CHEM*2880 Physical Chemistry

Department of Chemistry
University of Guelph

*WELCOME TO CHEM *2880!* Physical chemistry is the branch of chemistry that deals with the scientific analysis of properties and the behavior of chemical systems, primarily by physical theory and techniques. It covers many topics that are important in the biological sciences. Why do some reactions proceed in one direction and not backwards? How fast are chemical reactions in living organisms? How much energy does an organism consume? How do we know the mass and the shape of a protein? Physical Chemistry provides the methods and theoretical background to answer these and related questions. This course will present the principles of physical chemistry and their application in the biological sciences.

COURSE DESCRIPTION: CHEM*2880 Physical Chemistry F (3-1.5) [0.50]
This survey course is intended for students who are not specializing in chemistry or chemical physics. Topics include basic thermodynamics, chemical equilibrium, macromolecular binding, chemical kinetics, enzyme kinetics, transport processes, colligative properties and spectroscopy. This course describes macroscopic observable properties of matter in terms of molecular concepts.
Prerequisite(s): CHEM*1050, (1 of IPS*1500, MATH*1000, MATH*1080, MATH*1200)
Restriction(s): CHEM*2820

Instructor: Prof. Lori Jones, MACN 331 (West Wing); e-mail: lojones@uoguelph.ca
Office Hours: M/W 9:30 – 11:30 AM, **or** by appointment

Lectures: Mondays, Wednesdays & Fridays 8:30 – 9:20, ROZH 103

Seminar Leader: Jane Ferguson; e-mail: jfergu12@uoguelph.ca

Seminars: Thursdays 5:30 – 6:50 PM, ROZH 103

Note: When sending e-mail messages please include the course # in the subject line.

Method of presentation: Lectures will concentrate on the principles and concepts behind the material, while seminars provide further opportunities to engage with the material and develop your problem solving skills.

Textbook: R. Chang, Physical Chemistry for the Biosciences, University Science Books, 2005

Supplemental: M. Marshall & H. Leung, Problems and Solutions to accompany Chang's Physical Chemistry for the Biosciences, University Science Books, 2005.

Note: Two copies of the text and a copy of the solutions manual are on Library Course Reserve.

EVALUATION

The course grade will be calculated based on the following scheme:

CourseLink Quizzes	10%
Test I – Week 4 (Thursday, Oct. 6, 5:30 – 6:50 PM)	25%
Test II – Week 8 (Thursday, Nov. 3, 5:30 – 6:50 PM)	30%
Final Examination (Saturday, Dec. 10, 11:30 – 13:30)	35%

Seminars: The purpose of the scheduled seminar time is to provide you with an opportunity to further deepen your understanding of the course material and to apply the concepts through various types of questions and 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.

CourseLink Quizzes: Following the seminars, a quiz will open and is due Sunday, 11:55 PM (refer to the schedule below). You may use the text and any notes when attempting the quizzes. The maximum benefit from the quizzes will be obtained if you do them on your own under examination conditions. Quizzes are time limited and can only be attempted once. After the class deadline, you will be able to re-enter your quiz and review your work along with feedback. Use this opportunity to review your quiz, make corrections and solidify your understanding. If a quiz is not attempted, a grade of zero will be assigned.

Course Schedule:

Week	Dates	Topics	Text Ref	Seminar
Week 0	Sept. 8 – 9	Introduction Properties of Gases	Review Chapter 1 Ch 2, 2-1-2.3	First Class Meeting (no Quiz)
Week 1	Sept. 12 – 16	Properties of Gases & Spectroscopy	Ch 2, 2.4-2.6 (p. 21) Ch 14, 14.1 Ch 14, 14.2-14.4	Properties of Gases Quiz #1
Week 2	Sept. 19 – 23	Spectroscopy & 1st Law of Thermodynamics	Ch 14, 14.5-14.8 Ch 14, 14.9; Ch 3, 3.2 Ch 3, 3.3-3.4	Spectroscopy Quiz #2
Week 3	Sept. 26 – 30	1st & 2nd Law of Thermodynamics	Ch 3, 3.5-3.7 Ch 4, 4.1-4.3 Ch 4, 4.4- 4.5	Thermodynamics Quiz #3
Week 4	Oct. 3 – 7	2nd Law of Thermodynamics & Solutions	Ch 4, 4.6-4.8 Review Ch 5, 5.1-5.2	**Test #1**
Week 5 (no classes Oct. 10)	Oct. 12 – 14	Solutions	Ch 5, 5.3-5.5 Ch 5, 5.6 Ch 5, 5.7-5.8	Solutions Quiz #4
Week 6	Oct. 17 – 21	Solutions & Chemical Equilibrium	Ch 5, 5.9; Ch 6, 6.1 Ch 6, 6.2 – 6.5(p. 213)	Solutions Quiz #5
Week 7	Oct. 24 – 28	Chemical Equilibrium & Electrochemistry	Ch 6, 6.5(p. 213) – 6.6 Ch 7, 7.1 – 7.4 Ch 7, 7.5 – 7.7	Chemical Equilibrium Quiz #6
Week 8	Oct. 31 – Nov. 4	Electrochemistry & Acids & Bases	Review Review Ch 8, 8.1 – 8.4	**Test #2**
Test #2 – Thursday, November 3, 5:30 – 6:50 PM, ROZH 103				
Week 9	Nov. 7 – 11	Acids & Bases & Chemical Kinetics	Ch 8, 8.5 – 8.7 Ch 9, 9.1 – 9.2 Ch 9, 9.3 – 9.4	Acids & Bases Quiz #7
Week 10	Nov. 14 – 18	Chemical Kinetics	Ch 9, 9.5 – 9.6 Ch 9, 9.7 – 9.8 Ch 9, 9.9 – 9.11	Kinetics Quiz #8
Week 11	Nov. 21 – 25	Enzyme Kinetics	Ch 10, 10.1 – 10.2 Ch 10, 10.3 – 10.5 Ch 10, 10.6 – 10.7	Kinetics Quiz #9
Week 12 Note: Dec. 1 = Tues. schedule	Nov. 27 – Dec. 2 Note: Dec. 2 = Mon. schedule	Review	Review	No Quiz
Final Examination – Saturday, December 10, 11:30 AM – 1:30 PM, Location TBA				

Note: The above schedule is the best zeroth-order approximation.

Problem Sets and 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. Problem sets and end-of-chapter questions provide reinforcement of the principles covered in lectures, allow you to practice problem-solving techniques and check your own knowledge. Problem sets are posted on the course website and will not be graded. For full solutions, consult the textbook's Student Solutions Manual. Copies are available 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*2880 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**!

Properties of Gases:

Chapter 2: 6, 8, 20, 24, 42, 44, 46.

Spectroscopy:

Chapter 14: 2, 8, 16, 18, 26, 32, 36, 38, 40, 48, 50, 52, 56, 62, 66, 70, 74, 76, 82, 84.

Thermodynamics:

Chapter 3: 4, 6, 12, 14, 16, 22, 24, 32, 36, 38, 40, 42, 50, 54, 56, 60, 61, 64, 66, 76, 81, 82.
Chapter 4: 5, 6, 8, 10, 14, 18, 19, 20, 22, 26, 28, 32, 36, 38, 40, 44, 46, 50, 54, 58, 62, 66, 74.

Applications:

Chapter 5: 2, 8, 10, 12, 16, 30, 32, 34, 36, 38, 52, 54, 60, 63, 76, 78.
Chapter 6: 2, 4, 6, 8, 10, 14, 16, 18, 22, 28, 36, 42, 44, 46.
Chapter 7: 2, 4, 6, 8, 10, 14, 16, 18, 22, 24, 28, 30, 36, 38, 42, 46.
Chapter 8: 2, 4, 8, 10, 12, 14, 16, 22, 24, 26, 28, 34, 36, 40, 42, 44, 48, 52, 54, 56, 62, 66, 70, 72, 80.

Kinetics:

Chapter 9: 4, 6, 8, 10, 16, 22, 24, 30, 32, 34, 44, 46, 50, 52 (refer to 9.49 for def'n of a *curie*).
Chapter 10: 6, 8, 12, 14, 30, 32, 34, 36, 38.

LEARNING OUTCOMES

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

1. Demonstrate knowledge and understanding of the properties of, both ideal and real, gases and solutions.
2. Demonstrate an understanding of the basics of spectroscopy and interpret UV, IR and NMR spectra.
3. Understand and demonstrate knowledge of the four laws of classical thermodynamics, including interpreting equations, formulas and concepts related to these laws.
4. Understand and apply the concepts of chemical equilibrium and the response of chemical equilibria to changing conditions, such as temperature and pressure.
5. Demonstrate knowledge and understanding of reaction rates and the conditions that influence them.
6. Solve problems and interpret graphs based on experimental observations and quantitative data.

UNIVERSITY POLICIES

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

b) **Accessibility** – The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact ***Student Accessibility Services*** as soon as possible. For more information, contact SAS at 519-824-4120 ext. 56208, or e-mail csd@uoguelph.ca or refer to the website *www.csd.uoguelph.ca/csd/*

c) **When You Cannot Meet a Course Requirement -** if you are unable to meet a course requirement because of illness or compassionate reasons, please advise the course instructor in writing, with your name, id#, and e-mail contact. See the undergraduate calendar for info on regulations and procedures for Academic Consideration:
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

d) **Academic Misconduct Policy** – 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 community – faculty, staff, and students - 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. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor. The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

e) **Recording of Materials** – Presentations which are made in relation to course work – including lectures – cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

f) **Resources** – Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs:
Undergraduate Calendar: https://www.uoguelph.ca/registrar/calendars/undergraduate

i. **Drop Date**: The last date to drop one-semester courses, without academic penalty, is **Nov. 4**. For regulations and procedures for dropping courses, refer to the Undergraduate Calendar:
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., Thurs., Dec. 1 – classes rescheduled from Tue., Oct. 11; Tuesday schedule in effect
Fri., Dec. 2 – classes rescheduled from Mon., Oct. 10; Monday schedule in effect.