

# CHEMISTRY 112 / S18

Section 010

## Dr. Andrew Pounds,

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Office Hours: WF 10:00 a.m., F 3:00 p.m. (*or by appointment*)

CHM 112 is the second course in a two-part sequence to introduce students to the foundational principles of Chemistry. Students in CHM 112 will be exposed to the fundamental laws of mass and energy conservation and their application to chemical systems and reactions. Students will also study the role of energy and entropy in chemical systems and how they manifest themselves in chemical equilibrium. The approach to equilibrium will also be investigated through the study of chemical kinetics. Students in CHM 112 are expected to read at the college level and also set up and solve algebraic and trigonometric equations. As such students must have satisfied the math prerequisites for CHM 111 and made a grade of C or better in CHM 111. Upon completion of this course, a student will demonstrate competence in each of the following areas:

- solving chemical problems,
- understanding chemical concepts from the lecture by successfully applying these concepts on homework and tests,
- making accurate physical and chemical measurements in the laboratory, and
- writing clear and concise laboratory reports.

## Class Meeting Times and Locations

Lecture: MWF 2:00 – 2:50 p.m., GSC 450  
Lab: W 3:00 – 5:40 p.m., GSC 204

## Course Materials

*Chemistry, 4th ed.*, Burdge.

*Sapling Learning* online homework subscription, <http://www.saplinglearning.com/>

Laboratory Notebook (numbered, carbonless pages, available at bookstore)

Scientific Calculator (graphing with numerical solver preferred)

Laboratory Instructions (From WWW)

Approved Safety Glasses/Goggles

## Course Structure

Nine chapters of the text will be covered during the semester in the order listed on the class schedule. The lecture time will be used to expound on and augment the text and also discuss problem solving strategies. Students are responsible for all material covered in class as well as the material from the textual sections listed in the class schedule. While homework will not be collected, students are encouraged to complete as many problems as possible to gain competency with the material. Several unannounced in-class quizzes will be given during the semester. The best eight grades from the quizzes will count toward the final grade. Four 50 minute exams will be given per the schedule and the best three exam grades will count toward the final grade. A three hour final exam will be administered at the end of the term.

## Grading

Tests ( best 3 @ 100 pts)	300 pts
Quizzes (best 8 @ 25 pts)	200 pts
Sapling Online Homework	100 pts
Laboratory (8 @ 25 pts)	200 pts
Final Exam	200 pts

## Course Grade Scale

	<b>A</b> ≥900 pts
	<b>B</b> ≥800 pts
	<b>C</b> ≥700 pts
	<b>D</b> ≥600 pts
	<b>F</b> <600 pts

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Total Possible            1000 pts

The above course grading scale is assured, but may be *slightly* lowered based on class exam performance.

## General Information

*Honor Code:* All students in CHM 112 are expected to adhere to the Mercer University Honor Code. Any suspected violations will be reported to the Honor Council for further investigation.

*Attendance:* Attendance will be taken for the first ten class periods. Even if a student is not in class, they are responsible for all material covered in class as well as any announcements made during the lecture period. Attendance is required in lab. See policies in the lab section.

*Missed Quizzes:* No makeup quizzes will be given.

*Missed Exams:* Anyone missing an exam for *any* reason (personal illness, death in the immediate family, or other emergency) must notify Dr. Pounds **in advance** via e-mail, text message, phone, or voice message. The absence will be considered unexcused otherwise and no make-up opportunity will be offered. Make-up exams will be individually scheduled.

*Partial Credit:* Partial credit will not be awarded on any quiz, exam, prelab, or lab report unless individuals show their work and clearly delineate how they arrived at their answers.

*Re-grading Policy:* If a student suspects that an error was made in the grading of a submitted work, they may return the paper for re-grading with the understanding that the entire work will be re-graded and not only the portion in question.

*Posting of Grades:* To protect confidentiality, grades will not be posted. Students needing information about their grades or standings in the class should contact Dr. Pounds via e-mail.

*E-mail Listserv:* I maintain an e-mail listserv which I use copiously to send information to the class and which you can use to communicate with each other. To sign up for the listserv and to learn how to send information to it, please go to: <http://theochem.mercer.edu/mailman/listinfo/chm112>.

*Sapling Learning Online Homework:* Online homework assignments will be posted at [saplinglearning.com](http://saplinglearning.com), which you must purchase. Begin the assignments early so that you have an opportunity to address any technology issues. Late work will not be accepted except in extreme circumstances. Homework is an individual assignment; it is an honor code violation to work in groups or ask others how to do problems. As a group, you can study problems from the text on the same topics; however, when you are actually doing the online homework, it should reflect your individual understanding.

Directions for Students to Access Sapling:

1. Go to Sapling Learning and click on "US Higher Ed" at the top right.  
*If you already have an account skip to step 3 below.*
2. If you do not have an account
  - (a) If you have a *Facebook* account, you can use it to quickly create a Sapling Learning account. Click "Create an Account", then "Create my account through Facebook". You will be prompted to log into *Facebook* if you aren't already. Choose a username and password, then click "Link Account". You can then skip to step 3.
  - (b) Otherwise, you can click "Create an Account". Supply the requested information and click "Create My Account". Check your email (and spam filter) for a message from Sapling Learning and click on the link provided in that email.
3. Find your course in the list (you may need to expand the subject and term categories) and click the link (Mercer University - CHM 112 - Spring18 - POUNDS). (Of course, this will change based on what your course is called.)
4. Select a payment option and following the remaining instructions.

Once you have registered and enrolled, you can log in at any time to complete or review your homework assignments. During sign up or throughout the term, if you have any technical problems or grading issues, send an email to [support@saplinglearning.com](mailto:support@saplinglearning.com) explaining the issue. The Sapling Learning support team is almost always faster and better able to resolve issues than your instructor.

The bookstore also has ISBN numbers which will allow those on scholarship to have their sapling paid by their scholarship. They should have these numbers from my summer course, but if not, the Tech TA (or Devin Lindsey - manager) can supply you with those ISBN numbers.

*American Disability Act:* "Students requiring accommodations or modifications for a disability should inform the instructor at the close of the first class meeting or as soon as possible. The instructor will refer you to the ACCESS and Accommodation Office to document your disability, determine eligibility for accommodations under the ADA/Section 504 and to request a Faculty Accommodation Form. Disability accommodations or

status will not be indicated on academic transcripts. In order to receive accommodations in a class, students with sensory, learning, psychological, physical or medical disabilities must provide their instructor with a Faculty Accommodation Form to sign. Students must return the signed form to the ACCESS Director. A new form must be requested each semester. Students with a history of a disability perceived as having a disability or with a current disability who does not wish to use academic accommodations are also strongly encouraged to register with the ACCESS and Accommodation Office and request a Faculty Accommodation Form each semester. For further information, please contact Katie Johnson, Director and ADA/504 Coordinator, at 301-2778 or visit the ACCESS and Accommodation Office website at <http://www.mercer.edu/disabilityservices>.”

*Electronic Submission of Materials:* “Students bear sole responsibility for ensuring that papers or assignments submitted electronically to a professor are received in a timely manner and in the electronic format(s) specified by the professor. Students are therefore obliged to have their e-mail client issue a receipt verifying that the document has been received. Students are also strongly advised to retain a copy of the dated submission on a separate disk. Faculty members are encouraged, but not required, to acknowledge receipt of the assignment.”

## **Tips for Succeeding in Chemistry 112**

There is unquestionably a lot of material to be covered in Chemistry 112. It is also more mathematically rigorous than CHM 111. For that reason it is imperative to keep up with the class. The last thing you want to worry about is covering two chapters of new material the night before the test. You are expected to keep up with the class reading and problems. The unannounced quizzes are an added incentive for you to do this.

The book contains numerous problems which you should attempt. In addition I will give you a selection of problems you should attempt. The book problems and the additional problems are representative of some of the problems you will see on the exams. To become proficient you will need practice. In short, work as many problems as you can before the test. The student solutions manual provides solutions to the odd numbered problems. In addition, solutions to other problems described in class will sometimes be posted on the WWW (<http://theochem.mercer.edu/chm112>), or worked in class. Students who need solutions to additional even-numbered problems should contact the SI instructors or Dr. Pounds.

For more help in the course you should utilize the SI sessions for your class as well as the University’s free tutoring service. Both of these resources are here for you to use and, although they can not guarantee a higher grade in the course, they will most likely increase your understanding of chemistry and thereby positively affect your performance in the class.

## Tentative Class Schedule<sup>1</sup>

Week Starting	Chapter Sections	Lecture and Problem Solving Topics
January 7 <sup>th</sup>	18.1 – 18.5 10.1 – 10.3	Energy and Entropy (Review) Properties of Gases Derivation of the Ideal Gas Law
January 14 <sup>th</sup>	10.4 – 10.7	<b>MLK Holiday (Monday)</b> Gas Mixtures and Reactions of Gases Kinetic Theory of Gases Real Gases and Intermolecular Forces
January 21 <sup>st</sup>	11.1 – 11.2 11.3 – 11.5	Properties of Liquids Vapor Pressure Crystal Structure and Lattices Properties of Solids
January 28 <sup>th</sup>	11.6 – 11.7	Phase Changes, Phase Diagrams <b>EXAM #1, 2/2/18</b>
February 4 <sup>th</sup>	13.1 – 13.4	Physical Properties of Solutions Concentration and Solubility
February 11 <sup>th</sup>	13.5 – 13.7 14.1 – 14.2	Colligative Properties Colloids Reaction Rates, Rate Laws and Reaction Orders
February 18 <sup>th</sup>	14.3 – 14.6	Integrated Rate Laws Temperature Dependence Reaction Mechanisms, Catalysis
February 25 <sup>th</sup>	15.1 – 15.2 18.6	<b>EXAM #2, 2/26/18</b> Principles of Equilibria Equilibrium Constants Thermodynamics and Equilibrium
March 4 <sup>th</sup>		<b>SPRING BREAK</b>
March 11 <sup>th</sup>	15.3 – 15.5	Equilibrium Expression and The Law of Mass Action Solving Difficult Equilibrium Problems
March 18 <sup>th</sup>	16.1 – 16.3, 16.12	Le Châtelier's Principle <b>EXAM #3, 3/19/18</b> <b>LAST DAY FOR COURSE WITHDRAWAL 3/22/18</b> Acid/Base Theories Self-Ionization of Water and pH
March 25 <sup>th</sup>	16.4 – 16.11	Weak Acids, Ionization Constants Acid-Base Conjugate Pairs Polyprotic Acids Molecular Structure and Acid Strength Hydrolysis <b>Good Friday (3/30/18)</b>
April 1 <sup>st</sup>	17.1 – 17.3	The Common Ion Effect Acid/Base Equilibrium Buffers and Titrations <b>BEAR DAY (4/6/18)</b>
April 8 <sup>th</sup>	17.4 – 17.6	Common Ions and Solubility, Precipitation Reactions Solubility Equilibria Complex Ions
April 15 <sup>th</sup>	19.2 – 19.4	<b>EXAM #4, 4/16/18</b> Galvanic Cells Cell Potentials
April 22 <sup>nd</sup>	19.5 – 19.8	Free Energy, Equilibrium, and Cell Potential The Nernst Equation Batteries and Corrosion
April 29 <sup>th</sup>		<b>FINAL EXAM, 5/5/16, 2 p.m.</b> <b>(Saturday)</b>

<sup>1</sup> I reserve the right to modify this schedule as situations warrant.

## The Laboratory

**Safety always comes first in lab.** Developing good lab safety habits is important, even if the day's lab activities are not particularly dangerous. You will not be allowed in lab if you are not prepared. That means being appropriately dressed, having your safety glasses and knowing what you are supposed to do during the lab. The lab schedule is found at the end of this document. A link to the lab instructions and report forms is found on the class web page.

The lab instruction PDF files SHOULD NOT be printed and brought to lab. No points will be awarded for printed laboratory procedures. Instead, read the manual and think about what you are going to do and why. Write down the procedure and any questions you have in your lab notebook before coming to lab. **If you do not have your notebook with the hand written procedure in it, you will not be allowed in lab.** The lab report forms available from the same web site should be printed and turned in along with the yellow copies from your notebook. Data and observations MUST to be written in your notebook, not on the lab report form. Due dates are listed on the class schedule. **No credit is available for the lab report if you miss lab for any unexcused reason, including showing up unprepared, or if you are more than 10 minutes late.** It is important to show up on time, since we will go over safety notes in the first few minutes. You will lose 1 pt for each safety violation in a lab period (ie. removal of safety glasses for any reason in the laboratory). Lab reports are due before, **NOT** during the next laboratory session.

If you must miss a laboratory meeting for a Mercer University event, you need to see Dr. Pounds at least one week in advance to attempt to schedule an alternate laboratory meeting. Students will not be penalized for laboratories missed due to excused absence (as defined below) – up to a limit of three laboratory absences –and a complete laboratory report will still be required on the announced due date. **A passing grade for CHM 112 will NOT be available to any student who misses more than three laboratory meetings (excused or otherwise).**

Excused Absences (1) medical or mechanical emergencies with appropriate documentation presented to the professor as soon as possible (2) illnesses reported to the professor prior to the scheduled course meeting (documentation may be required); or (3) Mercer University events for which the appropriate office has provided an advance request to excuse participants.

### Laboratory Grading:

There will be eight pre-lab exercises (5 pts each) and eight lab reports (20 pts each) over the course of the semester for a total of 200 pts. The laboratory component is thus worth 20% of your final grade for CHM 112.

#### Prelabs:

Pre-lab exercises will be administered via *Canvas*. More information related to these exercises will be provided prior to the first lab.

#### Laboratory reports:

Complete laboratory reports will be turned in at the start of the next laboratory period following the period during which the experiment was conducted. The laboratory reports will consist of the following items, stapled together in this order:

1. Completed lab report coversheet on top. Blank PDF versions of the coversheet are available on the class web page for printing.
2. Copy pages of all laboratory notes for that experiment should include protocol notes, data and observations recorded in the laboratory, and all pen-on-paper numerical work required to determine the final result; turn in copy pages only (never remove the original pages from a laboratory notebook); make sure that every page in your lab notes is accurately dated.
3. Completed laboratory report form pages.
4. Any graphs required to determine the final result of an experiment – please see the graphing protocol, below.
5. It is acceptable to use computer software (including Microsoft Excel, MathCAD, etc.) to perform any calculations required to determine the final result. If you do use such software, simply include a printout as the last (bottom) item in your report.

## Graphing protocol:

All required lab report graphs must be computer-drawn, usually with Microsoft Excel, although other software options are permissible if pre-approved the instructor. CHM 112 students are allowed to sketch graphs (and anything else related to an experiment) in their lab notes, but the lab report that's turned in should include a computer-drawn graph if graphing was required. All data points should be shown on graphs, and the axes should be correctly labeled with both a measurement descriptive word (like "length") and the corresponding units (like "cm") inserted in the graphing software. Don't include any hand-written work on your submitted graph unless specifically instructed to do so for a particular report.

## Instructions for Writing in Your Lab Notebook:

Part of learning science includes practicing appropriate scientific methods. That process includes documenting your work. Here are a few instructions for using your laboratory notebook properly:

1. Every page should be dated; that's the first thing you should write when you turn to a new page; put the date in the box provided in the upper corner of the page
2. Every entry in the lab notebook should have a clear, descriptive heading; examples include:  
Instructions for Calorimetry Lab  
Data from Titrations Lab  
Calculations for Nickel Lab
3. Write under each heading in active voice in the first person, describing exactly what you plan to do, exactly what you did or exactly what you measured
4. Write in complete, grammatically correct sentences; lists, numbered protocols, and clearly labeled tables can also be appropriate in certain circumstances
5. Write in the notebook only with black ball-point pens [Chemistry students: get a supply of black ball-point pens, not just one]
6. Ideas and other notes about our lab work, including notes on preparing the lab report, should be entered in the lab notebook immediately after observations and other data recorded in the lab; this is part of what is called thinking in the lab notebook
7. Make drawings, especially of novel or unusual apparatus, big enough to draw lines/arrows in order to label the features illustrated
8. Construct tables with clearly labeled headings - including units - under which to record series of numerical data in the lab
9. Corrections to lab notes should be made on the originals with the copy page underneath. (Hint: You can put a torn-out copy page back under an original page and press firmly to record a correction on the copy page.) Don't ever write (at all) directly on the copy pages.

## Laboratory Policies:

**Report Due Dates and Late Policy:** Labs are due prior to the beginning of the following lab session (see table below), and lab 8 will be due to Dr. Pounds at the end of lab on 4/25/18. Late labs will lose 10 points/day, with a grade of zero resulting if the write-up is more than 3 days late.

**Cell Phone:** Out of courtesy for all those participating in the learning experience, all cell phones and pagers must be turned off before entering any classroom, lab, or formal academic or performance event.

**Chemical Sensitivity Statement:** This course includes the handling of chemicals, and the reasonable accommodation policy also applies to any chemical sensitivity, allergy, or other physical or medical condition that might limit a student's ability to participate in the required course activities. In these cases, the instructor may require a physician's documentation of the student's condition before arranging accommodation. If the instructor determines that the student's condition cannot be reasonably accommodated, then the student will be asked to select an alternative course.

**Physical Limitations Statement:** This course includes significant physical activity, and the reasonable accommodation policy also applies to any physical or medical condition that might limit a student's ability to participate in the required course activities. In these cases, the instructor may require a physician's documentation of the student's condition before arranging accommodation. If the instructor determines that the student's condition cannot be reasonably accommodated, then the student will be asked to select an alternative course.

**Safety Statement:** This course includes activities for which there are certain risks as well as established safety procedures to minimize these risks. The instructor will explain both the risks and the prescribed safety measures. Students enrolled in this course are required to document in writing their awareness of the reasonable risks inherent in the course activities and their agreement to follow the safety procedures specified by the instructor. If a student cannot meet these terms, then the student will be asked to select an alternative course.

## Laboratory Schedule

Lab Day	Experiment
January 10 <sup>th</sup>	NO LAB
January 17 <sup>th</sup>	NO LAB
January 24 <sup>th</sup>	NO LAB
January 31 <sup>st</sup>	NO LAB
February 7 <sup>th</sup>	NO LAB
February 14 <sup>th</sup>	Check-in Kinetics: Concentration Effect
February 21 <sup>th</sup>	Kinetics: Temperature Effect
February 28 <sup>th</sup>	Gaseous Equilibrium
March 7 <sup>th</sup>	SPRING BREAK
March 14 <sup>th</sup>	Spectroscopic Determination of Fe <sup>3+</sup>
March 21 <sup>st</sup>	Equilibrium in Aqueous Solution
March 28 <sup>th</sup>	Acids, Bases, and Buffers
April 4 <sup>th</sup>	NO LAB
April 11 <sup>th</sup>	Thermodynamics of Borax
April 18 <sup>th</sup>	Electrochemistry Check Out