Syllabus for CHM 203: General Chemistry I

MTWRF • HLSB 244 • 10:00–11:30 AM • Summer 2019

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http://freitag.creighton.edu/CHM203

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Office Hours:

Monday:	9:00–10:00 AM, 11:30 AM–12:30 PM
Tuesday:	11:30 AM–2:00 PM
Wednesday:	9:00–10:00 AM, 11:30 AM–12:30 PM
Thursday:	9:00–10:00 AM, 11:30 AM–2:00 PM
Friday:	11:30 AM–12:30 PM

I will be in during my scheduled office hours, but I am more than happy to see you anytime you find me in my office. You're also welcome to schedule an appointment; just send an email.

Textbook/Hardware. McMurry, J.; Fay, R.C.; Robinson, J.K. *Chemistry*, 7th Edition; Prentice Hall: New Jersey, 2016. You will also need a scientific calculator for exams and lectures. *You will not be able to use programmable calculators on the exams.* This includes graphing calculators. Pick up a \$10 calculator that does logarithms ($\ln x$, $\log x$) and exponentials (e^x, 10^x). This policy is followed in every general chemistry lecture and laboratory course.

Introduction/Attendance. Attendance in lecture is required. Note, however, that attendance is not normally taken. You are responsible for all information given in lecture, even if you are not present. In the extraordinarily unlikely event of a cancelled class, I will notify you via your Creighton University email. Of course, if the University is closed (usually for weather-related issues), we will not have class and no special announcement will be made.

Course Objectives. Students will be able to:

- evaluate and comment on the accuracy, precision and the propagation of error in measurements.
- convert correctly between different units of measurement.
- identify and count the number of subatomic particles in isotopes and calculate average atomic mass.

- recognize stoichiometric relationships, relate quantities of reactants and products in a balanced chemical reaction and calculate yields.
- write correct names and formulas for ionic, acid and binary molecular compounds.
- classify and balance acid-base, precipitation and reduction-oxidation reactions, while also considering the dissociation of ionic particles in solution.
- characterize atomic orbitals and connect the construct of the periodic table to elementary quantum theory.
- predict electron configuration of atoms and ions using the periodic table and identify periodic trends of atomic and ionic properties.
- draw Lewis (electron-dot) structures correctly.
- utilize VSEPR theory to predict molecular geometry, polarity and intermolecular forces.
- calculate work and enthalpy changes for chemical processes.
- explain the behavior of gases and calculate some physical quantities using the ideal gas approximation.
- relate the physical properties of solids, liquids and gases to the interactions between particles.

Exams. The exam dates are given in the *Course Timeline* section below. Plan on taking the exam on the given date. I will make other arrangements if you have an officially excused absence for University-sponsored events cleared with the

Dean's office. If for any reason you cannot make it at the scheduled time, you must contact me at least one week before the exam. This does not necessarily mean that your absence will be excused, but if you fail to notify me in advance, you will not be able to reschedule the exam under any circumstances. Of course, emergencies and unforeseen circumstances will be considered on an individual basis. (*"I couldn't find a babysitter,"* and *"I don't feel well"* aren't emergencies—car accidents, snowstorms, sudden illnesses that require a *documented* doctor's visit, and other acts of God are.)

Exams are written under the assumption that the student has reasonably mastered the material. For those who have not, the exams may be challenging to complete in the 90-minute time period. The exams will focus on the material covered in the chapter(s) listed with each exam in the *Timeline* below. Absolutely **NO** cell phones/watches or programmable calculators are allowed. If you are seen with either during any exam for any reason, you will receive a zero for that exam. This penalty is also applicable for other electronic devices except a non-programmable calculator. You will not be permitted to leave the room once the exam has started, but you may leave when you are finished.

Grading.

Item	Points	% of Course
Five exams, 100 pts each	500	83%
Final exam (ACS)	100	17%
Total	600	

If you believe you have found a grading error, you may submit your exam for regrading up to two days after it has been handed back. In some cases, I may ask you to attach a written explanation of why you are requesting a regrade. With your explanation(s) in mind, the *entire* exam will be regraded and returned to you after making any appropriate adjustments. Regrade requests will not be accepted after 12 Jul 2019.

The final exam will be a standardized, comprehensive exam prepared by the American Chemical Society (ACS). Your score on this exam will be either your raw percentage on the exam or your national percentile ranking, whichever is higher.

Determining Letter Grades. I do not have strict, predetermined cutoffs for letter grades; instead, I look for natural breaks in the distribution of course scores. However, the actual cutoffs will be within a few percentage points of the following:

A	B+	B	C+	C	D
91%	87%	80%	76%	68%	60%

These cutoffs are never increased. Course grades are rounded to the nearest whole number. To move on to CHM 205, you must get a C or better in this course. Creighton University defines letter grades as follows:

A   *outstanding achievement and an unusual degree of intellectual initiative*
B+   *high level of intellectual achievement*
B   *noteworthy level of performance*
C+   *performance beyond basic expectations of the course*
C   *satisfactory work*
D   *work of inferior quality, but passing*
F   *failure—no credit*

Notice that satisfactory work is reflected in the C grade. I am therefore not alarmed (but I am disappointed) if the average grade in the course is a C. On the other hand, I'd be quite thrilled if everyone demonstrated '*outstanding achievement and unusual degree of intellectual initiative*' and I could give all A's. You may ask about your grade over email, but because of privacy issues I can only reply if you send your question from your Creighton University account.

Extra Help. If for some reason you can't stop by my office, send an email. I should be able to reply fairly promptly, especially on weekdays. (Occasionally, emails sent to me from a non-Creighton account are held up by the University's spam filter. In that case, I will probably never see it. Your best bet is to use your Creighton account.) To request an appointment to see me outside of office hours, send an email. All emails will be sent to your official Creighton University account, so you should get in the habit of checking it regularly.

I've set up a website* with more tips on getting help, and links to some outside resources. There is a link to this site on the main course page, `http://freitag.creighton.edu/CHM203/`.

Academic Honesty. Creighton University has an established policy on academic honesty. You can read about it at your leisure in the Catalog.† In addition to the specific items mentioned there, academic misconduct includes representing the work of another to be your own, tampering with the experiment of another, defacing or tampering with library or student materials, or facilitating dishonesty on an exam. If you are found guilty of academic misconduct, you will receive a zero for the activity. Don't do anything dumb.

Parting Thoughts. Don't procrastinate, and don't be lazy. If you feel yourself falling behind, please come and see me even if you can't identify a specific problem. I should be able to tell where you're at progress-wise. If I think you're doing fine, I'll say so. If not, we'll try to figure out how to get you back up to speed. Take advantage of the resources that are available (myself, discussion groups, posted notes, etc.). If you require some other form of assistance, please don't hesitate to ask. If you sincerely want to learn, I want to help.

Course Timeline. The calendar below is a tentative timeline and list of topics and readings for the course. Some of the dates and coverage may shift. For an updated topic calendar, see the course website.

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
10 June 1 §1.1–10 Measurement; Significant Figures	11 2 §1.11–§2.9 Unit Conversions; The Atom	12 3 §2.10–§3.3 Nomenclature; Molar Mass	13 4 §3.3–3.7 Stoichiometry; Percent Composition	14 5 **Exam I** Chapters 1–2
17 6 §4.1–7 Solutions; Precipitation and Acid-Base Rxns	18 7 §4.8–13 Solution Stoichiometry; Redox Reactions	19 8 §5.1–7 Quantum Mechanics	20 9 **Exam II** Chapters 3–4	21 10 §5.8–14 Atomic Orbitals; Periodic Properties
24 11 §6.1–8 IE and EA; Ionic Bond and Lattice Energies	25 12 §7.1–6, 8–10 Covalent Bonds; Lewis Structures & Formal Charge	26 13 **Exam III** Chapters 5–6	27 14 §8.1,5–6 VSEPR Model; Intermolecular Forces	28 15 §8.3–4, 7–8 Hybrid Orbitals; MO Theory
1 July 16 §9.1–7 Work, First Law, Enthalpy; Calorimetry	2 17 **Exam IV** Chapters 7–8	3 18 §9.8–10,§10.1–4 Enthalpy Changes; The Ideal Gas Law	4 **Independence Day –** No class	5 – No class
8 19 §10.5–6 Dalton's Law; Kinetic Theory of Gases	9 20 §11.2–3 Phase Changes; Clausius-Clapeyron	10 21 **Exam V** Chapters 9–10	11 22 §11.6–7, 8–9 Solids and Phase Diagrams	12 23 **Final Exam** ACS Comprehensive

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*`http://freitag.creighton.edu/guide/help.html`

†`http://catalog.creighton.edu/undergraduate/academic-policies-procedures/academic-honesty/`

Problems. The answers to these problems are in the back of your text, so they will not be collected or graded, but it is critical that you understand them. Problems given in parenthesis are either similar to the first problem or ask about a similar idea in a different way; you should work these as needed. *Only do the 'harder' problems if the other problems were amusingly easy and you want more of a challenge.* You will *not* see questions like the 'harder' ones on the exams. Please stop by and see me if you have any questions.

Day		Easier		Harder
1	Ch. 1	$1(2^1, 46, 58)$, 38, 40, $5(6, 80, 82, 84, 88)$, $9(54)$, $11(12)$, 44, $56(60)$	$3(4, 74, 76)$, 86, $7(8, 90)$, $13^2(14, 62, 64)$	78, 106
2	Ch. 1	$42, 48(50, 52)$	$15(16, 70, 94)$, $17(18, 66^3)$, 72, $92(100)$	68, 104, 112
	Ch. 2	$1(2, 56, 58, 64, 66)$, $46(48, 50, 68)$, $52(54)$, 72, $7(8, 92, 94, 96, 98, 100^4, 102, 104)$, 106	$3(76)$, $4(78)$, $5(6, 90)$, $9(10, 108, 110^5, 112)$	74, 80
3	Ch. 2	$16(126, 128, 130)$, 17, $18(120)$	$19(21, 23, 134, 136)$, $24(132, 138, 146, 148)$, $140(150)$, 144	*n/a*
	Ch. 3	$3^6(4, 36, 38, 40)$	$5(42, 44, 46)$, 48, 50, $7(8, 52^7, 54)$	56
4	Ch. 3	82	$9(10, 58, 60, 62, 64, 68)$, $11(12, 80^8)$, $74(78)$, $15(16, 70, 72, 76)$, $17(86)$, $18(84)$, $21(88)$, 20	$66, 90, 94^9$
6	Ch. 4	$8(66)$, $10(70)$, $60(64)$, 16, 17, 68	$1(2, 3, 48, 52, 58)$, 54, $4(5, 50)$, $6(7, 56)$, $12(74, 76)$, $13(78, 82)$, $15(72, 84)$, 62, 80, $18(19, 90)$, 88	128, 140, 144
7	Ch. 4	102, $24(104, 106)$	$20(21, 92, 94)$, 22, $96(98)$, $26(27, 110)$, $28(112)$, $29(114)$, $30(118, 120)$, $31(116, 122, 124)$	130, 148
8	Ch. 5	$1(36, 40, 44)$, $2(32)$, 66, 68, $11(70)$	$3(38, 42, 46)$, 4, $48(50)$, $9(10, 58^{10}, 60, 62)$, 64, $74(76)$	$122, 140^{11}$
10	Ch. 5	88, $90(92)$, $15(16, 110)$, 104	84, $94(96, 98)$, 100, $17(18, 106, 108)$	120, 128
11	Ch. 6	2, 32, 34, 36, 64, 66	$1(38, 40, 42, 44)$, $3(46, 48)$, $5(6, 52bc)$, $7(54, 56)$, $8(58)$, 60, 62, 74, $13(76, 78, 80, 82, 84)$, $15(16, 72)$	4, 9, 52a, 88
12	Ch. 7	$1(2, 44, 48, 50)$, $40(42)$, 46, 60, 64, $6(8, 68)$, 74	$3(4)$, 52, 54, $56(58)$, $5(7^{12}, 66)$, $11(12, 13, 14)$, $15(16, 78, 80^{13})$, $19(21, 22, 84, 86, 88, 90)$	70, 72
14	Ch. 8	$2(42, 44)$, $11(12)$, $70(80)$	$1(46, 48, 50)$, $3(4, 58)$, $52(54)$, $13(14, 78)$, $76(82)$, $15(84, 86)$, $17(18, 72, 74)$	56, 98
15	Ch. 8	60, 62, $19(20)$, 88	$5^{14}(6)$, $7(8, 9, 10, 68)$, $64(66)$, $21(22, 90, 92, 94)$	102, 116
16	Ch. 9	$1(2, 46)$, 40, 44, $52(54)$, 72, 74	$3(4, 56, 58, 60)$, $5(6, 8, 66, 68, 70)$, $9(10, 76)$, $11(12, 80^{15}, 82)$, 78	50, 64

Day	Easier		Harder
18 Ch. 9	84, 88 (90, 92)	13 (86, 94) 15 (16, 98, 100,[16] 102, 104), 17 (18, 106, 108)	96
Ch. 10	1 (38), 5, 40, 64	7 (8, 56, 60, 62), 9 (10, 50, 52, 54), 11 (12, 72, 74, 76), 13 (14, 66, 68, 70, 78)	58
19 Ch. 10	90, 92, 94[17]	15 (16, 86), 82 (84), 88, 96[18] (98[17]), 104[17]	158, 146[17]
20 Ch. 11	34, 36	38, 3 (4, 40, 42, 44), 5 (6, 48, 50)	52 (54, 56)[18]
22 Ch. 11	58, 60, 66, 76, 82	9 (10), 11 (12), 68 (70, 72), 78, 13 (14), 15 (16, 88, 90), 84 (86)	74 (80) 112

[1] The correct answer is 2×10^{13} g.

[2] The correct answer for (b) is 1.26×10^3 $g\,L^{-1}$.

[3] For 1.66(c), the correct answer is 7.6181×10^{12} m^2.

[4] The correct answer for part (d) is 58 protons and electrons, and 90 neutrons.

[5] The correct answer is 26.0 u.

[6] The correct answer to part (b) is $2\,NaClO_3 \longrightarrow 2\,NaCl + 3\,O_2$.

[7] The correct answer to the second part is 1.19×10^{21} Fe(II) ions.

[8] The other product of this reaction is water.

[9] This question should say 17.33 mg of CO_2, not 1.444 mg.

[10] The correct answer here is 4.85×10^{-11} m.

[11] The correct answer to part (b) is 820.1 nm.

[12] The correct answer to (b) is $H\!-\!C\!\equiv\!N\!:$; the correct answer to (c) is $\left[\ddot{\underset{\cdot\cdot}{O}}\!=\!C\!-\!\ddot{\underset{\cdot\cdot}{O}}\!:\right]^{2-}$.

[13] All four pairs listed are resonance pairs.

[14] For the C—Cl bond, the overlap is between two sp^3 orbitals.

[15] For this problem, you may assume the density of water is 1.00 $g\,mL^{-1}$.

[16] For methyl *tert*-butyl ether, $\Delta_f H° = -313.6$ $kJ\,mol^{-1}$. (See problem 9.99.)

[17] By "average" speed, they really mean root-mean-square speed. The average speed is different.

[18] These problems will be a lot easier if you use a spreadsheet; stop by if you need help using the program.