

**Student Course Information**  
**CHEM\*1040 General Chemistry I – Fall 2008**  
**Department of Chemistry**  
**University of Guelph**

**Course Co-ordinator:** L. Jones  
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**Instructors:**

Section 01: ROZH 104 MWF 11:30 – 12:20	J. Prokipcak (SCIE 2503)
Section 02: ROZH 104 MWF 13:30 – 14:20	J. Prokipcak (SCIE 2503)
Section 03: ROZH 104 TTH 13:00 – 14:20	L. Jones (MACN 331)
Section 04: AXEL 200 MWF 16:30 – 17:20	A. Houmam (MACN 123)
Section 05: RDC 110 M 10–10:50; W 8–8:50 & F 9–9:50	R. Nicol (Ridgetown)
Section 06: PRSH 112 MTW 14:00 – 14:50	D. Mercer (Kemptville)

**COURSE DESCRIPTION:**

CHEM\*1040 General Chemistry I F,W (3-3) [0.50]

A course which 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): 1 of 4U Chemistry, OAC Chemistry (or equivalent), CHEM\*1060**

**Restriction(s): CHEM\*1100, CHEM\*1300**

**1. REQUIRED MATERIALS**

- (a) **Textbook Package:** General Chemistry, 9<sup>th</sup> ed., Darrell Ebbing and Steven Gammon, Houghton Mifflin Co., 2009; Student Solutions Manual, D. Bookin, D. Ebbing, and S. Gammon, Houghton Mifflin Co., 2009; Eduspace passkey booklet. These three items are shrink-wrapped together and may be purchased from the University Bookstore. (Note: You can choose to just buy an online package which provides access to Eduspace as well as the electronic version of the 9<sup>th</sup> ed. text. The regular 8<sup>th</sup> ed. package is also acceptable but you will need to purchase an Eduspace passkey from the Bookstore. )
- (b) **CHEM\*1040 Organic Chemistry Notes, Laboratory Manual and safety goggles** (not safety glasses) all can be purchased from the Chemistry Department in SCIE 3109 up to Tues., September 9, 4:00 p.m. Sales then move to SCIE 2512. (Goggles may also be purchased from the Bookstore.)
- (c) **Lab coats** are required and available from the Chemistry & Biochemistry Club, SCIE 3108 as well as the University Bookstore.
- (d) **Indigo Instruments Molecular Model Kit** is available in the University Bookstore. This is needed for the material on molecular shape and organic chemistry.
- (e) **Electronic calculator** with ln, exp or e<sup>x</sup>, log<sub>10</sub> and 10<sup>x</sup> functions and a **stapler**. Calculators or notebook computers capable of storing text information are **NOT** allowed in examinations.

## 2. “WET” LABORATORY– Begins Monday, September 8!

Students attend their chemistry labs 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 are the lecture section while the last two are the lab section (i.e., for section number 0110, the lecture section is 01 and the lab section is 10).

If your lab section is an odd number (e.g. 0243 = lab section 43), then you follow the “Week Acid Student Schedule”. If your lab section is an even number (e.g. 0358 = lab section 58), then you follow the “Week Base Student Schedule”. **The detailed laboratory schedule is provided on page 6 of this document.** The laboratory is an integral part of the course and you must attend all the labs.

### (a) **Laboratory Time and Authorisation**

You must attend your first lab to receive mandatory safety training, which is required by law. This safety lab is a prerequisite for all subsequent labs. As proof that you are registered in a particular lab section, **you must bring a computer print-out dated Sept. 01, 2008 or later of “My Class Schedule” from WebAdvisor to your first lab.** Also bring your lab manual.

### (b) **Laboratory Quizzes**

The in-lab quizzes count towards 20% of your laboratory grade, and will usually be based on the experiment that you are about to perform. **Refer to the Laboratory Schedule.** It is essential that each experiment be studied carefully in advance of your lab period; attempt the questions at the end of each lab to prepare for your lab quizzes.

### (c) **Laboratory Reports**

Laboratory reports are normally due exactly one week after your lab period and before 4:30 p.m. Submit your report into the appropriate grey box located near MACN 128.

### (d) **Missed Laboratory**

Refer to the “Purple Page for Lab Absences in First-Year Chemistry” (posted under “Resources” on the CHEM\*1040 Blackboard website) and follow the specified directions.

### (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, this week only. Refer to WebAdvisor for times and locations. The Problems Lab questions are posted on the course website, under “Resources” and answers are only provided within the labs.

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

Students who obtained a “wet” laboratory grade of **at least 60%**, but who failed the course as a whole, may apply for a laboratory exemption. The laboratory work must have been completed **during one of the three preceding semesters** in which the course was offered. To apply, complete the online “Laboratory Exemption Application” found on [www.chemistry.uoguelph.ca/labexemption](http://www.chemistry.uoguelph.ca/labexemption). **DEADLINE: TUESDAY, SEPTEMBER 9, 2008**

NOTE: Students repeating CHEM\*1040 who are granted a “wet” lab exemption **must complete the online “dry” computer laboratories.** You also need to attend the Problems Labs.

## 3. COURSE HELP

### (a) **CHEM\*1040 Web Site** - access through the portal <http://courselink.uoguelph.ca>.

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. Go to

[www.uoguelph.ca/ccs/accounts/central/undergraduate.shtml](http://www.uoguelph.ca/ccs/accounts/central/undergraduate.shtml), if you do not have a Central Login Account. The first page you enter is entitled “My Courselink” where all your Blackboard course links are listed, including CHEM\*1040. If you have any problems using Blackboard, refer to the “Courseware (Blackboard) Help” page at <http://courselink.uoguelph.ca/helpIndex.html>.

The course website provides a wealth of course resources (i.e., e-lectures & animations), quizzes, computer labs and a discussion board where you can get your course and lab questions answered.

(b) **Course Help**

(i) Your instructor will be available at certain times for consultation and help.

Office hours will be arranged at the first class meeting.

(ii) The **Chemistry Learning Centre** is located in SCIE 2101, where teaching assistants are available **M,W 9:30 am – 3:30 pm, T,TH 10:00 am – 4:00 pm & F 9:30 am – 2:30 pm** to answer your questions and help you with either the lecture or laboratory material.

(c) **Supported Learning Groups (SLGs)** – [www.lib.uoguelph.ca/assistance/supported\\_learning\\_groups/](http://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. The session time(s) and location(s) will be announced during the first week of classes. For more information, go to their website.

#### 4. EVALUATION

(a) The course grade will be calculated as follows:

Online “WebAssign” Homework	5%
Online Quizzes (course website)	5%
“Wet” Laboratory & Lab Quizzes	20%
Online “Dry” Laboratory Work (course web site)	7%
Midterm Examination	25%
Final Examination	38%

(b) **Online “WebAssign” Homework**

Weekly homework assignments are delivered through “WebAssign” on the Eduspace website. To access this site, you will need an Eduspace passkey, provided with the text or sold separately. Assignments are due 11:59 p.m. Wednesdays. If an assignment is not attempted, a grade of zero will be assigned. There will be 11 assignments and your worst assignment grade will be dropped prior to calculating your homework grade. A tutorial is provided to familiarise yourself with the system.

**Further details are provided on the course Blackboard website.**

(c) **Practice Online Quizzes (not for credit)**

The online Self-Assessment Quiz is available from the course website during September 4 – 12 and can only be accessed once. Find out what you know! There are also practice quizzes available on the course website for the entire semester and can be attempted as many times as you wish.

(d) **Online Quizzes for Credit**

The quizzes are delivered on the course Blackboard web site. You may use the text and any notes when attempting the quizzes. The maximum benefit from the quizzes will be obtained **if you do them on your own** under examination conditions. Quizzes are 75 minutes in duration, can only be

attempted once, and will be available on the dates listed from 7:00 a.m. Monday until 11:59 p.m. Thursday. **If a quiz is not attempted, a grade of zero will be assigned.** Do not leave your quiz attempt until the last day! Submitted quizzes may be accessed **ONLY** on the Friday to Thursday following each quiz. Use this opportunity to review your quiz, make corrections and solidify your understanding.

Quiz #1 – Atomic & Molecular Structure	September 22 – 25 (week 3)
Quiz #2 – Stoichiometry & Reactions	October 6 – 9 (week 5)
Quiz #3 – Equilibrium, Acids & Bases	October 27 – 30 (week 8)
Quiz #4 – Buffers & Titration Curves	November 10 – 13 (week 10)
Quiz #5 – Organic Chemistry	November 24 – 27 (week 12)

(d) **Online “Dry” Computer Laboratory Work**

Each computer lab consists of two parts: the Experiment and the Marking Module. Both are delivered on the website. The Experiment can be done at any time and can be done as many times as you wish. However, each time you repeat an experiment, you will be assigned a new “unknown” number. After you are satisfied with your results and have completed all calculations, **only then** open the Marking Module to input your results. You may only grade your lab work once. Note the time of the Marking Module deadlines!

1. *Atomic Spectroscopy Computer Lab* – explore energy levels in atoms and “fireworks” colours. This lab is based on Experiment 6 in your CHEM\*1040 Laboratory Manual and is to be completed Sept. 15 – 26. Your final results must be submitted through its marking module before **Sunday, September 28, 11:59 pm.**
2. *Volumetric Analysis Computer Lab* – test your understanding of stoichiometric concepts and analysis skills. This lab is to be completed Sept. 29 – Oct. 10. Your final results must be submitted before **Sunday, October 12, 11:59 pm.**
3. *Gaseous Equilibria Computer Lab* – study factors that influence chemical equilibria. This lab is to be completed Oct. 20 – Oct. 31. Your final results must be submitted before **Sunday, November 2, 11:59 pm.**
4. *Organic Chemistry Computer Lab* – investigate the molecular structure of organic molecules. This lab is partially based on Experiment #8 in your CHEM\*1040 Laboratory Manual and is to be completed November 3 – 14. The marking module needs to be submitted before **Sunday, November 16, 11:59 pm.**

(e) **Midterm Examination: Saturday, October 18, 9:30 – 11:00 a.m.**

Room assignments will be posted on the course web site under "Announcements" prior to the midterm. If you have a legitimate conflict, please apply in writing to Dr. Jones during the week of October 6 – 10 to request to write the alternate midterm on Thursday, October 16, 5:30 p.m. In your application, include your name, ID, e-mail address and reason for conflict.

(f) **Final Examination: Tuesday, December 9, 2:30 – 4:30 p.m.**

Refer to [www.uoguelph.ca/registrar/scheduling/index.cfm?exam\\_fall](http://www.uoguelph.ca/registrar/scheduling/index.cfm?exam_fall) prior to the final exam period for room assignments.

- (g) 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 allowed.**

## 5. POLICY ON MISSED WORK

a) **Missed Midterm Examination:**

If you did not write the midterm, documentation must be given to your instructor. 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, you need to contact your Program Counsellor as soon as possible (refer to [http://www.uoguelph.ca/uaic/program\\_counsellors.shtml](http://www.uoguelph.ca/uaic/program_counsellors.shtml) for the list of Program Counsellors). Official documentation is required. Consult the Undergraduate Calendar (Section VIII, under Academic Consideration – Incomplete Final Examinations /Final Assignments).

## 6. LECTURE SCHEDULE – Please read the appropriate sections in the text **before** lectures.

Week	Dates	Topics	*Assignment	Text Reference
Week 0		Measurement Atoms, Molecules & Ions The Mole	*topics 1–3 and 7 (review)	*Review, Ch 1, 2 & Ch 3, 3.1 – 3.5
Week 1–2	Sept. 8 to Sept. 19	Atomic structure, periodic trends, Lewis structures, VSEPR, bonding,	VSEPR tutorial	*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. 22 to Oct. 3	Stoichiometry & Reactions	<i>Stoichiometry</i> e-lectures: topics 4 – 6	Ch 3, 3.6 – 3.8 Ch 4, 4.1 – 4.4, 4.7 – 4.10 *Ch 5, 5.1 – 5.5
Week 5-6	Oct. 6 to Oct. 17	Equilibrium Intro acids & bases Midterm Review	Equilibrium simulation <i>Acid-Base</i> e-lectures, topics 1 – 3	Ch 14, 14.1 – 14.7 Ch 15, 15.1 – 15.3 Ch 15 15.6 – 15.8
	<b>Oct. 18</b>	<b>MIDTERM</b>	<b>9:30 – 11:00 a.m.</b>	
Week 7-9	Oct. 20 to Nov. 7	Acids & bases Salts, Buffers Titration curves	<i>Acid-Base</i> e-lectures, topics 4 – 7 <i>Salts</i> e-lectures, topics 1 – 3 <i>Buffers</i> e-lectures, topics 1 – 2 Titration animation	Ch 16, 16.1 Ch 16, 16.3 – 16.7
Week 10–12	Nov. 10 to Nov. 27	Intermolecular forces Organic chemistry Final Exam Review	Structural isomer tutorial *Nomenclature practice quiz Stereoisomers tutorial	Ch 11, 11.5 Ch 23, 23.1 – 23.7 Ch 24, 24.1 – 24.2 Organic Chemistry Notes – all questions

\* Topics marked with an asterisk are not covered in class but will be examined.

**Midterm Examination: Saturday, October 18, 9:30 – 11:00 a.m.** - covers week one through to six lectures, corresponding problem assignments, and references to the text. This exam will be made up of multiple choice, short answer questions, and problems similar to the problem assignments. A sample midterm is posted on the Blackboard course website.

**Final Examination: Tuesday, December 9, 2:30 – 4:30 p.m.** - covers the entire course.

## 7. FALL 2008 LAB SCHEDULE

DATE	“WEEK ACID” Student Schedule (ODD lab section numbers)		“WEEK BASE” Student Schedule (EVEN lab section numbers)	
Sept. 8 – 12	Arrive at regular starting time. Check-in, Safety*	No Quiz	Arrive 1 ½ hours after regular starting time. Check-in, Safety*	No Quiz
Sept. 15 – 19	<u>Experiment 2</u> : Chemical Reactions in Aqueous Solution	Quiz on Safety	<i>Online Computer Lab – Atomic Spectroscopy (Exp’t 6) – Blackboard</i>	Marking Module
Sept. 22 – 26	<i>Online Computer Lab – Atomic Spectroscopy (Exp’t 6) – Blackboard</i>	Marking Module	<u>Experiment 2</u> : Chemical Reactions in Aqueous Solution	Quiz on Safety
Sept. 29 – Oct. 3	<u>Experiment 3</u> : Standardization of Sodium Hydroxide	Quiz	<i>Online Computer Lab – Volumetric Analysis – Blackboard</i>	Marking Module
Oct. 6 – 10	<i>Online Computer Lab – Volumetric Analysis – Blackboard</i>	Marking Module	<u>Experiment 3</u> : Standardization of Sodium Hydroxide	Quiz
Oct. 14 – 17 Note: There are no classes Oct. 13	Arrive at regular starting time. Midterm Prep - Problems Lab Monday and exempt students may attend any lab this week.	No Quiz	Arrive 1 ½ hours after regular starting time. Midterm Prep - Problems Lab Monday and exempt students may attend any lab this week.	No Quiz
Oct. 20 – 24	<i>Online Computer Lab – Gaseous Equilibria - Blackboard</i>	Marking Module	<u>Experiment 5</u> : Buffers, Titration Curves and Indicators	Quiz
Oct. 27 – 31	<u>Experiment 5</u> : Buffers, Titration Curves and Indicators	Quiz	<i>Online Computer Lab – Gaseous Equilibria - Blackboard</i>	Marking Module
Nov. 3 – 7	<i>Online Computer Lab – Organic Chemistry - Blackboard.</i>	Marking Module	<u>Experiment 4</u> : Synthesis of Aspirin - an Important Acid Hand in report at the end of the lab.	Quiz
Nov. 10 – 14	<u>Experiment 4</u> : Synthesis of Aspirin - an Important Acid Hand in report at the end of the lab.	Quiz	<i>Online Computer Lab – Organic Chemistry - Blackboard</i>	Marking Module
Nov. 17 – 21	Arrive 1 ½ hours after regular starting time. Clean-Up & Review final lab grades	No Quiz	Arrive at regular starting time. Clean-Up & Review final lab grades	No Quiz

\* The Safety Laboratory is a legal requirement. You must attend a safety lab session.

## 8. PROBLEMS

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 quizzes and examinations. Work done on these problems is not graded, but there is a good correlation between mastering the concepts within the problems on a week-by-week basis and performance in the course as a whole.

**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.

**Work the problems independently.** Working from the solutions is **not** useful for learning. The detailed solutions to the problems are contained in the Student's Solutions Manual which is included with the text. 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 onto the other sections. More challenging questions are provided on the course website as "Questions of the Week". Links to these questions can be found within "Course work". If you would like more practice on a particular topic, the textbook has ACE practice tests on the Eduspace website.

### 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 & molecular structure, periodic trends, bonding & intermolecular forces: (Week 1–2)

Chapter 7: 7.25, 7.33, 7.37, 7.45, 7.69, 7.87, **7.97, 7.105**, 7.107.

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, **9.123**.

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, **10.93**.

### 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**, 3.129, 3.131.

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, 4.145.

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

### Equilibrium, and Introduction to acids and bases (Weeks 5–6)

Chapter 14: 14.23, 14.25, 14.35, 14.37, 14.39, 14.41, 14.43, 14.51, 14.53, 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, 15.107.

### Acids, Bases, Salts, Buffers and Titration Curves (Week 7 – 9)

Chapter 16:

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: (Week 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.

## 9. 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 on your previous exposure to chemistry while moving away from memorization terms and definitions to 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).

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<sub>2</sub>, F<sub>2</sub>, Cl<sub>2</sub>, Br<sub>2</sub>, I<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub>, P<sub>4</sub>, S<sub>8</sub>. (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 2.9-10)
- ◆ 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<sup>x</sup> and e<sup>x</sup>) and the quadratic formula.
- ◆ 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 -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 8.1-2 and 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 9.4-6 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 "correct" 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 3.6-7)
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. Know the solubility rules in Table 4.1 (page 129) and be able to apply them. (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 4.1-3 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 balanced equation coefficients are changed or the reaction is reversed? (Section 14.2)
3. Write an equilibrium constant expression for homogenous or heterogeneous equilibrium; relate  $K_p$  and  $K_c$  using the ideal gas law. (Sections 14.2-3)
4. Relate K to **extent of reaction**, relative amount of reactant/product at equilibrium. (Section 14.4)

5. Relate  $Q$  value to **direction of reaction**, forward or reverse, to reach equilibrium. (Section 14.5)
6. 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 15.7-8)
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 16.4-5).
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 or stoichiometric point).
15. 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.
16. 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)***

1. Identify and name the various functional groups (i.e., nomenclature rules). (Organic Notes (ON) pages 1-26)
2. Identify and relate the different types of isomers. (ON pages 30-38)
3. Identify types of intermolecular forces present within a molecule (Section 11.5)
4. Compare and contrast boiling points, melting points and water solubility based on intermolecular forces. (ON pages 39-44)
5. Identify chemically reactive centres (electrophiles, nucleophiles and free radicals), reaction intermediates and intermediates stability. (ON pages 45-6)
6. Understand the following representative organic reactions:
  - (a) *Alkanes* – substitution reaction through halogenation (ON pages 47-48)

- (b) *Alkenes & Alkynes* – addition of acid or hydrogen & polymerisation (ON pages 48-52)
  - (c) *Alkyl Halides* – nucleophilic substitution reactions (ON pages 52-3)
  - (d) *Aromatics* – substitutions through nitration or halogenation (ON page 54)
  - (e) *Alcohols* – oxidation with dichromate and acid (ON pages 55-6)
  - (f) *Aldehydes & Ketones* – addition of hydrogen and nucleophilic attack of water and alcohol (ON pages 56-8)
  - (g) *Carboxylic Acids* – formation of esters, acid halides and polyesters (ON pages 58-9; 60-64)
  - (h) *Esters* – formation of amides and polyamides (ON pages 59-64)
  - (i) *Acid Halides* – formation of amides and esters (ON pages 60)
7. Understand the difference between addition & condensation polymers (ON pp. 51-2; 61-3).
8. Understand the acid & base properties of organic compounds and their salts. (ON pp. 65-6)

### 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 and apply knowledge to new problems (i.e., problem solving skills)
- numeracy (refer to [www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec\\_d0e501.shtml](http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec_d0e501.shtml))
- inquiry (refer to [www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec\\_d0e544.shtml](http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec_d0e544.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 (refer to [www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec\\_d0e551.shtml](http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec_d0e551.shtml))
- love of learning ([www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec\\_d0e575.shtml](http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec_d0e575.shtml))

## 10. 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 Help Room, whatever you need to do, do it. The resources are here, you just need to go get them.”