (d) **Scientific calculator** with ln, e^x, log₁₀ and 10^x functions. Note: Calculators or notebook computers capable of storing text information are **NOT** allowed in examinations.
- (e) **Indigo Instruments Molecular Model Kit** is available from one of 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 one needs to purchase access to either OWL or Sapling Learning. For those who decide not to purchase the 10th ed. textbook package w/ OWL access, the alternative is a Sapling Learning account. One (\$24.99 USD) or two semesters access can be purchased online (credit card, pre-paid credit card or Paypal account) at *www.saplinglearning.ca*. The campus bookstores also carry one semester access cards for purchase. CHEM*1050 will also offer optional online homework through OWL or Sapling Learning in Winter 2014.

2. “WET” LABORATORY – Begins Monday, September 9! Bring your lab manual.

The laboratory is an integral part of CHEM*1040 and a schedule is provided on the next page. Students attend their chemistry laboratories according to their lab section number. Your course section number describes the lecture and lab section in which you are registered. The first two numbers represent the lecture while the last two are the lab section (*e.g.*, 0125 = lecture section 01 and lab section 25). If your lab section is an odd number (*e.g.*, 0243 = lab section 43), then you follow the “Week Acid Schedule”. If your lab section is even (*e.g.*, 0358 = lab section 58), then you follow the “Week Base Schedule”.

(a) **Mandatory First Lab Meeting**

You must attend the first lab to receive mandatory safety training, which is required by law. This safety lab is a pre-requisite for all subsequent labs. As proof of your registration in a particular lab section, you must bring a computer print-out dated **Sept. 01, 2013 or later** of “My Class Schedule” from WebAdvisor to your first lab meeting.

(b) **Mandatory online WHMIS training module - CourseLink**

Information will be provided at your first lab meeting and on the Wet Lab CourseLink site.

(c) **Pre-laboratory Quizzes – delivered through CHEM*1040 Wet Lab CourseLink site**

Pre-lab quizzes are worth 3% of your final grade. They will usually be based on the “wet” lab activities that you are about to perform – **refer to 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.

(c) **Laboratory Reports – submitted electronically this semester!**

You will be using a new electronic system for lab reports 1, 2, 3 & 5. (The report for Exp’t#4 is handed in at the end of the lab period.) You will collect your data and submit a copy to your TA before leaving the lab. You will then complete your lab report online – further information provided on CHEM*1040 Wet Labs CourseLink site, under “Content”. Lab reports are normally due 1 week after your lab and before the start of your normal lab period (*e.g.*, Mon. 2:30 – 5:20 pm = deadline of 2:30 pm following week).

(d) **Missed Laboratory**

Refer to the “*Purple Page for Lab Absences in First-Year Chemistry*” handout, posted on the CHEM*1040 course and the Wet Lab CourseLink websites under “Content”.

(e) **Thanksgiving Week**

All students will attend the Problems Lab this week to prepare for the midterm. Students registered in a Monday lab can choose any lab time to attend during this week. Refer to WebAdvisor for possible times and locations to attend. The Problems Lab questions are posted on the course website under Content. Answers are provided only within the scheduled labs.

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

DEADLINE: TUESDAY, SEPTEMBER 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.*, W’12, F’12 or W’13).

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 Week 6.

(g) **CHEM*1040 Wet Lab CourseLink Website** – delivers pre-lab quizzes (see “Content” tab), provides lab information and is where your final laboratory grades are posted.

FALL 2013 CHEM*1040 LABORATORY SCHEDULE

DATE	"WEEK ACID" Schedule (ODD lab section numbers)		"WEEK BASE" Schedule (EVEN lab section numbers)	
Sept. 9 – 13	Arrive at regular starting time. Check-in & safety training. Bring printout of "My Class Schedule & your lab manual. Note: Safety training is mandatory and a legal requirement.	No Quiz	Arrive 90 min after regular starting time. Check-in & safety training. Bring printout of "My Class Schedule & lab manual. Note: Safety training is mandatory and a legal requirement.	No Quiz
Sept. 16 – 20	Arrive at regular starting time. <u>Experiment 1:</u> Introduction to Laboratory Equipment	Pre-lab quiz on Safety & Exp't 1	Arrive 90 min after regular starting time. <u>Experiment 1:</u> Introduction to Laboratory Equipment	Pre-lab quiz on Safety & Exp't 1
Sept. 23 – 27	Arrive at regular starting time. <u>Experiment 2:</u> Chemical Reactions in Aqueous Solution	Pre-lab Quiz on Exp't 2	Do not go to lab room this week. <i>Online Computer Lab:</i> <i>Dry Lab A: Atomic Spectroscopy</i>	Marking Module
Sept. 30 – Oct. 4	Do not go to lab room this week. <i>Online Computer Lab:</i> <i>Dry Lab A: Atomic Spectroscopy</i>	Marking Module	Arrive at regular starting time. <u>Experiment 2:</u> Chemical Reactions in Aqueous Solution	Pre-lab Quiz on Exp't 2
Atomic Spectroscopy Marking Module Deadline: Sunday, October 6, 11:55 PM				
Oct. 7 – 11	Arrive at regular starting time. <u>Experiment 3:</u> Standardization of Sodium Hydroxide	Pre-lab Quiz on Exp't 3	Do not go to lab room this week. <i>Online Computer Lab:</i> <i>Dry Lab B: Volumetric Analysis</i>	Marking Module
Oct. 15 – 18 (No classes Oct. 14)	Arrive at regular starting time. Midterm Prep - Problems Lab (Monday and exempt students may attend any lab this week.)	No Quiz	Arrive 90 min after regular starting time. Midterm Prep - Problems Lab (Monday and exempt students may attend any lab this week.)	No Quiz
Oct. 21 – 25	Do not go to lab room this week. <i>Online Computer Lab:</i> <i>Dry Lab B: Volumetric Analysis</i>	Marking Module	Arrive at regular starting time. <u>Experiment 3:</u> Standardization of Sodium Hydroxide	Pre-lab Quiz on Exp't 3
Volumetric Analysis Marking Module Deadline: Sunday, October 27, 11:55 PM				
Oct. 28 – Nov. 1	Arrive at regular starting time. <u>Experiment 4:</u> Synthesis of Aspirin Hand in report at end of the lab.	Pre-lab Quiz on Exp't 4	Do not go to lab room this week. <i>Online Dry Lab C:</i> <i>Gaseous Equilibria</i>	Marking Module
Nov. 4 – 8	Do not go to lab room this week. <i>Online Dry Lab C:</i> <i>Gaseous Equilibria</i>	Marking Module	Arrive at regular starting time. <u>Experiment 5:</u> Buffers, Titration Curves and Indicators	Pre-lab Quiz on Exp't 5
Documentation is due to your TA this week for any Expt. 1, 2 & 3 lab absences.				
Gaseous Equilibria Marking Module Deadline: Sunday, November 10, 11:55 PM				
Nov. 11 – 15	Arrive at regular starting time. <u>Experiment 5:</u> Buffers, Titration Curves and Indicators	Pre-lab Quiz on Exp't 5	Do not go to lab room this week. <i>Online Dry Lab D:</i> <i>Aspects of Organic Chemistry</i>	Marking Module
Nov. 18 – 22	Do not go to lab room this week. <i>Online Dry Lab D:</i> <i>Aspects of Organic Chemistry</i>	Marking Module	Arrive at regular starting time. <u>Experiment 4:</u> Synthesis of Aspirin Hand in report at end of the lab.	Pre-lab Quiz on Exp't 4
Organic Chemistry Marking Module Deadline: Sunday, November 24, 11:55 PM				
Nov. 25 – 27 (No labs Nov. 28 & 29)	Arrive at regular starting time. Clean-up and check out. (Thurs. & Fri. students have no lab period this week.)	No Quiz	Arrive 90 min after regular starting time. Clean-up and check out. (Thurs. & Fri. students have no lab period this week.)	No Quiz
This week any remaining documentation for lab absences must be submitted else a grade of zero is assigned.				

3. EVALUATION

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

	Scheme #1:	Scheme #2:	Scheme #3:	Scheme #4:
Optional Online Homework (OWL or Sapling)	10%	10%	0%	0%
Optional Research Study Participation	2%	0%	2%	0%
Online “Wet” Pre-lab Quizzes (Courselink)	3%	3%	3%	3%
Online “Dry” Lab Work (Courselink)	7%	7%	7%	7%
“Wet” Lab Reports	12%	12%	12%	12%
Midterm Examination	27%	28%	32%	33%
Final Examination	39%	40%	44%	45%

- (b) **Optional Online Homework** (OWL or Sapling Learning)

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 will be reduced (Schemes #1 & #2 above). Access is purchased either online or through the bookstores. W'14 CHEM*1050 will also be offering the choice of OWL or Sapling. If an assignment is not attempted, a grade of zero will be assigned. Assignments are due 11:55 pm on Wednesdays, starting Sept. 18. There are 11 assignments and your worst score will be dropped prior to calculating your final homework grade.

- (c) **Optional Research Study Participation** (*courselink.uoguelph.ca – course site*)

You are invited to participate in a research study, involving two surveys and a learning task, to examine how conceptual learning approaches and beliefs/attitudes about chemistry predict chemistry performance. Further details will be provided in class and posted on course website under “Content”.

- (d) **Practice Online Quizzes** – not for credit (*courselink.uoguelph.ca*)

A Self-Assessment Quiz is available until Sept. 15, 23:55 and can only be accessed once. Find out what you know! There are practice quizzes provided on the course site to help you prepare for the midterm and final examination. The practice quizzes can be attempted as many times as you wish.

- (e) **Online “Dry” Laboratory Work** (*courselink.uoguelph.ca*)

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 grade your work. You can grade your work only once and have 60 min. to enter your answers. If a marking module is not attempted, a grade of zero is assigned. The Lab Schedule includes dates/deadlines for these activities.

1. *Dry Lab A: Atomic Spectroscopy* – explore energy levels in atoms and “fireworks” colours. To be completed Sept. 23 – Oct.4. Final results must be submitted through the Atomic Spectroscopy Marking Module before **Sun., Oct. 6, 11:55 p.m.**, else a grade of zero is assigned.
2. *Dry Lab B: Volumetric Analysis* – test your understanding of stoichiometric concepts and analyses skills. To be completed Oct. 7 – 25. Final results due before **Sun., Oct. 27, 11:55 p.m.**
3. *Dry Lab C: Gaseous Equilibria* – study factors that influence chemical equilibria. To be completed Oct. 28 – Nov. 8. Final results due before **Sun., Nov. 10, 11:55 p.m.**
4. *Dry Lab D: Aspects of Organic Chemistry* – investigate the molecular structure of organic molecules. To be completed Nov. 11 – 22. Final results due before **Sun., Nov. 24, 11:55 p.m.**

- (f) **Midterm Examination: Saturday, October 19, 13:00 – 14:30**

Room assignments will be posted on the course website prior to the midterm. This examination includes material up to and including week six lectures, corresponding text references and laboratories. The examination will consist of multiple choice, short answer questions and problems. Sample midterms are posted on the course website, under “Resources” for your reference.

Midterm Conflict: If you have a legitimate conflict, you may request to write the alternate midterm on Thursday, October 17, 5:30 – 7:00 p.m. Apply by Friday, October 11 on-line at www.chemistry.uoguelph.ca/alternateexam. Return to the site to check the status of your request.

(g) **Final Examination: Wednesday, December 4, 11:30 - 13:30**

For room assignments, refer to www.uoguelph.ca/registrar/scheduling/index.cfm?exam_fall prior to the final exam period. The final examination covers the entire course.

- (h) All examinations will be closed book, with **no** written or printed materials of **any** kind 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 given to your instructor. (Note: 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 (refer to www.uoguelph.ca/uaic/programcounsellors for a list of Program Counsellors). Official documentation is required. Consult the Undergraduate Calendar (Section VIII, under Academic Consideration).

c) **Other Missed Work** (with the exception of missed “wet” labs – see section 2 d)

Either contact the Course Co-ordinator or your instructor. If a valid excuse is received, your work will be re-evaluated. Otherwise, a grade of zero will be assigned. For information on regulations and procedures for Academic Consideration, refer to the Undergraduate Calendar: www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

5. COURSE RESOURCES

(a) **CHEM*1040 Website** - access through the 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), practice quizzes and a discussion board to post your course questions.

(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.

(c) **Chemistry Learning Centre** (3rd Floor Library – Science Commons – LIB 360)

Graduate teaching assistants are available to answer questions and assist you with either the lecture or laboratory material. Hours are posted on the course website under “News”.

(d) **Supported Learning Groups** (SLGs) – www.lib.uoguelph.ca/assistance/supported_learning_groups/

SLGs are regularly scheduled small group study sessions. Attendance is voluntary and open to all students enrolled in the course. The study groups 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

Instructors will cover the same material but may do so in a different order. Thus, it is important that you attend your assigned lecture section. 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 Resources	Text Reference
Week 0	Sept. 5 to Sept. 6	Measurement Significant Figures Atoms, Molecules, Ions & the Mole	Self-Assessment Quiz Stoichiometry e-lectures: *Review topics 1–3 and 7	*Review: Ch 1, 2 & Ch 3, 3.1 – 3.5
Week 1–2	Sept. 9 to Sept. 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	Sept. 23 to Oct. 4	Stoichiometry & Reactions	Stoichiometry e-lectures: topics 4 – 6 Nomenclature Practice Titration & Analysis Problem Questions of the Week Stoichiometry & Rxns Practice Quiz A & B	Ch 3, 3.6 – 3.8 Ch 4, 4.1 – 4.4, 4.7 – 4.10 *Review 5.1 – 5.5
Week 5–6 (no classes Oct. 14)	Oct. 7 to Oct. 18	Equilibrium Acids & Bases Midterm Review	Equilibrium simulation Equilibrium Practice Quiz Acid-Base e-lectures, topics 1 – 3 Questions of the Week	Ch 14, 14.1 – 14.9 Ch 15, 15.1 – 15.3 Ch 15, 15.6 – 15.8
Sat., Oct. 19		MIDTERM EXAMINATION 13:00 – 14:30		
Week 7–9	Oct. 21 to Nov. 8	Acids & Bases Salts Buffers Titration curves	Acid-Base e-lectures, topics 4 – 7 Acids and Bases Practice Quiz <i>Salts</i> e-lectures, topics 1 – 3 <i>Buffers</i> e-lectures, topics 1 – 2 Salts and Buffers Practice Quiz Titration Curves Practice Quiz Questions of the Week	Ch 16, 16.1 Ch 16, 16.3 – 16.7
Week 10–12 (Nov 28 follows a Monday schedule.)	Nov. 11 to Nov. 28	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 – 24.2 Organic Chemistry Notes – all questions
Wed., Dec. 4		FINAL EXAMINATION 11:30 – 13:30		

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 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.

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, 4.135, 4.137, 4.140.

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, 15.51, 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.

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, 24.31, 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: H₂, F₂, Cl₂, Br₂, I₂, N₂, O₂, P₄, S₈. (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 5.3–5.5)

- ◆ 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. For practice, go to 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 7.1–8.7)

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. Understand what ionization energy, electron affinity and electronegativity is, and how these parameters change as a function of position in the Periodic Table. (Section 8.6)

Lewis structures, VSEPR & bonding (Sections 9.2–9 & 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. Understand the concept of resonance. (Section 9.7)
3. Understand how the concept of formal charge 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 associated with 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. Understand how the concepts of limiting reagent (or reactant), theoretical yield, actual yield and percentage yield interrelate. 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.
4. Be able to apply the solubility rules in Table 4.1. (Sections 4.2–4.3)
5. Understand the difference between molecular and net ionic equations. Be able to write either. (Section 4.2)
6. Write neutralization reactions. (Section 4.3)
7. Understand the logic behind both gravimetric and volumetric analyses, and be able to perform stoichiometric calculations involving solids, solutions or gases. (Sections 4.1–4.3 and 5.3–5.5)

Chemical Equilibrium (Chapter 14)

1. Describe the characteristics of dynamic equilibrium. (Section 14.1)
2. Understand the dependence of K on the way the balanced equation is written. What happens to K if the reaction is reversed? (Section 14.2)
3. Write an equilibrium constant expression for homogenous or heterogeneous equilibrium. (Sections 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. (Section 14.7)

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

1. Understand the different 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 equilibrium constant 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).

- Recognize and determine the pH of buffer solutions; suggest a reasonable buffer solution to maintain a certain pH. (Section 16.6)
- Understand how and why an indicator changes color (Section 15.8 & 16.7).
- Know the difference between equivalence point (or stoichiometric point), endpoint, and midpoint (or half equivalence or stoichiometric point).
- Follow the reaction of strong acid with strong base, weak acid with strong base or strong acid with weak base to determine the pH at various points in a titration including: (1) before titration, (2) before equivalence point, (3) at equivalence point and (4) after equivalence point.
- Write an equation for an acid/base reaction. Determine reaction direction from acid/base strengths.

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

- Identify and name the various functional groups (i.e., nomenclature rules). (Organic Notes (ON) pages 1–26)
- Identify and relate the different types of isomers. (ON pages 30–38)
- Identify types of intermolecular forces present within a molecule (Section 11.5)
- Compare and contrast boiling points, melting points and water solubility based on intermolecular forces. (ON pages 39–44)
- Identify chemically reactive centres (electrophiles, nucleophiles and free radicals), reaction intermediates and intermediates stability. (ON pages 45–46)
- Understand the following representative organic reactions:
 - Alkanes* – substitution reaction through halogenation (ON pages 47–48)
 - Alkenes* – addition of acid or hydrogen & polymerisation (ON pp.48–52)
 - Alkyl Halides* – nucleophilic substitution reactions (ON pages 52–53)
 - Alcohols* – oxidation with dichromate and acid (ON pages 55–56)
 - Aldehydes & Ketones* – addition of hydrogen and nucleophilic attack of water and alcohol (ON pages 56–58)
 - Carboxylic Acids* – formation of esters and polyesters (ON pages 58–59; 60–64)
 - Esters* – formation of amides and polyamides (ON pages 59–64)
- Understand the difference between addition & condensation polymers (ON pp. 51–52; 61–63).
- Understand the acid & base properties of organic compounds and their salts. (ON pp. 65–66)

c) CHEM*1040 Skills

Through the content and concepts presented and the problems discussed, another purpose of this course is to help you further develop skills that will aid you in your future courses within your program and major as well as beyond. These skills are:

- ability to think critically & apply knowledge to new problems (i.e., problem solving skills)
- numeracy (www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec_d0e353.shtml)
- inquiry (www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec_d0e396.shtml)
- observing and the ability to design a simple experiment
- work co-operatively with others and independently
- depth and breadth of understanding as well as the capacity to know when you do not understand (www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec_d0e403.shtml)
- love of learning (www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec_d0e427.shtml)

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 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 the Centre for Students with Disabilities as soon as possible at 519-824-4120 ext. 56208, csd@uoguelph.ca or 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 which apply to undergraduate, graduate and diploma programs:
www.uoguelph.ca/registrar/calendars/index.cfm?index
 - i. **Drop Date**: The last date to drop one-semester courses, without academic penalty, is **Oct. 31**. For regulations and procedures for dropping courses, refer to the Undergraduate Calendar:
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., Thurs., Nov. 28 – classes are rescheduled from Mon., Oct. 14; Monday schedule in effect