

## **CHEM 640: Biological Physical Chemistry (3 credits)**

### **Fall 2012**

The course presents the basic principles of physical chemistry with applications to biological systems. Topics include the laws of thermodynamics, phase equilibria, chemical equilibria, chemical reaction kinetics and brief introduction to quantum chemistry and spectroscopy.

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<b>Line number:</b>	11584
<b>Instructor:</b>	Krzysztof Kuczera, 5090 Malott, phone: 864-5060 ; email: <a href="mailto:kkuczera@ku.edu">kkuczera@ku.edu</a>
<b>Time &amp; Place:</b>	9:00–9:50 AM, MWF, 2074 Malott
<b>Textbook:</b>	P. Atkins and J. de Paula, Physical Chemistry for the Life Sciences, 2 <sup>nd</sup> Ed., W.H. Freeman, 2011.
<b>Discussion meetings:</b>	Wednesdays 2:30–3:20, 1003 Malott Thursdays 3:00–3:50, 1003 Malott
<b>Office hours:</b>	T,W 10:00-11:00 am or by appointment
<b>Teaching Assistant:</b>	Kobra Nasiri, 1010 Malott, Phone: 864-3053, email: <a href="mailto:nasiri@ku.edu">nasiri@ku.edu</a> Office hours: W 11:00-12:00 or by appointment

The overall **course grade** will be determined by the sum of four components  
(weights in parentheses):

$$\begin{aligned} & \text{(on-line quizzes)} \times (0.15) + \text{(homework)} \times (0.30) \\ & + \text{(average of the three hour exam scores)} \times (0.30) + \text{(final exam score)} \times (0.25) \end{aligned}$$

#### **Exam dates:**

Exam #1	Friday, September 21, in class
Exam #2	Friday, October 19, in class
Exam #3	Friday, November 16, in class
FINAL	Monday, December 10, 7:30–10:00 am

**Quizzes.** On-line quizzes in Blackboard will appear several times a week, aimed at engaging students in systematic reading of class material.

**Problem solving.** Learning of the complex concepts of physical chemistry cannot be achieved without the experience and insight gained by problem solving. Solutions to sample problems are given in the textbook, will be discussed in class, presented on Web site, assigned as homework and covered in discussion sections. Familiarity with the problems covered is ABSOLUTELY NECESSARY for success in the exams.

**Homework.** Problem sets will be assigned weekly.

**Solution format.** Each problem solution should *start on a new page* and include:

- a) the problem text (may be abbreviated, copied and pasted, etc.)
- b) summary (e.g. “problem deals with heat flow in chemical reactions”)
- c) solution, including equations and justification in words (e.g. “Using the ideal gas equation  $pV = nRT \dots$ ”)
- d) final answer: quantity with correct value and units (+ significant figures)
- e) comments and discussion when appropriate (i.e. almost always)

**Reading:** I recommended reading the relevant chapters of textbook and on-line lecture notes both before and after the material is covered in class. In order to better understand the material it is useful to look at alternative presentations of material, such as

0. P. Atkins and J. de Paula, *Physical Chemistry for the Life Sciences*, 2<sup>nd</sup> Ed., W.H. Freeman, 2011, ISBN 1-4292-3114-9 (class text).

1. Tinoco, Sauer & Wang, *Physical Chemistry, Principles and Applications in Biological Sciences*, 3<sup>rd</sup> Ed. QH345.T56 2002

2. Eisenberg & Crothers, *Physical Chemistry with Applications to the Life Sciences*. QD453.2E37 1979

3. Alberty & Silbey, *Physical Chemistry*. QD453.2.A45 2001

**Electronic materials.** Electronic materials will be at class website and on Blackboard.  
*Blackboard:* syllabus, announcements, quizzes, homework assignments, grades.  
*Class website:* cross-linked lecture notes, sample problem solutions, study guide, trial exams.

Location: <http://oolung.chem.ku.edu/~kuczera/640/640.html>

## Syllabus

Dates	Topic	Chapter
08/20–08/22	Introduction, Gases	
08/24–09/07	The First Law & Thermochemistry	<b>1</b>
09/10–09/21	The Second Law & Entropy	<b>2</b>
<b>09/21</b>	<b>Exam #1</b>	
09/24–09/28	Free energy	<b>2</b>
10/01–10/05	Phase equilibria of pure substances	<b>3</b>
10/10–10/19	Mixtures	<b>3</b>
<b>10/19</b>	<b>Exam #2</b>	
10/22–11/05	Chemical Equilibrium, Acid-Base Equilibria	<b>4</b>
11/07–11/16	Chemical Reaction Kinetics	<b>6</b>
<b>11/16</b>	<b>Exam #3</b>	
11/19–11/26	Reaction Mechanisms	<b>7-8</b>
11/26–12/05	Quantum Mechanics & Spectroscopy	<b>9</b>