

## CHEMISTRY 111, INTRODUCTORY CHEMISTRY

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### COURSE DESCRIPTION:

The properties and theories of the solid, liquid and gaseous states of matter, the stoichiometry and thermochemistry of chemical reactions and theories and applications of molecular structure and bonding. Proficiency in algebra is essential. High school chemistry is strongly recommended. Intended for science majors: biology, chemistry, earth sciences, and physics. 3 hours lecture, 1 hour recitation, 2 hours laboratory. Prerequisites: A C- grade or higher in CHEM 110 or satisfactory score on the Chemistry Placement Test before registration, or permission of the department chair. General Education G2 and L course.

Lecture: MWF at 2:00-2:50 in Brossman 102

Recitation: Tuesday 9:00 Caputo 211, Tuesday 4:10 Roddy 153, or Wednesday 3:00 Roddy 153

Laboratory: Tuesday 10:00 Caputo 328, Tuesday 5:10 Caputo 328 or Wednesday 4:00 Caputo 328

### 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, 7th Edition; Richard S. Moog and John J. Farrell, John Wiley & Sons, 2017. ISBN-9781119110705
3. Laboratory Notebook: Duplicate page Laboratory Notebook; quadrille-ruled
4. Safety Glasses  
A grade of C- or better (C or better for chemistry majors) in CHEM 111 is prerequisite for CHEM 112.

### TENTATIVE EXAM SCHEDULE

Exam 1	Chapters 1 - 2	February 10
Exam 2	Chapters 3 - 4	March 17
Exam 3	Chapters 5 - 6	April 7
Exam 4	Chapters 7 - 8	April 28
Final	Chapters 1 - 9	Thursday, May 4 at 10:15-12:15

### LABORATORY SCHEDULE

#### Week beginning

Jan 16		Check-In and Safety Discussion
Jan 23	Expt. 1	Measurements and Density; Part II
Jan 30	Expt. 2	Formula and Composition of a Hydrate; Part A
Feb 6	Expt. 2	Formula and Composition of a Hydrate; Part B
Feb 13	Expt. 6	Identification of Common Chemicals
Feb 20	Expt. 6	Identification of Common Chemicals
Feb 27	Expt. 7	Titration of Acids and Bases; Part B only
March 6		Spring Break
March 13	Expt. 13	Molecular Models and Covalent Bonding
March 20	Expt 8	Gravimetric and Volumetric Analysis
March 27	Expt 8	Gravimetric and Volumetric Analysis
April 3	Expt. 10	Evaluation of the Gas Law Constant
April 10	Expt. 12	Spectrophotometric Analysis of Commercial Aspirin
April 17	Expt. 11	Thermochemistry: The Heat of Reaction
April 24	Expt. 6	Identification of Common Chemicals Timed Test

### HOMEWORK

Answers to the odd numbered homework problems are found in Appendix C. Answers to the Checkpoints are in Appendix D. Chapter 1: 4, 9, 10, 11, 14, 23, 27, 28, 30, 31, 35, 41, 43, 45, 47, 50, 53, 56, 57, 58, 61, 63, 65, 66, 67, 70, 73, 81, 83, 87, 89, 91, 95, 101, 103, 105 Know the name and symbols of the following elements: H, He, Li Be, B, C, N, O, F, Ne, Na, Mg, Al, Si

P, S, Cl, Ar, K Ca, Cr, Mn, Fe, Co Ni, Cu, Zn, Br, Sr, Ag, Sn, I, Ba, Pt, Au, Hg, Pb, Bi, U Name and symbols of the polyatomic ions in Table 1.6

Chapter 2: 3, 5, 9, 15, 17, 21, 23, 24, 27, 28, 29, 31, 33, 35, 41, 42, 45, 49, 51, 53, 57, 69, 71, 75, 79, 81, 85, 89, 91, 95, 96, 97, 99, 100, 103, 113, 114, 115, 19, 123, 127, 131, 133, 141

Chapter 3: 5, 7, 9, 11, 17, 19, 21, 23, 27, 28, 29, 31, 33, 37, 39, 41, 43, 45, 47, 50, 51, 54, 55, 57, 61, 63, 65, 75, 76, 77, 88, 89, 91, 113, 115, 116, 117, 121, 126, 127, 128, 131, 132, 133, 134, 136, 139, 141, 145, 147, 149, 151, 153, 155, 157, 162, 163, 165, 166, 169, 173, 177, 187

Chapter 4: 1, 3, 5, 9, 13, 15, 19, 25, 29, 31, 33, 35, 39, 43, 47, 51, 55, 57, 59, 67, 75, 77, 79, 81, 83, 85, 87, 89, 91, 93, 95, 103, 105, 109, 111, 113, 118, 121, 127

Chapter 5: 3, 7, 10, 16, 17, 25, 27, 29, 31, 35, 37, 41, 43, 47, 57, 63, 64, 65, 66, 67, 71, 72, 75, 76, 83, 87, 91, 95, 97, 99, 103, 107, 111, 113, 117, 119, 123, 125, 129, 131, 133, 138, 141

Chapter 6: 3, 5, 6, 7, 10, 15, 16, 19, 21, 25, 27, 29, 31, 35, 39, 41, 42, 44, 45, 51, 53, 57, 59, 61, 67, 71, 75, 77, 79, 81, 108

Chapter 7: 5, 6, 9, 15, 16, 19, 21, 31, 33, 40, 42, 44, 47, 51, 53, 55, 57, 59, 66, 70, 71, 75, 77, 81, 83, 91, 92, 107

Chapter 8: 1, 2, 7, 9, 10, 11, 13, 20, 23, 24, 29, 37, 38, 40, 45, 47, 55, 60, 63, 74, 75, 77, 79, 80, 81, 83, 90, 92

Chapter 9: 1, 5, 7, 8, 13, 17, 33, 36, 37, 39, 41

**CHEMISTRY PEER LEARNING HOURS: RODDY 256** 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 at any or all of the Peer Learning Hours. All Peer Learning Hours are staffed by a chemistry tutor to assist you.

#### GRADING SYSTEM

Exams (4)		400 pts
Quizzes\Worksheets		100 pts
Final Exam		100 pts
Laboratory:	Lab Notebooks (8 x 15 pts)	120 pts
	Experiment 6 flow chart	3 pts
	Timed Test	32 pts
	Lab Quizzes (9 x 5 pts)	<u>45 pts</u>
	Total	800 pts

The lowest lecture quiz grade will be dropped at the end of the semester.

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 in the course. A grade of C for chemistry majors and C- for non-chemistry majors is required for second semester Introductory Chemistry, CHEM 112.

#### OFFICE HOURS

Monday, Thursday, Friday 10:00– 11:00; Tuesday 1:00-2:00; Wednesday 11:00-12:00 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 to the end of the syllabus) 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. All missed work must be made up within one week of the student's return to class. 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 have points deducted unless prior arrangements have been made. The average student will need to spend approximately 1 hour and 15 minutes preparation time for the course every day (including weekends) 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 pop 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. In some cases reading assignments will be made which will not be covered in lecture. Study all assigned homework problems until you understand them (not just until you obtain an answer). Plan to work only a few new problems 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.

### **LABORATORY**

You should read the lab safety rules found in the introduction of the laboratory manual. A copy of these rules must be signed and returned to the instructor at the first lab. You should bring your laboratory manual, laboratory notebook, and safety goggles to the first lab. Laboratory experiments should be done during the assigned laboratory period. Any work outside of this period must be approved by the course 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. Before coming to lab you are expected to have diligently studied the experiment, written a one sentence purpose and outlined the procedure in your laboratory notebook. 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.

### **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 students own work.

### **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.

### **CHEMISTRY 111 OBJECTIVES:**

Students are expected to:

Chapter 1

1. Classify matter into categories of elements, compounds and mixtures.
2. Learn the names and symbols of the common elements.
3. Use the SI system of units. Convert between the common SI units and SI and English units.
4. Maintain appropriate significant figures when performing calculations.

5. Know the major components of the atom and their relative masses and charges.
6. Distinguish between isotopes and ions.
7. Predict the formula of ionic compounds
8. Distinguish between metals, nonmetals and semimetals on the Periodic Table.
9. Describe the nomenclature of families, groups and periods in the Periodic Table.
10. Use and convert between temperature scales
11. Understand and use the concept of density.

#### Chapter 2

1. Determine the number of moles in a given mass.
2. Determine the mass of a given number of moles.
3. Determine the molar mass of a compound.
4. Determine the % composition from a molecular formula or the empirical formula from % composition.
5. Balance chemical equations.
6. Use stoichiometry to predict the moles or mass of a reactant or product.
7. Determine the limiting reagent and use it to predict the amount of product and the % yield.
8. Distinguish between solute, solvent and solution.
9. Determine the concentration of a solution from mass of solute or volume of known solution.

#### Chapter 3

1. Know the regions of the electromagnetic spectrum.
2. Calculate wavelength, frequency, and energy associated with electromagnetic radiation.
3. Understand how spectroscopy can be used as an investigative tool to understand the nature of the atom.
4. Understand the concept of energy levels and ionization energy of atoms.
5. Predict electron configuration of atoms. Relate electron configuration to position in the Periodic Table.
6. Know the periodic relationships of size of atoms and ions.
7. Determine the Average Valence Electron Energy (AVEE) for atoms. Relate AVEE to atomic properties.

#### Chapter 4

1. Determine the number of valence electrons for an atom.
2. Describe the sharing of electrons in a covalent bond.
3. Draw Lewis Structures for covalent molecules and polyatomic ions.
4. Use Lewis structure to describe resonance.
5. Use partial charge to explain the distribution of electrons in a bond.
6. Use formal charge to determine the best of several alternative Lewis structures.
7. Determine the shape of molecules and the electron distribution using Electron Domain Theory.
8. Determine if molecules are polar or nonpolar.

#### Chapter 5

1. Describe the main group metals, nonmetals and transition metals and their ions.
2. Predict the products of reactions that produce ionic compounds.
3. Describe the three dimensional structure of ionic compounds.
4. Describe and draw Lewis structures for ionic compounds.
5. Describe the electron distribution in metallic bonds.
6. Use bond type triangles to relate the bonding in metallic, covalent and ionic compounds.
7. Determine the oxidation number of an atom in a compound or ion.
8. Determine if a reaction is an oxidation-reduction reaction.
9. Name basic ionic compounds, binary covalent compounds and acids.

#### Chapter 6

1. Know the relationships in the simple gas laws.
2. Use the ideal gas law to calculate one of the variables.
3. Determine the density and molar mass of gasses.
4. Use Dalton's Law of Partial Pressures to describe mixtures of gasses.
5. Use the kinetic molecular theory to explain the gas laws on a molecular basis.

#### Chapter 7

1. Understand the First Law of Thermodynamics.
2. Understand the concept of a state function.
3. Use specific heat to determine the amount of heat gained or lost.
4. Calculate the enthalpy of reaction using enthalpies of atom combination.
5. Relate bond length to the enthalpy of atom combination.

6. Use Hess's Law and enthalpies of formation to determine the enthalpy of reaction.
7. Use calorimetry data to determine enthalpies of reaction.

#### Chapter 8

1. Describe the structure of gases, liquids and solids.
2. Describe the types and relative strengths of intermolecular forces.
3. Use intermolecular forces to predict relative boiling points and melting points of compounds.
4. Use phase diagrams to describe phase changes.
5. Describe phase equilibria and solubility equilibria.
6. Use intermolecular forces to predict the solubility of covalent molecules in molecular solvents.\
7. Use solubility rules to predict the solubility of ionic compounds in water.
8. Write net ionic equations to describe chemical reactions.

#### Chapter 9

1. Distinguish between ionic, network covalent, molecular and ionic solids.
2. Describe the forces that hold solids together.
3. Relate the structure of metals to their physical properties.
4. Determine the unit cell of a crystal.

### 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.

## **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 and bear your name and date. The title, purpose, an outline of the procedure, and list of safety precautions must be in the notebook before coming to lab. Each section should have a clear label: (purpose, safety hazards, procedure, data). 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 record the correct value to the side.

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. You should review pages ten and eleven of your laboratory manual for more information on the laboratory 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 list the major results of the experiment. This list 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: date completed and initials or signature
2. Format: organization, neatness, completeness
3. Purpose: describe what is being measured or determined
4. Procedure: outline of the procedure
5. Safety precautions
6. Data Presentation: significant figures, labels, neat tables and units
7. Results: quality of results
8. Conclusions: one paragraph (when requested)
9. Questions
10. Graphs: title, labels, units, equal increments on axis, full page size

**Submitted Lab Reports must have the pages Stapled together.**