CHEM 345 – Principles of Physical Chemistry

3 credits
Spring 2021

Syllabus Subject to Change
Due to ongoing uncertainty related to the COVID pandemic and the shift to remote learning, the policies and schedules in this syllabus are subject to change. Any changes will be communicated to students in writing, including posting a revised syllabus on Blackboard.

Instructor: Dr. Shuhua Ma
Office: On-line
Email: sma@towson.edu

Class Schedule
Mondays, Wednesdays, and Fridays 11:00 – 11:50am on zoom.

Office hours
Mondays, Wednesdays, and Fridays at 1:00 – 2:00pm or by appointment.

Required Materials

1. Textbook: "*Physical Chemistry for the Chemical and Biological Sciences*", Raymond Chang, 3rd edition, 2000, University Science Books.
2. Problems and solutions to accompany "*Physical Chemistry for the Chemical and Biological Sciences*", Helen O. Leung and Mark D. Marshall, 2000, University Science Books.
3. A calculator with capabilities for square roots, logarithms and exponential operations; it should be with you at all meetings and exams.

Course Description

CHEM 345 is a one semester 3 credit lecture course that examines the principles of physical chemistry emphasizing empirical derivations. Topics of particular interest include the principles of thermodynamics, kinetics, quantum mechanics and spectroscopy, and their applications in chemical systems. Students need to be familiar with the use of basic integral and differential calculus.

Course Prerequisites

- MATH 211 (Calculus for Applications) or MATH 273 (Calculus I)
- PHYS 211 (General Physics I; Non-calculus based) or PHYS 241 (General Physics I Calculus-based)
- CHEM 132/132L (General Chemistry II and Lab)

Course contents

During lectures we will discuss physical chemistry principles, and illustrate their applications with examples. The objective sheets will be provided for each chapter. Some topics listed in the textbook will not be covered due to the requirement of this course and the limitation of time. The course schedule listed at the end of this document should be viewed as somewhat tentative, as the pace of lectures will depend on the real situation in class.

Homework

Selected questions at the end of each chapter will be assigned as homework, they will be posted on Blackboard. The homework will not be collected for grading. However, to succeed in CHEM 345, you are strongly suggested to work on the assigned problems and understand them. It is also recommended that you devote a notebook to solving these problems so that they can be easily referenced. You are encouraged to work on these problems in groups, but everyone is expected to understand how to work all of them.

Grading Policy

The grading will be based on the assignments and exams. There will be two assignments, six in-class exams, and one final exam. The assignments and exams will be given on Blackboard. The in-class exams will cover the materials presented in the lectures and those illustrated by the most recent homework problems. The final exam will be comprehensive.

The final grade will be based upon the total points accumulated by each student divided by the total points possible, and your letter grade will be assigned on a plus/minus scale. The distribution is as follows:

Assignments (2 @ 20 pts)	40 pts	8%
In-Class Exams (6 @ 60 pts)	360 pts	72%
Final Exam (100 pts)	100 pts	20%
Total points	500 pts	100%

Letter Grade	Percentage range	Minimum Points
A	93 – 100	465
A^-	90 – 93	450
B^+	87 – 90	435
B	83 – 87	415
B^-	80 – 83	400
C^+	75 – 80	375
C	70 – 75	350
D^+	65 – 70	325
D	60 – 65	300
F	< 60	< 300

I reserve the right to adjust this curve depending on the overall performance of the class. However, I will under no circumstances raise this curve.

Attendance and make-up Policy

Attendance in lectures is expected, material missed due to absence is your responsibility. Attendence in exams is required. **Late assignments will not be accepted and there will be no make-up exams given**. The dates for the exams are fixed and will not change. If one of the in-class exams is missed due to unavoidable time conflict or emergency, then equivalent percentage of the final exam grade will serve as a substitute for the missed in-class exam grade. A grade of zero will automatically be assigned for any additional missed exams.

Statement on Academic Dishonesty

Academic dishonesty is described in TU's Student Academic Integrity Policy and is to be followed by all students, faculty, and staff. Any student who is found to be responsible for academic dishonesty will be assigned a penalty up to and including a grade of zero for the involved academic work. And any suspected academic dishonesty will be reported to the department chairperson and to the Office of Student Conduct & Civility Education for further investigation.

Statement on Disruptive Behavior

Disruptive behaviors are not acceptable. When students' behaviors become disruptive to class, students will be removed from the classroom immediately. Depending on the nature and level of disruptive behaviors, the instructor may report students to the CARE team of Student Affairs Office. If the incident occurs before the final withdrawal date, students must withdraw from the course. If the withdrawal period has expired, students will receive the earned grade up to the date on which the incident occurs.

Cell Phone Policy

Any non-emergency use of cell phones (voicing, texting, calculating, etc.) is not allowed during lectures and exams. Cell phones must be either turned off or set to not make noise. The use of a cell phone during exams will be treated as an academic dishonesty.

Statement on accommodations for students with disabilities

Students who may need accommodations and/or disability support are encouraged to contact Towson University Accessibility & Disability Services (ADS) for personal guidance. More information can be found on Accessibility & Disability Services website. Students with approved accommodations should submit their memos to the instructor the first week of class.

Chemistry Tutor Center

Additional help may be available at Chemistry Tutor Center that is free and open on a walk-in basis. Please contact professor Liina Ladon (lladon@towson.edu) or visit her website (http://pages.towson.edu/ladon/) for more information.

Chemistry Department Statement on Classroom Diversity and Inclusion

The students, faculty, and staff at Towson University represent a diverse and vibrant community of learners and scholars. As a community, we value the unique contributions of each individual and promote active participation in all aspects of the learning process by each community member. Your instructor supports Towson University's goal of fostering a diverse and inclusive educational setting. Your instructor strives to create a classroom environment built upon the principles of mutual respect and support. Toward this end, all members participating in this course are expected to demonstrate respect for all other members of the class. If you feel these expectations have not been met, please speak with your instructor or the designated diversity liaison, Dr. Cindy Zeller (czeller@towson.edu).

For further information regarding the diversity and inclusion policies of Towson University, please see the Towson University Commitment to Diversity, the Fisher College of Science and Mathematics Diversity Action Website, and the Chemistry Department Diversity Action Plan.

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Your instructor retains all copyrights to all original materials distributed in this course (including but not limited to, lecture videos, handouts, power point slides, assignments, and exams). Reposting, selling, or otherwise distributing these materials in any fashion at any time is prohibited. Students are not allowed to download lecture videos, which must be viewed on Blackboard.

Tentative Course Schedules

Week #	Dates	Topics	Text Ref.	Exams/Assignments
1	01/25	Syllabus, Introduction	Notes	
	01/27	The ideal gas equation, Real gases	Ch 2	
	01/29	Real gases	Ch 2	
2	02/01	The kinetic model of gases	Ch 3	
	02/03	Maxwell Distribution Laws Molecular collisions	Ch 3	
	02/05	Equipartition of energy	Ch 3	
3	02/08	Heat and heat change	Ch 4	
	02/10	Calorimetry	Ch 4	
	02/12	Work, Gas expansion and compression	Ch 4	Exam 1
4	02/15	Gas expansion and compression, the First Law of thermodynamics	Ch 4	
	02/17	Enthalpy and enthalpy change	Ch 4	
	02/19	Adiabatic expansion of an ideal gas	Ch 4	
5	02/22	Temperature variation of the enthalpy	Ch 4	
	02/24	Heat of formation, Reaction enthalpy, The enthalpy of phase transitions	Ch 4	
	02/26	Temperature dependence of the reaction enthalpy	Ch 4	Exam 2
6	03/01	Entropy and the Second Law	Ch 5	
	03/03	Calculation of entropy change	Ch 5	
	03/05	Calculation of entropy change	Ch 5	
7	03/08	Absolute entropy and the Third Law The Gibbs energy	Ch 5 Ch 6	
	03/10	Pressure dependence of Gibbs energy	Ch 6	
	03/12	Temperature dependence of Gibbs energy	Ch 6	Exam 3, Assignment 1 due
8	03/15 – 03/19, Spring Break			
9	03/22	The Clapeyron and the Clausius – Clapeyron equations	Ch 6	
	03/24	Phase diagrams Partial molar properties	Ch 6 Ch 7	
	03/26	The Thermodynamics of mixing	Ch 7	
10	03/29	Ideal-dilute and real solutions	Ch 7	
	03/31	The variation of ΔG with composition	Ch 9	

	04/02	Equilibrium constant and equilibrium composition	Ch 9	Exam 4
11	04/05	Temperature dependence of the equilibrium constant	Ch 9	
	04/07	The Debye-Hückel limiting Law	Ch 8	
	04/09	Calculating the solubilities of salts	Ch 8	
12	04/12	Electrochemical cells	Ch 10	
	04/14	Thermodynamics of electrochemical cells	Ch 10	
	04/16	Introduction to chemical kinetics	Ch 12	Exam5
13	04/19	Reaction rate and Rate laws	Ch 12	
	04/21	Simple order reactions	Ch 12	
	04/23	Determine the order and rate constant of a reaction	Ch 12	
14	04/26	Determine the order and rate constant of a reaction	Ch 12	
	04/28	Arrhenius equation	Ch 12	
	04/30	Transition state theory	Ch 12	Exam 6
15	05/03	Introduction to quantum mechanics and spectroscopy	Ch 14 Ch 17	
	05/05	Partical in a one-dimensional box	Ch 14	
	05/07	Partical in a one-dimensional box	Ch 14	Assignment 2 due
16	05/10	Harmonic oscillator and infrared spectroscopy	Ch 17	
	05/12	Wednesday, Final Exam 10:15 a.m.-12:15 p.m.		