

## CHEMISTRY 112, INTRODUCTORY CHEMISTRY

Instructor: Dr. Rickard  
e-mail: [Lyman.Rickard@millersville.edu](mailto:Lyman.Rickard@millersville.edu)

Phone: 871-7412  
Office: Caputo Hall 215

### COURSE MATERIALS

1. Text: Chemistry: Structure and Dynamics, 5th Edition; J. N. Spencer, G. M. Bodner and L. H. Rickard; John Wiley & Sons, 2012, ISBN-13 978-0-470-587119
2. Chemistry: A Guided Inquiry Part 2, 8th Edition; The Pogil Project, Kendall Hunt Publishing Company, 2022. ISBN-9781792490705
3. Laboratory Notebook: Lab Notebook with duplicate pages, permanent bound, quadrille-ruled
4. Safety Goggles/Glasses

A C- or better in CHEM 111 is a prerequisite for this class.

### COURSE DESCRIPTION

Continuation of CHEM 111. The interactions of matter and energy-thermodynamics, kinetics and electrochemistry. Equilibria in aqueous systems theory and practice. Coordination chemistry and descriptive chemistry of the elements. 3 hrs. lec., 1 hr. discussion, 2 hrs. lab. Prereq: CHEM 111 with a grade of C- or higher; C for chemistry majors.

Lecture: MWF at 9:00-9:50 in Brossman Hall 102

Recitation: Wednesday 2:00 or Thursday 8:00 or Thursday 12:15 in Roddy 153

Laboratory: Wednesday 3:00 or Thursday 9:00 or Thursday 1:15 Caputo 332

### TENTATIVE EXAM SCHEDULE

Exam 1: Chapters 10 & 11: Oct 3

Exam 2: Chapters 12 & 13: Nov 7

Exam 3: Chapter 14: Dec 5

Final Exam: Dec 10 at 8:00 Cumulative

### LABORATORY SCHEDULE

Date	Lab	Experiment Title
8/27 & 28	Expt 16	Determination of an Equilibrium Constant, Part A
9/3 & 4	Expt 16	Determination of an Equilibrium Constant, Part B
9/10 & 11	Expt 14	Equilibrium: Le Chatelier's Principle
9/17 & 18	Expt 19	Determination of Ionization Constant of an Acid
9/24 & 25	Expt 18	Weak Acids, Bases and Salts, Method III
10/1 & 2	Expt 20	Investigation of a Buffer
10/8 & 9	Expt 33-35	Qualitative Analysis
10/15 & 16	Expt 33-35	Qualitative Analysis
10/22 & 23	Expt 28	A Penny's Worth of Chemistry
10/29 & 30	Expt 25	Investigation of Voltaic Cells, Parts A & B
11/5 & 6	Expt 33-35	Qualitative Analysis
11/12 & 13	Rate Law	Rate Law of Crystal Violet
11/19 & 20	Expt 15	Kinetics Study of Iodine Clock Reaction
12/3 & 4	Expt 15	Kinetics Study of Iodine Clock Reaction

### HOMEWORK ASSIGNMENTS

Read each chapter as it is covered in lecture.

Chapter 10: 1, 2, 5, 9, 10, 11, 12, 15, 17, 21, 23, 25, 27, 28, 29, 31, 35, 37, 41, 44, 45, 48, 49, 53, 61, 63, 65, 71, 73, 75, 77, 79, 81, 85, 89, 95, 103, 105, 107, 112, 117

Chapter 11: 3, 7, 13, 15, 17, 19, 21, 33, 35, 37, 39, 41, 43, 47, 51, 54, 55, 63, 64, 67, 68, 69, 70, 77, 85, 87, 89, 91, 93, 95, 96, 97, 98, 105, 106, 107, 109, 111, 113, 115, 117, 120, 121, 125, 129, 131, 133, 143, 145, 147

Chapter 12: 1, 3, 4, 8, 9, 12, 13, 19, 21, 24, 26, 29, 31, 41, 46, 49, 51, 52, 53, 55, 57, 59, 67, 69, 71, 73, 77, 78, 81, 85, 89, 105, 111

Chapter 13: 1, 5, 9, 11, 15, 21, 23, 27, 29, 31, 33, 39, 43, 45, 49, 50, 51, 55, 59, 63, 73, 75, 79, 83, 87, 95

Chapter 14: 10, 11, 13, 14, 17, 19, 21, 23, 26, 27, 28, 31, 33, 35, 41, 42, 43, 46, 47, 48, 49, 50, 51, 52, 57, 61, 63, 65, 75, 82, 83, 84, 85, 86, 88, 89, 91, 108, 109

## CHEMISTRY PEER LEARNING

Chemistry Peer Learning Hours are dedicated times available for students to come together and work on chemistry! If you are looking for a place to work on your chemistry assignments or need assistance with your chemistry classes, Peer Learning Hours are here for you. No need to sign-up. Stop-by Caputo 211 at any or all of the Peer Learning Hours. All Peer Learning Hours are staffed by a chemistry tutor to assist you.

**Chemistry Peer Learning Hours:** Tuesday & Wednesday 5:00 – 7:00 pm in Caputo 211

Thursday 4:30 – 6:30 in Roddy 211

## GRADING SYSTEM

Exams (3)	300 pts	
Quizzes\Worksheets	100 pts	(The lowest quiz grade will be dropped.)
Final Exam	200 pts	
Laboratory	10 Prelabs @ 5 pts = 50 pts	
	9 lab reports @ 14 = 126 pts	
	Qual Analysis	20 pts
	Qual Analysis flow chart	<u>4 pts</u>
Total	800 pts	

Letter Grade	Points	Percentage
A	736 - 800	92 - 100
A-	720 - 735	90 - 92
B+	704 - 719	88 - 90
B	656 - 703	82 - 88
B-	640 - 655	80 - 82
C+	616 - 639	77 - 80
C	544 - 615	68 - 77
C-	520 - 543	65 - 68
D+	512 - 519	64 - 65
D	488 - 511	61 - 64
D-	480 - 487	60 - 61
F	Below 480	< 60

A passing grade in the lecture component (360 pts of the possible 600) of the course must be achieved in order to receive a passing grade.

## OFFICE HOURS

Monday, Wednesday, Friday 10:00-11:00; Tuesday 10:00-12:00. Feel free to come by any time that I am in my office. If you have difficulty finding a time to meet with me, make an appointment to see me.

## ATTENDANCE

Regular attendance is expected for all lectures, recitations and laboratories. If an absence results in a missed exam, quiz or lab, a request for excused absence form (attached) must be submitted to the instructor. Absences are excused for illness, family emergencies or university activities. Absences due to university activities must be discussed with the instructor in advance and arrangements made for making up the missed work. If an exam or quiz is missed and the absence is excused, the final exam grade will be substituted for the missed work.

## STUDENT RESPONSIBILITIES

You are responsible for all assigned work and material covered in class and lab. Work submitted after the due date will receive a grade of F unless prior arrangements have been made. However, the work must still be submitted or a grade of zero will be recorded. The average student will need to spend approximately 1 hour and 15 minutes preparation time for the course every day (including weekends) outside of class in order to receive an average grade. A higher grade will normally require additional study time. Two days of 5 hours each are not equivalent to an hour and 15 minutes each day. You should diligently prepare all assignments. When you encounter material which you cannot master alone you should seek help immediately. The primary source of help should be the course instructor. You will find my office hours listed in the syllabus and posted on my office door. If you are having difficulty in the course I expect you to come see me.

## **PROBLEM ASSIGNMENTS/QUIZZES**

Frequent problem assignments will be made from the text. The problem assignments will *not* be collected and graded. Instead, there will be frequent quizzes in lecture or recitation taken from the assigned problems and recitation worksheets. You are expected to read each chapter as it is being covered in lecture. Study the chapter in detail to increase your understanding of the material. Study all assigned homework problems until you understand them (not just until you obtain an answer). Plan to work only a few new problems (5-8) each night plus reading (60 minutes). Then review the problems from the previous night (15 minutes). You should be confident of the homework assignment before coming to class. The homework problems assigned are the minimum number of problems you are expected to work. They represent a broad overview of the types of problems you are expected to understand. You are expected to work additional problems and to spend additional time on those problems that give you difficulty.

## **CLASSROOM ETIQUETTE**

Arrive for class, recitation and laboratory on time. Turn off all cell phones while in class, recitation or lab. Cell phones may *not* be used as a calculator during quizzes or tests. Talking during lecture is a distraction to others who are trying to listen.

## **ACADEMIC HONESTY**

Students are expected to be familiar with the University's policy on academic honesty and dishonesty found in the *Student Handbook* and the *Academic Honesty and Dishonesty* brochure. Academic dishonesty includes cheating on an exam or quiz, presenting another student's work as one's own in a laboratory report or notebook, fabricating data in a laboratory experiment. Students are encouraged to work together on homework assignments, preparation for exams and laboratory reports. However, the results submitted in a laboratory report must represent the student's own work.

## **LABORATORY**

All laboratory procedures can be found on D2L. Before coming to lab, you are expected to have diligently studied the experiment and outlined the procedure in your laboratory notebook. You should bring your laboratory notebook, and safety goggles to all labs. Laboratory experiments should be done during the assigned laboratory period. Any work outside of this period must be approved by the lab instructor; a chemistry faculty member must be available to supervise your work; and another student must be in the lab with you at all times. The pre-lab assignment should be completed but will not be handed in to the instructor. There will be a pre-lab quiz given in lab at the beginning of each new experiment.

## **THE LABORATORY NOTEBOOK**

The laboratory notebook is a permanent record of your work in the laboratory. You must have your notebook with you in order to work in the lab. All notebooks must be permanently bound and begin with a table of contents. All entries should be in ink. Each page must be consecutively numbered. As each page is completed you should sign/initial and date the page. The procedure must be outlined in the notebook and the safety precautions listed before coming to lab. All data must be recorded in the notebook using correct significant figures and proper units. Never write data on another sheet of paper with the idea of transferring it to the notebook. Notebooks should be relatively neat and orderly, however, data should never be recopied into another notebook. If an error is made, do not obliterate the data (also do not use white out, tear out pages or tape in new pages). Draw a single line through any errors and write the correct data.

The notebook is a record of your work as it is done. The notebook should be kept in such a way that the instructor can turn to any experiment and tell exactly what you did during the experiment. All data must include the appropriate units and be labeled to identify the data. All calculations, graphs, tables and assigned questions must be included in the notebook. All lab notebooks should be reviewed and initialed by the instructor at the end of each laboratory period.

A conclusion will be required for some lab reports. The conclusion should be one paragraph. It should state the major results of the experiment. This statement of results should agree with the purpose of the experiment written at the beginning of the report. This should be followed by a statement describing whether you are confident in the results. The remainder of the conclusion should be an argument to convince the reader why you feel your results are appropriate or not. This argument can refer to the agreement between multiple trials, agreement with other student results, trends in the data such as a linear graph or other observations from the experiment.

Laboratory notebooks will be evaluated on the following criteria:

1. Each page: page #, date completed and name

2. Format: organization, neatness, completeness
3. Purpose: describe what is being measured or determined
4. Outline of the Procedure
5. List of Safety Precautions
6. Data Presentation: data in tabular form, significant figures, labels and units
7. Sample calculations: neat orderly, with units and correct significant figures
8. Results: quality of results
9. Conclusions: one paragraph (as described above)
10. Questions
11. Graphs: title, labels, units

## COURSE OUTLINE

Chapter	Topic
10	Kinetics and Equilibrium Reactions That Don't Go to Completion Gas-Phase Reactions The Rate of a Chemical Reaction The Collision Theory of Gas-Phase Reactions Equilibrium Constant Expressions Reaction Quotients Changes in Concentration That Occur as a Reaction Comes to Equilibrium The Effect of Temperature on an Equilibrium Constant LeChâtelier's Principle Equilibrium Reactions Which Involve Pure Solids and Liquids
11	Acids and Bases Properties of Acids and Bases The Arrhenius & Bronsted Definitions of Acids and Bases Conjugate Acid--Base Pairs The Role of Water in the Bronsted Model pH as a Measure of the Concentration of the $\text{H}_3\text{O}^+$ Ion The Relative Strengths of Acids and Bases Relationship of Structure to Relative Strengths of Acids Acid and Base pH Calculations Buffers and Buffer Capacity
12	Oxidation-Reduction Oxidation Numbers Recognizing Oxidation--Reduction Reactions Voltaic Cells Oxidizing and Reducing Agents Relative Strengths of Oxidizing and Reducing Agents Standard-State Cell Potentials Nonstandard Conditions & The Nernst Equation Electrolysis and Faraday's Law
13	Thermodynamics Spontaneous Chemical and Physical Processes Entropy as a Measure of Disorder Entropy and the Second Law of Thermodynamics The Third Law of Thermodynamics Calculating Entropy Changes for Chemical Reactions Gibbs Free Energy The Effect of Temperature on the Free Energy of a Reaction Equilibria Expressed in Partial Pressures Interpreting Standard-State Free Energy of Reaction Data The Relationship Between Free Energy and Equilibrium Constants The Temperature Dependence of Equilibrium Constants

- 14     Rates of Chemical Reaction
- The Forces That Control a Chemical Reaction
  - Chemical Kinetics and Instantaneous Rates of Reaction
  - Rate Laws and Rate Constants
  - Order and Molecularity
  - Collision Theory of Chemical Reactions
  - The Mechanisms of Chemical Reactions
  - Determining the Order of a Reaction
  - The Integrated Form of First-Order and Second-Order Rate Laws
  - The Activation Energy of Chemical Reactions
  - Catalysts and the Rates of Chemical Reactions

### Millersville University Policies

ADA Program (Office of Learning Services) Americans With Disability Act | Millersville University (if you have a disability that requires accommodations under the Americans with Disabilities Act, please present your letter of accommodations and meet with me as soon as possible so that I can support your success in an informed manner. Accommodations cannot be granted retroactively. If you would like to know more about the Millersville University Office of Learning Services-please contact the office at 717-871- 5554)

- Academic Honesty Policy link [Governance Manual \(millersville.edu\)](#); for additional information please see the following: [What is Academic Integrity? | Millersville University](#)
- Attendance Policy link: [Class Attendance Policy | Millersville University](#)
- Inclusion Statement: [Millersville University Inclusion Statement | Millersville University](#)
- Land Acknowledgement: [Land Acknowledgement | Millersville University](#)
- Policy on Delays and Cancellations link [Policy on Delays & Cancellations | Millersville University](#)
- Preferred Name FAQs link [Preferred Name FAQs | Millersville University](#)
- Privacy Rights under FERPA link [Annual Notification of Student Rights Under FERPA | Millersville University](#)
- Student Conduct and Community Standards Handbook link [studentcodeofconduct.pdf \(millersville.edu\)](#)
- 
- Title IX Reporting Requirements and the Faculty member: Millersville University is committed to maintaining a safe education environment for all students. In compliance with Title IX of the Education Amendments of 1972 and guidance from the Office for Civil Rights, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report sexual violence or any other abuse of a students who was, or is, a child (under 18 years of age) when the abuse allegedly occurred to the person. Information about Title IX, resources and reporting can be found at: [What is Title IX | Millersville University](#)

**Request for Excused Absence** To be completed within one week of returning to class.

Student Name:

Dates of Absence:

Reason for Absence (circle one): Illness, Family Emergency, University Activity

I request this absence be excused and that: (check all that apply)

\_\_\_\_\_ my final exam grade be substituted for the missed lecture quiz.

\_\_\_\_\_ my final exam grade be substituted for the missed test.

\_\_\_\_\_ my final exam grade be substituted for the missed pre-lab quiz.

\_\_\_\_\_ I be allowed to make-up the missed laboratory experiment. The lab must be made-up and the laboratory report submitted for grading within one week of returning to class.

Attach documentation to support the request for an excused absence.