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

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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, Media Enhanced Edition, Darrell Ebbing and Steven Gammon, Houghton Mifflin Company, 2008; Student Solutions Manual, David Bookin, Darrell Ebbing, and Steven Gammon, Houghton Mifflin Company, 2005; Study Guide, Larry Krannich, Houghton Mifflin Company, 2005. These three books are shrink-wrapped together and may be purchased from the University Bookstore. (Note: This is the same package used in fall 2007; the regular 8th ed. package is also acceptable.)

(b) **CHEM*1040 Organic Chemistry Notes** are purchased from the Chemistry Department.
CHEM*1040 Laboratory Manual is purchased from the Chemistry Department.
Safety goggles (not safety glasses) are purchased from the Chemistry Department.
Chemistry sales run Jan. 7-9, 9:00 a.m. to 4:00 p.m. in SCIE 2110. Sales then move to SCIE 1110.

(c) A **Lab coat** is required and available from the University Bookstore.

(d) **Indigo Instruments Molecular Model Kit** is available in the University Bookstore.
This is needed for the material on molecular shape as well as organic chemistry.

(e) **i>Clicker Student Response Unit** is available in the University Bookstore. Students will use a personal response units (commonly known as "*clickers"*) to register their responses to questions posed in class. Participation marks will be awarded towards your final grade.

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

2. "WET" LABORATORY– Begins Monday, January 7!

A detailed laboratory schedule is found on page 6 of this document. There are two different laboratory schedules. To determine which schedule you are to follow, you must determine your lab section number. Based on the course section you are registered in, the last two numbers are your lab section (i.e., if your section number is 0104, you're registered in lab section 04). If your lab section is an odd number (e.g. 0101, 0103, 0105, etc.), then you follow the "Week Acid Student Schedule". If your lab section is an even number (e.g. 0102, 0104, 0106, etc.), then you follow the "Week Base Student Schedule". **The laboratory is an integral part of the course and you must attend all labs.**

(a) **Laboratory Time and Authorisation**
You must attend your first lab to receive mandatory safety training. This safety laboratory is a prerequisite for all subsequent labs. As proof that you are registered in a lab section, **you must bring a computer print-out of WebAdvisor's "My Class Schedule" dated Jan 01, 2008 or later to your first lab**. Bring your lab manual if possible.

(b) **Laboratory Quizzes**
The in-lab quizzes count toward your laboratory grade (~20%), and will usually be based on the experiment that you are about to perform. **Refer to the Laboratory Schedule**. It is essential that the experiment be studied carefully in advance of your laboratory period.

(c) **Laboratory Reports**
Laboratory reports are normally due one week after your lab and before 4:30 pm.
Submit your report in 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 "Course Resources" on the CHEM*1040 Blackboard course site and follow the specified directions.

(e) **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 CHEM*1040 Blackboard "quiz" entitled "Laboratory Exemption Application" found under "Assessments" on the course website. **DEADLINE:** TUESDAY, JANUARY 8, 2008

NOTE: Students repeating CHEM*1040 who are granted a "wet" lab exemption **must complete the online "dry" computer laboratories.** These students are also strongly encouraged to attend the Problems Laboratory in Week 5. Refer to the Laboratory Schedule. You may attend any lab that week in SCIE 2105. Check WebAdvisor for specific times. The questions for the Problems Lab will be posted on Blackboard under Course Resources.

3. COURSE HELP

(a) **CHEM*1040 Web Site -** access through the portal ***http://courselink.uoguelph.ca.***
Your **User ID** 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,* 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://www.uoguelph.ca/courselink/faq_main.html*.

The course website is an integral part of the course. It provides resources (i.e., e-lectures & animations), quizzes, computer labs and a discussion board where you can post course and lab questions. Important announcements for the course will also be posted on the website.

(b) **Course Help**

(i) Dr. Jones will be available for consultation and help on Wednesdays 2:30 pm – 4:30 pm, Fridays 10:00 am – 12:00 pm **OR** by appointment.

(ii) The **First-year Chemistry Learning Centre** is located in SCIE 3106, where teaching assistants are available Tuesday to Thursday to answer your questions and help you with either the lecture or lab material. Hours are posted under Announcements on Blackboard.

(c) **Supported Learning Groups (SLGs) -** *www.learningcommons.uoguelph.ca/SLG*

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:

In-class participation (i.e., "clickers")	3%
Online Homework (i.e., WebAssign)	6%
Online Quizzes (i.e., Blackboard)	5%
Online "Dry" Laboratory Activities (i.e., Blackboard)	7%
"Wet" Laboratory & Laboratory quizzes	20%
Midterm Examination	22%
Final Examination	37%

(b) **In-class "clicker" participation**

Clickers will be used to promote engagement during lectures and provide feedback on your lecture preparation. Students will register their clicker on-line through Blackboard. A participation score will be based on the number of clicker responses, regardless of your answer, and corresponds to the following response rates: 0 = 0–32%; 1 = 33–59%; 2 = 60–84%; 3 = 85–100%. It is your responsibility to ensure that your clicker is registered and functional.

(c) **Online Homework**

Weekly homework assignments are delivered on the course website through "WebAssign", which is provided by the textbook publisher for free this semester. If an assignment is not attempted, a grade of zero will be assigned. A tutorial is provided to familiarise yourself with this system. Further details are provided on the course website.

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

The online Self-Assessment Quiz is available on the course website during January 7 – 131 and can only be accessed once. Find out what you know! Practice quizzes are available on the course website the entire semester and can be attempted as many times as you wish.

(e) **Online Quizzes for Credit**

The quizzes are delivered on the course 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**. 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 11:55 p.m. Wednesday. 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 Thursday to Sunday following each quiz. Use this opportunity to review your quiz, make corrections and solidify your understanding.

Quiz #1 – Atomic & Molecular Structure	January 21 – 23 (week 3)
Quiz #2 – Stoichiometry and Reactions	February 4 – 6 (week 5)
Quiz #3 – Acids and Bases	March 3 – 5 (week 8)
Quiz #4 – Buffers & Titration Curves	March 17 – 19 (week 10)
Quiz #5 – Organic Chemistry	March 31 - April 2 (week 12)

(f) **Online "Dry" Computer Laboratory Activities** (refer to the Lab Schedule on page 6)

Each computer lab consists of two parts: the experiment and the marking module. Both are delivered on the website. The experiments 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, following the directions carefully. You may only grade your lab work once. Note the time of the marking module deadlines!

1. *Atomic Spectroscopy Computer Lab* – based on Experiment 6 in your laboratory manual.
   - marking module to be completed before **Monday, February 4, 5:00 pm**.
2. *Volumetric Analysis Computer Lab* – test your analysis skills.
   - final results to be submitted before **Monday, March 3, 5:00 pm.**
3. *Gaseous Equilibria Computer Lab* – study what influences chemical equilibria
   - marking module is to be completed before **Monday, March 17, 5:00 pm.**
4. *Organic Chemistry Computer Lab* – partially based on Experiment #8 in your lab manual.
   - marking module is to be completed before **Monday, March 31, 5:00 pm.**

(g) **Midterm Examination**: **Saturday, February 9, 4:00 p.m. – 5:30 p.m. ROZH 101 & 104**

Room assignments will be posted on the course web site under "Announcements" a week before the midterm.

Midterm Conflict: If you have a legitimate conflict, please apply in writing to Dr. Jones by February 1 to request to write the alternate midterm on Thursday, February 7, 5:30 p.m. In your application, include your name, ID, e-mail address and reason for conflict. The location of the alternate test will be posted on the web site under "Announcements".

(h) **Final Examination: Wednesday, April 9, 08:30 – 10:30 a.m.**

Refer to *www.uoguelph.ca/registrar/scheduling/index.cfm?exam_winter* prior to the final exam period for room assignments.

(i) 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**. Non-text electronic calculators may be used.

5. POLICY ON MISSED WORK

a) **Missed Midterm Examination:**
If you did not write the midterm examination, documentation must be given to Dr. Jones directly. If a valid excuse is received, the percentage value of the midterm will be added to the percentage value of the final examination. Otherwise, a grade of zero will be assigned. No make-up midterm examinations 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 *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 review the appropriate sections in the text **before** lectures.

Week	Dates	Topics	*Assignment	Text Reference
Week 0		Measurement Atoms, Molecules & Ions		*Review Appendix A, Ch 1 & sections 2.1-2.8
Week 1 – 2	Jan. 7 to Jan. 18	Atomic structure, Periodic trends, Lewis structures, VSEPR, bonding, intermolecular forces	VSEPR tutorial	*Review: Sect. 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 Ch 11, 11.5
Week 3 – 4	Jan. 21 to Feb. 1	Stoichiometry & Reactions	*Stoichiometry* e-lectures: *topics 1–3 and 7 (review) topics 4 – 6	*Review, Sect. 2.9 – 2.10 & 3.1 – 3.5 Ch 3, 3.6 – 3.8 Ch 4, 4.1 – 4.4, 4.7 – 4.10 *Ch 5, 5.1 – 5.5
Week 5	Feb. 4 – 8	Equilibrium Midterm Review	Equilibrium simulation	Ch 15, 15.1 – 15.7
	Feb. 9	**MIDTERM 4:00 – 5:30 p.m. ROZH 101 & 104**		
Week 6 – 9	Feb. 11 to Mar. 14	Acids and bases Salts Buffers Titration curves	*Acid-Base* e-lectures, topics 1– 7 *Salts* e-lectures, topics 1 – 3 *Buffers* e-lectures, topics 1 – 2 Titration animation	Ch 16, 16.1 – 16.3 Ch 16, 16.6 – 16.8 Ch 17, 17.1 Ch 17, 17.3 – 17.7
Week 10 – 12	Mar. 17 to Apr. 4	Organic chemistry Final Exam Review	Structural isomer tutorial *Nomenclature practice quiz Stereoisomers tutorial	Ch 24, 24.1 – 24.7 Ch 25, 25.1 Organic Chem Notes – all questions

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

The midterm will cover the material from weeks one through five. The final examination covers the entire course. The examinations will be made up of multiple choice, short answer questions, and problems.

7. WINTER 2008 LABORATORY SCHEDULE ("Wet" Labs are shaded)

Week Date	**"WEEK ACID" Student Schedule** (**ODD** lab section numbers)		**"WEEK BASE" Student Schedule** (**EVEN** lab section numbers)	
1 Jan. 7 – 11	**Arrive at regular starting time.** Check-in, Safety*	No Quiz	**Arrive 1 ½ hours after regular starting time.** Check-in, Safety*	No Quiz
2 Jan. 14 – 18	**Arrive at regular starting time.** Experiment 7: Bonding and Molecular Structure	**Quiz on Safety**	**Arrive 1 ½ hours after regular starting time.** Experiment 7: Bonding and Molecular Structure	**Quiz on Safety**
3 Jan. 21 – 25	Experiment 2: Chemical Reactions in Aqueous Solution	No Quiz	Online Computer Lab – Atomic Spectroscopy (Exp't 6) - Blackboard	Marking Module
4 Jan. 28 – Feb. 1	Online Computer Lab – Atomic Spectroscopy (Exp't 6) - Blackboard	Marking Module	Experiment 2: Chemical Reactions in Aqueous Solution	No Quiz
5 Feb. 4 – 8	**Arrive at regular starting time.** Midterm Prep - Problems Lab Lab exempt students may attend any laboratory time this week.	No Quiz	**Arrive 1 ½ hours after regular starting time.** Midterm Prep - Problems Lab Lab exempt students may attend any laboratory time this week.	No Quiz
6 Feb. 11 – 15	Experiment 3: Standardization of Sodium Hydroxide	**Quiz**	Online Computer Lab – Volumetric Analysis - Blackboard	Marking Module
7 Feb. 25 – 29	Online Computer Lab – Volumetric Analysis - Blackboard	Marking Module	Experiment 3: Standardization of Sodium Hydroxide	**Quiz**
8 Mar. 3 – 7	Experiment 5: Buffers, Titration Curves and Indicators	**Quiz**	Online Computer Lab – Gaseous Equilibria - Blackboard	Marking Module
9 Mar. 10 – 14	Online Computer Lab – Gaseous Equilibria - Blackboard	Marking Module	Experiment 5: Buffers, Titration Curves and Indicators	**Quiz**
10 Mar. 17 – 20* (Mar. 21 no classes)	Experiment 4: Synthesis of Aspirin - an Important Acid **Hand in report 2 days after exp't.**	**Quiz**	Online Computer Lab – Organic Chemistry - Blackboard	Marking Module
11 Mar. 24 – 28	Online Computer Lab – Organic Chemistry - Blackboard	Marking Module	Experiment 4: Synthesis of Aspirin - an Important Acid **Hand in report 2 days after exp't.**	**Quiz**
12 Mar. 31 – Apr. 4	**Arrive at regular starting time.** Clean-Up & Review final lab grades	No Quiz	**Arrive 1 ½ hours after regular starting time.** Clean-Up & Review final lab grades	No Quiz

* The Safety Laboratory is a legal requirement.

8. PROBLEMS

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, the follow questions have been selected from the problems at the end of the chapters in the textbook. 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 more challenging sections. More challenging questions are also provided on the course website as "Questions of the Week". Links to these questions can be found within "Coursework". If you would like more practice on a particular topic, the textbook also has ACE practice tests on the publisher student web site. There is a link to this site on the CHEM*1040 Blackboard web site. For more information see the *MEDIA GUIDE FOR STUDENTS* within your textbook package.

Review:

Chapter 1: 1.29, 1.35, 1.75, 1.77, 1.121.

Chapter 2: 2.37, 2.45, 2.59, 2.61, 2.69, 2.71, 2.73, 2.77, 2.79, 2.81, 2.85, 2.87, 2.93, 2.95, 2.103, 2.105, 2.113, 2.117, 2.121.

Chapter 3: 3.31, 3.33, 3.39, 3.55, 3.59, 3.61, 3.67.

Chapter 5: 5.69, 5.71, 5.81, 5.113.

Chapter 7: 7.19, 7.27, 7.31, 7.39,

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

Chapter 7: 7.63, 7.81, 7.85.

Chapter 8: 8.16, 8.21, 8.24, 8.33, 8.37, 8.43, 8.55, 8.57, 8.59, 8.75.

Chapter 9: 9.37, 9.39, 9.43, 9.51, 9.53, 9.57, 9.59, 9.63, 9.65, 9.71, 9.87, 9.91, 9.93.

Chapter 10: 10.21, 10.25, 10.27, 10.29, 10.33, 10.35, 10.39, 10.43, 10.47, 10.59, 10.63, 10.67.

Chapter 11: 11.57, 11.63, 11.65.

Stoichiometry and Reactions (Weeks 3–4)

Chapter 3: 3.18, 3.75, 3.77, 3.83, 3.85, 3.87, 3.91, 3.97, 3.99, 3.111, 3.113.

Chapter 4: 4.25, 4.29, 4.31, 4.33, 4.35, 4.37, 4.45, 4.63, 4.65, 4.71, 4.75, 4.79, 4.81, 4.83, 4.87, 4.99, 4.101, 4.103, 4.105, 4.109, 4.113, 4.117, 4.119, 4.121, 4.129.

Chemical Equilibrium (Week 5)

Chapter 15: 15.17, 15.19, 15.29, 15.31, 15.33, 15.35, 15.37, 15.45, 15.47, 15.49, 15.51, 15.53, 15.55, 15.57, 15.67, 15.69, 15.77, 15.81.

Acids, bases, salts and buffers (Weeks 6–8)

Chapter 16: 16.21, 16.22, 16.23, 16.25, 16.27, 16.29, 16.45, 16.47, 16.51, 16.53, 16.55, 16.61, 16.65, 16.79, 16.93, 16.101.

Chapter 17: 17.1, 17.9, 17.17, 17.19, 17.21, 17.23, 17.29, 17.33, 17.35, 17.39, 17.45, 17.47, 17.49, 17.51, 17.53, 17.57, 17.59, 17.65, 17.67, 17.69, 17.71, 17.75, 17.77, 17.93, 17.99, 17.103, 17.105, 17.107.

Titration curves (Week 9)

Chapter 17: 17.15, 17.25, 17.79, 17.81, 17.83, 17.85, 17.101, 17.111, 17.113.

Organic Chemistry: (Week 10–12)

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

Chapter 24: 24.14, 24.21, 24.25, 24.31, 24.35, 24.37, 24.49, 24.51, 24.61.

Chapter 25: 25.25, 25.49, 25.51.

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. During the first few weeks of classes, we will review some basic concepts <u>but</u> this will not be a comprehensive review. **You must review carefully Chapters 1-5 of the text 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 in 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)
- 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)
- that you 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. (Section 3.2)
- use % composition & molar mass to determine empirical and molecular weights. (Sect's 3.3 – 3.5)
- 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)
- concepts and terminology associated with the ideal gas law (pV=nRT) (Sections 5.3-5)
- 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)
- the use of exponential (i.e., scientific) notation; logarithms (e.g., log & ln); exponentials (i.e., 10^x and e^x); 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 electron configurations for any atom or ion using only the Periodic Table. (Sect'n 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. (Section 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 & intermolecular forces (Sect's 9.2-9; 10.1-4 & 11.5)

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)
8. Identify types of intermolecular forces present within a molecule (Section 11.5)

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 128) and be able to apply them. (Sec's 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 15)

1. Describe the characteristics of dynamic equilibrium. (Section 15.1)
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 15.2)

3. Write an equilibrium constant expression for homogenous or heterogeneous equilibrium; relate K_p and K_c using the ideal gas law. (Sections 15.2-3)
4. Relate K to ***extent of reaction***, relative amount of reactant/product at equilibrium. (Sect'n 15.4)
5. Relate Q value to ***direction of reaction***, forward or reverse, to reach equilibrium. (Section 15.5)
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 15.7)

Acids, bases, salts, buffers and titration curves (Chapters 16 & 17):

1. Understand the different definitions of acids and bases (i.e., Arrhenius, Brønsted-Lowry and Lewis). Identify examples of each. (Sections 16.1-16.3)
2. Identify the six common strong acids (see Table 16.1).
3. Identify strong bases (group I and II hydroxides and oxides) (see Table 16.1)
4. Identify conjugate acid/base pairs in an acid/base reaction. (Section 16.2)
5. Write an equation for the auto-ionization of water and its equilibrium constant expression. (Section 16.6)
6. Recognize strong acid and base aqueous solutions, and determine the pH and equilibrium concentrations. (Sections 16.7-8)
7. Calculate pH from $[H^+]$ or $[H^+]$ from pH; relate $[OH^-]$ and $[H^+]$ using K_w. (Section 16.8)
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 17.1 & 17.3)
9. Write the equilibrium constant expression for a weak acid or weak base dissociation, determine pH and equilibrium concentrations. (Sections 17.1 & 17.3)
10. Relate K_a and K_b using K_w. (Section 17.4)
11. Classify salts as producing neutral, acidic or basic solutions in water; determine the pH of a salt solution (Sections 17.4-5).
12. Recognize and determine the pH of buffer solutions; suggest a reasonable buffer solution to maintain a certain pH. (Section 17.6)
13. Understand how and why an indicator changes color (Section 16.8 & 17.7).
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: before titration, before equivalence point, at equivalence point and after equivalence point.
16. Write an equation for an acid/base reaction. Determine reaction direction from acid/base strengths.

Organic chemistry

1. Identify and name the various functional groups (i.e., nomenclature rules). (Organic Notes pages 1-26)
2. Identify and relate the different types of isomers. (Organic Notes (ON) pages 30-38)
3. Compare and contrast boiling points, melting points and water solubility based on intermolecular forces. (ON pages 39-44)
4. Identify chemically reactive centres (electrophiles, nucleophiles and free radicals), reaction intermediates and intermediates stability. (ON pages 45-6)

5. Understand the following representative organic reactions:
    (a) *Alkanes* – substitution reaction through halogenation (ON pages 47-48)
    (b) *Alkenes* and *Alkynes* – addition of acid or hydrogen & polymerisation (ON pp. 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* and *Ketone*s – addition of hydrogen and nucleophilic attach 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)
6. Understand the acid & base properties of organic compounds and their salts. (pages 65-6)

c) **CHEM*1040 Skills**

Through the content and concepts presented and the problems discussed, another purpose of this courses is to help you further develop skills that will aid you in your later 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)
- inquiry (refer to www.uoguelph.ca/registrar/calendars/undergraduate/current/c02/sec_d0e544.shtml)
- observing and ability to design a simple experiment
- work cooperatively 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)
- love of learning (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."