Fall 2017 | **CHM 220 : Physical Chemistry for Life Science**

INSTRUCTORS:

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CLASS MEETINGS: Monday and Wednesday 13:10 -14:00, Friday 15:10-16:00 (ES 1050)

TUTORIAL MEETINGS: TUTORIALS START WEEK OF SEPTEMBER 11.

Mondays 11:00 – 12:00; Wednesdays 14:00 – 15:00; Thursdays 16:00 – 17:00

Please note that the marked CHM 220 term tests will be returned only at your tutorial class. Therefore, it is imperative that you attend the particular tutorial class to which you have been assigned.

OFFICE HOURS AND HELP SESSIONS: Office hours will take place on Mondays after class in LM155 from 14:00-15:00. Additional extra help sessions will be held before tests.

REQUIRED TEXT: The required text for CHM 220 is Physical Chemistry for the Chemical and Biological Sciences, 3rd edition, by Raymond Chang. It is available from the University of Toronto Textbook Store at 214 College Street. The textbook provides another useful resource to better understand lecture material and to provide more sample problems. Note, however, that you are not responsible for material in the text that is not covered in lectures.

On behalf of the Department of Chemistry, we would like to welcome you to your second-year course in introductory physical chemistry for the biosciences.

A central theme of CHM 220 is that, starting from a few basic physical principles, it is possible to rationalize a wide variety of observations and even make predictions. Basic physical chemistry principles can be used to understand phenomena ranging from the small scale behavior of single molecules to complex biological processes to the large scale optimization of industrial chemical processes.

One of the goals of CHM 220 is to give you an introduction to this remarkable relationship between physical chemistry concepts and observations. This course will cover key concepts in modern physical chemistry and biophysics. It will prepare you for 300-level bio-stream sciences or will serve as an introductory course for physical chemistry. Problems will involve calculations and some mathematical

concepts, as well as qualitative topics. It is important both to ***understand*** the ideas presented from a conceptual point of view, and to be able *to use* them.

This outline is designed to provide you with information about the course, to let you know what we hope to do and to point out what we expect from you.

1) *You are responsible for material taught in lectures*. If you do not understand something, do get clarification right away. Note that, due to the large size of the class, it is not possible to answer questions by e-mail. However, you are encouraged to ask questions during lectures or during tutorials.
2) *You must be able to apply concepts taught in lectures to solve problems*. Note that tutorials will provide very useful examples of problems that you should be able to solve on tests and on the exam, and provide an excellent opportunity to ask questions. It is, therefore, highly recommended that you take advantage of this resource.

COURSE WEBSITE:

The course website will serve as a primary source for much of the information upon which you need to remain up-to-date. The course lecture notes, tutorial assignments, test information and other course material will be posted frequently on the website as the course progresses. Visit the course website on a regular basis!

Like many other courses, CHM220 uses the Blackboard LMS for its course website. To access the CHM 220 website, or other Blackboard-based course websites, go to the UofT portal at

http://portal.utoronto.ca/

Click the "log-in to the portal" icon and login using your UTORid and password. Once you have logged in, you'll see the link to the CHM 220 course website as well as the link to any of your other course websites which use the Blackboard system.

LECTURES: You should make every effort to attend the lectures, since the fundamental content of the course is going to be discussed there. Outlines of the lectures will be posted on-line, but details and example questions will be only provided during the lectures.

TEST AND EXAM SCHEDULE: Two tests will be held according to the dates provided below. Any changes to the schedule will be announced to the class. A cumulative exam will be given at the end of the semester (date to be determined). Both the final and midterm examinations are, closed-book examinations, where non-programmable electronic calculators are allowed.

SCHEDULE

Term Test 1:	Wednesday, October 11th, 2017, 18:10 – 19:40
Term Test 2:	Monday, November 13th, 2017, 18:10 – 19:40
Final Exam:	(3hrs) TBD (during examination period December 9th – December 20th)

MARKING SCHEME

Term Tests	(2 × 25%)	50 %
Final Examination		50 %
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Final Mark		100%

GETTING ASSISTANCE

Your tutorial teaching assistants will help as much as they can during allocated contact hours. Neither the lecturer nor the tutors will be able to respond to e-mail messages concerning problem solving issues, except in exceptional cases.

ABSENCE

If you miss a test or a significant period of class work through illness or a related reason, you should request consideration by submitting a completed University of Toronto Student Medical Certificate that is available at the Faculty of Arts and Science web site

http://www.artsci.utoronto.ca/current/undergraduate/forms

The document must be presented to the course administrator ***within one week*** of the date of absence. Only serious illness (or equivalent reasons) will be accepted as justification for absence (note: the U of T Medical Certificate, filled out by your doctor, stating merely that you saw him/her on a given day is not adequate. Your doctor must certify that *you were too sick to attend the test*, etc.). For more information regarding missed term work, consult the 2017-18 Arts and Science Calendar.

There will be no make-up tests.

ACCESSIBILITY NEEDS

The University of Toronto is committed to accessibility. If you require accommodations for a disability, or have any accessibility concerns about the course, the classroom or course materials, please contact Accessibility Services as soon as possible:

disability.services@utoronto.ca or http://studentlife.utoronto.ca/accessibility .

ANNOUNCEMENTS

Official announcements regarding test locations, material covered for each test and other important announcements will be posted on the CHM 220 site on Blackboard. **It is absolutely your responsibility to check these postings regularly for important announcements.**

TENTATIVE COURSE SCHEDULE

TOPIC	APPROX. # OF LECTURE
THERMODYNAMICS & KINETICS	12 LECTURES

- **Chapter 3 - Kinetic Theory of Gases:** Pressure of a Gas; Kinetic Energy and Temperature; The Maxwell Distribution Laws; Molecular Collisions and the Mean Free Path; Equipartition of Energy
- **Chapter 4 - The First Law of Thermodynamics:** Work and heat; The First Law; Enthalpy and enthalpy changes; Gas Expansions; Thermochemistry and Bond Energies
- **Chapter 5 - The Second and the Third Laws of Thermodynamics:** Spontaneous Processes; Entropy; The Second Law of Thermodynamics; Entropy changes; Third Law of Thermodynamics
- **Chapter 6 - Gibbs and Helmholtz Energies**: Definitions; Standard Gibbs energy; Changes of Gibbs energy with temperature and pressure; Phase equilibria
- **Chapter 7 - Non-Electrolyte Solutions**: Concentration units; Binary mixtures of volatile liquids; Real solutions; Colligative properties
- **Chapter 9 - Chemical Equilibria**: Chemical equilibrium in gaseous systems; Heterogeneous equilibria; Influence of temperature, pressure and catalysts on equilibrium constant; Real gases; Reactions in solution
- **Chapter 16 - Intermolecular Forces**: Intermolecular interactions; Ionic bond; Types of Intermolecular forces
- **Chapter 22 - Macromolecules**: Methods for determining size, shape and molecular mass of macromolecules; Structure of synthetic polymers
- **Chapter 12 - Kinetics**: Reaction rate; Reaction order; Molecularity of reaction; Reversible reactions; Consecutive reactions; Parallel reactions; Temperature effect on reaction rate; Oscillating reactions

QUANTUM MECHANICS & SPECTROSCOPY	12 LECTURES

- **Chapter 14 - Quantum Mechanics and Atomic Structure**: The Wave Theory of Light; Planck's Quantum Theory; The Photoelectric Effect; Bohr's Theory of Hydrogen Emission Spectra; de Broglie's Postulate; The Heisenberg Uncertainty Principle; The Schrodinger Wave Equation; Particle in a 1D, 2D and 3D Box; Quantum-Mechanical Tunneling; The Schrodinger Wave Equation for the Hydrogen Atom ; Many-Electron Atoms and the Periodic Table
- **Chapter 15 - The Chemical Bond**: Lewis Structures; Valence Bond Theory; Hybridization of Atomic Orbitals; Electronegativity and Dipole Moments; Molecular Orbital Theory Diatomic Molecules; Resonance and Electron Delocalization; Frost-Musulin Diagrams
- **Chapter 17 - Spectroscopy**: Infrared Spectroscopy; Electronic Spectroscopy; Fluorescence and Phosphorescence; Applications of Energy Transfer