Student Course Information
CHEM*1040 General Chemistry I – Fall 2009
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 2506)
Section 02: ROZH 104 MWF 13:30 – 14:20	J. Prokipcak (SCIE 2506)
Section 03: ROZH 104 TTH 13:00 – 14:20	F. Auzanneau (MACN 127)
Section 04: WMEM 001 MWF 16:30 – 17:20	A. Houmam (MACN 123)
Section 05: RDC 110 MWF 9:00 – 9:50	I. O'Halloran (Ridgetown)
Section 06: FRS 216 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) **Stapler** - all lab reports must be stapled **prior to** their submission in the Grey Boxes near MACN 128.

(b) **Scientific 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.

(c) **Textbook Package**: General Chemistry, 9th ed., Darrell Ebbing and Steven Gammon, Houghton Mifflin Co., 2009 plus Ebbing/Gammon OWL with e-Book Printed Access Card.

(d) **CHEM*1040 Organic Chemistry Notes**, **Laboratory Manual** and **safety goggles** (not safety glasses) all are purchased from the Chemistry Department in SCIE 2101 Wednesday, Sept. 9 1:00 - 4:00 p.m. as well as Sept. 10, 11, 14 & 15 from 10:30 a.m. to 4:00 p.m.

(e) **Lab coats** are required and available from the Chemistry & Biochemistry Club in SCIE 2111(same times as the Chemistry Sales).

(f) **Indigo Instruments Molecular Model Kit** is available from the University Bookstore. This is needed to assist you with molecular shapes and organic chemistry.

2. "WET" LABORATORY– Begins Monday, September 14! Bring your lab manual.

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 (e.g., for section number 0125, the lecture section is 01 and the lab section is 25).

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 laboratory schedule is provided on the next page. (Note the change in schedule Nov. 2-6.) The laboratory is an integral part of the course and you **must** attend all "wet" laboratories.

(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 pre-requisite 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, 2009 or later** of "My Class Schedule" from WebAdvisor to your first lab.

(b) **Laboratory Quizzes**

The in-lab quizzes account for ~3 out of 15% of your lab 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 the lab to help prepare for your lab quizzes.

(c) **Laboratory Reports**

Laboratory reports are normally handed in exactly one week after your lab period (and not an earlier day) and before 4:30 p.m. Submit your **stapled** report in the appropriate Grey Box (labelled with your laboratory room number) located near MACN 128.

(d) **Missed Laboratory**

Refer to the "Purple Page for Lab Absences in First-Year Chemistry" handout (also posted on the CHEM*1040 website under Content/Resources).

(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 (see Content/Resources). Answers are provided only within the labs.

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

DEADLINE: TUESDAY, SEPTEMBER 15, 2009

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. Apply online at www.chemistry.uoguelph.ca/labexemption.

NOTE: Students repeating CHEM*1040 who are granted a "wet" lab exemption **must complete the online "dry" computer labs** and can attend any Problems Labs session Thanksgiving Week to prepare for the midterm.

FALL 2009 LAB SCHEDULE

DATE	**"WEEK ACID" Student Schedule** (**ODD** lab section numbers)		**"WEEK BASE" Student Schedule** (**EVEN** lab section numbers)	
Sept. 14 – 18	**Arrive at regular starting time.** Check-in, Safety Bring a printout of "My Class Schedule & your lab manual. Note: Safety training is mandatory and a legal requirement.	No Quiz	**Arrive 1 ½ hours after regular starting time.** Check-in, Safety Bring a printout of "My Class Schedule & your lab manual. Note: Safety training is mandatory and a legal requirement.	No Quiz
Sept. 21 – 25	**Arrive at regular starting time.** Experiment 0: Introduction to Laboratory Equipment	No Quiz	**Arrive 1 ½ hours after regular starting time.** Experiment 0: Introduction to Laboratory Equipment	No Quiz
Sept. 28 – Oct. 2	Experiment 2: Chemical Reactions in Aqueous Solution	**Quiz on Safety**	*Online Computer Lab: Atomic Spectroscopy (Exp't 6)*	*Marking Module*
Oct. 5 – 9	*Online Computer Lab: Atomic Spectroscopy (Exp't 6)*	*Marking Module*	Experiment 2: Chemical Reactions in Aqueous Solution	**Quiz on Safety**
Oct. 13 – 16 (No classes M. Oct. 12)	**Arrive at regular starting time.** Midterm Prep - Problems Lab (Monday and exempt students may attend any lab this week only.)	No Quiz	**Arrive 1 ½ hours after regular starting time.** Midterm Prep - Problems Lab (Monday and exempt students may attend any lab this week only.)	No Quiz
Oct. 19 – 23	Experiment 3: Standardization of Sodium Hydroxide	**Quiz**	*Online Computer Lab: Volumetric Analysis*	*Marking Module*
Oct. 26 – 30	*Online Computer Lab: Volumetric Analysis*	*Marking Module*	Experiment 3: Standardization of Sodium Hydroxide	**Quiz**
Nov. 2 – 6	*Online Computer Lab: Gaseous Equilibria*	*Marking Module*	Experiment 5: Buffers, Titration Curves and Indicators	**Quiz**
Nov. 9 – 13	Experiment 5: Buffers, Titration Curves and Indicators	**Quiz**	*Online Computer Lab: Gaseous Equilibria*	*Marking Module*
Nov. 16 – 20	*Online Computer Lab: Organic Chemistry*	*Marking Module*	Experiment 4: Synthesis of Aspirin - an Important Acid **Hand in report at end of the lab.**	**Quiz**
Nov. 23 – 27	Experiment 4: Synthesis of Aspirin - an Important Acid **Hand in report at end of the lab.**	**Quiz**	*Online Computer Lab: Organic Chemistry*	*Marking Module*
Nov. 30 – Dec 2 (No labs Th. Dec. 3)	**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

3. EVALUATION

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

OWL Homework	5%
Online Quizzes for Credit (course website)	5%
Online "Dry" Laboratory Work (course website)	7%
"Wet" Laboratory & Laboratory Quizzes	15%
Midterm Examination	28%
Final Examination	40%

(b) **OWL Homework** (www.cengage.com/owl)

Chemistry is not a subject which can be learned by simply reading a chemistry book. To consolidate your understanding you must work with and use the material and ideas in your text. Weekly homework assignments will be delivered through "OWL" (Online Web Learning). To access this site, you will need an OWL access card, provided with the text (or sold separately). Note all OWL access lasts for 24 months (despite package labels). Assignments are due 11:59 p.m. on Wednesdays, starting Sept. 23. 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 final homework grade. Further details are provided on the course website.

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

An online Self-Assessment Quiz is available from the course website during September 10 – 20 and it can only be accessed once. Find out what you already know! There are also practice quizzes available on the course website and these can be attempted as many times as you wish.

(d) **Online Quizzes for Credit** (***courselink.uoguelph.ca)***

Quizzes will be delivered on the D2L course website. 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	Sept. 28 – Oct. 1 (week 3)
Quiz #2 – Stoichiometry & Reactions	Oct. 12 – 15 (week 5)
Quiz #3 – Equilibrium, Acids & Bases	Nov. 2 – 5 (week 8)
Quiz #4 – Buffers & Titration Curves	Nov. 16 – 19 (week 10)
Quiz #5 – Organic Chemistry	Nov. 30 – Dec. 3 (week 12)

(e) **Online "Dry" Laboratory Work** (***courselink.uoguelph.ca)***

Each computer lab consists of two parts: the Experiment and the Marking Module. Both are delivered on the course website. The Experiment can be done as many times as you wish, but it can only be graded once. 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 grade your results. Note 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 between Sept.28 – Oct.12. Your final results must be submitted through the Atomic Spectroscopy Marking Module before **Monday, October 12, 11:59 pm**.

2. *Volumetric Analysis Computer Lab* – test your understanding of stoichiometric concepts and analysis skills. This lab is to be completed Oct. 19 – Nov. 1. Your final results must be submitted before **Sunday, November 1, 11:59 pm**.

3. *Gaseous Equilibria Computer Lab* – study factors that influence chemical equilibria. This lab is to be completed Nov. 2 – 15. Your final results must be submitted before **Sunday, November 15, 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 Nov. 16 – 29. Your final results need to be submitted before **Sunday, November 29, 11:59 pm.**

(f) **Midterm Examination**: **Saturday, October 17, 9:30 – 11:00 a.m.**

Room assignments for the examination will be posted on the course web site prior to the midterm. This examination covers week one through week five lectures, corresponding homework assignments, and text references. The examination will consist of multiple choice, short answer questions, and problems. A sample midterm is posted on the course website.

Midterm Conflict: If you have a legitimate conflict, please apply via e-mail to the Course Co-ordinator, Dr. Jones (lojones@uoguelph.ca), during the week of Oct. 5 – 9 to request to write the alternate midterm on Thursday, October 15, 5:30 p.m., including your name, student ID and reason for conflict. The location of the alternate midterm will be posted on the course website.

(g) **Final Examination: Monday, December 14, 7:00 - 9:00 p.m.**

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

(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 allowed**.

4. POLICY ON MISSED WORK

a) **Missed Midterm Examination:**

If you did 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, you need to contact your Program Counsellor as soon as possible (refer to *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).

c) **Other Missed Work** (with the exception of missed labs - see section 2 d)

Either contact the Course Co-ordinator, Dr. Jones, or give your documentation to your instructor. (Note: Doctor's notes are always acceptable, but not required.) If a valid excuse is received, your work will be re-evaluated. Otherwise, a grade of zero will be assigned.

5. 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. Please read 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 Ref.
Week 0	Sept. 10 to Sept. 11	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. 14 to Sept. 25	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. 28 to Oct. 9	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 Ch 5, 5.1 – 5.5
Week 5	Oct. 13 to Oct. 16	Equilibrium Midterm Review	Equilibrium simulation Equilibrium Practice Quiz Questions of the Week	Ch 14, 14.1 – 14.7
Week 6-9	Oct. 19 to Nov. 13	Acids & bases Salts, Buffers Titration curves	Tutorial on logarithms and pH Acid-Base e-lectures Acids and Bases Practice Quiz Salts & Buffers e-lectures Salts and Buffers Practice Quiz Titration Curves Practice Quiz Animations, exercises & problems, etc. Questions of the Week	Ch 15, 15.1 – 15.3 Ch 15, 15.6 – 15.8 Ch 16, 16.1 Ch 16, 16.3 – 16.7
Week 10–12	Nov. 16 to Dec. 3	Intermolecular forces Organic chemistry 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

6. COURSE HELP

(a) **CHEM*1040 Web Site -** 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. If you do not have a Central Login Account, go to www.uoguelph.ca/ccs/accounts/central/undergraduate.shtml,. The course website provides a wealth of course resources (i.e., e-lectures & animations), practice quizzes and a discussion board to post your course and lab questions.

(b) **Your Instructor**

Your instructor will be available at certain times for consultation and help. Office hours will be arranged at the first class meeting.

(c) **Chemistry Learning Centre** (SCIE 2101)

Teaching assistants are available Mondays, Wednesdays & Fridays from 9:30 a.m. to 3:30 p.m. as well as Tuesdays & Thursdays from 10:00 a.m. to 4:00 p.m. to answer your questions and help you with either the lecture or laboratory material. The **Centre opens Wednesday, Sept. 16.**

(d) **Supported Learning Groups (SLGs)**

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 at: *www.lib.uoguelph.ca/assistance/supported_learning_groups/*

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 quizzes and examinations. For the end of chapter problems, answers are provided at the back of your textbook. Many of these questions can be found on OWL under "End-of-Chapter Questions. Solutions manuals can be found in the Chemistry Learning Centre, on course reserve at the library and sold at the University Bookstore.

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 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 (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.

Chemical Equilibrium (Week 5)

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.

Acids, Bases, Salts, Buffers and Titration Curves (Week 6 – 9)

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.

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 & Intermolecular Forces: (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_2, F_2, Cl_2, Br_2, I_2, N_2, O_2, P_4, S_8. (Section 2.5)
- and are familiar with the names and formulas of simple inorganic and organic compounds. Familiarise yourself with Tables 2.4 to 2.6. Sections 2.6 – 2.8 and pages 1-26 in the Organic Notes.
- how to write and balance simple chemical equations by inspection. (Sections 2.9-10)
- 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.
- 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 & 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. (Sect. 14.4)
5. Relate Q value to ***direction of reaction***, forward or reverse, to reach equilibrium. (Sect. 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 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* & *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)
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 courses 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)
- inquiry (refer to 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)
- 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."