

SYLLABUS

CHEM 236-001 Physical Chemistry for Chemical Engineers

Fall 2016

Instructor: Kathleen Gilbert, PhD, PE Department of Chemistry and Env. Science NJIT, Newark, NJ 07102 Email: gilbert@njit.edu (best way to contact!) See instructor after the first session regarding use of earlier editions of the text.	Classes: 9/6/16 through 12/13/16: T 2:30 – 4:40 pm in Kupf 103 Th 1 – 3:55 pm in Kupf 103 Class on T 11/22/16 from 1 - 3:55 pm; no class on Th 11/24/16. <u>There are some required Moodle assignments.</u>
TEXTBOOK: Atkins & dePaula, <i>Physical Chemistry, 10th Edition.</i> <u>eBooks are NOT recommended – see below.</u>	
Office hours: By appointment only; email the instructor.	

Chem 236. Physical Chemistry for Chemical Engineers (5-0-0) Prerequisites: (Chem 122 or Chem 126) and Chem 124 and (ChE 230 or ChE 232) with a grade C or better. This course will introduce the chemical engineering students to the concepts of order, disorder, chemical equilibrium, and phase equilibrium. Credit for this course will not be given if credit for Chem 235 has been given.	Course Grading: <table><tr><td>Worksheets & HW Demonstrations</td><td>8%</td></tr><tr><td>Quizzes</td><td>22%</td></tr><tr><td>Exam 1</td><td>20%</td></tr><tr><td>Exam 2</td><td>20%</td></tr><tr><td><u>Exam 3/Final</u></td><td><u>30%</u></td></tr><tr><td>Total</td><td>100%</td></tr></table>	Worksheets & HW Demonstrations	8%	Quizzes	22%	Exam 1	20%	Exam 2	20%	<u>Exam 3/Final</u>	<u>30%</u>	Total	100%
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Notes on Worksheets and Homework Demos

- Worksheets are required and will be given on days when there is neither a quiz nor an exam. Missed worksheets for any reason will NOT be made up; they will either be a zero or averaged out, depending on if there is a Dean of Students approved excuse.
- Homework assignments will not be collected or graded, however students will be required to demonstrate assigned exercises or problems in front of the class by writing on the board and describing their work step by step, as noted in the first session. The number of homework demonstrations required is based on class size and will be communicated the first day of class.

Notes on Quizzes and Exams

- There will be three quizzes in class throughout the semester to ensure each student is completing the homework assignments in a timely manner. Quizzes are 40 minutes. Exams are 90 minutes.
- All quizzes and exams are open book ONLY – closed notes and no extra papers allowed in your textbook. Only one print copy of Atkins' Physical Chemistry, any edition, is allowed during the quizzes and exams. No other books or papers. *Tiny* bookmarks of size less than 1/2" x 1" are allowed. Writing in the textbook is allowed; renters are advised to use *tiny* post-it note pieces.

- No eBooks, or any other electronic devices except for calculators are allowed during quizzes and exams. You MUST use a print copy of the text book, or use no book at all during the quizzes and exams.
- Some programmable/graphing calculators are allowed during quizzes and exams, however Texas Instruments TI89, TI92 Plus, NSpire, TI89 Titanium, Voyage 200, and any model of Calctimate. Be advised that ANY calculator that appears to have Internet or file access during the exam will be subject to review by the TA or instructor writing down the make and model, and clarifying that the calculator does not violate the class rules. The TA and instructor reserve the right to take a photo of the calculator in question to verify the make and model of the calculator.
- Note that because other graphing and programmable calculators are allowed, ALL WORK must be shown. This includes the equation with variables and parameters only, and the equation with all numbers. Missing steps WILL result in lost points. Correct answers without proper work will not receive credit.

Notes on Class Attendance:

- Students who miss class due to a valid personal or medical reason MUST contact the Dean of Students office with the valid excuse and get it approved. The Dean of Students will then contact me and any other professors whose classes were missed. Missed worksheets, quizzes, or exams without a Dean of Students approved excuse will result in a zero grade.
- No student will be exempted from demonstrating homework; if there is a Dean of Students approved excuse for their homework demonstration date, that student will either demonstrate the same homework question later or sign up for another exercise or problem. Students are advised to do their homework demonstrations EARLY in the semester to avoid any issues due to absences.
- The instructor reserves the right to assign online Moodle assignments, including viewing unnarrated or narrated lectures or taking brief online quizzes (separate from the in-class quizzes), as needed to make up class time. Online quizzes will count as worksheets. Viewing online lectures is the responsibility of the student. Material found only online WILL be fair game for quizzes and exams.

Notes on Grading:

- The default grading scale is as follows:

Letter Grade	Overall Class Percent
A	90 or above
B+	85 - 89
B	80 - 84
C+	75 - 79
C	70 - 74
D	60 - 69
F	59 or below

Departures from this grading scale will be considered on a class-wide basis for individual semesters.

In every case, the increments of the grading scale will remain the same.

Only exact percentages will be considered; example would be an overall class percent of 79.9% is a C+ not a B using this grading scale.

COURSE SCHEDULE – CHEM 236 FALL 2016 GILBERT (Atkins 10th Edition Chapters)

T 9/6, Th 9/8	Intro, Ch. 2 First Law (all; <i>both in-person and online lecture</i>)
T 9/13, Th 9/15	Ch. 3 Second and Third Laws (all)
T 9/20, Th 9/22*	Ch. 4 Physical transformations of pure substances (4A, 4B.1, 4B.2), Quiz #1
T 9/27, Th 9/29	Ch. 5 Simple mixtures (5A, 5B, 5C, 5E, 5F)
T 10/4 *EXAM 1*	EXAM 1 (Ch. 2, 3, 4, 5) First, Second and Third Laws, Physical transformations of pure substances, Simple mixtures - Sections noted above
Th 10/6, T 10/11	Ch. 5 (continued)
Th 10/13, T 10/18*, Th 10/20	Ch. 6 Chemical equilibrium (6A, 6B), Quiz #2
T 10/25, Th 10/27, T 11/1	Ch. 19 Molecules in motion (1B, 19A, 19B, 19C.1)
Th 11/3 **EXAM 2**	EXAM 2 (focusing on Ch. 6 & Ch. 19 (with 1B)) Chemical equilibria and Molecules in motion – Sections noted above

*******Monday November 7th 2016 is last day to withdraw*******

T 11/8, Th 11/10, T 11/15, Th 11/17, T 11/22*	Ch. 20 Chemical kinetics (all), Quiz #3
T 11/29, Th 12/1	Ch. 20 (continued)
T 12/6, Th 12/8, T 12/13	Ch. 21 Reaction dynamics (21A, 21C)
TBD *** FINAL EXAM *** <i>F 12/16/16 - Th 12/22/16</i>	EXAM 3 (focusing on Ch. 20 & 21) –The rates of chemical reactions and Reaction dynamics - Sections noted above

Quizzes * will be announced during the class before the quiz or earlier. There will be three quizzes, and the lowest quiz grade dropped. Quizzes will last 40 minutes, and be open book closed notes as noted above for exams. Exams are 90 minutes with class held afterwards.

THIS SYLLABUS MAY CHANGE BASED ON MATERIAL COVERED AND OTHER FACTORS.

Please review the NJIT Integrity Code; any indications of CHEATING on any quiz or exam will be treated seriously according to NJIT policy and procedures. Do NOT risk your college career for a few points!!!

Measures not limited to retaining copies of graded quizzes and exams, and moving students during quizzes or exams may be used to minimize the occurrence of cheating. Please note that ENTIRE CLASSES have been punished under the NJIT Integrity Code - knowing that others are cheating is not an excuse to cheat! In certain cases, not reporting cheating including letting someone copy from your quiz or exam paper can result in YOU being brought before the NJIT Integrity Board. DON'T BECOME AN EXAMPLE OF WHAT NOT TO DO!

Any assignment that can be worked on with others or with the use of the Internet will be clearly identified as such. In this class, worksheets are meant to be worked on together or with the assistance of the Internet if students so choose. The instructor reserves the right to ask to see and review the written work for the online homework problems.

Homework Problems. Please complete the homework problems before the class problem demonstration session to ensure maximum benefit. Problem numbers are for the 10th edition of Atkins and dePaula, which is ordered by a lettered section within a numbered chapter; the homework is ordered the same way. Homework is found at the very end of each chapter, after the text of all sections.

There will be a signup sheet with demonstration day and a place for student initials to reserve a demo.

Atkins' Physical Chemistry TENTH (10th) Edition Homework		
Ch.	Exercises	Problems
1	(no lecture or homework - material is necessary to understand other chapters)	
2	Online Ch. 2 #1 - #5	
3	3B.2a, 3C.4a, 3D.2a Online Ch. 3 #1 - #5	3A.9, 3D.5
4	4B.6a, 4B.13a	4B.8
5	5A.7a, 5A.9a, 5A.11a, 5B.3a, 5B.8a, 5B.10a, 5B.11a, 5B.12a, 5B.13a, 5C.1a, 5C.2a, 5C.3a, 5C.7a, 5C.10a, 5E.1a	5A.3, 5C.1, 5C.2, 5C.4, 5C.6, I.A.5.1, I.A.5.4
6	6A.4a, 6A.5a, 6A.6a, 6A.9a, 6A.11a, 6B.2a, 6B.4a Online Ch. 6 #1 - #3	6A.1, 6A.2, 6A.3, 6B.3
1B	1B.5a, 1B.6a	
19	19A.1a, 19A.2a, 19A.4a, 19A.7a, 19A.9a, 19A.10a, 19B.2a, 19B.4a, 19B.5a, 19B.6a, 19B.7a	19B.4, 19B.6
20	20A.2a, 20A.4a, 20B.1a, 20B.2a, 20D1a, 20E.1a, 20E.2a, 20F.1a, 20H.1a, 20H.2a	20A.2, 20A.4, 20B.3, 20B.13, 20B.17, 20D.2, 20D.3, 20D.4 20G.1
21	21A.4a, 21C.5a Online Ch. 20 & 21 Homework #1 - #3	21A.1, 21C.5

As can be seen above, part of Chapter 1 is taught before Chapter 19 as it used to be in that chapter. I.A. is "Integrated Activity" - these are found after all other exercises and problems in a chapter.

There are 68 exercises and 27 problems. For 45 students, that means demonstrate a total of two of any type of homework question for each student to receive full credit for homework demos.

A reminder that quiz and exam material may come from ANY covered material in the textbook and the lectures. If there is not a specific homework exercise or problem on the topic, that does not mean there will not be a quiz or exam question on that same topic. Be prepared for anything that is covered by the lectures, online material, and the textbook!

Learning outcomes for Chem 236:

By the end of the course, you should be able to do the following:

1. Calculate thermodynamic functions of chemical reactions (enthalpy, entropy, Gibbs energy, heat capacity) based on the tabulated data at the reference and arbitrary temperatures.
2. Sketch, interpret, and use phase diagrams for one component systems.
3. Derive the basic thermodynamic relations and to state the approximations and the applicability.
4. Calculate the thermodynamic functions of components in pure compounds and mixtures.
5. Sketch the phase diagrams for liquid-gas, liquid-liquid, and liquid-solid equilibria for mixtures and to interpret them.
6. Calculate activities of ions in solutions.
7. Calculate the transfer parameters (diffusion coefficient, viscosity, thermal and electrical conductivity).
8. Determine the Arrhenius parameters of a chemical reaction from the rate vs. temperature data.
9. Process data for reactions of simple orders.
10. Build up mechanisms of complex chemical reactions, construct corresponding systems of ODE, and use the steady-state approximation.
11. Estimate rate constants of elementary chemical reactions using the Simple Collision Theory and the Transition State Theory.