Student Course Information

General Chemistry II

CHEM*1050

Winter 2002

Coordinator: Dr. R. J. Balahura C&M 378

1. Required Materials

(a) "Chemistry: Molecules, Matter, and Change", 4th edition, Peter Atkins and Loretta Jones; "Student's Solutions Manual for Atkins and Jones's Chemistry: Molecules, Matter, and Change", Charles Trapp; W. H. Freeman and Company, 1999. These two books are shrink-wrapped together and may be purchased in the University Bookstore.

(b) Laboratory Manual for CHEM*1050. You must have your laboratory manual before attending your first laboratory. Purchased in the Department.

(c) Safety goggles: available in the University Bookstore.
Lab coats are not required but students are encouraged to wear them.

(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

Laboratories begin in Week 1, Monday, January 7. A Lab manual is required in Week 1. The laboratory is an integral part of the course. If less than 70% of the laboratory is completed, no grade will be assigned in the course.

(a) Laboratory Time and Location
Your laboratory time and location appear on the timetable issued by the registrar. You must take the labs in the time period assigned. **If you have not been assigned a laboratory, see T. Conroy in C&M 155 immediately.**

(b) Quizzes
A brief quiz will be held at the beginning of certain 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.
A student who earns **at least 12/20** in the laboratory, but who fails the course as a whole, may be granted 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 laboratory exemption must be made before Tuesday, January 8 by filling in the application posted on the bulletin board, around the corner from MACN 125.
Students repeating CHEM*105 are strongly encouraged to attend the Problems Laboratory. You may attend any of the labs. The Problem sheets may be picked up in any of the labs in the week preceding the Problems Laboratory.

3. Web Site

The web site can be accessed through the portal at **http://courselink.uoguelph.ca**. Your **username** is your Central Login ID (that part of your assigned University of Guelph e-mail address before the @ sign) and your **password** is your 7-digit student ID Number (you must include all zeros). The first page is **"**myWebCT: your name**"** which will list all your WebCT courses including CHEM*1050. **The CHEM*1050 web site is an integral part of the course and must be consulted often.** If you have any problems accessing the web site or have not been assigned a Central Login ID, please contact WebCT Support at "**webct@uoguelph.ca".** Please note, it can take up to one week to obtain a Central Login ID.

4. Help

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

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

The Lecture Help schedule is posted on the CHEM*1050 web site.

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

Tuesday	4:00 - 5:00 p.m.
Wednesday	4:00 - 5:00 p.m.
Thursday	4:00 - 5:00 p.m.

(c) Supported Learning Groups (SLG's)

SLG's 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 class meeting. These sessions have proven very helpful for students.

(d) A **Midterm Review Quiz** will be available in week 5 and a **Final Exam Review Quiz** will be available in week 12 on the CHEM*1050 ONLINE site. These quizzes are for self-study and will remain posted until the end of the semester.

(e) The web site contains a variety of activities to help you with the course. There are practice quizzes and examinations, an animation on electrochemical cells, many examples with full solutions, a question of the week, and much more. Please note, 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 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. The quizzes are 75 minutes in duration and will be available on the dates listed below from 1:00 a.m. Monday until 11:55 p.m. 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 and **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 and Spontaneity,** Jan. 28 - Jan. 31
Quiz #2 - **Redox and Electrochemical Cells**, Mar. 4 - Mar. 7
Quiz #3 - **Electrochemistry and Kinetics**, Mar. 25 - Mar. 28

Midterm Examination

Saturday, February 9, 9:00 - 10:30 a.m. Room assignments will be posted throughout the C&M building and on the web site under "Announcements".

Midterm Conflict: Apply in writing to the course coordinator during the week of Jan. 28 - Feb. 1 to write the Alternate Midterm on Thursday Feb. 7, 5:30 p.m.. Include your name, ID, and reason for conflict and leave the application in the folder on the door of C&M 378. If you are not contacted the week of the examination, your application to write the alternate midterm has been approved. The room for the alternate midterm will be posted on the web site under "Announcements".

(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. For a missed examination, **documentation must be given to your professor in person.** We are not responsible for documentation lost because it was not sent to the right 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.

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	Lecture	Topics	Text Reference
Weeks 1-5 Jan. 7 to Feb. 8	1-15	Thermochemistry Ionic compounds and lattice enthalpies Covalent compounds and bond enthalpies Entropy and Free Energy Applications of thermodynamics Review class	Ch 6, 6.1-6.16 Ch 8, 8.3, 8.4 Ch 9, 9.6, 9.7 Ch 17, 17.1-17.12
Feb. 9, 9:00-10:30 a.m.	**Midterm Exam**	**Chapter 6; sections 8.3, 8.4; sections 9.6, 9.7; chapter 17; corresponding problem assignments.**	
Week 6 Feb. 11-15	16-18	Redox processes, half-reactions, balancing redox reactions	Ch 18, 18.1, 18.2
Feb. 18-22		**WINTER BREAK**	
Weeks 7-9 Feb. 25 to Mar. 15	19-27	Galvanic cells Cell potential, standard potential Free energy, equilibrium The Nernst equation Practical cells Electrolysis Review class	Ch 18, 18.3, 18.4 Ch 18, 18.5-18.8 Ch 18, 18.9 Ch 18, 18.10 Ch 18, 18.11, 18.12 Ch 18, 18.13-18.16
Weeks 10-12 Mar. 18 to Apr. 5	28-35	Rates of reactions Radioactive decay	Ch 13, 13.1-13.14 Ch 22, 22.7

*The final examination covers the entire course and is scheduled by the registrar.

8. Laboratory Schedule

Week 1 Jan. 7-11	Check-in, Safety in the Laboratory (WHMIS)	No Quiz
Week 2 Jan. 14-18	Experiment 1 - Enthalpy of formation	Quiz
Week 3 Jan. 21-25	Experiment 2 - Measurement of an Equilibrium Constant **(C&M 152, C&M 157, C&M 159)** Experiment 3 - Determination of ΔG^o, ΔH^o, ΔS^o **(MACN 128 & 130)**	Quiz Quiz
Week 4 Jan. 28-Feb. 1	Experiment 3 - Determination of ΔG^o, ΔH^o, ΔS^o **(C&M 152, C&M 157, C&M 159)** Experiment 2 - Measurement of an Equilibrium Constant **(MACN 128 & 130)**	Quiz Quiz
Week 5 Feb. 4-8	Problems Laboratory - Preparation for the midterm	No Quiz
Week 6 Feb. 11-15	Experiment 4 - Begin Oxidation and Reduction **Part A (C&M 152, C&M 157, C&M 159)** **Part B (MACN 128 & 130)**	No Quiz
Feb. 18-22	**WINTER BREAK**	
Week 7 Feb. 25-Mar. 1	Experiment 4 - Complete Oxidation and Reduction **Part B (C&M 152, C&M 157, C&M 159)** **Part A (MACN 128 & 130)**	Quiz
Week 8 Mar. 4-8	Experiment 5 - Galvanic Cells	Quiz
Week 9 Mar. 11-15	Experiment 6 - Electrolysis	Quiz
Week 10 Mar. 18-22	Experiment 7 - Chemical Kinetics	No Quiz
Week 11 Mar. 25-28	Clean-up	No Quiz
Week 12 Apr. 1-5	Final Exam Review Quiz - CHEM*1050 ONLINE	

9. Problems

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

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 effect of constant practice.

Work the problems independently. Working from the solutions is **not** useful for learning.
If you have difficulties, it is your responsibility to seek help. We want to help!

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

PROBLEMS

I Thermochemistry, Lattice Enthalpies, Bond Enthalpies, Thermodynamics

Text: 6.5, 6.7, 6.9, 6.11, 6.15, 6.19, 6.21, 6.27, 6.29, 6.33, 6.37, 6.39, 6.41, 6.43, 6.45, 6.49, 6.51, 6.53, 6.57, 6.63, 6.65, 6.69, 6.71, 6.75, 6.79, 6.89, 6.107, 8.11, 8.13, 8.15, 8.77, 8.81, 9.29, 9.33, 9.35, 17.3, 17.5, 17.7, 17.11, 17.15, 17.23, 17.25, 17.27, 17.29, 17.35, 17.37, 17.39, 17.43, 17.45, 17.47, 17.49, 17.51, 17.53, 17.57, 17.59, 17.63, 17.69, 17.77, 17.83, 17.89.

Problem-solving Skills CD - **Q&A:** chapter 6, chapter 17.

II Electrochemistry

Text: 18.1, 18.3, 18.7, 18.11, 18.15, 18.17, 18.19, 18.21, 18.25, 18.27, 18.31, 18.35, 18.39, 18.43, 18.45, 18.49, 18.51, 18.53, 18.55, 18.57, 18.65, 18.67, 18.69, 18.77, 18.81, 18.83, 18.87, 18.99, 18.101, 18.123.

Problem-solving Skills CD - **Q&A:** chapter 18.

III The Rates of Reactions

Text: 13.1, 13.3, 13.7, 13.9, 13.17, 13.19, 13.21, 13.23, 13.27, 13.29, 13.33, 13.39, 13.41, 13.47, 13.49, 13.51, 13.61, 13.65, 13.67, 13.69, 13.75, 13.77, 13.81, 13.83, 13.87, 13.91, 13.103, 22.37, 22.43, 22.47, 22.77.

Problem-solving Skills CD - **Q&A:** chapter 13, chapter22, section 22.7.

10. Special Notes

I Concept and Integrated Problems

No solutions for the following problems will be available. To check an answer or for help doing any of these problems, please see your professor or go to the Help Room.

1. **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. $H_2(g) + ½\ O_2(g) \longrightarrow H_2O(l)$
2. $H_2O(g) \longrightarrow H_2(g) + ½\ O_2(g)$
3. $2H(g) + O(g) \longrightarrow H_2O(g)$
4. $H^+(aq) + OH^-(aq) \longrightarrow H_2O(l)$
5. $2H(g) \longrightarrow H_2(g)$
6. $2H(g) + O(g) \longrightarrow H_2O(l)$

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

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

   (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.

6. 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

7. 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?

8. The reaction

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

is believed to occur by the following mechanism:

$2NO(g) \rightleftharpoons N_2O_2(g)$ (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.

II Electron Affinity

Unfortunately there are two ways of defining electron affinities and the text we are using has chosen the most confusing definition. We will use the definition that is consistent with thermochemical conventions. Thus, **electron affinity refers to the enthalpy change for the addition of an electron to any gaseous species**. For example, consider the reactions below:

$Cl(g) + e^-(g) \longrightarrow Cl^-(g)$ ΔH_{eg} = electron-gain enthalpy = -349 kJ.mol^{-1}

$O(g) + e^-(g) \longrightarrow O^-(g)$ ΔH_{eg} = electron-gain enthalpy = -141 kJ.mol^{-1}

$O^-(g) + e^-(g) \longrightarrow O^{2-}(g)$ ΔH_{eg} = electron-gain enthalpy = $+844$ kJ.mol^{-1}

This means that ΔH_{eg}, the electron-gain enthalpy, is equal to –(electron affinity) values listed in the text, $\Delta H_{eg} = -E_{ea}$.