UNIVERSITY of GUELPH

Department of Chemistry

CHEM*1050 General Chemistry II

Winter 2020 Student Course Information

Course Description: CHEM*1050 General Chemistry II F,W (3-3) [Credit Weight: 0.50]
This course provides an introductory study of the fundamental principles governing chemical transformations: thermodynamics (energy, enthalpy, and entropy); kinetics (the study of rates of reactions); and redox/electrochemistry.

Prerequisite(s): CHEM*1040

Course Co-ordinator: L. Jones (lojones@uoguelph.ca; MACN 331 West; Ext. 56123)

Instructors:

Lecture 01: ROZH 104 MW 17:30 – 18:50 L. Jones (MACN 331 West; lojones@uoguelph.ca)
Lecture 02: ROZH 104 TTh 13:00 – 14:20 R. de Laat (SSC 2506; rdelaat@uoguelph.ca)
Lecture 03: ROZH 104 MWF 12:30 – 13:20 P. Rowntree (SSC 2515; rowntree@uoguelph.ca)

Laboratory: Times and locations are listed on WebAdvisor (http://webadvisor.uoguelph.ca/).
The Teaching Assistant (TA) list is posted on CourseLink, under Content >> Web Lab Resources

1. COURSE MATERIALS

(a) **Textbook:** CHEM*1040's D. Ebbing & S. Gammon, General Chemistry, 10th, 9th or 8th ed. The publisher provides 10th ed. textbook options (text and/or e-book plus OWL resources) which can be purchased from one of the campus bookstores. OWL study materials include eBook, Thinkwell videos, tutorials, visualizations, simulations, student solutions manual & practice quizzes aligned with the course objectives. **Note:** 10th edition copies of the text and solutions manual are found on Library Course Reserve.

(b) **CHEM*1050 Laboratory Manual** is purchased from the Chemistry Department.
Sales run Jan. 6-10, 9:30 AM – 3:30 PM in SSC 2106.

(c) **Safety Goggles** (not safety glasses) and a **Lab coat** are **both mandatory**.
Goggles can be purchased from the Chemistry Department or University Bookstore.
A lab coat can be purchased from the University Bookstore.

(d) **Scientific calculator** with ln, e^x, $\log_{10}$ and 10^x functions is required. Calculators or notebook computers capable of storing information are **NOT** allowed in exams, *e.g.*, graphing calculators. It is your responsibility to bring a properly working calculator to exams and know how to use it.

(e) **Pearson Mastering Chemistry** (optional) - to complete the optional online homework one must purchase access to a Mastering Chemistry account. If you purchased an account last semester your access continues, and you can simply add the CHEM*1050 course to your account. Instructions are provided on CourseLink under *Content >> Course Resources >> Mastering Chemistry Info*.

For those considering purchasing access to an account, there is a ***two-week grace period*** on payment, so one can explore the site prior to paying. A 12-month access card can be purchased from the University Bookstore (*https://bookstore.uoguelph.ca/t-digitalsearch.aspx;* $74.25), the Co-op Bookstore ($66) or the Mastering Chemistry site ($66). To set-up an account, please follow the registration instructions provided on CourseLink under *Content >> Course Resources >> Mastering Chemistry Info*.

2. WET LABORATORIES – Begins Monday, Jan. 13! Bring your lab manual!

Labs are a required component of this course. A schedule is provided on the following page. Students attend their labs according to their lab section. For example, CHEM*1050*0123 has the section number 0123, where the last two numbers represent the lab section (*i.e.*, 23 = Mon. 2:30 PM). If your lab section ends with an **odd** number (*i.e.*, 1, 3, 5, 7 or 9), as is the case for lab section 23, you follow the "**Week A Schedule**". If it ends in an even number (*i.e.*, 2, 4, 6, 8 or 0), you follow the "Week B Schedule".

(a) **Mandatory Online Lab Safety Course**: Most of you will have completed the CourseLink "*Student Science Safety I (F19)*" last semester. If so, simply show your electronic badge to your TA (print or electronic form) prior to your first wet lab experiment. If not, please complete the online course, which takes 2-3 hours. You must obtain a grade of 90% or better on the final quiz to receive your electronic badge. You have unlimited attempts to pass the quiz.

(b) **Mandatory 1st Lab Meetings – Jan. 13 to 16**

You must attend your first lab to receive mandatory safety training, required by law. This safety meeting is a pre-requisite for all subsequent scheduled labs. As proof of your registration, you must either bring a printed copy of WebAdvisor's "*My Class Schedule*", dated **Jan. 01, 2020 or later**, or a device that can display your schedule electronically. You do not need a lab coat or googles for this first lab meeting, but you do need your CHEM*1050 lab manual.

(c) **Lab Flowcharts:** Prior to each "wet" lab, you must prepare a procedural flowchart to show the main tasks/procedural steps of the experiment, and the order in which they will be carried out. Your flowchart is presented to your TA prior to starting your scheduled lab. You will not be allowed to proceed with the experiment without it. Further info can be found in your lab manual.

(d) **Online "Wet" Pre-lab Quizzes – CHEM*1050 CourseLink – Starts Jan. 16**

Pre-lab quizzes are based on the "wet" lab activities that you are to perform **– refer to Lab Schedule**. To prepare, review the material in your lab manual. Pre-lab quizzes open the Thursday before your particular "wet" lab week and closes 60 minutes prior to the start of your lab period. You have 2 attempts at each quiz. Using Universal Design principles, all quizzes have been designed with ample time for all to complete. If a quiz is not attempted, a grade of zero is assigned. To access, go to *Content >> Pre-Lab Quizzes*. NOTE: Each quiz is available for review for two weeks after the final class deadline, *e.g.*, Quiz#1 can be reviewed Jan. 31 – Feb. 14.

(e) **Laboratory Reports – submitted electronically online**

Lab reports are submitted through Chemistry's online General Lab Marker System (ULab). During your lab period, you collect data and submit a copy to your TA before leaving the lab. You then complete your online lab report on your own and submit it for grading. Lab reports are normally due one week after your lab and by 11:55 PM. Marks are deducted for lateness. Further info and the link to the site are provided on CourseLink, under *Content >> "Wet" Lab Resources*. Additional info can be found in the Introduction section of your lab manual.

(f) **Week 11 – Final Exam Preparation Problems Lab**

This 90 minute lab session is provided to help you prepare for the final exam. Questions are posted on CourseLink under *Content >>"Wet" Lab Resources*. Attempt the questions prior to your lab to gain the most benefit. Answers are only provided during the lab sessions. Students exempt from the lab this semester are invited to attend any of the sessions running this week – refer to WebAdvisor for lab times/locations.

(g) **"Wet" Lab Exemptions for students repeating CHEM*1050**

DEADLINE: WEDNESDAY, JANUARY 8 → *www.chemistry.uoguelph.ca/labexemption*

Students who previously attempted the course in full (*i.e.*, did not drop the course), obtained a wet lab grade of **at least 60%,** but who failed the course, may apply for a lab exemption. The "wet" lab must have been completed in F'19, W'19 or F'18, with a maximum of one excused absence. One must successfully apply online by the deadline to be granted a "wet" lab exemption. If exempted from the "wet" lab (reports + quizzes), students **must** still complete all online "dry" labs.

WINTER 2020 CHEM*1050 LABORATORY SCHEDULE

DATE	WEEK A Schedule (Sections ending with **ODD** number)	Activity	WEEK B Schedule (Sections ending with **EVEN** number)	Activity
Week 1 Jan. 6 – 10	No CHEM*1050 Labs this Week	Independent Study	No CHEM*1050 Labs this Week	Independent Study
Week 2 Jan. 13 – 17	**Arrive for regular starting time.** Sign-in & safety training. Safety training is mandatory and a legal requirement.	Bring Class Schedule & Lab Manual	**Arrive 90 min after regular starting time** (i.e. for 10 AM, 4 PM or 8:30 PM)**.** Sign-in & safety training. Safety training is mandatory and a legal requirement.	Bring Class Schedule & Lab Manual
Week 3 Jan. 20 – 24	**Arrive for regular starting time.** Experiment 1: Equilibrium Constant.	**Pre-lab Quiz on WHMIS & Exp't 1**	**Do not go to lab room this week.** *Online Computer Lab:* *Dry Lab A: Bomb Calorimetry*	*Dry Lab A Marking Module*
Week 4 Jan. 27 – 31	**Do not go to lab room this week.** *Online Computer Lab:* *Dry Lab A: Bomb Calorimetry*	*Dry Lab A Marking Module*	**Arrive for regular starting time.** Experiment 1: Equilibrium Constant.	**Pre-lab Quiz on WHMIS & Exp't 1**
Dry Lab A: Bomb Calorimetry Marking Module DEADLINE: Sunday, February 2, 11:55 PM.				
Week 5 Feb. 3 – 7	**Arrive for regular starting time.** Experiment 2: Enthalpy of Formation.	**Pre-lab Quiz on Exp't 2**	**Do not go to lab room this week.** *Online Computer Lab:* *Dry Lab B: ΔG^o, ΔH^o, and ΔS^o.*	*Dry Lab B Marking Module*
Week 6 Feb. 10 - 14	**Do not go to lab room this week.** *Online Computer Lab:* *Dry Lab B: ΔG^o, ΔH^o, and ΔS^o.*	*Dry Lab B Marking Module*	**Arrive for regular starting time.** Experiment 2: Enthalpy of Formation.	**Pre-lab Quiz on Exp't 2**
Winter Break Feb. 17 – 21 – No Classes – No Labs				
Dry Lab B: Determination of ΔG^o, ΔH^o, and ΔS^o Marking Module DEADLINE: Sunday, February 23, 11:55 PM.				
Week 7 Feb. 24 – 28	**Arrive for regular starting time.** Experiment 3: Voltaic Cells.	**Pre-lab Quiz on Exp't 3**	**Do not go to lab room this week.** *Online Computer Lab:* *Dry Lab C: Electrolysis*	*Dry Lab C Marking Module*
Week 8 Mar. 2 – 6	**Do not go to lab room this week.** *Online Computer Lab:* *Dry Lab C: Electrolysis*	*Dry Lab C Marking Module*	**Arrive for regular starting time.** Experiment 3: Voltaic Cells.	**Pre-lab Quiz on Exp't 3**
Dry Lab C: Electrolysis Marking Module DEADLINE: Sunday, March 8, 11:55 PM.				
Week 9 Mar. 9 – 13	**Arrive for regular starting time.** Experiment 4: Chemical Kinetics.	**Pre-lab Quiz on Exp't 4**	**Do not go to lab room this week.** *Online Computer Lab:* *Dry Lab D: Catalytic Hydrolysis of Salicin*	*Dry Lab D Marking Module*
Week 10 Mar. 16 – 20	**Do not go to lab room this week.** *Online Computer Lab:* *Dry Lab D: Catalytic Hydrolysis of Salicin*	*Dry Lab D Marking Module*	**Arrive for regular starting time.** Experiment 4: Chemical Kinetics.	**Pre-lab Quiz on Exp't 4**
Week 11 Mar. 23 – 27	**Arrive for regular starting time.** Clean-Up and Final Exam Preparation Problems Lab. (Lab exempt students may attend any lab this week)	Attempt problems (on CourseLink) ***prior*** to lab.	**Arrive 90 minutes after regular starting time.** Clean-Up and Final Exam Preparation Problems Lab. (Lab exempt students may attend any lab this week)	Attempt problems (on CourseLink) ***prior*** to lab.
Dry Lab D: Catalytic Hydrolysis of Salicin Marking Module DEADLINE: Sunday, March 29, 11:55 PM.				
Week 12 Mar. 30 – Apr. 3	No CHEM*1050 Labs this Week	Independent Study	No CHEM*1050 Labs this Week	Independent Study

April 3rd is absolutely the last day to resolve any lab grade questions (first with your T.A.) and submit an application for lab regrade. Any remaining lab excuses must also be submitted by 5 PM on April 3rd, or else a grade of zero is assigned.

3. EVALUATION

(a) Your final course grade will be based on the scheme that produces the higher score:

Course Components	*Scheme #1:*	*Scheme #2:*
Optional Online Homework (MasteringChemistry)	7%	0%
Online "Wet" Pre-lab Quizzes (CourseLink)	3%	3%
Online "Dry" Lab Work (CourseLink)	10%	10%
"Wet" Lab Reports (General Lab Marker System)	12%	12%
Midterm Examination (Sat., Feb. 8, 10:00 – 11:30 AM)	28%	32%
Final Examination (Thurs., April 9, 7:00 – 9:00 PM)	40%	43%

Note: To obtain credit, a minimum of 50% in the overall course **AND** at least **five** out of the eight lab activities must have been completed, else a maximum final grade of 49% is assigned.

(b) **Optional Online Homework (Pearson Mastering Chemistry)**

Chemistry is not a subject that can be easily learned by simply reading a book. To consolidate your understanding, one must work with the course concepts on a regular basis. Interactive homework is one way to keep up and test your understanding. Access is purchased through one of the campus bookstores. Follow the instructions provided on CourseLink (*Content >> Course Resources >> MasteringChemistry Info*) to set-up an account. Complete "Intro to MasteringChemistry" to familiarize yourself with the system and "Chemistry Primer" as a review – these activities are not for credit. There are 11 graded assignments. Each is comprised of a quiz (weighted 50%; 2 attempts/question) and adaptive follow-up questions (50%; multiple attempts), generated once the quiz questions have been attempted. If you receive 95.0% or higher on the quiz, you are exempted from any adaptive follow-up questions. Your worst assignment will be dropped prior to calculating your final grade out of 10. Quizzes are due **Fridays 11:55 PM, starting Jan. 17**, and adaptive follow-ups are due the following **Tuesday 11:55 PM**. If an assignment is not attempted, a grade of zero is assigned.

(c) **Practice Online Quizzes** – not for credit (see *CourseLink >> Content*)

Topic specific practice quizzes, and a Midterm Prep Quiz, are posted under the appropriate Week. These quizzes can be attempted multiple times to help you test your knowledge.

(d) **Online "Dry" Labs** (see *CourseLink >> Content >> Online "Dry" Labs*)

Each online lab consists of 2 parts: the experiment and its marking module. Both are delivered through CourseLink. Background info and worksheets are provided in your lab manual. Experiments can be done as many times as you wish, however, some labs assign a new "unknown" number with each attempt. Make sure to record this number for grading purposes. Once you have completed all calculations, **only then** open the marking module to evaluate your work. You have one attempt and 60 minutes to enter your answers. If a marking module is not attempted, a grade of zero is assigned.

1. *Dry Lab A: Bomb Calorimetry* – complementing Expt#2, this lab uses a constant-volume calorimeter to determine $\Delta H_{combustion}$ for an unknown sample. Marking module closes **Sun., Feb. 2, 11:55 PM**.
2. *Dry Lab B: Determination of ΔG^o, ΔH^o, and ΔS^o* – study a weak acid dissociation reaction to determine thermodynamic constants. Marking Module closes **Sun., Feb. 23, 11:55 PM**.
3. *Dry Lab C: Electrolysis* – this lab complements Expt#3. You will determine Faraday's constant through applying electricity to an acidic solution. Marking Module closes **Sunday, Mar. 8, 11:55 PM**.
4. *Dry Lab D: Catalytic Hydrolysis of Salicin* – investigate the different mechanisms involved for an acid and an enzyme in the hydrolysis of salicin. Marking Module closes **Sun., Mar. 29, 11:55 PM**.

NOTE: Results can be reviewed during the two week period following each marking module's deadline.

(e) **Midterm Examination**: **Saturday, February 8, 10:00 – 11:30 AM,** locations TBA

Room assignments will be posted on CourseLink a few days prior to the exam. The midterm includes material up to and including Week 5 lectures, corresponding text references and laboratories. It will consist of multiple choice type questions. Past midterms can be found under Content >> Course Resources.

(f) **Midterm Conflict**: If you have a legitimate conflict, you may request to write the alternate midterm on Thurs., Feb. 6, 5:30–7:00 PM. Apply online by Fri., Jan. 31, via *www.chemistry.uoguelph.ca/alternateexam*

(g) **Final Examination: Thursday, April 9, 7:00 – 9:00 PM,** locations TBA
For room assignments, refer to *www.uoguelph.ca/registrar/scheduling/index.cfm?exam_fall* prior to the final exam period. This exam evaluates the entire course through multiple choice questions.

(h) Both exams are common for all CHEM*1050 sections and are closed book. Notes, printed material of any kind, any communication with other students or any other aids are not permitted. Computers or calculators capable of storing text information or formulas are **not permitted**.

4. POLICY ON MISSED WORK

A grade of zero is assigned for any missed work except for valid medical or compassionate reasons.

(a) **Missed Laboratory:** Applications to be excused from a missed pre-lab quiz and/or lab are submitted through ULab. Refer to "*Purple Page for Lab Absences in First-Year Chemistry*" posted on CourseLink, under *Content >> "Wet" Lab Resources* for details on how to apply.

(b) **Missed Midterm Examination:** If you do not write the midterm, documentation must be e-mailed to Prof. Jones or given to your Instructor. Doctor's notes are acceptable, but not required. If a valid excuse is received, the percentage value of the midterm is 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.**

(c) **Missed Final Examination:** If you miss a final exam, contact your Program Counsellor as soon as possible (refer to *www.uoguelph.ca/uaic/programcounsellors* for contact info). Official documentation is required within **five working days** of the missed examination. Consult the Undergraduate Calendar: *https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml*

(d) **Other Work:** When you find yourself unable to meet an in-course requirement, due to illness or compassionate reasons, e-mail Prof. Jones via your U of G account. Include your full name and student ID number. If a valid excuse is received, your work will be re-evaluated; otherwise, a grade of zero is assigned. Regulations and procedures for Academic Consideration are found in the Undergraduate Calendar (*https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml*)

5. EQUAL OPPORTUNITY AND EVALUATION POLICY

The University is committed to academic integrity and has high ethical and moral standards. All students will be treated equally and evaluated using the criteria presented in this outline. Evaluation criteria are based strictly on achievement and not effort. There is no extra work for extra credit or to "make up" a grade. The need to obtain a higher grade for various reasons is not grounds for increasing your grade. If your grade were "bumped" (*i.e.* you received a grade you did not legitimately earn), it would be unfair to all the other students in the course.

6. COURSE RESOURCES

(a) **CHEM*1050 Website –** access through portal *http://www.uoguelph.ca/courselink/*
Your **Username** is the part of your UofG e-mail address before the "@" sign. Your **password** is the same as your University e-mail. The course website provides a wealth of resources *(i.e.*, video resources, animations, questions of the week, and sample midterms, *etc*.), practice quizzes and a discussion board to post your course questions. Course announcements are posted on the course homepage to help you stay up-to-date. It is your responsibility to check this site on a regular basis.

(b) **Your Instructor –** will be available at certain times for consultation and assistance. These office hours are arranged at the 1st class meeting and are posted on CourseLink, along with their lecture materials.

(c) **Chemistry Learning Centre** (3rd Floor Library – Science Commons – LIB 360)
Teaching Assistants (TAs) are available to answer questions and assist you with both the lecture and laboratory material. Hours: Mon. 13:00 – 16:00; Tues. – Thurs. 10:00 – 16:00 & Fri. 10:00 – 13:00.
The Centre opens Wednesday, January 8th.

(d) **Supported Learning Groups** (SLGs) – *www.lib.uoguelph.ca/get-assistance/studying/slgs*

SLGs are regularly scheduled small group study sessions. Attendance is voluntary and open to all students in the course. SLGs are facilitated by students who have successfully completed the course. SLG leaders attend all lectures and work with faculty/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 prep. Session time(s) and location(s) are available on the SLG website.

7. LECTURE SCHEDULE

You must attend the lecture section in which you are registered. Instructors will cover basically the same material but may do so in a different order. You are responsible for all course material, whether it is explicitly discussed in class or assigned. To best prepare for class, review the appropriate sections in the text **<u>before</u>** your lecture.

Week	Dates	Topics	Text Ref.
Week 1–5	Jan. 6 to Feb. 7	Energy, heat, enthalpy, work, calorimetry, thermochemical equations, Hess's law and standard enthalpies of formation.	Ch. 6, 6.1 - 6.9 Ch. 11, 11.2 Ch. 18, 18.1
		Bond enthalpies and ionic compounds	Ch. 9, 9.1 and 9.11
		Entropy, free energy, equilibrium and bioenergetics.	Ch. 18, 18.2 - 18.7

MIDTERM EXAMINATION: Saturday, February 8, 10:00 – 11:30 AM

Week 6	Feb. 10 to Feb. 14	Redox processes, half-reactions, balancing redox reactions.	Ch. 4, 4.5 – 4.6 Ch. 19, 19.1

FEBRUARY 17 to 21 – WINTER BREAK – NO CLASSES

Week 7–9	Feb. 24 to Mar. 13	Galvanic cells, cell notation, standard cell potentials, free energy, equilibrium, Nernst equation, commercial cells and electrolysis	Ch. 19, 19.2-19.11
Week 10–12	Mar. 16 to Apr. 3	Reaction rates, rate laws, order, Arrhenius equation, reaction mechanisms, catalysis and radioactive decay Final exam review	Ch. 13, 13.1 – 13.9 Ch. 20, 20.4

FINAL EXAMINATION: Thursday, April 9, 7:00 – 9:00 PM

Note: You are expected to be respectful of your fellow classmates and your lecturer during class. Please refrain from making noise during lectures that distracts others and make sure your cell phone is turned off prior to class.

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 the midterm and final exam. For the end of chapter problems, answers are provided at the back of your textbook. For full solutions, consult the textbook's Student Solutions Manual. Copies are available in the Chemistry Learning Centre and on Course Reserve at the library.

Work the problems in the week the material is covered in lectures. A common reason why students are unsuccessful in CHEM*1050 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 first, then look at the solutions. Working from the solutions is not useful for learning. If you have difficulties, **seek help early**!

The questions within the text are organised according to categories (*e.g.*, Review, Concept and Cumulative-Skills Problems). If you find the early review questions unchallenging, move on to the other sections. Additional questions are provided under "*Resources*" on the course website as "*Questions of the Week*", which represent the types of questions that may appear on examinations.

Thermodynamics (Weeks 1 – 5):

Chapter 6: 6.35, 6.37, 6.41, 6.53, 6.55, 6.59, 6.61, 6.67, 6.69, 6.79, 6.81, 6.85, 6.99, 6.103, 6.115, 6.117, 6.155.
Chapter 9: 9.85, 9.107, 9.109.
Chapter 18: 18.23, 18.25, 18.27, 18.29, 18.31, 18.35, 18.39, 18.43, 18.45, 18.55, 18.61, 18.65, 18.69, 18.73, 18.75, 18.83, 18.85, 18.89, 18.97, 18.108, 18.121.

Electrochemistry (Weeks 6 – 9)

Chapter 19: 19.39, 19.41, 19.101 19.25, 19.33, 19.43, 19.45, 19.47, 19.51, 19.53, 19.55, 19.59, 19.61,19.63, 19.67, 19.71, 19.75, 19.79, 19.83, 19.85, 19.87, 19.91, 19.93, 19.95, 19.105, 19.111, 19.113, 19.117, 19.119, 19.123, 19.141.

Chemical Kinetics (Weeks 10 – 12):

Chapter 13: 13.31, 13.33, 13.41, 13.45, 13.49, 13.53, 13.55, 13.57, 13.59, 13.63, 13.69, 13.71, 13.75, 13.79, 13.81, 13.85, 13.99, 13.101, 13.105, 13.107, 13.117, 13.119, 13.125,13.143.
Chapter 20: 20.27, 20.61, 20.63, 20.67, 20.75.

9. CHEM*1050 EXPECTATIONS AND LEARNING OBJECTIVES

CHEM*1050 continues from CHEM*1040 to build up your understanding of general chemistry. In reviewing the course content of CHEM*1050 you may feel you know most of the material already. **Don't be misled!** The topics may be familiar, but we will be providing a deeper understanding of the fundamental concepts within chemistry. The purpose of CHEM*1040 and CHEM*1050 is to build upon your previous exposure to the subject. You will need to move away from just memorization terms and definitions and spend more time thinking about the processes and concepts within chemistry. This will lay the foundation for more advanced courses such as analytical chemistry (*i.e.*, CHEM*2400 or CHEM*2480), biochemistry (*i.e.*, BIOC*2580), organic chemistry (*i.e.*, CHEM*2700), inorganic chemistry and physical chemistry (*i.e.*, CHEM*2060, CHEM*2880 and CHEM*2820). **Note that the course is not designed to "teach" you chemistry. It is, however, constructed to help you <u>learn</u> chemistry.**

For some of you, it may have been more than a year since you last took a chemistry course and it is not unrealistic to assume that you have forgotten some of what you have already learned. We will review some basic concepts <u>but</u> 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:

- 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.)
- 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)
- info 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)
- 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)
- 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 CHEM*1040 Organic Notes.
- how to write and balance simple chemical equations by inspection. (Sections 2.9–2.10)
- 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)
- 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)
- 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 5.3–5.4)
- definitions for kinetic energy, potential energy and internal energy, as well as the units for energy and the law of conservation of energy. (Section 6.1)
- distinguish between an exothermic process and an endothermic process. (Section 6.3)
- 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 in a linear equation, and 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*1050 Learning Objectives** – this course can be subdivided into three sub-sections and the learning objectives for each are as follows:

Thermodynamics (Sections 6.1 – 6.8, 9.1, 9.11, 11.2 and 18.1-18.7)

1. Define a thermodynamic system, surroundings, work, heat & internal energy change. (Section 6.2)
2. Relate the heat absorbed or evolved to the specific heat, mass & temperature change. (Section 6.6)
3. Understand the differences between coffee-cup and bomb calorimetry (Section 6.6)
4. Describe pressure-volume work verbally and mathematically. (Section 6.3)
5. Understand what a state function is, and the differences between enthalpy and internal energy based on calorimetric data (Sections 6.3 + 18.1)
6. Write a thermochemical equation given pertinent information and learn how to manipulate (reversing and multiplying) thermochemical equations. (Section 6.4)
7. Calculate the heat absorbed or evolved from a reaction given its enthalpy of reaction and the mass of a reactant or product. (Section 6.5)

8. Apply Hess's law to obtain the enthalpy change for one reaction from the enthalpy changes of a number of other reactions. (Section 6.7 + 11.2)
9. Define standard state and standard enthalpy of formation. (Section 6.8)
10. Calculate the heat (enthalpy) of reaction from the standard enthalpies of formation of the substances in the reaction. (Section 6.8)
11. Calculate the heat of a phase transition using standard enthalpies of formation for the different phases. (Section 6.8 + 11.2)
12. Define bond energy and estimate ΔH from bond energies. (Section 9.11)
13. Describe the energetics of ionic bonding, including lattice energy and describe the Born–Haber cycle to obtain a lattice energy from thermodynamic data. (Section 9.1)
14. Define spontaneous process, entropy and the second law of thermodynamics. (Section 18.2)
15. State the third law of thermodynamics and situations in which the entropy usually increases. Predict the sign of the entropy change of a reaction. (Section 18.3)
16. Define standard entropy (absolute entropy) and calculate ΔS° for a reaction. (Section 18.3)
17. Calculate the entropy change for a phase transition. (Section 18.2)
18. Define free energy, G and describe how $\Delta H - T\Delta S$ functions as a criterion of a spontaneous reaction. (Section 18.4 & 18.7)
19. Define the standard free energy of formation, ΔG°_f. and the meaning of its sign. Calculate ΔG°_{Rxn} from standard free energies of formation values. (Section 18.4)
20. Describe how the free energy changes during a chemical reaction and how it relates to K and Q. (Section 18.5 – 18.6)
21. Calculate ΔG° and K at various temperatures and describe how ΔG° at a given temperature (ΔG°_T) is approximately related to ΔH° and ΔS° at that temperature. (Section 18.7)
22. Understand the difference between ΔG and ΔG°.
23. Describe how a nonspontaneous reaction can become spontaneous through the coupling of reactions and what is meant by $\Delta G^{\circ\prime}$.

Electrochemistry (Sections 19.1-19.11)

1. Recognize *oxidation-reduction* reactions, learn oxidation-number rules and be able to assign oxidation numbers to determine which species undergo *oxidation* and *reduction*. (Section 4.5)
2. Balance redox reactions in either acidic or basic environments. (Section 4.6 & 19.1)
3. Understand the construction of galvanic cells, i.e., identify anode, cathode and overall cell reaction, as well as, describe the function of a salt bridge or inert electrode (Section 19.2)
4. Write the cell reaction from the cell notation, and vice versa. (Section 19.3)
5. Define standard cell potential and volt. Use a table of standard reduction potentials to determine the relative strengths of oxidizing and reducing agents, as well as, calculate cell potential and evaluate the direction of spontaneity. (Section 19.4-5).
6. Calculate the standard free-energy change and the equilibrium constant from standard cell potential, and vice versa. (Section 19.6)
7. Calculate cell potential for nonstandard conditions using the Nernst equation. (Section 19.7)
8. Relate the basics of electrochemistry to some commercial voltaic cells, e.g., lead storage cell, nickel-cadmium cell, Leclanché dry cell, zinc–carbon dry cell and hydrogen fuel cell. (Section 19.8)
9. Explain the electrochemical process of the rusting of iron and cathodic protection. (Section 19.8)

10. Understand the construction of electrolytic cells. (Section 19.9)
11. Predict the most likely half-reactions in the electrolysis of molten salts (Section 19.9)
12. Predict the most likely half-reactions in an aqueous electrolysis. (Section 19.10)
13. Define overvoltage and use given values to predict half-reactions in electrolysis. (Section 19.10)
14. Apply stoichiometry and Faraday's constant to electrolysis problems. (Section 19.11)
15. Relate electrolysis to metallurgic processes and industrial cells, e.g., Hall-Heroult cell, Downs cell, chloro-alkali membrane cell, and electrorefining. (Section 19.9 – 19.10 & 21.2)

Chemical Kinetics (Sections 13.1-13.6 and 20.4)

1. Explain reaction rate, instantaneous rate and average rate of a reaction. (Section 13.1)
2. Describe how reaction rates may be experimentally determined. (Section 13.2)
3. Define and provide examples of a rate law, rate constant, and reaction order. Determine the order of a reaction from the rate law and determine the rate law from initial rates. (Section 13.3)
4. Apply the integrated rate laws for 1^{st}-order, 2^{nd}-order, and zero-order reactions to solve chemical kinetics problems. (Section 13.4)
5. Define half-life of a reaction and relate half-life to the rate constant for 1^{st}-order, 2^{nd}-order, and zero-order reactions. Determine half-life and activity from a radioactive decay constant. (Sections 13.4 & 20.4)
6. Plot kinetic data to determine the order of a reaction. (Section 13.4)
7. Apply the Arrhenius equation to solve kinetics problems. (Section 13.6)
8. State the postulates of collision theory. Describe how temperature, activation energy (E_a), and molecular orientation influence reaction rates. (Section 13.5)
9. State the transition-state theory and define activated complex. (Section 13.5)
10. Interpret potential-energy curves for endothermic and exothermic reactions. (Section 13.5)
11. Define elementary reaction, reaction mechanism, molecularity and reaction intermediate. Give examples of unimolecular, bimolecular, and termolecular reactions and determine the molecularity of an elementary reaction. (Section 13.7)
12. Using the rate-determining step in a mechanism, determine the rate law from a mechanism with an initial slow step or a mechanism with an initial fast, equilibrium step. (Section 13.8)
13. Define homogeneous catalysis and heterogeneous catalysis. Describe how a catalyst influences the rate of a reaction and how it changes the potential-energy curve of a reaction. (Section 13.9)

c) CHEM*1050 Learning Outcomes

On successful completion of this course, students should be able to:

1. Understand and demonstrate knowledge of the four laws of classical thermodynamics, including interpreting equations, formulas and concepts related to these laws.
2. Understand and apply the concepts of chemical equilibrium and electrochemistry to solve both qualitative and quantitative problems.
3. Demonstrate knowledge and understanding of reaction rates and the conditions that influence them.

4. Perform laboratory experiments demonstrating safe and proper use of standard chemical glassware and equipment.
5. Record, graph, chart and interpret data obtained from experiments through working co-operatively with others or independently.

10. ADVICE FROM STUDENTS ON HOW TO DO WELL IN CHEM*1050

- "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 textbook, pay attention in lecture, ask questions, visit your Prof., go to SLG's, go to the Chem Learning Centre, whatever you need to do, do it. Resources are there, you just need to go get them."

11. UNIVERSITY POLICIES & INFORMATION

a) **Academic Advisors** – If you are concerned about any aspect of your academic program, make an appointment with a Program Counsellor within your degree program. For contact info, please refer to: *https://www.uoguelph.ca/uaic/programcounsellors*

b) **Academic Assistance** – If you are struggling to succeed academically, the Learning Commons (*https://www.lib.uoguelph.ca/*) offers numerous academic resources, including workshops related to time management, taking multiple choice exams and general study skills. You can also set up individualized appointments with a learning specialist.

c) **Academic Integrity** – The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. Note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from the responsibility of verifying the academic integrity of their work before submission. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult their Instructor. Refer to the Academic Misconduct Policy in the Undergraduate Calendar:
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

d) **Accessibility** – The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student. When accommodations are needed, students are required to register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway. Accommodations are available for both permanent and temporary disabilities. Note that common illnesses, such as a cold or the flu, do not constitute a disability. Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance, and no later than the 40th Class Day. For more information, go to the SAS website: *www.uoguelph.ca/sas*

e) **Copies of out-of-class assignments –** Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

f) **Copyright of Course Materials –** All course materials are copyrighted by the Department of Chemistry, the instructor who prepared the materials or the publisher who provided the materials. These materials can only be reproduced with permission and in conjunction with associated copyright rules. **Note**: Lectures and laboratories **cannot** be recorded without the permission of the presenter. Material recorded with permission is restricted to personal use for that course, unless further permission is granted.

g) **Course Evaluation** (CEVAL) – Students will be invited to complete a short online evaluation of their TA**,** as well as their Instructor and the course, near the end of the semester. The department regards this information as important in evaluating the course, as well as your TA and Instructor's performances. All comments are reviewed and your suggestions are followed whenever possible. To access the online evaluation, go to *https://courseeval.uoguelph.ca/*.

h) **E-mail Communication** – As per university regulations, all students are required to check their <uoguelph.ca> e-mail account **regularly**: e-mail is the official route of communication between the University and its students.

i) **Use of Personal Information** – Personal information is used by University officials to carry out their authorized academic, administrative responsibilities and to establish a relationship for alumni and development purposes. The University of Guelph's policy on the Collection, Use and Disclosure of Personal Information can be found in the Undergraduate Calendar: *https://www.uoguelph.ca/registrar/calendars/undergraduate/current/intro/index.shtml*

j) **Resources** – Academic Calendars provide information about the University of Guelph's procedures, policies and regulations: *www.uoguelph.ca/registrar/calendars/index.cfm?index*

i. **Drop Date**: Students have until the last day of classes to drop courses, without academic penalty. Evaluate your performance regularly and if you are not doing well, seek advice from your Instructor prior to this date. Students who drop the course will not be eligible for a wet lab exemption if they repeat CHEM*1050 in a subsequent academic semester. Regulations and procedures for course registration are listed in the Undergraduate Calendar: *https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml*

ii. **Schedule of Dates**:
www.uoguelph.ca/registrar/calendars/undergraduate/current/c03/index.shtml
e.g., Last Day to add W'20 courses is Friday, January 10
No classes/labs are scheduled during the week of Feb. 17-21 for the Winter Break.
Friday, April 10 is a holiday. No exams are scheduled on this date nor Saturday April 11.

k) **Wellness –** If you are struggling with personal or health issues:

- **Counselling Services** (*https://wellness.uoguelph.ca/counselling/*) offers individualized appointments to help students work through personal struggles that may be impacting their academic performance.
- **Student Health Services** (*https://wellness.uoguelph.ca/health/*) provides medical attention.
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations (*http://www.selfregulationskills.ca/*)