Chemistry 3423-P01
Physical Chemistry II

Department of Chemistry College of Arts & Sciences

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Office Hours: M, T, F, 8:30 – 10:50 am

Course Location: Room A103 E. E. O'Banion Science Building
Class Meeting Days & Times: MWF 11:00- 11:50 a.m.

Course Abbreviation and Number: CHEM 3423

Catalog Description: CHEM 3423. Physical Chemistry. (3-0) Credit 3 semester hours. A continuation of CHEM 3413. Rate processes, kinetic theory and transport properties of gases and liquids. An introduction to the Fundamentals of Quantum mechanics and spectroscopy. Atomic and molecular structure. Electric and magnetic properties of molecules..

Prerequisites: MATH 2043; CHEM 3413.

Co-requisites: None

Required Text: "Physical Chemistry", K. J. Laidler, Meiser, and Sanctuary, Edition:4th

Recommended Text: "Physical Chemistry", Thomas Engle and Philip Read, Pearson 3rd edition
"Physical Chemistry", P. W. Atkins, Oxford, Edition: 5th, 1994

Access to Learning Resources:

PVAMU Library:
Telephone: (936) 261-1500;
web: http://www.pvamu.edu/pages/3585.asp

University Bookstore:
Telephone: (936) 261-1990;
web: https://www.bkstr.com/Home/10001-10734-1?demoKey=d

Course Overview:

CHEM 3423 is a lecture course focusing on fundamental principles of Physical Chemistry. The course will emphasize the study of elementary chemical kinetics and reaction transition theory, elements of quantum theory, and molecular spectroscopy . The course will present the underlying theory of chemical phenomena through theoretical and practical problems. A major emphasis will be placed upon solution of numerical problems as a way of demonstrating the underlying theory and practical applications of Physical Chemistry. Many activities will require use of computer skills as an adjunct to the development of problem-solving abilities and the skill to synthesize and apply knowledge in new contexts.

Course Learning Objectives/Accrediting Body *American Chemical Society (ACS)* **Standards Met: A, C, E, F**

At the end of this course, the student will

- Understand how to derive and apply rate equations for chemical reactions
  - Understand the concept of the order of a reaction with respect to one reactant and to the overall order
- Demonstrate knowledge of the definition of rate constant and a rate coefficient
  - Understand the role of temperature and use of the Arrhenius Equation for determining reaction rates and Activation Energies
- Demonstrate a basic knowledge of classical electromagnetic theory
  - Understand the Bohr Model and its role in the development of Quantum Mechanics
  - Understand the historical development of quantum mechanics and the way that its postulates led to the formulation of modern quantum mechanics.
  - Understand the central role of the Schrodinger Equation to explain simple systems
  - Understand how chemical spectroscopy is concerned with a coupling mechanism between classical electromagnetic waves and quantum mechanical atoms and molecules
  - Understand how absorption, spontaneous emission, and stimulated emission are described by the Einstein coefficient and provide the basic theoretical framework for chemical spectrometers
  - Understand the role of electric and magnetic moments in chemical systems and their importance to spectroscopy
  - Understand the different spectroscopic studies in the various electromagnetic regions and how these relate to chemical structure
  - Understand the difference between absorption spectroscopy and Raman spectroscopy
  - Understand the concept of molecular term symbols

COURSE OUTLINE:

DATE	TOPIC
Week 1-Week 3	**Chemical Kinetics I. The Basic Ideas** 9.1 Rates of Consumption and Formation 9.2 Rate of Reaction 9.3 Empirical Rate Equations 9.4 Analysis of Kinetic Results 9.5 Techniques for Very Fast Reactions 9.6 Molecular Kinetics 9.7 The Arrhenius Equation 9.8 Potential-Energy Surfaces 9.9 The Pre-exponential Factor 9.10 Reactions in Solution 9.11 Reaction Dynamics **EXAM 1**
Week 4- Week 7	**11. Quantum Mechanics and Atomic Structure** 11.1 Electromagnetic Radiation and the Old Quantum Theory 11.2 Bohr's Atomic Theory 11.3 The Foundations of Quantum Mechanics 11.4 Schrödinger's Wave Mechanics 11.5 Quantum-Mechanical Postulates 11.6 Quantum Mechanics of Some Simple Systems 11.7 Quantum Mechanics of Hydrogenlike Atoms 11.8 Physical Significance of the Orbital Quantum Numbers 11.9 Angular Momentum and Magnetic Moment 11.10 The Rigid Linear Rotor 11.11 Spin Quantum Numbers 11.12 Many-Electron Atoms 11.13 Approximate Methods in Quantum Mechanics **EXAM 2**
Week 8 – Week 10	**13. Foundations of Chemical Spectroscopy** 13.1 Emission and Absorption Spectra 13.2 Atomic Spectra 13.3 Pure Rotational Spectra of Molecules 13.4 Vibrational-Rotational Spectra of Molecules 13.5 Raman Spectra 13.6 Electronic Spectra of Molecules

Week 11 – Week 12	**14. Some Modern Applications of Spectroscopy**
	14.1 Laser Spectroscopy 14.2 Spectral Line Widths 14.3 Types of Lasers 14.4 Laser Techniques for Chemistry 14.5 Magnetic Spectroscopy 14.6 Nuclear Magnetic Spectroscopy 14.7 Electron Magnetic Resonance (EMR) 14.8 Mössbauer Spectroscopy 14.9 Photoelectron Spectroscopy 14.10 Photoacoustic Spectroscopy 14.11 Chiroptical Methods 14.12 Mass Spectrometry
	EXAM 3
Week 13 – Week 14	**15. Statistical Mechanics**
	15.1 Forms of Molecular Energy 15.2 Principles of Statistical Mechanics 15.3 The Partition Function 15.4 Thermodynamic Quantities from Partition Functions 15.5 The Partition Function for Some Special Cases 15.6 The Internal Energy, Enthalpy, and Gibbs Energy Functions 15.7 The Calculation of Equilibrium Constants 15.8 Transition-State Theory 15.9 The Approach to Equilibrium 15.10 The Canonical Ensemble
Week 15	**Course Review Day**
May 1-7	**FINAL EXAMINATION**

Course Evaluation Methods

This course will utilize the following instruments to determine student grades:

Exams – written tests designed to measure knowledge of presented course material
Exercises and Quizes – written assignments designed to supplement and reinforce course material

Grading Matrix

Instrument	Value (points or percentages)	Total
Hour Exams	3 Exams at 100 points each	300
Attendance		100
Final Exam	200 points	200
Total:		**600**

Grade Determination:
A = 90% and above;
B = 80% – 89%;
C = 70% – 79%;
D = 60% – 69%;
F = 59% or below

Course Procedures

Formatting Documents:
Microsoft Word is the standard word processing tool used at PVAMU. If you're using other word processors, be sure to use the "save as" tool and save the document in either the Microsoft Word, Rich-Text, or plain text format.

Exam Policy
Exams and Quizzes should be taken as scheduled. No makeup examinations will be allowed except under documented emergencies (See Student Handbook). Students with excused absences may be allowed to take a make-up exam at a time designated by the instructor.

Professional Organizations and Journals

Students enrolled in Physical Chemistry are expected to take advantage of professional development activities available through such organizations as the American Chemical Society (ACS), American Institute of Chemical Engineers (AIChE), and the National Organization of Black Chemists and Chemical Engineers (NOBCChE).

University Rules and Procedures

Disability statement (See Student Handbook):
Students with disabilities, including learning disabilities, who wish to request accommodations in class should register with the Services for Students with Disabilities (SSD) early in the semester so that appropriate arrangements may be made. In accordance with federal laws, a student requesting special accommodations must provide documentation of their disability to the SSD coordinator.

Academic misconduct (See Student Handbook):

You are expected to practice academic honesty in every aspect of this course and all other courses. Make sure you are familiar with your Student Handbook, especially the section on academic misconduct. Students who engage in academic misconduct are subject to university disciplinary procedures.

Forms of academic dishonesty:

1. Cheating: deception in which a student misrepresents that he/she has mastered information on an academic exercise that he/she has not mastered; giving or receiving aid unauthorized by the instructor on assignments or examinations.

2. Academic misconduct: tampering with grades or taking part in obtaining or distributing any part of a scheduled test.

3. Fabrication: use of invented information or falsified research.

4. Plagiarism: unacknowledged quotation and/or paraphrase of someone else's words, ideas, or data as one's own in work submitted for credit. Failure to identify information or essays from the Internet and submitting them as one's own work also constitutes plagiarism.

Nonacademic misconduct (See Student Handbook)

The university respects the rights of instructors to teach and students to learn. Maintenance of these rights requires campus conditions that do not impede their exercise. Campus behavior that interferes with either (1) the instructor's ability to conduct the class, (2) the inability of other students to profit from the instructional program, or (3) campus behavior that interferes with the rights of others will not be tolerated. An individual engaging in such disruptive behavior may be subject to disciplinary action. Such incidents will be adjudicated by the Dean of Students under nonacademic procedures.

Sexual misconduct (See Student Handbook):

Sexual harassment of students and employers at Prairie View A&M University is unacceptable and will not be tolerated. Any member of the university community violating this policy will be subject to disciplinary action.

Attendance Policy:

Prairie View A&M University requires regular class attendance. Excessive absences will result in lowered grades. Excessive absenteeism, whether excused or unexcused, may result in a student's course grade being reduced or in assignment of a grade of "F". Absences are accumulated beginning with the first day of class.

Student Academic Appeals Process

Authority and responsibility for assigning grades to students rests with the faculty. However, in those instances where students believe that miscommunication, errors, or unfairness of any kind may have adversely affected the instructor's assessment of their academic performance, the student has a right to appeal by the procedure listed in the Undergraduate Catalog and by doing so within thirty days of receiving the grade or experiencing any other problematic academic event that prompted the complaint.

Technical Considerations for Online and Web-Assist Courses

Minimum Hardware and Software Requirements:

-Pentium with Windows 7 or PowerMac with OS 10
-56K modem or network access
-Internet provider with SLIP or PPP
-8X or greater CD-ROM
-64MB RAM
-Hard drive with 40MB available space
-15" monitor, 800x600, color or 16 bit
-Sound card w/speakers
-Microphone and recording software
-Keyboard & mouse
-Netscape Communicator ver. 4.61 or Microsoft Internet Explorer ver. 5.0 /plug-ins -Participants should have a basic proficiency of the following computer skills:

- ·Sending and receiving email
- ·A working knowledge of the Internet
- ·Proficiency in Microsoft Word
- ·Proficiency in the Acrobat PDF Reader
- ·Basic knowledge of Windows or Mac O.S.

Netiquette (online etiquette): students are expected to participate in all discussions and virtual classroom chats when directed to do so. Students are to be respectful and courteous to others in the discussions. Foul or abusive language will not be tolerated. When referring to information from books, websites or articles, please use ADA standards to reference sources.

Technical Support: Students should call the Prairie View A&M University Helpdesk at 936-261-2525 for technical issues with accessing your online course. The helpdesk is available 24 hours a day/7 days a week. For other technical questions regarding your online course, call the Office of Distance Learning at 936-261-3290 or 936-261-3282

Communication Expectations and Standards:
All emails or discussion postings will receive a response from the instructor within 48 hours.

You can send email anytime that is convenient to you, but I check my email messages continuously during the day throughout the work-week (Monday through Friday). I will respond to email messages during the work-week by the close of business (5:00 pm) on the day following ***my receipt*** of them. Emails that I receive on Friday will be responded to by the close of business on the following Monday.

Submission of Assignments:
Assignments, Papers, Exercises, and Projects will distributed and submitted through your online course. Directions for accessing your online course will be provided. Additional assistance can be obtained from the Office of Distance Learning.

Discussion Requirement:
Because this is an online course, there will be no required face to face meetings on campus. However, we will participate in conversations about the readings, lectures, materials, and other aspects of the course in a true seminar fashion. We will accomplish this by use of the discussion board.

Students are required to log-on to the course website often to participate in discussion. It is strongly advised that you check the discussion area daily to keep abreast of discussions. When a topic is posted, everyone is required to participate. The exact use of discussion will be determined by the instructor.

It is strongly suggested that students type their discussion postings in a word processing application and save it to their PC or a removable drive before posting to the discussion board. This is important for two reasons: 1) If for some reason your discussion responses are lost in your online course, you will have another copy; 2) Grammatical errors can be greatly minimized by the use of the spell-and-grammar check functions in word processing applications. Once the post(s) have been typed and corrected in the word processing application, it should be copied and pasted to the discussion board.