

CHEMISTRY 103
Fall 2022
Syllabus

Week	Topic	Pages in OpenStax
Aug 31	I. Matter & Measurement (Chapter 1, Appendices B and C)	
	A. Domain and methods of chemistry	1-29
	B. Calculations: units, digits and uncertainty	29-51, 1189-1198
Sept 5	II. Atomic Structure (Chapters 2 and 6)	
	A. Early chemical laws	67-78
	B. Modern atomic structure	79-87
	C. Atomic mass, Avogadro's number and the mole	309-312
	D. Percent composition and empirical formula	313-320
Sept 12	III. Electronic Structure and the Periodic Table (Chapter 3)	
	A. Electromagnetic radiation and quantization	115-131
	B. The Bohr atom and atomic line spectra	131-135
	C. Quantum mechanics and hydrogen-like orbitals	135-148
	D. Periodic table and electron filling in atoms	148-157
	E. Periodic trends	158-169
Sept 19	IV. Ionic Bonding (Chapters 3 and 4)	
	A. Electronegativity and bond polarity	201-205
	B. Ions and ionic bonding	169-172, 196-199
	C. Ionic nomenclature and polyatomic ions	172-177, 203-207
Sept 26	V. Covalent Bonding (Chapter 4)	
	A. Molecules and covalent bonding	199-201, 239-241
	B. Covalent nomenclature	210-213
	C. Lewis dot structures, resonance	213-220, 223-227
	D. Valence shell electron pair repulsion model	227-239
Oct 3	VI. Chemical Reaction Stoichiometry (Chapters 6 and 7)	
	A. Chemical equations	341-348
	B. Stoichiometric calculations	363-373
	C. Solution stoichiometry	320-328
Oct 10	VII. Chemical Reaction Types (Chapters 7 and 11)	
	A. Electrolytes, ions and net ionic equations	604-607, 346-348
	B. Precipitation and acid-base reactions	348-356
	C. Oxidation-reduction reactions	356-363
	D. Titrations and gravimetry	373-381

Day	Topic	Pages in OpenStax
	VIII. Gases (Chapter 8)	
	A. Gas pressure and the kinetic molecular theory	397-405, 438-442
	B. Diffusion and effusion	433-438
	C. Gas laws	407-433
Oct 17	D. Real gases	443-446
	IX. Thermochemistry (Chapters 9, 12, and 13)	
	A. Heat, work, energy, enthalpy, and calorimetry	461-492
	B. Standard enthalpies of formation and Hess's Law	493-499
Oct 24	C. Bond dissociation energies	499-504
	D. Entropy and free energy	657-676, 709-711
	X. Liquids and Solids (Chapter 10)	
	A. Intermolecular forces	521-534
Oct 31	B. Liquids	534-551
	C. Solids	558-570
	D. Phase diagrams	551-558
	XI. Solutions (Chapters 6 and 11)	
Nov 7	A. Concentration measurements and solubility	327-332, 599-605
	B. Henry's and Raoult's laws	607-623
	C. Boiling-point elevation and freezing-point depression	625-630
Nov 14	D. Osmotic pressure	630-636
	XII. Chemical Equilibrium (Chapter 13)	
	A. Equilibrium and equilibrium constant	685-697, 702-715
	B. Le Châtelier's Principle	698-701
	XIII. Acids and Bases (Chapter 14)	
Nov 28	A. Nature of acids and bases	729-733
	B. pH scale	733-739
Dec 5	C. Equilibrium calculations for weak acids and bases	744-762
	D. Acid-base properties of salts	754-759
Dec 5	E. Common ion effect and buffers	762-770

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Text: E. J. Neth, P. Flowers, K. Theopold, R. Langley, W. R. Robinson, *Chemistry: Atoms First*, OpenStax: Houston, TX, ISBN: 9781938168154 (2016). <https://openstax.org/details/books/chemistry-atoms-first>

Instructors: Office Phone Office Hours E-Mail
 William McNamara ISC 2035 221-4868 T (11:00–12:30); R(1:00–2:30) wmcnamara@wm.edu

Course Goals: This course is intended for science concentrators and pre-medical students. It introduces the student to the nature of atoms and molecules, stoichiometry, states of matter, solutions, reactions, kinetics and equilibrium.

Lectures: Monday, Wednesday, Friday, 10:00-10:50 a.m., ISC 1127

Help Sessions: Weekly, Thursday 5:30-6:20PM in ISC 1127 (rotating instructor)

Examinations: Each of the three exams covers about a third of the course material and contains (i) problems requiring numerical answers similar to the problems in the problem sets, (ii) short-answer questions, and (iii) multiple-choice questions. Below are rough estimates for what will be covered on each exam (subject to change).

Grading:	Syllabus Topics	Chapters in OpenStax	Date
18% First Test	I – IV	1 – 4	Oct 5 (Wednesday)
18% Second Test	V – VIII	4, 6 – 9	Nov 9 (Wednesday)
18% Third Test	IX – XII	10, 11, 13	Dec 2 (Friday)
12% Problem Sets	----	----	----
34% Final Exam	Course & XIII	Course & 14 – 15	Section 1: Dec 13 (7:00 p.m.)

Problem Sets (graded): There are thirteen problem set assignments for the semester listed on the reverse side of this page. These problem sets are available through *Achieve*. Each problem set is due by 5:00 p.m. on the day indicated. Each problem set will be automatically graded. To help with the learning process, you get unlimited tries to get correct answers for each problem, with no deduction in score for subsequent attempts. You may work in small groups; however each student is ultimately responsible for mastering the material for themselves. Solutions to the assigned problems will be posted on *Achieve* after the problem set is due.

You will receive 1% toward your final grade for each successfully completed problem set, for up to 12 sets. A successfully completed problem set is one on which the student scores $\geq 75\%$. Since 1 of the 13 sets can be missed without affecting the problem set component of the grade, no problem sets will be accepted late.

Addition Practice Problems (not graded): Working problems is important for reinforcing the chemical principles emphasized in the lecture and text. There are numerous problems and exercises within and at the end of each chapter. Solutions to the odd numbered problems are found in the downloadable student solutions guide. Many of these problems are very similar to the assigned problems in the homework sets. You should practice similar text book problems if you are having difficulty with an assigned problem.

Achieve Homework Sets (graded)

Problem Set #	Units	Date Available	Date Due
1	I & II	Aug. 31 st 8:00 a.m.	Sept. 12 th 5:00 p.m.
2	II & III	Sept. 12 th 8:00 a.m.	Sept. 19 th 5:00 p.m.
3	III	Sept. 19 th 8:00 a.m.	Sept. 26 th 5:00 p.m.
4	IV	Sept. 26 th 8:00 a.m.	Oct. 3 rd 5:00 p.m.
5	V & VI	Oct 3 rd 8:00 a.m.	Oct. 10 th 5:00 p.m.
6	VI & VII	Oct. 10 th 8:00 a.m.	Oct. 17 th 5:00 p.m.
7	VIII	Oct. 17 th 8:00 a.m.	Oct. 24 th 5:00 p.m.
8	IX	Oct. 24 th 8:00 a.m.	Oct 31 st 5:00 p.m.
9	IX & X	Oct 31 st 8:00 a.m.	Nov. 7 th 5:00 p.m.
10	X	Nov. 7 th 8:00 a.m.	Nov. 14 th 5:00 p.m.
11	XI	Nov. 14 th 8:00 a.m.	Nov. 21 st 5:00 p.m.
12	XII & XIII	Nov. 21 st 8:00 a.m.	Nov. 30 th 5:00 p.m.
13	XIII	Nov. 30 th 8:00 a.m.	Dec.9 th 5:00 p.m.

Additional Practice Problems (not graded)

Chapter	Problems
1	3, 9, 11, 13, 15, 17, 19, 23, 35, 37, 39, 45, 47, 49, 51, 53, 55, 59, 65, 71, 77, 81, 87, 89, 91, 93, 97
2	1, 3, 5, 7, 11, 17, 19, 25, 29, 37, 39, 41, 46, 45, 47, 49, 51, 53, 55, 57, 61
3	3, 5, 7, 9, 11, 15, 17, 19, 21, 23, 27, 33, 35, 37, 41, 45, 9, 53, 55, 57, 61, 67, 69, 71, 73, 75, 77, 79, 81, 83, 85, 93, 97, 99
4	3, 5, 7, 9, 13, 15, 21, 23, 25, 27, 29, 31, 40, 46, 48, 50, 52, 66, 70, 72, 79, 85(a-e), 89, 91, 95, 99
6	3, 8, 12, 14, 18, 22, 26, 28, 30, 32, 36, 38, 40, 42, 46, 48, 52, 54
7	3, 5, 7, 9, 11, 13, 17, 19, 21, 25, 29, 31, 33, 37, 39, 41, 43, 45, 47, 51, 57, 61, 63, 65, 71, 73, 75, 79, 81, 83, 87, 89, 93
8	5, 7, 15, 27, 29, 31, 33, 37, 39, 43, 45, 49, 51, 53, 55, 57, 61, 63, 65, 69, 75, 81, 85, 87, 89, 91, 95(a,b), 101, 103
9	7, 9, 11, 19, 21, 23, 25, 27, 31, 41, 49, 53, 55, 57, 59, 61, 63, 65, 67, 69, 71, 81, 88, 91, 92, 94, 100, 104
10	5, 7, 9, 11, 15, 21, 27, 35, 37, 39, 47, 51, 53, 55, 57, 65, 69, 73, 75, 77, 85
11	5, 9, 13, 15, 23, 25, 33, 35, 39, 41, 47, 49, 59, 65
12	3, 15, 17, 19, 21, 25, 31, 33, 37, 51
13	3, 5, 7, 9, 13, 15, 17, 33, 37, 39, 41, 45, 47, 49, 51, 53, 55, 65, 69, 73, 75, 77, 79, 81, 85, 87, 95
14	3, 5, 7, 9, 11, 19, 21, 25, 29, 33, 35, 47, 49, 61, 65, 67, 69(a-d), 71, 79(b-d), 87, 89, 91, 95, 97

How to access Achieve: Go to <https://achieve.macmillanlearning.com/start> to log in or create an account.

- Go to <https://store.macmillanlearning.com/us/product/Achieve-Essentials-for-OpenStax-General-Chemistry-Atoms-First-1-Term-Access/p/1319400078> to create an account, or log in to your account. This link is for the student store, the cost of online homework module is \$42.
- Our Course ID is 6afaj3
- Alternatively, you can register for the course with the link below once you are registered.
<https://achieve.macmillanlearning.com/courses/6afaj3>
- Our course is Chem 103 2022 at The College of William and Mary.

COVID-19 Policy:

If you feel unwell, please do not attend class. If you have cold or flu-like symptoms, please do not attend class. All lectures are recorded and all notes will be posted.