

CHEMISTRY 103
Fall 2018
Syllabus

Week	Topic	Pages in OpenStax
Aug 29	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, 1213-1222
Sept 3	II. Atomic Structure (Chapters 2 and 6)	
	A. Early chemical laws	67-78
	B. Modern atomic structure	78-86
	C. Atomic mass, Avogadro's number and the mole	307-310
	D. Percent composition and empirical formula	311-318
Sept 10	III. Electronic Structure and the Periodic Table (Chapter 3)	
	A. Electromagnetic radiation and quantization	115-128
	B. The Bohr atom and atomic line spectra	128-134
Sept 17	C. Quantum mechanics and hydrogen-like orbitals	134-148
	D. Periodic table and electron filling in atoms	148-157
	E. Periodic trends	157-169
Sept 24	IV. Ionic Bonding (Chapters 3 and 4)	
	A. Electronegativity and bond polarity	199-203
	B. Ions and ionic bonding	169-172, 193-197
	C. Ionic nomenclature and polyatomic ions	172-177, 203-207
Oct 1	V. Covalent Bonding (Chapter 4)	
	A. Molecules and covalent bonding	197-199, 236-239
	B. Covalent nomenclature	207-210
	C. Lewis dot structures, resonance	210-217, 220-225
	D. Valence shell electron pair repulsion model	225-236
	VI. Chemical Reaction Stoichiometry (Chapters 6 and 7)	
	A. Chemical equations	341-348
	B. Stoichiometric calculations	361-371
	C. Solution stoichiometry	318-326
Oct 8	VII. Chemical Reaction Types (Chapters 7 and 11)	
	A. Electrolytes, ions and net ionic equations	603-606, 346-348
	B. Precipitation and acid-base reactions	348-355
	C. Oxidation-reduction reactions	355-361
	D. Titrations and gravimetry	371-378

Day	Topic	Pages in OpenStax
	VIII. Gases (Chapter 8)	
	A. Gas pressure and the kinetic molecular theory	395-405, 435-440
	B. Diffusion and effusion	430-435
Oct 17	C. Gas laws	405-427
	D. Real gases	441-444
	IX. Thermochemistry (Chapters 9, 12, and 13)	
Oct 22	A. Heat, work, energy, enthalpy, and calorimetry	459-490
	B. Standard enthalpies of formation and Hess's Law	491-497
	C. Bond dissociation energies	497-502
Oct 29	D. Entropy and free energy	653-670, 706-708
	X. Liquids and Solids (Chapter 10)	
	A. Intermolecular forces	519-532
	B. Liquids	532-549
Nov 5	C. Solids	556-568
	D. Phase diagrams	549-556
	XI. Solutions (Chapters 6 and 11)	
	A. Concentration measurements and solubility	326-331, 597-603
	B. Henry's and Raoult's laws	606-620
Nov 12	C. Boiling-point elevation and freezing-point depression	620-627
	D. Osmotic pressure	627-633
	XII. Chemical Kinetics (Chapter 17)	
	A. Reaction rates	895-904
	B. Rate laws and reaction order	904-911
	C. First-order reactions	911-914, 918-920
	D. Kinetics and mechanism	921-933
Nov 19	E. Catalysts and temperature effects	933-938
	XIII. Chemical Equilibrium (Chapter 13)	
	A. Equilibrium and equilibrium constant	679-692, 695-706
Nov 26	B. Le Châtelier's Principle	692-695
	XIV. Acids and Bases (Chapter 14)	
	A. Nature of acids and bases	731-736
	B. pH scale	736-741
	C. Equilibrium calculations for weak acids and bases	742-758
	D. Acid-base properties of salts	760-764
Dec 3	E. Common ion effect and buffers	771-779

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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:	<u>Office</u>	<u>Phone</u>	<u>Office Hours*</u>	<u>E-Mail</u>
J. C. Poutsma	ISC 1054	221-2584	T (1:30–3:00); F (9:00–10:30)	jcpout@wm.edu
Robert Pike	ISC 2043	221-2555	T (9:30–11:00); R (2:30–4:00)	rdpike@wm.edu

* Please note that office visitations are not necessarily restricted to these times or to your particular professor since the same syllabus, problem assignments, and course structure are being used in both sections. Additional times arranged by appointment.

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: Section 1 – Monday, Wednesday, Friday, 11:00-11:50 a.m., ISC 1127
 Section 2 – Monday, Wednesday, Friday, 12:00-12:50 p.m., ISC 1127

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.

Grading:	Syllabus Topics	Chapters in OpenStax	Date
18% First Test	I – IV	1 – 4	Oct 3 (Wednesday)
18% Second Test	V – IX	4, 6 – 9	Nov 7 (Wednesday)
18% Third Test	X – XIII	10, 11, 13, 17	Nov 30 (Friday)
12% Problem Sets	----	----	----
34% Final Exam	Course & XIV	Course & 14 – 15	Section 1: Dec 19 (9:00 a.m.) Section 2: Dec 12 (9:00 a.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 *Sapling*. 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 three tries to get correct answers for each problem, with no deduction in score for subsequent attempts. After a third unsuccessful try, no points will be awarded for that problem. You may work in small groups; however each student is ultimately responsible for mastering the material for him/herself. Solutions to the assigned problems will be posted on *Sapling* 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.

***Sapling* Homework Sets (graded)**

Problem Set #	Units	Date Available	Date Due
1	I & II	Aug. 29 th 8:00 a.m.	Sept. 10 th 5:00 p.m.
2	II & III	Sept. 10 th 8:00 a.m.	Sept. 17 th 5:00 p.m.
3	III & IV	Sept. 17 th 8:00 a.m.	Sept. 24 th 5:00 p.m.
4	IV & V	Sept. 24 th 8:00 a.m.	Oct. 1 st 5:00 p.m.
5	V & VI	Oct. 1 st 8:00 a.m.	Oct. 8 th 5:00 p.m.
6	VI & VII	Oct. 8 th 8:00 a.m.	Oct. 17 th 5:00 p.m.
7	VIII	Oct. 17 th 8:00 a.m.	Oct. 22 nd 5:00 p.m.
8	IX	Oct. 22 nd 8:00 a.m.	Oct. 29 th 5:00 p.m.
9	IX & X	Oct. 29 th 8:00 a.m.	Nov. 5 th 5:00 p.m.
10	X & XI	Nov. 5 th 8:00 a.m.	Nov. 12 th 5:00 p.m.
11	XI & XII	Nov. 12 th 8:00 a.m.	Nov. 19 th 5:00 p.m.
12	XII & XIII	Nov. 19 th 8:00 a.m.	Nov. 28 th 5:00 p.m.
13	XIV	Nov. 28 th 8:00 a.m.	Dec. 10 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
17	3, 7, 13, 15, 19, 23, 25, 27, 29, 37, 45, 51, 53, 55, 63

How to access Sapling: Go to www.saplinglearning.com/login to log in or create an account.

- Under Enroll in a new course, you should see Courses at William & Mary. Click to expand this list and see courses arranged by subject. Click on a subject to see the terms that courses are available.
- Click on the term to expand the menu further (note that Semester 1 refers to the first course in a sequence and not necessarily the first term of the school year).
- Once the menus are fully expanded, you'll see links to specific courses. Click on the link for *College of William & Mary - CHEM 103 - Fall18 – Pike/Poutsma*.
- Review the system requirements and confirm that Flash is updated and enabled in your browser.