Student Course Information
General Chemistry II
CHEM*1050
Winter 2005

Course Coordinator:			
Dr. John D. Goddard	MACN 340		
jgoddard@uoguelph.ca			
Lecturers:			
Dr. Mark Baker	MACN 122	Section 1	ROZH 104 MWF 12:30-13:20
mbaker@uoguelph.ca			
Dr. Lori Jones	MACN 331	Section 3	ROZH 101 MWF 16:30-17:20
lojones@uoguelph.ca			
Dr. Dan Thomas	MACN 120	Section 4	ROZH 104 MW 17:30-18:50
dfthomas@uoguelph.ca			

1. Required Materials

(a) " General Chemistry@, 8th edition, Ebbing and Gammon. AStudents Solutions Manual General Chemistry Ebbing and Gammon.@ These two books are shrink-wrapped together and may be purchased in the University Bookstore.

(b) Laboratory Manual for CHEM*1050. Purchased in the Department.

(c) Safety goggles and lab coats are required and available in the University Bookstore.

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

2. Laboratory

Labs begin in Week 1 on Monday, January 10. Bring your lab manual if possible. The laboratory is a required part of the course.

(a) Laboratory Time and Location

You must attend your first lab in order to receive mandatory safety training. The first safety lab is a prerequisite for all following labs. As proof that you are registered in the lab, **you must bring a recent computer printout of "My Class Schedule" from WebAdvisor to your first lab.**

(b) Quizzes

A brief quiz will be held at the beginning of some of the laboratory periods. See the Laboratory Schedule for details. These quizzes count towards your laboratory grade, and will usually be based on the experiment that you are about to perform.

(c) Laboratory Reports

Laboratory reports are due exactly one week after the lab. Submit the report to your demonstrator at the beginning of the next laboratory period.

(d) Laboratory Exemptions for students who are repeating CHEM*1050.

Students who obtained a lab grade of **at least 60 per cent** but who fail 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. Application for a lab exemption must be made before Tuesday, January 11 by filling in the application form posted near the water fountains on the second floor of SCIE.

Students repeating CHEM*105 with a lab exemption are strongly encouraged to attend the Problems Laboratory in Week 5. You may attend any of the labs that week. The Problem sheets may be picked up in any of the labs in Week 4.

3. Web Site

The web site can be accessed through the portal at **http://courselink.uoguelph.ca**. Your **username** is your Central Email Account Login ID (that part of your assigned University of Guelph e-mail address before the @ sign) and your **password** is your Central Email Account Password. The first page is your "myWebCT page" which will list all your WebCT courses including CHEM*1050. **CHEM*1050 WebCT is an integral part of the course and must be accessed often.**

4. Help

(a) Your professor will be available at certain times for consultation and help. Office hours will be announced at the first lecture.

(b) **Lecture Help in the Chemistry Help Room (MACN 106 in the MACN foyer)**

The Lecture Help schedule is posted on the CHEM*1050 WebCT page.

Lab Help in the Chemistry Help Room (MACN 106 in the MACN foyer)

Tuesday, Wednesday, Thursday (Beginning in Week 2.)	16:00 - 17:00

(c) 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 senior students who have recently taken the course. SLG leaders attend all lectures, take notes and work with faculty and staff to create study activities that integrate course content with effective approaches to learning. Students who attend SLG sessions have an opportunity to apply and demonstrate their understanding of course concepts in a safe practice environment. The group study format exposes students to various approaches to learning, problem-solving, and exam preparation. The session times and locations will be announced during the first lecture. These sessions have proven very helpful for students.

(e) CHEM*1050 WebCT contains a variety of materials to assist you with the course. There are practice quizzes and examinations, an animation on electrochemical cells, many examples of problems with full solutions, a question of the week, and much more. All important announcements for the course will be made on the web site.

5. Examinations and Grades

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

Midterm	30%
Final Examination	40%
Laboratory	20%
Online Quizzes	10%

(b) Quiz and Midterm Examination Dates

Quizzes

The quizzes are delivered on the web site. You may use the textbook and any notes when attempting the quizzes. The maximum benefit from the quizzes will be obtained if you do them on your own and under examination conditions. The quizzes are 75 minutes in duration and will be available on the dates listed below from 01:00 Tuesday until 23:55 Thursday. Answers and help for questions on your quiz may be accessed on the Friday, Saturday and Sunday of the quiz week. Each quiz can only be accessed at these times. **No reason for missing a quiz will be accepted. If a quiz is not attempted, a grade of zero will be assigned.** Please do not leave your quiz attempt until the last day!

Quiz#1 **Thermochemistry, Entropy, Spontaneity.**	**Feb. 01 - Feb. 03**
Quiz#2 **Redox and Electrochemical Cells**.	**Mar. 08 - Mar. 10**
Quiz#3 **Electrochemistry**.	**Mar. 22 - Mar. 24**
Quiz#4 **Kinetics.**	**Apr. 05 - Apr. 07**

Midterm Examination

Saturday, February 12, 9:30 - 11:00 a.m. Room assignments will be posted in the MACN building and on the WebCT page.

Midterm Conflict: Apply in writing to the course coordinator during the week of Jan. 31 - Feb 4 to write the **Alternate Midterm on Thursday Feb. 10, 17:30.** Include your name, ID, and reason for conflict and leave the application in the folder on the door of MACN 340. If you are not contacted the week of the examination, your application to write the alternate midterm has been approved. The rooms for the alternate midterm will be posted on the WebCT site.

(c) All examinations will be closed book, with no written or printed materials of any kind permitted. Electronic calculators can be used but no electrical outlets are available in exam rooms. Computers or calculators capable of storing text information or formulas are not allowed in examinations.

6. Policy on Missed Examinations

A grade of zero will be assigned for any missed examination except for valid medical or compassionate reasons.

Missed Midterm Exam. For a missed midterm examination, documentation must be given to your professor in person. There is no need to consult a doctor to obtain a note. However, if you have consulted a medical practitioner because of illness or injury, the doctor's note is acceptable documentation. In the case of a missed midterm, if a valid reason for missing the midterm is received, the percent value of the midterm will be added to the final examination.

No make-up midterm will be given.

Missed Final Exam. Consult the Undergraduate Calendar and your Program Counsellor for the appropriate course of action.

7. Lecture Schedule

Lecturers will cover the same material but may do so in a different order. Thus it is important that you attend your assigned lecture section throughout the semester. Please read the appropriate sections in the text before lectures.

Week / Date	Lectures	Topics	Text Reference
Weeks 1-5 Jan.10-Feb. 11	1-15	Energy, Heat, Enthalpy, Work, Thermochemical Equations, Calorimetry, Hess=s Law, Standard Enthalpies of Formation, Fuels. Bond Enthalpies. Energetics of ionic compounds. Entropy and Free Energy, Thermodynamics and Equilibrium.	Ch 6, 6.1-6.9 Ch. 19, 19.1 Ch 9, 9.11 Ch.9, 9.1 Ch 19, 19.2-19.5 Ch.19, 19.6-19.7
Feb. 12, 9:30-11:00	**Midterm Exam**	**Lectures 1 to 15 and corresponding problem assignments.**	
Week 6 Feb. 14-18	16-18	Redox processes, half-reactions, balancing redox reactions.	Ch 20, 20.1
Feb. 21-25		**WINTER BREAK**	
Weeks 7-9 Feb. 28 to Mar.18	19-27	Voltaic cells, Cell notation, Electromotive force (emf), Standard Cell emfs,Standard lectrodePotentials, Equilibrium constants from emfs, The Nernst equation, Commercial Voltaic cells, Electrolysis.	Ch 20, 20.2-20.3 Ch 20, 20.4-20.5 Ch 20, 20.6 Ch 20, 20.7 Ch 20, 20.8 Ch 20, 20.9-20.11
Weeks 10-12 Mar. 21 to Apr. 08	28-35	Reaction Rate, Experimental Kinetics, Rate and Concentration, Rate Laws, Temperature and Rate, Arrhenius, Reaction Mechanisms. Radioactive decay Friday Mar. 25 is a holiday.	Ch 14, 14.1-14.2 Ch.14, 14.3-14.4 Ch.14, 14.5-14.6 Ch.14, 14.7-14.8 Ch 21, 21.4

Midterm Examination, Saturday, Feb. 12, 09:30 - 11:00.
The midterm exam will consist of multiple choice questions, short answer questions, and problems similar to those in the problem assignments.
Final Examination, Thursday, Apr. 21, 14:30 -16:30.
The final examination covers the entire course.

8. Laboratory Schedule

Week 1 Jan. 10-14	Check-in, Safety in the Laboratory (WHMIS) All students **must** bring a printout of AMy Class Schedule@ to their lab in Week 1.	No Quiz
Week 2 Jan. 17-21	Experiment 1 - Enthalpy of formation Quiz on WHMIS and on Experiment 1.	Quiz
Week 3 Jan. 24-28	Experiment 2 - Measurement of an Equilibrium Constant **SCIE 2101, 2102, 2103** Experiment 3 - Determination of ΔG^o, ΔH^o, ΔS^o **SCIE 2104, 2108**	Quiz Quiz
Week 4 Jan. 31- Feb. 4	Experiment 3 - Determination of ΔG^o, ΔH^o, ΔS^o **SCIE 2101 , 2102, 2103** Experiment 2 - Measurement of an Equilibrium Constant **SCIE 2104, 2108**	Quiz Quiz
Week 5 Feb. 7-11	Problems Laboratory - Preparation for the midterm	No Quiz
Week 6 Feb. 14-18	Experiment 4 - Begin Oxidation and Reduction **Part A SCIE 2101, 2102, 2103** **Part B SCIE 2104, 2108**	No Quiz
Feb. 21-25	**WINTER BREAK**	
Week 7 Feb. 28-Mar. 4	Experiment 4 - Finish Oxidation and Reduction **Part B SCIE 2101, 2102, 2103** **Part A SCIE 2104, 2108**	Quiz
Week 8 Mar.7- 11	Experiment 5 - Galvanic Cells	Quiz
Week 9 Mar. 14-18	Experiment 6 – Electrolysis	Quiz
Week 10 Mar. 21-24	Experiment 7 - Chemical Kinetics Friday Mar. 25 is a holiday.	No Quiz
Week 11 Mar. 28-Apr. 1	Clean-up	
Week 12 Apr.4-Apr.8	Check Final Lab Grades.	

9. Problems

Problems are assigned to reinforce the principles covered in lectures, to help you to develop problem-solving skills, and to check your own knowledge. Work done on the problems is not graded, but there is a good correlation between mastering the problems on a week-by-week basis and performance in the course as a whole.

Work the problems in the week that the material is covered in lectures.

A common reason why students fail first year Chemistry is that they fall so far behind with the material that they never catch up. Lectures become harder to comprehend without the reinforcement of constant practice.

Work the problems independently. Working from the solutions is **not** useful for learning.

Solutions to problems

The detailed solutions to the problems are in the Student Solutions Manual which is included with the text. The Student Solutions Manual will also be on two-hour reserve in the library along with several copies of the text.

PROBLEMS

I Thermochemistry, Bond Enthalpies, Entropy and Free Energy, Thermodynamics and Equilibrium.

Text: Conceptual: 6.29, 6.33 Practice: 6.45, 6.49, 6.55, 6.61, 6.63, 6.65, 6.69, 6.73, 6.75 General:, 6.87, 6.89, 6.97, 6.103, 6.111 Cumulative: 6.121
Conceptual: 19.17,19.19,19.21, 19.23 Practice:19.25, 9.79, 19.29, 19.33, 19.37, 19.41, 19.45, 19.55, 19.59, 19.63 General: 9.101, 9.103, 19.67, 19.69, 19.77, 19.79, 19.83, 19.91, 19.95 Cumulative:9.113, 19.103

II Electrochemistry

Text: Conceptual: 20.19, 20.27 Practice: 20.33, 20.35, 20.37, 20.39, 20.41, 20.45, 20.47, 20.49, 20.53, 20.55, 20.57, 20.61, 20.65, 20.69, 20.73, 20.77, 20.79, 20.81, 20.85, 20.87, 20.89 General: 20.95, 20.99, 20.105, 20.107, 20.111, 20.113, 20.117 Cumulative: 20.125

III Chemical Kinetics

Text: Conceptual: 14.25, 14.27 Practice: 14.35, 14.39, 14.43, 14.47, 14.49, 14.51, 14.53, 14.57, 14.63, 14.65, 14.69, 14.73, 14.75, 14.79 General: 14.93, 14.95, 14.99, 14.101, 14.111, 14.113, 14.119 Cumulative: 14.125.
Conceptual: 21.23, 21.57 Practice: 21.59, 21.65, 21.71

I Conceptual and Integrated Problems

To check an answer or for help with any of these problems, please see your professor or go to the Help Room.

1. **Given the data**:

Bond Enthalpies, kJ.mol^{-1}		Enthalpies of Formation, kJ.mol^{-1}	
O–H	463	OH^-(aq)	–229.9
H–H	436	H_2O(l)	–285.8
		H_2O(g)	–241.8

Calculate ΔH for each of the following reactions.

1. $H_2(g) + 2\ O_2(g) \rightarrow H_2O(l)$
2. $H_2O(g) \rightarrow H_2(g) + 2\ O_2(g)$
3. $2H(g) + O(g) \rightarrow H_2O(g)$
4. $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$
5. $2H(g) \rightarrow H_2(g)$
6. $2H(g) + O(g) \rightarrow H_2O(l)$

2. Calculate the work needed to make room for products in the combustion of 1 mole of methane gas to carbon dioxide and water vapour at STP.

3. Calculate the lattice enthalpy of magnesium chloride from the following data.
   enthalpy of formation of Mg(g): 148 kJ.mol^{-1}
   first ionization energy of Mg(g): 736 kJ.mol^{-1}
   second ionization energy of Mg(g): 1450 kJ.mol^{-1}
   enthalpy of formation of Cl(g): 122 kJ.mol^{-1}
   electron affinity of Cl(g): –349 kJ.mol^{-1}
   enthalpy of formation of $MgCl_2$(s): –641 kJ.mol^{-1}

4. At the normal boiling point of ethyl ether, 34.5°C, ΔH^o of vaporization is 26.0 kJ.mol^{-1}. Assuming that the volume of 1 mole of liquid ethyl ether is negligible and that ethyl ether vapor behaves as an ideal gas, calculate q, w, ΔU, ΔS, and ΔG for the reversible vaporization of 1 mole of ethyl ether at a constant pressure of 1 atm.

5. At what temperature will the vapour pressure of water equal 6oo Torr ? Assume the enthalpy and entropy changes to be independent of temperature.

6. The standard free energy of formation of benzene is positive. Benzene is a common, stable organic molecule. Is there a conflict between these facts ?

7. A hydrogen electrode having a $H_2(g)$ pressure of 1.00 atm is combined with a standard calomel electrode, whose half-reaction is

$Hg_2Cl_2(s) + 2e^- \rightarrow 2Hg(l) + 2Cl^-(aq)$ $E^o = 0.268$ V

(a) If the cell potential is 0.800 V, find the pH of the solution surrounding the hydrogen electrode.
(b) Calculate the cell potential when the hydrogen electrode is immersed in a neutral solution.

8. The time-concentration data below were collected for the following reaction.

A -----> Products

Determine the order of the reaction graphically and calculate the rate constant.

Time, s	0	1	2	3	4
[A], M	1.00	0.430	0.270	0.200	0.160

9. A charcoal sample from Stonehenge, an ancient megalithic site near Salisbury in Southern England, is analyzed by carbon-14 dating. A 1.00-g sample gave 9.65 disintegrations per minute. A 1.00-g sample of carbon from a modern source gave 18,400 disintegrations in 20.0 hours. How old is the charcoal from Stonehenge?

10, The reaction

$2NO(g) + O_2(g)$ -----> $2NO_2(g)$ $\Delta U = -113$ kJ

is believed to occur by the following mechanism:

$2NO(g) \Omega N_2O_2(g)$ (rapid equilibrium, K)

$N_2O_2(g) + O_2(g)$ -----> $2NO_2(g)$ (slow, k)

(a) Derive the rate law predicted by this mechanism.
(b) Draw the energy profile (plot of energy versus reaction coordinate) for the reaction, clearly labelling all intermediates.