

Fall 2018

# CHEM 236 - Physical Chemistry for Chemical Engineers

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## Chem 236: *Fall 2018 Course Syllabus*

**NJIT Academic Integrity Code:** All Students should be aware that the Department of Chemistry & Environmental Science (CES) takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

### COURSE INFORMATION

**Course Description:** Chem 236, Physical Chemistry for Chemical Engineers

**Number of Credits:** 4 credits, 5 contact hours

**Prerequisites:** - Chem 122 or 126 with a grade C or better  
- Chem 124 with a grade C or better  
- 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-Section and Instructors

Course-Section	Instructor
Chem 236: 001	Dr. Kristal

**Office Hours:** Monday 2pm - 4pm  
Tuesday 10am - 11:20am  
Thursday 1:30pm - 4pm  
Friday 1pm - 3pm *by appointment*

#### Required Textbook:

<b>Title</b>	Physical Chemistry
<b>Author</b>	Peter Atkins and Julio de Paula
<b>Edition</b>	10 <sup>th</sup> or 11 <sup>th</sup> . For approval of older editions please contact the instructor
<b>Publisher</b>	Freeman for 10 <sup>th</sup> edition; Oxford for 11 <sup>th</sup> edition
<b>ISBN #</b>	10 <sup>th</sup> edition: 978-1-4292-9019-7; 11 <sup>th</sup> edition: 978-0-19-876986-6

**University-wide Withdrawal Date:** The last day to withdraw with a **W** is Monday, November 12, 2018. It will be strictly enforced.

## Learning Outcomes:

At the end of 236, you will be able to

1. Distinguish the different thermodynamic functions of chemical reactions (U, H, S, G, A and C) and evaluate their variation with conditions such as pressure, temperature and volume.
2. Derive basic thermodynamic relations for different conditions
3. Calculate thermodynamic functions of components in pure compounds and mixtures.
4. Interpret and use phase diagrams for one component systems and binary mixtures.
5. Calculate thermodynamic relations for non-ideal systems using activities.
6. Determine equilibrium constants and reaction quotients based on reaction data.
7. Evaluate how equilibrium responds to change in conditions.
8. Understand the relation between equilibrium, thermodynamics and kinetics.
9. Calculate transfer parameters for gases.
10. Determine the order of reactions and Arrhenius parameters.
11. Derivate rate laws for chemical reactions based on the mechanism.
12. Estimate rate constants of elementary reactions using the Simple Collision Theory and the Transition State Theory.

## POLICIES

All CES students must familiarize themselves with, and adhere to, all official university-wide student policies. CES takes these policies very seriously and enforces them strictly.

**Grading Policy:** The final grade in this course will be determined as follows:

Homework	10%
Quizzes	20%
Midterm Exam I	20%
Midterm Exam II	20%
Final Exam	30%

Your final letter grade in this course will be based on the following tentative curve:

A	90.0%-100%	C	70.0%-74.9%
B+	85.0%-89.9%	D	60.0%-69.9%
B	80.0%-84.9%	F	<60.0%
C+	75.0%-79.9%		

**Attendance Policy:** Attendance at classes will be recorded and is **mandatory**. Each class is a learning experience that cannot be replicated through simply “getting the notes.”

**Lectures:** Students are expected to read the specified textbook material and review the slides posted on Moodle before coming to class. The lectures will consist out of in depth discussion of the material and solving of exercises and problems on worksheets.

**Homework:** Homework will be assigned both online on Moodle and as exercises and problems from the book. The online homework will count directly towards the final grade as described above. The assigned homework from the textbook will not be collected, but will serve as a base for the questions on the quizzes and exams.

**Quizzes:** Short (15-20 minute) quizzes will be given every Tuesday on weeks without exams, as indicated in the Tentative Course Schedule below. Quizzes will be based on the worksheets handed out at lecture and the assigned homework.

**Exams:** There will be two midterm exams held in class during the semester and one comprehensive final

exam. The following exam periods are tentative and therefore possibly subject to change:

Midterm Exam I	Tuesday October 9th
Midterm Exam II	Tuesday November 6th
Final Exam Period	December 15 - 21, 2018

The final exam will test your knowledge of all the course material taught in the entire course.

All quizzes and exams are **closed book**. A formula sheet will be given. No electronic devices are allowed during exams except for calculators.

**Makeup Exam Policy:** There will normally be **NO MAKE-UP QUIZZES OR EXAMS** during the semester. In the event that a student has a legitimate reason for missing a quiz or exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the CES Department Office/Instructor that the exam will be missed so that appropriate steps can be taken to make up the grade.

## ADDITIONAL RESOURCES

**Chemistry Tutoring Center:** Located in the Central King Building, Lower Level, Rm. G12. Hours of operation are Monday - Friday 10:00 am - 6:00 pm. For further information please click [here](#).

**Accommodation of Disabilities:** Office of Accessibility Resources and Services (*formerly known as Disability Support Services*) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you are in need of accommodations due to a disability please contact Chantonette Lyles, Associate Director at the Office of Accessibility Resources and Services at 973-596-5417 or via email at [lyles@njit.edu](mailto:lyles@njit.edu). The office is located in Fenster Hall Room 260. A Letter of Accommodation Eligibility from the Office of Accessibility Resources Services office authorizing your accommodations will be required.

For further information regarding self-identification, the submission of medical documentation and additional support services provided please visit the Accessibility Resources and Services (OARS) website at:

- <http://www5.njit.edu/studentsuccess/disability-support-services/>

**Important Dates** (See: [Fall 2018 Academic Calendar, Registrar](#))

Date	Day	Event
September 4, 2018	T	First Day of Classes
September 10, 2018	M	Last Day to Add/Drop Classes
November 12, 2018	M	Last Day to Withdraw
November 20, 2018	T	Thursday Classes Meet
November 21, 2018	W	Friday Classes Meet
November 22 - 25, 2018	R - Su	Thanksgiving Break - University Closed
December 12, 2018	W	Last Day of Classes
December 14, 2018	F	Reading Day
December 15 - 21, 2018	F - R	Final Exam Period

## Course Outline

Lecture	Chapter	Topic	Quizzes/Exams
1 T 9/4	2A, 2B	Internal energy, calculating q and w, Enthalpy	
2 F 9/7	2C	Thermochemistry	
3 T 9/10	2D	State functions and exact differential	Quiz 1 on 2A-2C
4 F 9/14	2E	Adiabatic changes	
5 T 9/17	3A	Entropy: 2 <sup>nd</sup> law, Carnot cycle, change in entropy	Quiz 2 on 2D-2E
6 F 9/21	3B, 3C	Measuring entropy: 3 <sup>rd</sup> law. G and A	
7 T 9/25	3C, 3D	Maximum work, G <sub>m</sub> , Maxwell relations	Quiz 3 on 3A-3B
8 F 9/28	3D	Variation of G with p and T	
9 T 10/2	4A, 4B	Phase diagrams, phase rule	Quiz 4 on 3C-3D
10 F 10/5	4B	Dependence of phase stability on conditions, slopes	
11 T 10/9	<b>EXAM</b>	There will be no lecture after the exam	<b>EXAM CHAPTERS 2-4</b>
12 F 10/11	5A	Mixtures: G and S of mixing, chemical potential	
13 T 10/16	5A, 5B	Raoult's law, Henry's law, Colligative properties	
14 F 10/19	5C	Phase diagrams of binary systems, level rule	
15 T 10/23	5C	Azeotropes, phase separation	Quiz 5 on 5A-5B
16 F 10/26	5E, 5F	Activities	
17 T 10/30	6A	Equilibrium constant, reaction quotient	Quiz 6 on 5C
18 F 11/2	6B	Response of equilibria to conditions	
19 T 11/6	<b>EXAM</b>	There will be no lecture after the exam	<b>EXAM ON CHAPTERS 5-6</b>
20 F 11/9	1B	Maxwell-Boltzmann, mean velocities in gas	
21 T 11/12	1B, 19A	Collision frequency, mean free path, Collision flux	
22 F 11/15	19A	Thermal conductivity, viscosity	
23 W 11/21	20A, 20B	Rate of reaction, integrated rate laws	Quiz 7 on 1B and 19A
24 T 11/27	20D, 20C	Arrhenius equation, reactions approaching equilibrium	
25 F 11/29	20E	Elementary reactions, steady-state approximation	
26 T 12/4	20E	Steady-state approximation, pre-equilibria	Quiz 8 on 20A, 20B and 20D
27 F 12/7	20F	Examples of reaction mechanisms	
28 T 12/11		<b>INTEGRATED ACTIVITY/REVIEW</b>	
<b>TBD</b>		<b>FINAL EXAM</b>	

