Winter 2012 Student Course Information
CHEM*1040 General Chemistry I
Department of Chemistry
University of Guelph

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COURSE DESCRIPTION: CHEM*1040 General Chemistry I F, W (3-3) [0.50]
This course introduces concepts of chemistry, the central link between the physical and biological sciences. Principles discussed include chemical bonding, simple reactions and stoichiometry, chemical equilibria and solution equilibria (acids, bases, and buffers), and introductory organic chemistry.
Prerequisite(s): 1 of 4U Chemistry, OAC Chemistry (or equivalent), CHEM*1060

1. COURSE 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 edition, Darrell Ebbing and Steven Gammon, Houghton Mifflin Co., 2009 plus Solutions Manual. (Same text as F'11)

(d) **CHEM*1040 Organic Chemistry Notes**, **Laboratory Manual** and **Safety Goggles** (not safety glasses) all are purchased from the Chemistry Department.

(e) A **Lab Coat** is required.

(f) An **Indigo Instruments Molecular Model Kit** is available from the University Bookstore. This is required to assist you with molecular shapes (Expt#7) and organic chemistry (Dry Lab#4).

2. EVALUATION

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

Online Homework*	8%
Online "Dry" Laboratory Activities	7%
"Wet" Laboratory & Laboratory quizzes	15%
Midterm Examination	30%
Final Examination	40%

*For new students not doing the Online Homework, the 8% will be added to the Midterm.

(b) **Online Homework** (*www.saplinglearning.com/* - free access provided by Sapling Learning for anyone repeating the course)
All students repeating the course must do the Online Homework.
For new students, to complete the **optional** online Sapling Homework you will need to purchase access either online with a credit card (www.saplinglearning.ca) or in the University

Bookstore. "Weekly homework assignments will be delivered through the **Sapling Learning** website. Assignments are due 11:59 p.m. on Wednesdays, starting Jan. 18. 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.

(c) **Practice Online Quizzes** (not for credit - *courselink.uoguelph.ca*)
A Self-Assessment Quiz is available on Courselink during January 9 – 13 and can only be accessed once. Find out what you know! Practice quizzes are available throughout the semester and can be attempted as many times as you wish. Test your knowledge in preparation for the exams.

(d) **Online "Dry" Computer Lab Activities** (*courselink.uoguelph.ca*)
Each computer lab consists of two parts: the experiment and the marking module. Both are delivered on the course website. The experiments can be accessed at the specified times and can be done as many times as you wish. However, within some labs, 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, carefully following the directions provided. You may only grade your lab work once. These activities are included within the Lab Schedule for your reference (see section 5).

1. *Volumetric Analysis Computer Lab* – test your analytical skills.
   - final results to be submitted before Sunday, **February 5, 11:59 pm.**
2. *Gaseous Equilibria Computer Lab* – study what influences chemical equilibria
   - marking module is to be completed before Sunday, **February 19, 11:59 pm.**
3. *Atomic Spectroscopy Computer Lab* – based on Experiment 6 in your laboratory manual.
   - marking module to be completed before Sunday, **March 11, 11:59 pm**.
4. *Organic Chemistry Computer Lab* – partially based on Experiment #8 in your lab manual.
   - marking module is to be completed before Sunday, **April 1, 11:59 pm.**

(e) **Midterm Examination**: **Monday, March 5, ROZH 104, 1730-1850**

(f) **Final Examination:** **Tuesday, April 17, 1430-1630**
Refer to *www.uoguelph.ca/registrar/scheduling/index.cfm?exam_winter* prior to the final exam period for room assignments. The final examination covers the entire course.

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

3. "WET" LABORATORY– Begins Monday, January 9. Bring your lab manual.

The laboratory is an integral part of the course and you **must** attend all "wet" laboratories. Students attend their wet labs according to their lab section number. Your course section number is made up of the lecture and lab section numbers. The first two numbers are the lecture section while the last two are the lab section (e.g., section 0107 means lecture section 01 and lab section 07).

If your lab section is an odd number (e.g. 0103 = lab section 03), then you follow the "Week Acid Student Schedule". If your lab section is an even number (e.g. 0108 = lab section 08), then you follow the "Week Base Student Schedule". The laboratory schedule is provided on the next page and important lab information is provided on the course website, under content.

(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 of your lab registration, you must bring a computer print-out dated **Jan. 01, 2012 or later** of "My Class Schedule" from WebAdvisor.

(b) **Laboratory Quizzes**

A brief quiz will be given before some of the laboratories. **Refer to the Laboratory Schedule**. These quizzes account for roughly 3 out of 15% of your lab grade, and will usually be based on the experiment that you are about to perform. It is essential that each experiment be studied carefully in advance of your laboratory period. Attempt the questions at the end of the lab to prepare for the quiz.

(c) **Laboratory Reports**

Laboratory reports are normally handed in exactly one week after your lab period (not on an earlier day) and before 4:30 p.m. Submit your **stapled** report into the appropriate Grey Box (labelled with your lab room number) located near MACN 128. If your report is not received, a grade of zero will be assigned.

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

DEADLINE: WEDNESDAY, JANUARY, 11, 2012

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 (i.e., F10, W11 or F11). Apply online at www.chemistry.uoguelph.ca/labexemption.

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

4. POLICY ON MISSED WORK

a) **Missed Wet Laboratory**

Refer to the "Purple Page for Lab Absences in First-Year Chemistry" handout (refer to the "Content" tab on the CHEM*1040 website). Documentation must be given to your laboratory TA.

b) **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 examinations will be given.**

c) **Missed Final Examination:**

If you miss a final exam, official documentation is required. Contact your Program Counsellor as soon as possible (refer to *www.uoguelph.ca/uaic/program_counsellors.shtml* to identify your Program Counsellors). Consult the Undergraduate Calendar (Section VIII, Academic Consideration).

d) **Other Missed Work**

Provide documentation to your instructor. If a valid excuse is received, your work will be re-evaluated. Otherwise, a grade of zero will be assigned.

5. WINTER 2012 CHEM*1040 LABORATORY SCHEDULE

Week Date	**"WEEK ACID" Student Schedule** (**ODD** lab section numbers)		**"WEEK BASE" Student Schedule** (**EVEN** lab section numbers)	
1 Jan. 9 – 13	**Arrive at regular starting time.** Check-in & Safety training Bring a printout of "My Class Schedule & your lab manual. Note: Safety training is mandatory and a legal requirement.	No Quiz	**Arrive 90 min after regular starting time.** Check-in & Safety training Bring a printout of "My Class Schedule & your lab manual. Note: Safety training is mandatory and a legal requirement.	No Quiz
2 Jan. 16 – 20	**Arrive at regular starting time.** Experiment 1: Introduction to Laboratory Equipment	No Quiz	**Arrive 90 min after regular starting time.** Experiment 1: Introduction to Laboratory Equipment	No Quiz
3 Jan. 23 – 27	**Arrive at regular starting time.** Experiment 2: Chemical Reactions in Aqueous Solution	**Quiz on Safety**	*Volumetric Analysis Computer Lab*	*Marking Module*
4 Jan. 30 – Feb 3	*Volumetric Analysis Computer Lab*	*Marking Module*	**Arrive at regular starting time.** Experiment 2: Chemical Reactions in Aqueous Solution	**Quiz on Safety**
Volumetric Analysis Marking Module Final Deadline: Sunday, February 5, 11:59 pm				
5 Feb. 6 – 10	**Arrive at regular starting time.** Experiment 3: Standardization of Sodium Hydroxide	**Quiz**	*Gaseous Equilibria Computer Lab*	*Marking Module*
6 Feb. 13 – 17	*Gaseous Equilibria Computer Lab*	*Marking Module*	**Arrive at regular starting time.** Experiment 3: Standardization of Sodium Hydroxide	**Quiz**
WINTER BREAK – February 20 to 24 – NO CLASSES – NO LABS				
Gaseous Equilibria Marking Module Final Deadline: Sunday, February 19, 11:59 pm				
7 Feb 27 – Mar.2	**Arrive at regular starting time.** Experiment 5: Buffers, Titration Curves and Indicators	**Quiz**	*Atomic Spectroscopy Computer Lab*	*Marking Module*
8 Mar. 5 – 9	*Atomic Spectroscopy Computer Lab*	*Marking Module*	**Arrive at regular starting time.** Experiment 5: Buffers, Titration Curves and Indicators	**Quiz**
Atomic Spectroscopy Marking Module Final Deadline: Sunday, March 11, 11:59 pm				
9 Mar. 12 – 16	**Arrive at regular starting time.** Experiment 6: Bonding & Molecular Structure Bring Molecular Model Kit!	No Quiz	**Arrive 90 min after regular starting time.** Experiment 6: Bonding & Molecular Structure Bring Molecular Model Kit!	No Quiz
10 Mar. 19 – 23	**Arrive at regular starting time.** Experiment 4: Synthesis of Aspirin **Hand in report at end of the lab.**	**Quiz**	*Organic Chemistry Computer Lab*	*Marking Module*
11 Mar.26 – 30	*Organic Chemistry Computer Lab*	*Marking Module*	**Arrive at regular starting time.** Experiment 4: Synthesis of Aspirin **Hand in report at end of the lab.**	**Quiz**
Organic Chemistry Marking Module Final Deadline: Sunday, April 1, 11:59 pm				
12 Apr. 2– 6	**Arrive at regular starting time.** Review lab grades & sign-out.	No Quiz	**Arrive 90 min after regular starting time.** Review lab grades & sign-out.	No Quiz

6. LECTURE SCHEDULE

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

Week	Dates	Topics	*Online Resources	Text Ref.
Week 0		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	Jan. 9 to Jan. 20	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 3 – 4	Jan. 23 to Feb. 3	Equilibrium Acids & bases	Equilibrium simulation Equilibrium Practice Quiz Tutorial on logarithms and pH Acid-Base e-lectures Acids and Bases Practice Quiz Questions of the Week	Ch 14, 14.1 – 14.7 Ch 15, 15.1 – 15.3 Ch 15, 15.6 – 15.8
Week 5 – 7	Feb. 6 to Mar. 2	Acids & bases Salts, Buffers Titration curves	Salts & Buffers e-lectures Salts and Buffers Practice Quiz Titration Curves Practice Quiz Animations, exercises & problems, etc. Questions of the Week	Ch 16, 16.1 Ch 16, 16.3 – 16.7
		MIDTERM – Monday, March 5, 1730-1850, ROZH 104		
Week 8 – 9	Mar. 5 to Mar. 16	Atomic structure, periodic trends, Lewis structures, VSEPR, bonding,	Periodic Tables VSEPR tutorial Atomic & Molecular Structure Practice Quiz Questions of the Week	*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 10–12	Mar. 19 to Apr. 6	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

7. COURSE RESOURCES

(a) **CHEM*1040 Web Site -** access through the portal **http://www.uoguelph.ca/courselink/**
The website is an integral part of the course and must be accessed several times per week. All important course announcements will be posted on this site. There are a wealth of resources (e.g., e-lectures, animations, practice quizzes, etc.) and a discussion board to post your course and lab questions.

(b) **Course Help**

(i) Dr. Balahura will be available for help at specific times or by appointment. Office Hours will be announced at the first class meeting.

(ii) The **Chemistry Learning Centre (Lib 360)** is where a graduate teaching assistant is available to assist you with lecture or lab material. Hours are posted on course website.

(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 <u>not</u> 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 and further information is available on the SLG website.

8. 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.

Stoichiometry and Reactions (Weeks 1–2)

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, Acids & Bases (Weeks 3–4)

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.

Acid-Base Equilibria (Weeks 5–7)

Chapter 16:
Weak Acids & Bases: 16.1, 16.9, 16.23, 16.25, 16.35, 16.39, 16.41, 16.45, 16.51, 16.53, 16.55, 16.57, 16.59, 16.63, 16.65, 16.101, 16.111, 16.115.
Salts & Buffers: 16.27, 16.29, 16.71, 16.73, 16.75, 16.77, 16.81, 16.83, 16.113, 16.141.
Titration Curves: 16.15, 16.31, 16.85, 16.87, 16.89, 16.93, 16.107, 16.109, 16.119, 16.121, 16.135, 16.143.

Atomic structure, periodic trends, molecular structure and bonding (Weeks 8–9):

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.

Organic Chemistry & Intermolecular Forces: (Weeks 10–12)

Chapter 11: 11.63, 11.69, 11.71.

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

Chapter 23: 23.14, 23.25, 23.29, 23.35, 23.39, 23.41, 23.53, 23.55, 23.65.

Chapter 24: 24.29, 24.31, 24.53, 24.55.

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 the memorization of terms and definitions, and shift toward 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 a few basic concepts but 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 & 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:

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.

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 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)

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 *Ketones* – 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 (both within the lectures and laboratories), another purpose of this courses is to help further develop skills that will aid you in 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."
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