

## ChemBio 2P03 Course Outline - Fall 2011

### **Bio-Physical Chemistry**

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Welcome to Introductory Bio-Physical Chemistry! This course outline will summarize the most important information about this course. Please also keep yourself current using the course website on “Avenue to Learn”. As the instructor of this course, I strive to provide you with all the necessary resources to start understanding bio-physical chemistry and its applications.

#### **Course Content:**

##### **I. The fundamental laws of thermodynamics**

- preservation of energy
- state functions
- Carnot cycle and entropy
- free energy

##### **II. Thermodynamic Equilibria**

- chemical equilibria
- electrochemical systems
- phase equilibria

##### **III. Applications of Equilibria; Transport Properties**

- 2-dimensional systems
- colligative properties
- molecular motion
- diffusion, sedimentation, viscosity, electrophoresis

##### **IV. Kinetics**

- rate laws, reaction orders and reaction mechanisms
- transition states and potential energy surfaces
- catalysis and enzyme kinetics
- pattern formation in living systems

#### **Textbook: (strongly recommended but not required)**

- Tinoco, Sauer, Wang & Puglisi: Physical Chemistry: Principles and Applications in Biological Sciences, 4th Ed. 2002, Prentice Hall, ISBN-10: 013095943X, ISBN-13: 9780130959430.

#### **Office Hours:**

Dr. Kruse: Mon, Wed after class; by email on “Avenue to Learn”

TA's: tutorial time; by email on “Avenue to Learn”; special hours before exams as announced

#### **Evaluation:**

12 weekly sets of 6 homework questions on A2L	=	12 x 6 x 0.5%
3 Midterm exams (50 min, 16 questions during lecture time)	=	3.0 x 16%
Part 1 of final exam (16 questions, non-cumulative)	=	1 x 16%
Part 2 of final exam (cumulative over 3 midterms)	=	0.3 x 16%
<u>scaled to replace any midterm with lower average</u>	=	<u>0.3 x 16%</u>
Total	=	100%

**- Scheduled Midterm dates: Wednesdays, 28 Sept, 19 Oct, 09 Nov 2011 at 8:30am**

A2L quizzes account for a total of 36% of the total grade and are due by the end of the week in which the material was discussed. They will be accepted on the A2L course website up until the marked **end date**, which is approximately **one week after the work is due**. In case of a conflict with other coursework, homework quizzes **can be submitted early**. Missed homework quizzes on A2L cannot be substituted for and will be assigned a grade of ZERO. An extension can be requested from the instructor for properly documented cases on an individual basis. In documenting your case, please keep in mind that if you had submitted the material on the end date itself, you would have already been one week past the due date for completing this work, so you need to ***prove your inability to perform work for a period of more than one week***.

The entire course material is covered by a total of 4 non-cumulative exams (3 midterms and the first part of the final exam), for a total of 64% of the final grade. All of these are optional for passing the course and can be skipped, with a grade of ZERO assigned. Due to the built-in flexibility of the marking process, there will be **NO make-up midterms under any circumstances**. The second part of the final exam will be cumulative over the material of the first 3 midterms, and the score on this part will be scaled appropriately and substituted for any of the 3 midterms that were skipped, or to replace a lower score.

While it is thus possible to skip all 3 midterm exams and make up for it with the final exam, I would strongly advise against it. Somebody effectively attempted something similar last year (the grading structure was somewhat different) and ended up failing the course, because participating in the midterm exams provides valuable practice and takes off a lot of pressure at the end (many students who wrote all midterms were able to use the final exam to make up for 'bad days' during the term). Conversely, a lot of students performed consistently strong throughout the term last year and got "A+" grades without having to show up for the final exam at all (due to the change in grading structure, this year you will have to study at least for the first, non-cumulative part of the final – still a lot less work than reviewing the entire course material).

Deferrals of final exams will be handled according to university regulations.

A2L quiz (1 question = 0.5%), midterm (1 question = 1%) and final exam grades will be posted on "Avenue to Learn". Every 'point' given or missed on an exam represents 1% of your final grade, with no intention to 'scale' or 'curve'. This way you always know where you are at and whether you need to work harder or can afford to take a break.

### **Tutorials, Homework Practice and Practice Exams:**

I will post a total of 4 sets of homework assignments, 3 practice midterm exams and 1 practice final exam on "Avenue to Learn". They will be discussed during tutorial time by the TA's. As any other part of the course, tutorial attendance, work on the homework sets and practice exams are optional. The homework sets are designed to aid your understanding of the course material (if you are so inclined). The practice exams have an identical format and equivalent content to the real exams and are designed to aid your preparation for the exams and help you get a better grade in the course (if you are so inclined). It will be to your benefit to take them seriously. No course

credit is assigned to participation in these components of the course, therefore eliminating the need for any measures to enforce honesty. ***It is the responsibility of the TA's to help you learn, but they will not force you to.*** If you have any suggestions of how we can help you learn better, please bring them to my attention and I will do my best to implement them, taking into account the limited resources and large number of students in the course.

### **Approximate Lecture Schedule for ChemBio 2P03 (Fall 2011)**

#	Date	Contents	TSWP
1	Fri, 09 Sept 2011	Introduction; 1st Law of Thermodynamics – Energy Conversion & Conservation	1, 2
2	Mon, 12 Sept 2011	The First Law of Thermodynamics – Describing the State of a System	2
3	Wed, 14 Sept 2011	The First Law – Relations between Variables; Phase Changes	2
4	Fri, 16 Sept 2011	The First Law of Thermodynamics – Chemical Reactions	2
5	Mon, 19 Sept 2011	The Second Law of Thermodynamics – Carnot Cycle & Entropy	3
6	Wed, 21 Sept 2011	The Third Law of Thermodynamics	3
7	Fri, 23 Sept 2011	The Second Law – Gibbs Free Energy; Helmholtz Free Energy	3
8	Mon, 26 Sept 2011	Summary of “Fundamental Laws of Thermodynamics” & Review for Midterm	<u>1,2&amp;3</u>
9	Wed, 28 Sept 2011	<b>*** 1<sup>st</sup> Midterm ***</b>	<u>1,2&amp;3</u>
10	Fri, 30 Sept 2011	Free Energy & Partial Derivatives	3
11	Mon, 03 Oct 2011	Chemical Potentials in Ideal and Non-ideal Systems	4
12	Wed, 05 Oct 2011	Chemical Equilibrium Constants	4
13	Fri, 07 Oct 2011	Electrochemical Systems	4
14	Wed, 12 Oct 2011	One Component System Phase Equilibria	5
15	Fri, 14 Oct 2011	Multi-Component System Phase Equilibria	5
16	Mon, 17 Oct 2011	Summary of “Chemical & Physical Equilibria” & Review for Midterm	<u>3,4&amp;5</u>
17	Wed, 19 Oct 2011	<b>*** 2<sup>nd</sup> Midterm ***</b>	<u>3,4&amp;5</u>
18	Fri, 21 Oct 2011	Biochemical Applications of Chemical Equilibria	4
19	Mon, 24 Oct 2011	Physical Equilibria in 2-Dimensional Systems (Membranes, Surfaces)	5
20	Wed, 26 Oct 2011	Colligative Properties	5
21	Fri, 28 Oct 2011	Molecular Motion & Kinetic Theory	6
22	Mon, 31 Oct 2011	Diffusion	6
23	Wed, 02 Nov 2011	Sedimentation; Viscosity	6
24	Fri, 04 Nov 2011	Electrophoresis	6
25	Mon, 07 Nov 2011	Summary of “Applications of Equilibria; Transport” & Review for Midterm	<u>4,5&amp;6</u>
26	Wed, 09 Nov 2011	<b>*** 3<sup>rd</sup> Midterm ***</b>	<u>4,5&amp;6</u>
27	Fri, 11 Nov 2011	Kinetic Rate Laws & Order of a Reaction	7
28	Mon, 14 Nov 2011	Higher Order Reactions	7

#	<i>Date</i>	<i>Contents</i>	<i>TSWP</i>
29	Wed, 16 Nov 2011	Reaction Mechanisms	7
30	Fri, 18 Nov 2011	Temperature Dependence of Reactions	7
31	Mon, 21 Nov 2011	Transition State Theory; Potential Energy Surfaces	7
32	Wed, 23 Nov 2011	Application Examples of Kinetics	7
33	Fri, 25 Nov 2011	Catalysis	7,8
34	Mon, 28 Nov 2011	Michaelis-Menten Kinetics (Enzymes)	8
35	Wed, 30 Nov 2011	Competition and Inhibition in Enzyme Kinetics	8
36	Fri, 02 Dec 2011	Pattern Formation in Living Systems	--
37	Mon, 05 Dec 2011	Summary of "Kinetics" & Review for Final Exam	<u>1-8</u>

### **Approximate Tutorial Schedule (Fall 2011)**

#	<i>Date</i>	<i>Contents</i>
1	Mon/Tue, 12/13 Sep 2011	Prerequisite knowledge for "Laws of TD" (see HW set)
2	Mon/Tue, 19/20 Sep 2011	Core material for "Laws of TD" (see HW set)
3	Mon/Tue, 26/27 Sep 2011	Review of "Laws of TD"; practice midterm
4	Mon/Tue, 03/04 Oct 2011	Prerequisite knowledge for "Equilibria" (see HW set)
5	Tue, 11 Oct 2011	Core material for "Equilibria" (see HW set)
6	Mon/Tue, 17/18 Oct 2011	Review of material for "Equilibria"; practice midterm
7	Mon/Tue, 24/25 Oct 2011	Prerequisite knowledge for "Appl. of Equilibria; Transport" (see HW set)
8	Mon/Tue, 31 Oct / 01 Nov 2011	Core material for "Appl. of Equilibria; Transport" (see HW set)
9	Mon/Tue, 07/08 Nov 2011	Review of material for "Appl. of Equilibria; Transport"; practice midterm
10	Mon/Tue, 14/15 Nov 2011	Prerequisite knowledge for "Kinetics" (see HW set)
11	Mon/Tue, 21/22 Nov 2011	Core material for "Kinetics" (see HW set)
12	Mon/Tue, 28/29 Nov 2011	Review of material for "Kinetics"; practice final exam

**Disclaimer:** Changes to the course schedule and marking scheme may be made at the discretion of the instructor and announced to the students at any time during the course. An effort will be made to keep inconveniences from changes to a minimum.

In this course we will be using "Avenue to Learn". Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

**Copyright policy:** In this course you will have access to material that is subject to copyright laws. This includes (but is not limited to) the textbook, solutions manual and all resources developed by the instructor such as lab manuals, demonstration videos, quizzes, assignments, tests, class notes and class slides. You are not allowed under any circumstances to share or redistribute this material in any printed or electronic form without the explicit written consent of the copyright holder. This includes posting any course material on Internet bulletin boards, course repositories, social networks, etc.

**Academic dishonesty:** You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at [www.mcmaster.ca/academicintegrity](http://www.mcmaster.ca/academicintegrity)

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.