

Instructor: Dr. Charles H. Mahler, Phone (570) 321-4351 or (570) 322-8840 (h), mahler@lycoming.edu  
Office Hours: **Heim 202, MWF 10 AM – 12 noon**, by appointment, or drop by.

*If you have questions or comments about anything in the course, please come see me. I am ready and willing to meet with you and discuss your concerns, answer questions, explain concepts, solve problems, etc. I would rather help you to understand something before a lab or test or other assignment, than to find out you don't understand it while grading your work.*

**CLASS:** MWF from 9:00 to 9:50 AM in Heim 215. **LAB:** T from 8:00 to 11:50 AM in Heim 204.

Prerequisites: CHEM 111, MATH 129, PHYS 225 and 226; or consent of instructor.

Materials for Course:

*Physical Chemistry, 10<sup>th</sup> Ed.* Peter Atkins and Julio de Paula; *ACS Style Guide, 3<sup>rd</sup> Ed.*; Casio fx-260 solar calculator (no passing or sharing allowed in exams); Bound Laboratory Notebook with quadrille pages (for lab use only); Safety Glasses or Goggles; Laboratory Manual for Chemistry 330-331W.

Evaluation and Grading:

Grades will be based on the following weighting scheme: 3 Exams (45%), a Final Exam (20%), Labs (25%), and Quizzes (10%). 2 extra credit points (to a limit of 15, on a 1000 point scale) will be given for each Chemistry Colloquium attended. Alternative extra credit will be available for those whose schedules conflict with colloquium (but you must see me to arrange this by Friday, October 27, 2017).

**ALL EXAMINATIONS ARE COMPREHENSIVE, ESPECIALLY THE FINAL.**

The following scale will determine the final letter grade: **A**  $\geq$  90% > **B**  $\geq$  80% > **C**  $\geq$  70% > **D**  $\geq$  60% > **F**. Plus and minus grades are included in these ranges and will be determined at the end of the semester. Adjustments to this scale are possible, but unlikely.

<u>Exams:</u>	<u>Hour Exam 1</u>	Tuesday, September 19, 2017 (in lab)
	<u>Hour Exam 2</u>	Tuesday, October 17, 2017 (in lab)
	<u>Hour Exam 3</u>	Tuesday, November 21, 2017 (in lab)
	<u>Final Exam</u>	Friday, December 15, 2017, 8:30 – 11:30 AM

Content:

Physical Chemistry provides the theoretical basis for explaining and interpreting chemical systems by focusing on the energy, time, and structure involved as they change. In this course we will study and attempt to understand many of the basic principles and phenomena of chemical systems in equilibrium and their energies, including Gases and their properties, Chemical Thermodynamics, Phase Relationships and Diagrams, Chemical Equilibrium, Electrochemistry, and basics of Statistical Thermodynamics. Physical Chemistry II 331W will continue where this course ends and cover kinetics and quantum mechanics. Both semesters have comprehensive, multiple-choice ACS exams as part of the final (in the Spring the final covers both semesters).

Lecture Attendance and Absences:

Lecture attendance with calculator and textbook is required. All lecture absences after three will be penalized 2 percent (of total possible points) per day. **All lecture and lab absences need an excuse.** Notification is expected as soon as possible for planned (athletic events, class trips) or emergency (illness) absences; call or e-mail me or the Department Secretary (570 321-4180). The cause of absences must be verified by a Dean or substantiated (note from coach or parent, doctor's excuse, etc.).

Exam and Lab Absences:

**No** make-up exams will be given. The (cumulative) final exam grade (as a percent) will be substituted for **one** excused absence exam grade (as a percent). Barring exceptional circumstances, **all** subsequent missed exams will receive a grade of zero. Because students often work in groups in lab, absences hurt everyone and should be avoided. Make-up labs will vary (and may not be possible), depending on the circumstances of that week's experiment. In some cases, students may be allowed to work outside scheduled lab hours by first obtaining permission from a chemistry professor (who must be in the building while they work and be notified when they leave), and then having a "buddy" present.

Quizzes:

Eight quizzes will be given at the end of the period on Mondays this semester: Sept. 4, Sept. 11, Oct. 2, Oct. 9, Oct. 30, Nov. 6, Nov. 13, and Dec. 4, 2017. The lowest quiz grade will be dropped, but no other quiz make-ups will be provided.

Homework:

Each chapter has a set of recommended problems (posted on Moodle, with keys) which students are strongly encouraged to work. In addition, there may be graded homework problems assigned. These are due at the start of the next lecture (or as soon as you enter lecture, if late), and we will go over the solution in that lecture. Many students find it useful to keep a copy of the problem to review. No late homework will be accepted. *If you must be absent, have someone else take notes and hand in any assignments for you.*

Quiz and exam questions will often be similar to homework problems. Almost all of the "discussion questions" are useful (i.e. the first several exercises for each chapter). Note that answers for the (a) exercises and some problems are given in the back of the textbook.

Chapter 1, Exercises 1A.1, 2, 3, 6, 8, 10; 1B.1, 2, 4, 5, 6; 1C.1, 4, 5, 8; Chapter 2, Exercises 2A.2, 3, 4, 5, 6; 2B.1, 3; 2C.1, 2, 3, 4, 5; 2D.4, 5; 2E.2, 3, 4; Chapter 3, Exercises 3A.1, 2, 3, 4, 5, 6, 8, 10, 11; 3B.2, Problem 3, 3C.1, 2, 3, 4, 5; 3D.1, 3, 4, Problems 5, 6, 7; Chapter 4, Exercises 4A.1, 2, 3; 4B.2, 3, 4, 5, 6, 9, 11, 12, 13; Chapter 5, Exercises 5A.4, 6, 7, 8, 9; Problems 5A.3, 5; Exercises 5B.1, 2, 3, 4, 5, 8, 9, 10, 12; Discussion 5C.1; Exercises 5C.1, 2, 3, 4, 6, 7; Problem 5C.5; Exercises 5D.1, 2, 3, 4; 5E.1, 2; 5F.1, 3; Chapter 6, Exercises 6A.3, 4, 5, 6, 8, 9, 11; 6B 1, 3, 4, 5; 6C. 1, 2, 3; 6D.1, 2.

Review Sessions:

A review session will be held before each exam. The reviews will be in Heim 204 (the lab) or other announced room (Heim 215) from 8:30 to 10 PM the Sunday evening prior. This may be changed by a vote of the whole class. Keys for problems, quizzes, and exams will be posted on Moodle and/or reviewed in class. Final exam review time is TBA.

Miscellaneous:

*Administrative procedures* (withdrawals, etc.) will follow the published guidelines and rules of the college and department. There will be a class web page and Moodle will also be used. This syllabus is also available online at <http://www.lycoming.edu/chem/fall2017/330syl.htm>.

General Comments:

All problems solved on exams, quizzes, and labs must show work and include units to receive full credit. Students are responsible for knowing material in the assigned reading, problems, labs, and lectures. Working problems, studying and understanding the material are keys to doing well. It is assumed that the students are familiar with the background material in Chemistry, Physics and Mathematics. While I am glad to help you in reviewing these topics, it is your responsibility to make up any weaknesses or deficiencies you might have. Much of the course material involves a high degree of conceptual understanding (not simple memorization), so adequate preparation and study are essential. It is **not** sufficient to learn the material from the lecture alone - you should read and think about the topics covered **before** attending lecture. If you still can't get a problem or concept, please see me for help. We will cover much detailed and difficult material this semester, so our pace must be geared toward those who are prepared to learn. In homework and exams be neat, box answers, show your work and units (partial credit will be given).

Academic Honesty:

On all exams and lab reports, copying someone else's work or allowing another to copy your work and submit it as their own is academic dishonesty and can lead to penalties such as failing the assignment or even dismissal from the college. Unless otherwise stated, all work submitted for a grade should be your own work (although you can study with others to understand the concepts). Always include citations for all sources consulted in labs or homework to avoid plagiarism. For further information on the college policy on academic dishonesty, see the *Pathfinder* or *Student Handbook*. Scores will be posted, generally after exams, using a secret, four-character code chosen by each student. If you prefer not to have your scores posted, let me know (in writing) by Friday August 31, 2017.

Laboratory: In the first lab (Tuesday August 29, 2017), we will go over the lab schedule, safety issues, writing lab reports, error analysis, and the use of spreadsheet programs in the Lynn ITS lab. The first lab will also have an overview for each experiment. Please be sure to bring your notebook and take good notes. Lab report due dates are given on the schedule (below). Start work on lab reports well before they are due - these cannot be done well at the last minute. Many Physical Chemistry Lab Reports involve as much time (or more) in writing and calculation as the original experimental procedure did. The report for one experiment may be done as a poster instead. More information will be given out in lab.

Pre-Labs:

There will be a pre-lab overview of each experiment during the first week of lab. Three later experiments have photographic pre-labs on Moodle which illustrate some of the equipment and techniques used in that experiment. Each student is responsible for looking at the online pre-lab before the experiment starts. Students who do not may be penalized in their grade for that experiment. Printouts of the photographs will also be available in lab for reference of the group(s) doing that experiment that week. The instructor will also be available for any questions.

Writing Project: In response to student feedback from previous years, we will start the Writing Project at the end of the semester. Only the “Project Topic” (due Mon. Oct. 30) and draft “Project References” (draft due Wed. Dec. 13, final version due Friday of the first week in Spring 2017) will be due this semester. More information about all aspects of the writing project is in the 330-331W Lab Manual and will be discussed later. The grades will count in the homework and quizzes category. This is designed to allow more time for the Writing Project as it continues in the Spring Semester in Physical Chemistry II 331W.

College Policies:

Because this course meets a distribution requirement, it includes a writing component. At least 10 pages of writing must be produced by each student during the semester and some of those assignments will be formally evaluated for writing. I will be reserving some class or office time to help each student with written work.

Lycoming College provides academic support for students who officially disclose diagnosed learning, physical, and psychological disabilities. If you have a diagnosed disability and would like to seek accommodations, please contact Jilliane Bolt-Michewicz, Assistant Dean of Academic Services/Director of the Academic Resource Center. Dean Bolt-Michewicz will help you arrange for appropriate academic accommodations. She can be reached by calling (570) 321-4050, emailing [michewicz@lycoming.edu](mailto:michewicz@lycoming.edu), or visiting her office (Academic Resource Center, 3rd Floor of Snowden Library).

Departmental and ACS policy:

The following are not allowed to be used during quizzes and exams: programmable calculators (unless the memory is cleared by the instructor), cell phones, PDA's, headphones, or other personal electronic devices.

Relevant Departmental and College Learning Goals:

This course contributes to the following departmental learning goals, i.e. that students who complete a major in chemistry will be able to:

1. Exhibit proficiency in the major sub-disciplines of chemistry [i.e. Physical Chemistry]
2. Perform wet laboratory techniques as appropriate to the major sub-disciplines of chemistry
3. Understand and use modern chemical instrumentation
4. Exhibit integrative, problem-solving skills, such as experimental design, data manipulation, and data interpretation
5. Communicate the results of chemical investigations effectively in written and oral form
6. Search the chemical literature, evaluate the results of the search, and access desired research materials
7. Demonstrate responsible conduct in the laboratory, including laboratory safety and ethical research practices

In support of the Lycoming College Mission Statement and the College Philosophy, this course seeks to help students enrolled in it to “explore new concepts and perspectives” and “develop communication and critical thinking skills” as part of a “distinguished baccalaureate education in the liberal arts and sciences”.

Learning Objectives:

Upon completion of the two-semester Physical Chemistry sequence, students should be able to:

- Perform calculations involving laboratory procedures (including stoichiometry, solution concentration) and experimental data
- Be able to analyze data and its associated error, and prepare graphs using graphical analysis software
- Use common laboratory tools properly (including balances, volumetric glassware, barometers, spectrometers, calorimeters, timing devices)
- Understand the fundamental principles of thermodynamics, including equations of state, state functions, chemical and phase equilibria, and statistical mechanics, and how these relate to energy in chemistry.
- Understand the fundamental principles of kinetics, including rate laws, mechanisms, kinetic molecular theory, transport properties, and reaction dynamics, and how these relate to reaction time and rates in chemistry.
- Understand the fundamental principles of quantum mechanics including wave functions, eigenvalues and operators, the particle in a box, harmonic oscillator, and rigid rotor models, basic molecular orbital theory, and how these relate to atomic and molecular structure and spectroscopy.
- Perform calculations related to thermodynamics, kinetics, and quantum mechanics ) and understand how the calculated parameters relate to the chemistry of the system
- Communicate scientific data clearly in written and oral presentations

*Adapted from the American Chemical Society's Committee on Professional Training's Physical Chemistry Supplement*

**Revised Laboratory Schedule for Physical Chemistry I 330, Fall 2017**

<b>Date (Tues.)</b>	<b>Group Exothermic</b>	<b>Group Endothermic</b>
Aug. 29	Check In, Pre-Labs, Excel, etc.	Check In, Pre-Labs, Excel, etc.
Sept. 4	Electrochemistry Due Wed. Sept. 20	Electrochemistry Due Wed. Sept. 20
Sept. 12	Bomb Cal. Part I	Cp/Cv Ratio Part I
Sept. 19	EXAM ONE	EXAM ONE
Sept. 26	Bomb Cal. Part II Due Wed. Oct. 11	Cp/Cv Ratio Part II Due Wed. Oct. 11
Oct. 3	Cp/Cv Ratio Part I	Bomb Cal. Part I
Oct. 10	Cp/Cv Ratio Part II Due Wed. Oct. 18	Bomb Cal. Part II Due Wed. Oct. 18
Oct. 17	EXAM TWO	EXAM TWO
Oct. 24	Conductivity Due Wed. Nov. 1	Solution Cal. Part I
Oct. 31	Spartan Due Wed. Nov. 15	Solution Cal. Part II Due Wed. Nov. 15
Nov. 7	Solution Cal. Part I	Spartan Due Wed. Nov. 29
Nov. 14	Solution Cal. Part II Due Wed. Dec. 6	Conductivity Due Wed. Dec. 6
Nov. 21	EXAM THREE	EXAM THREE
Nov. 28	Surprise	Surprise
Dec. 5	Checkout, review	Checkout, review

**Lab groups:**

Exothermic: Adalea, Michael, Jahmere, Andrew

Endothermic: Victoria, Caleb, Paige, Leann

**Important Dates for Physical Chemistry 330 Fall 2017**

*Exams* (Tuesdays in lab): Sept. 19, Oct. 17, Nov. 21, Final Friday Dec. 15

*Quizzes* (Mondays): Sept. 4, Sept. 11, Oct. 2, Oct. 9, Oct. 30, Nov. 6, Nov. 13, and Dec. 4, 2017

**Fall Semester 2017 Writing Project Deadlines:**

- Topics due by Mon. Oct. 30
- References Draft due by Wed. Dec. 13