Chem 2214B: Physical Chemistry for Life Sciences
2017 Winter Course Outline

Course Description

Basic thermodynamic concepts and relations and illustration of their relevance and applications to biological systems. In addition, some aspects of electrochemistry, and spectroscopic techniques will be introduced, again with emphasis on the role of these techniques in understanding the structure and nature of important biological molecules.

Prerequisite Requirements

Unless you have either the prerequisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites. The prerequisite for this class is Chemistry 1301A/B and Chemistry 1302A/B, or the former Chemistry 1100A/B and 1200B, or the former Chemistry 1050; 0.5 course from: Calculus 1000A/B, 1100A/B or 1500A/B, and 0.5 course from: Applied Mathematics 1201A/B, Calculus 1301A/B, 1501A/B, or the former Calculus 1201A/B, Mathematics 1225A/B, 1229A/B, 1600A/B, or the former Linear Algebra 1600A/B. Anti-requisites are Chemistry 2374A, 2384B and the former Chemistry 2274A.

Lecture and Instructor Information

<table>
<thead>
<tr>
<th>Section</th>
<th>Time</th>
<th>Room</th>
<th>Instructor</th>
<th>Office</th>
<th>Email</th>
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</thead>
<tbody>
<tr>
<td>001</td>
<td>MWF 2:30–3:30 pm</td>
<td>UCC 58</td>
<td>Prof. Yang Song</td>
<td>ChB 22</td>
<td><a href="mailto:yang.song@uwo.ca">yang.song@uwo.ca</a></td>
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</tbody>
</table>

Office hours
Thursdays 2:30-3:30 PM, or by appointment (email or in-class).

Email policy
For your own protection, students must use only their @uwo.ca email account for all inquiries related to this course. It is very easy for anyone to set up a web-mail account with anyone else’s name in the email address. All emails coming from non-uwo servers will be ignored. All emails coming to the instructor should include “Chem 2214” in the subject line to avoid delay in response.
Course Materials


Tentative Lecture Topics

Topics | Chapter in Tinoco
-------|------------------------
1. Introduction | Chapter 1 and 2
2. The properties of gases | Chapter 2
   Ideal gas law and van der Waals equation of state
3. The first law of thermodynamics | Chapter 2
   Work, heat, expression of the first law, enthalpy, internal energy
   Thermochemistry
4. The second law of thermodynamics | Chapter 3
   Entropy and Gibbs free energy
5. Physical equilibria | Chapter 4 and 6
   Temperature and pressure dependence of Gibbs Free energy
   The phase diagram
6. Chemical equilibrium | Chapter 4 and 7
   Relation between the equilibrium constant and $\Delta G$
   Electrochemistry
7. The thermodynamic description of mixtures | Chapter 6
   Ideal solutions, Rault's law, Henry's law, colligative properties
8. Transport processes | Chapter 8
   Diffusion and diffusion coefficient
   Fick's first and second laws
   Solvation and sedimentation
9. Spectroscopy | Chapter 13 and 14
   Beers' Law. UV-Visible spectroscopy and fluorescence.
   Infrared spectroscopy. Proton nuclear magnetic resonance.
   Circular Dichroism. Optical rotation and Optical Rotatory Dispersion.
   Mass spectrometry.
Lab Information

For the labs, students of the entire class will be divided in two groups A and B (regardless of your original registered sections, i.e., 051 or 052). The first day in the lab you start directly with the experiments. There is not a separate registration day for the lab. Make sure you bring with you the lab coat, safety glasses, the lab manual and you follow the dress code of the labs. Be prepared for the experiment before your arrival at the lab. As the starting date of the labs approaches more information will be given in the lectures regarding the experiments and the structure of the labs.

Lab time: Fridays 9:30 AM – 12:30 PM (You will do labs every other week; see following schedule)

<table>
<thead>
<tr>
<th>Dates</th>
<th>Group A</th>
<th>Date</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 20</td>
<td>Vapour pressure</td>
<td>Jan 27</td>
<td>Vapour pressure</td>
</tr>
<tr>
<td>Feb 3</td>
<td>Electromotive force</td>
<td>Feb 10</td>
<td>Electromotive force</td>
</tr>
<tr>
<td>Feb 17</td>
<td>Diffusion</td>
<td>Mar 3</td>
<td>Diffusion</td>
</tr>
<tr>
<td>Mar 10</td>
<td>Viscosity</td>
<td>Mar 17</td>
<td>Viscosity</td>
</tr>
</tbody>
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All labs will be in ChB Room 110 (first floor).

Lab Coordinator: Dr. Doug Hairsine scidwh@uwo.ca
Lab TAs: Miss Nazhen Liu nliu63@uwo.ca Miss Darya Komsa dkomsa@uwo.ca

Lab safety: Lab coat, safety glasses, proper footwear (shoes must cover the entire foot), socks, and ankle-length pants must be worn in the lab. Also refer to the laboratory guideline in Chem 2214 lab manual.

Students must seek approval from TAs whenever they leave the laboratory during experiments. They must return within a reasonably short period. Students leaving without approval will not be allowed to return to the lab, and will receive 0% on their lab mark.

Due to limited resources, students are asked to work in pairs or groups of three in the lab. However, each student is expected to learn all aspects of the experiments. Likewise, each student is expected to contribute equally with their highest level of skills and effort. In the event of unequal contributions, the TAs may require the students to work individually for the remaining of the lab. Each student must write his/her own lab report independently and thus may receive a mark different from that of the partner(s). Lab partners who must plot or tabulate identical data should ensure that other aspects of their graphs or tables are “individualized”; for example, use different font sizes or types for the title and axes.
Course Website

Students should check OWL (http://owl.uwo.ca) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class. The missing of critical information due to your failure to check OWL cannot be used as a basis for appeal.

Learning Outcomes

Upon successful completion of this course, the student is expected to demonstrate the ability to:

- Describe the basic principles of thermodynamics and other selected physical chemistry topics.
- Solve problems by correctly formulating the physical/chemical processes and executing accurate calculations.
- Conduct physical chemistry laboratory experiments efficiently and with in-depth understanding.
- Compile professional standard lab reports with critical data analysis.
- Work both independently for course work and collaboratively as a team in the lab.

Evaluation

Components

The overall course grade, out of 100, will be calculated as listed below. Listed next to the respective components are their maximum contributions toward the course grade.

<table>
<thead>
<tr>
<th>Component</th>
<th>Notes</th>
<th>Value</th>
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<tbody>
<tr>
<td>Laboratory (lab reports)</td>
<td>4 labs, 5% each; see lab manual</td>
<td>20</td>
</tr>
<tr>
<td>Homework assignments</td>
<td>4 problem sets, 5% each</td>
<td>20</td>
</tr>
<tr>
<td>Midterm Test</td>
<td>Thursday, Feb 27, 7:00-9:00 PM</td>
<td>25</td>
</tr>
<tr>
<td>Final Exam</td>
<td>Scheduled by the Registrar</td>
<td>35</td>
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Students must pass the laboratory components in order to pass the course. Students must also pass the test components (midterm and final combined) to pass the course. Final exam must be written. Students must attend all lectures and lab sessions. Lecture notes and all important information for the course will only be provided during lectures. Absence in a lab session will result in a grade of zero unless academic accommodation has been obtained from the Faculty of Science Counsellors.

Students who are late in submission of homework assignment or lab report without approved academic accommodation are subject to late penalty. The penalty for a late homework
assignment is 25% per day late for up to two days; after third day, the assignment in no longer acceptable and you will receive zero for that assignment. The penalty for a late lab report is 10% per day for up to 5 days; after 6th day, the report is no longer acceptable and you will receive zero for that lab.

**Important Legalities**

It is Department of Chemistry policy that any student repeating a chemistry course must repeat the entire course, including the lab component. There are no lab exemptions.

Students seeking academic accommodations based on medical (physical or mental) illness should begin by contacting the Academic Counsellors of their home faculty. Please visit the following link for policy on Accommodation for Illness: [http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf).

There is no opportunity for a reweight of the other course components after the test or exam has been written. *The reason of “I did not want to write a heavily weighted final” is not a valid reason for writing the midterm test while ill.*

It is university policy that a regularly scheduled class (lecture, lab, or tutorial) takes precedence over tests and exams. Therefore, if another course schedules a test or exam that takes place during your lab or tutorial, the instructor for that course must accommodate you.

No electronic devices (e.g., phones, iPods, etc.) may be in your possession during tests and exams, even for timekeeping purposes. Only Sharp EL-510R(B)/510RN(B) scientific calculators are allowed in midterm and final examinations.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at this website: [http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf).

Computer-marked, multiple-choice tests and exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

**Missed Course Components**

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or supporting documentation to the Academic Counselling Office of your home faculty as soon as possible.

If you are a science student, the Academic Counselling Office of the Faculty of Science is located in WSC 191, and can be contacted at 519-661-3040 or sciabmsac@uwo.ca. Their website is [http://www.uwo.ca/sci/undergrad/academic_counselling/index.html](http://www.uwo.ca/sci/undergrad/academic_counselling/index.html).
A student requiring academic accommodation due to illness must use the Student Medical Certificate (https://studentservices.uwo.ca/secure/medical_document.pdf) when visiting an off-campus medical facility.

For further information, please consult the university’s medical illness policy at http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf.

If you miss any of the evaluation components legitimately, they will be reweighed as the following.

**Missed lab.** If you miss a laboratory experiment for a valid reason, present documentation to an academic counselor in your Dean’s office. If your documentation is approved, proper accommodation will be made by allowing for you to do the lab another week if possible, or by waiving the experimental part of the lab, but you still need to write up the lab report using your partner’s data. If all those arrangement are not possible, that particular lab will be entirely waived and your lab mark will be based on the remaining labs.

**Missed homework assignment.** If you cannot submit your homework assignment by the due time for a valid reason, present documentation to an academic counselor in your Dean’s office. If your documentation is approved, that particular assignment will be waived and your homework assignment mark will be based on the remaining assignments.

**Missed midterm test.** If you miss the midterm test for a valid reason, contact an academic counselor in your Dean’s office. If an accommodation is approved, the weight of the midterm will be transferred to the final exam. **There is no makeup midterm.**

**Missed final exam.** If you miss the Final Exam, contact your faculty’s Academic Counselling Office as soon as possible. They will assess your eligibility to write the Special Exam (the name given by the university to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (see http://www.registrar.uwo.ca/examinations/exam_schedule.html).

**Accessibility**

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 ext. 82147 if you have questions regarding accommodation.

**Support Services**

Learning-skills counsellors at the Student Development Centre (http://www.sdc.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual
support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western (http://www.health.uwo.ca/mental_health) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC, http://westernusc.ca/services.

The website for Registrarial Services is http://www.registrar.uwo.ca.

Social Media

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Facebook - www.facebook.com/ChemistryatWestern