

**CHEM – Convert to separate lab CHEM 3710L course  
Department of Chemistry for Catalog 2015-16**

**Two proposals are presented that are related as follows:**

First-Change the number of credit hours for CHEM 3710 from 4 to 3 by removing the associated lab portion to make it separate, and fix the CHEM 3720 prerequisites to list both lecture and lab.

• **Second- Convert existing lab into a separate lab course CHEM 3710L (1) Physical Chemistry that would be associated with the above, but have clarified and needed prerequisite.**

**Overview:**

Overall the two proposals are to convert the current CHEM 3710 (4) with one combined lecture and lab grade into a CHEM 3710 (3) lecture and a CHEM 3710L (1) lab where they would be two separate classes and each course would receive a separate grade. Two proposals are submitted together to accomplish this change. The first is to convert CHEM 3710 (4) with lecture and lab to a CHEM 3710 (3) with lecture only. The second proposal is to create a separate course CHEM 3710L (1).

CHEM 3710 (3) Physical Chemistry I lecture would be identical to the current CHEM 3710 (4) Physical Chemistry I lecture portion but without the associated CHEM 3710L laboratory portion. The new CHEM 3710 (3) would provide an important option for students who did not need to take the lab portion and who did not meet the lab portion requirements.

The new lab course would be created by using the current online description in registration CRN and adding a needed requirement for CHEM 3210 Quantitative Analysis and other courses currently required for CHEM 3710. This lab already exists but not as a separate course. A syllabus for CHEM 3710L (lab) is at the end of this document.

**New Proposed text:**

**CHEM 3710L - Physical Chemistry I Laboratory  
(1) Credit Hours**

Laboratory experience to support and enhance topics covered in CHEM 3710.

Laboratory 3 hours. Prerequisites: CHEM 3210 with a minimum grade of C; CHEM 3020 and CHEM 3020L with minimum grades of C; and MATH 1920 and 1921 with minimum grades of C or MATH 1960 with a minimum grade of C; or department head approval.

Corequisites: PHYS 1040 and PHYS 1040L or PHYS 2310 and PHYS 2310L or department head approval; or Prerequisites: PHYS 1040 and PHYS 1040L with minimum grades of C or PHYS 2310 and PHYS 2310L with minimum grades of C or department head approval.

Corequisite: CHEM 3710; or Prerequisite: CHEM 3710 with a minimum grade of C; or department head approval. Laboratory/studio course fee will be assessed.

**Rationale:**

Note that lab would have as a prerequisite CHEM 3210 (Quantitative Analysis) with a C. A student taking this lab would have to take the lecture CHEM 3710 (3) with this lab. All chemistry students would be required to do both. Our Chemistry BS degree would require the lecture and lab: CHEM 3710 (3) and CHEM 3710L(1). However other students (such as the Engineering students) could take the lecture without lab. In other words, students could either take lecture and lab or just take lecture if that was all their program required.

Our Physical Chemistry I class for fall semester CHEM 3710 (4) has 3 labs (CHEM 3710L) each designed for a maximum of 20 students which already is over the ideal amount for an upper level chemistry lab with 10 different experiments. Each lab has 10 experiments and the students work in pairs. Last year and this year we had to go above 20 in the labs to try to accommodate the demand. We are having chemistry students who cannot get into this class in a timely manner. It has been difficult to meet the needs of our own majors and the lab becomes much less than optimal with these larger numbers squeezed into lab. A better number for an upper level lab with so many different experiments would be about 16. Due to the lab, we are having great difficulty accommodating the Chemical Engineering majors who have grown in numbers as indicated by "UTC Department Profiles" in which Chemical Engineering majors are 9 in 2010, 49 in 2011, 65 in 2012, and 103 in 2013. We can handle this growth in lecture but not in lab. Consider the numbers of students in the Chemical Process Operations class taught in the fall semester and note that in 2010 there were 7 students, in 2011 8, 2012 14, 2013 19, and in 2014 there are 27 students enrolled. However, the Chemical Engineering needs can be met with just the 3 hour lecture portion of our Physical Chemistry I course.

We have for many years required our chemistry students to take among the other prerequisites a course all our chemistry majors take called Quantitative Analysis with Laboratory ( CHEM 3210 which includes a lab ). This course provides important lab skills and experiences and technical knowledge that is important to have prior to the CHEM 3710L lab activities. We have allowed the Chemical Engineering and Environmental Engineering students to do the Physical Chemistry class without this prerequisite class. We have substituted an engineering class ENGR 2220 just to have something on record for them to have completed. The Engineering class actually has no connection to the required Chemistry Quantitative Analysis pre-requisite course. So students are coming into this upper level lab with different experiences and levels of preparation.

Beginning in the fall of 2015, we need to make a change to enforce the real prerequisite for all students going into Physical Chemistry Lab so all the students will have the needed background to be prepared for the lab work. However, the Physical Chemistry lecture would not need this same restriction. So a 3 credit hour lecture CHEM 3710 (3) that is identical to the lecture portion of the current CHEM 3710 (4) would continue to be offered.

CHEM 3710 (3) would become the primary option for Engineering students. Chemical or Environmental Engineering students who chose to take CHEM 3210 could take the lab portion CHEM 3710L (1) and they might choose to do so to complete a chemistry minor. However, most engineering students would take the new 3 hour lecture CHEM 3710 (3) portion without lab. According to our conversation with Chemical Engineering coordinator (Dr. Frank Jones) this new option (lecture only) would meet their needs.

CHEM 3710 (4) Physical Chemistry I is the only chemistry class that does not have the same prerequisites for everyone in the class. This creates problems in laboratory background and work. This change would give Chemical Engineering students two options where now they have only one.

This change would allow us to continue to meet the needs of our majors where we are falling behind. Our majors must all take this class and need to do the lab as part of our American Chemical Society (ACS) certification requirements and as a prerequisite for Physical Chemistry II (CHEM 3720) lecture and lab. The Chemical Engineering students do not have this Physical Chemistry lab certification issue and do not take Physical Chemistry II (CHEM 3720).

**Effects on department:** Allow us to meet the needs of our students in this critical laboratory course. No new resources needed.

**Effects on other Departments:** Chemical Engineering and Environmental Engineering students would all take the lecture portion of the course exactly as they do now. They would not be required to do the lab. However, they could do so along as they had the same standard prerequisites as the chemistry majors who do take the laboratory portion. However, the needs of the Engineering students could be met with just the lecture portion that would be available to them without requiring the lab.

## PHYSICAL CHEMISTRY I LABORATORY Fall 2014 section 0

COURSE: CHEM 3710L 40725  
TITLE: Physical Chemistry I Laboratory  
CREDIT: 0 hours (25% of CHEM 3710 grade)  
MEETING day,time,loc: Monday (M) 02:00 pm - 04:50 pm Grote 315

FACULTY Name: Thomas R. Rybolt  
Email: [tom-rybolt@utc.edu](mailto:tom-rybolt@utc.edu) (checked at least once a day M-F)  
Office Location: Grote 318A  
Office Hours: Tues 8:30 - 11:00, Thurs 8:30 - 11:00  
Office Phone: 425-4499

### COURSE DESCRIPTION & PREREQUISITES AND COREQUISITES:

CHEM 3710L - Physical Chemistry I Laboratory

Laboratory experience to support and enhance topics covered in CHEM 3710. Laboratory 3 hours. Corequisite: CHEM 3710 or department head approval. Laboratory/studio course fee will be assessed.

CHEM 3710 - Physical Chemistry I  
(4) Credit Hours

Examines thermodynamics, kinetics, and quantum mechanics with applications to physical and chemical properties of matter. Fall semester. Lecture 3 hours, laboratory 3 hours. Prerequisites: CHEM 3210 with a minimum grade of C or ENGR 2220 with a minimum grade of C; CHEM 3020 and CHEM 3020L with minimum grades of C; and MATH 1920 and 1921 with minimum grades of C or MATH 1960 with a minimum grade of C; or department head approval. Corequisite: CHEM 3710L or department head approval. Corequisites: PHYS 1040 and PHYS 1040L or PHYS 2310 and PHYS 2310L or department head approval; or Prerequisites: PHYS 1040 and PHYS 1040L with minimum grades of C or PHYS 2310 and PHYS 2310L with minimum grades of C or department head approval. Laboratory/studio course fee will be assessed.

### ACCOMMODATION STATEMENT:

ADA STATEMENT: If you are a student with a disability (e.g. physical, learning, psychiatric, vision, hearing, etc.) and think that you might need special assistance or a special accommodation in this class or any other class, call the Disability Resource Center (DRC) at 425-4006 or come by the office, 102 Frist Hall <http://www.utc.edu/disability-resource-center/>

### COUNSELING CENTER STATEMENT:

If you find that personal problems, career indecision, study and time management difficulties, etc. are adversely affecting your successful progress at UTC, please contact the Counseling and Career Planning Center at 425-4438 or <http://www.utc.edu/counseling-personal-development-center/index.php>

### COMMUNICATION:

Communication will be primarily by weekly meeting, but may include *UTC Learn* course site, or email. To enhance student services, the University uses your UTC email address for all communications. Please check your UTC email on a regular basis. If you have problems with accessing your UTC email account, contact the Call Center at 423/425-4000.

## **COURSE LEARNING OUTCOMES:**

*The overall outcomes for the category are:* Upon completion of the required credit hours in this category, students will be able to:

- Construct graphic and analytical models from a description of a specific natural phenomenon.
- Formulate a hypothesis based on empirical data.
- Apply the scientific method to solve problems.
- Design experiments to test hypotheses.
- Express conclusions and implications from scientific experiments using a variety of methods.

## **EVALUATION/ASSESSMENT & CLASS PARTICIPATION/ATTENDANCE POLICY & LATE ASSIGNMENT SUBMISSION/MAKE-UP POLICY:**

### **CHEM 3710L**

In this laboratory course you will have an opportunity to study some of the physical properties of matter that are associated with various chemical substances. The Physical Chemistry Laboratory is designed to demonstrate the application of principles covered in the lecture portion of the course. **You should strive to integrate your knowledge of theory and experiment and understand how these two aspects of Physical Chemistry are interrelated.** Each week refer to your lecture textbook for needed background information and read sections that go along with your lab work. Lecture can help you understand lab, but lab can also help you understand lecture.

**Lab Course information:** *Go to UTC Learn to find all course information.* **You must print course information and keep the material organized in a notebook. You are responsible for having all needed pages for work each day.** Safety information and detailed lab instructions are provided in the *Laboratory Manual for Computational and Experimental Physical Chemistry* that you will access at the UTC Learn course website. Be sure you have correct syllabus and schedule for your section.

### **Attendance:**

You are required to attend all sessions of the laboratory. One day will be available at the end of the semester for a make-up lab. If you miss lab, discuss with me as soon as possible. If you miss the day that labs are due then the next time I see you, the labs must be ready to hand to me.

### **Breakage:**

Most equipment breakage is the result of carelessness. Students who break an item may have their lab grade for that experiment reduced. The damage of a major piece of equipment or an instrument will result in a 0 for that experiment.

### **Grades:**

The lab grade comprises 25% of your course grade. Your grade is based on the average of 10 lab reports and the successful completion of molecular modeling and linear regression assignments at the beginning of the semester. Although your laboratory grade will be based on your written lab reports, improper conduct in lab or lack of preparation for lab would affect your grade. You need to keep up during the semester and strive to understand what you are doing. You must prepare before lab. We are there to help answer questions but will not tell you what to do. That information you will obtain by reading experiment.

**Honesty:** One of the distinguishing features of Science as a human endeavor is its emphasis on absolute honesty and truthfulness. You should cultivate this habit in all your undergraduate work. In this lab as in all others whether your data is "good" or "bad" it is real and thus what you have to work with, analyze, and try to understand. You are expected to write your own report. Although you may discuss the experiment with other students and your lab partner, you may not copy, paraphrase, or rewrite portions of another person's report. *You are not allowed to permit other persons to use your reports for unethical purposes. Discussions for the purpose of understanding are fine; whereas, copying any portion of another's work for the purpose of generating a lab report without understanding is not an acceptable practice. Copying a portion of another's work will result in a minimum of a 0 on the lab report for the first offense and a 0 for the entire 3710L grade for the second offense. The person who copies and a person who allows copying (by for example sharing electronic files of lab reports) will both receive the same consequence.*

**Notebook, Calculator and Goggles:** A bound laboratory notebook (*not* spiral bound) is required. All recorded information is to be written directly in this notebook. You must use ink. You are not allowed to record information temporarily on scraps of paper or tear pages out of the notebook. You should include enough information so that it is clear what type of data and units are being recorded. You should date each data page. Some data is collected directly by computer, but otherwise you should write key numbers in a lab notebook. Proper use of lab notebooks may be checked during any lab. You will need to have calculator and approved safety goggles for all lab days.

## **COURSE SCHEDULE/TOPICAL OUTLINE & TEACHING/LEARNING STRATEGIES:**

### **Experiments and Lab Information:**

The laboratory experiments and computational chemistry experiments to be conducted during this semester are listed below. The online lab manual gives background theory as well as specialized instructions for your experimental work, data analysis, and lab reports. If some corrections or updates are needed during the semester, they will be placed on a page in the experiment drawer.

		<b>General PChem Subject</b>
AS	Adsorption from Solution	equilibrium, surfaces
EX	Exothermic Reaction	thermodynamics, heat
FP	Freezing Point Depression	thermodynamics, solutions
HV	Heat of Vaporization	thermodynamics, phases, heat
IS	Reaction Rate of Sucrose Inversion	kinetics
LV	Liquid Vapor Equilibrium	thermo, phase diagrams
ME	Molecular Energy of DNA nucleobase pairs	modeling, biostructures
MM	Molecular Modeling of Organic Reaction	modeling, equilibrium
RO	Determination of Reaction Order	kinetics
SM	Spectra of Conjugated Molecules	quantum, spectroscopy

*You must prepare for each experiment before the scheduled lab time. When you step in the door, you should know what you are doing and have a plan of action. You will not do a full experiment until the third week in lab, but you will be doing other required activities the first and second weeks in lab.*

### **HONOR CODE PLEDGE (from the [UTC Student Handbook](#)):**

"I pledge that I will neither give nor receive unauthorized aid on any test or assignment. I understand that plagiarism constitutes a serious instance of unauthorized aid. I further pledge that I exert every effort to insure that the Honor Code is upheld by others and that I will actively support the establishment and continuance of a campus-wide climate of honor and integrity."

**COURSE URL:**

Go to UTCLearn and select course FA.14.CHEM.3710.40725 and login using UTC ID and mail password.

**Preparation:**

*For the first week in lab, students must print out and bring to lab:*

Syllabus (includes Orientation Plan and Schedule)  
Appendix D – Molecular Modeling (Scigress) Tutorial and  
Appendix E – Molecular Mechanics Assignment

*For the second week in lab, students must print out and bring to lab remaining material:*

*\*\*\* Organize all the lab material into a three-ring notebook in the order below \*\*\**

**Syllabus** (with Orientation Plan and Schedule)

**Laboratory Manual for Physical Chemistry I****Introduction (includes pages below)**

Cover page  
Table of Contents  
List of Experiments  
Literature Values  
Course Information and Lab Policy  
Directions for Lab Work  
Lab Notebook  
Lab Reports *\*\*\*Important Style Issues - Refer here when writing reports\*\*\**

**Experiments**

AS Adsorption from Solution  
EX Exothermic Reaction  
FP Freezing Point Depression  
HV Heat of Vaporization  
IS Reaction Rate of the Inversion of Sucrose  
LV Liquid–Vapor Equilibrium  
ME Molecular Energy of Nucleobase pairs  
MM Molecular Modeling and Equilibrium  
RO Determination of Reaction Order  
SM Spectra of Conjugated Molecules

**Appendices**

**A. Safety**  
**B. Significant Figures and Errors**  
**C. Use of Computer, Balances, Instruments**  
**D. Molecular Modeling (Scigress) Tutorial**  
**E. Molecular Modeling (Scigress) Assignment** (*turn in answers on separate pages when due*)  
**F. Linear Regression and Excel Directions**  
**G. Data Analysis Assignment** (*turn in answers on these pages when due*)

**3710 Lab Schedule Fall 2014 Rybolt section Monday 2:00 – 4:50 Grote 315**

Date/Exp	AS	EX	FP	HV	IS	LV	ME	MM	RO	SM
Aug 18	Scigress tutorial and problems									
25	Introduction, Safety, Graphing/regression/math exercise, Prep for first expt									
Sep 1	----- no lab -----									
8	0	1	2	3	4	5	6	7	8	9
15 *	9	0	1	2	3	4	5	6	7	8
22	8	9	0	1	2	3	4	5	6	7
29 *	7	8	9	0	1	2	3	4	5	6
Oct 6	6	7	8	9	0	1	2	3	4	5
13 *	5	6	7	8	9	0	1	2	3	4
20	----- no lab -----									
27	4	5	6	7	8	9	0	1	2	3
Nov 3 *	3	4	5	6	7	8	9	0	1	2
10	2	3	4	5	6	7	8	9	0	1
17 *	1	2	3	4	5	6	7	8	9	0
24	make-up lab (one lab that you have not completed may be done this day)									
Dec 1 *	all labs due by Monday 2:05 pm (hand to me—or slide under my office door)									

**\* Lab reports due on these days. You must follow the required format or lab reports will not be accepted. Any lab report that is not complete or not done in a careful and professional manner will receive an F. No late lab reports (5 minutes after official start time) accepted.**

One **Make-up lab** (not due till end of semester) is allowed once during semester, but it cannot be your first report. To have lab count as Make-up lab on due date of report, give me a piece of paper with the two letter code, date, your name, and statement, “ this is my one make-up lab.”

**Group Numbers and Names**

0	-
1	-
2	-
3	-
4	-
5	-
6	-
7	-
8	-
9	-

## Introduction to CHEM 3710 lab, Assignments, and Preparing for Experiments

### Week One

Molecular Mechanics Tutorial—Do Appendix Tutorial and Modeling assignment. Turn in at start of next lab.

### Week Two - discuss items below

- 1) Bring lab manual (print from website put in organized notebook), any additional 3710 Lab handouts, calculator, bound notebook, and goggles.
- 2) Go through Lab Manual (Introduction, Experiments, and Appendices) and discuss details.
- 3) Go through 3710 Lab handouts and discuss details.
- 4) Discuss safety rules, chemical hygiene plan, waste disposal, point out lab safety features and collect signed safety sheets.
- 5) Discuss balances and lab cleanliness.
- 6) Point out location of chemicals for experiments.
- 7) Indicate location of experiments.  
The experiment locations are indicated by cards on benches or labels on drawers.
- 8) Go over use of interface devices
- 9) Go over computer usage this semester.
- 10) Assign partners and go over schedule.
- 11) Make assignments for today and coming week.

Data Analysis Assignment — Do Assignment - start in lab. Turn in at start of next lab.

Initial Work for first experiment (do today)

AS use of computer interface to measure absorbance

EX use of computer interface, calculate how to make solutions, ready resistance heater

FP use of computer interface, make up test tubes and label them

HV use of computer interface, how to read barometric pressure

IS how to use polarimeter, clean water bath, set up polarimeter tube (caution it is fragile)

LV how to use refractometer, and understand experiment set-up

ME how to use Scigress, understand expt

MM how to use Scigress, understand expt

RO how to use automated polarimeter,

SM how to use uv/vis spectrophotometer, how to use Scigress

*\*\*\*Make sure you are well prepared to start your lab work at next meeting\*\*\**