

CHMY 151H SYLLABUS
Honors General Chemistry
Section 1
Fall 2009 Semester

Instructor:

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Introduction

Welcome to first semester of Honors General Chemistry (CHMY 151H) at Montana Tech. This course is designed to introduce you to some of the fundamental principles of chemistry such as stoichiometry, simple chemical reaction types, atomic properties, molecular structure and chemical bonding. The conceptual and problem solving skills you learn in this course are similar to the ones you will need in many other science and engineering courses. Perhaps the words, “fundamental principles of chemistry” are new to you and may cause you to question whether you belong in this class. However, remember that any science seeks to explain the world in as simple terms and concepts as possible. Everyone, scientist or not, likes to quote Albert Einstein; Einstein said, “Everything should be made as simple as possible, but not simpler.” So when we say “fundamental principles of chemistry”, we mean the simplest model (or picture) that explains all data we *generally* observe. To these simple models we do other stuff like add mathematics or additional details that allow us to use the model quantitatively; that is we can then make physical measurements (mass, distance, time, temperature, etc) based upon predictions that are made by the model. So one of the most important skills you can develop for studying science or engineering is to be able to develop a simple picture of the phenomenon you wish to understand. To this end, the instructor and text authors have provided a number of ways to help you expand your picture-developing and problem-solving skills. The oldest and most important learning tool is class attendance and participation, which is required. The text and related websites also contain good illustrations that can help in using physical models. The online homework is designed to encourage practice in solving chapter problems. Successful practice will make you feel more comfortable and confident as a Problem Solver, and will ensure you are prepared for the exams. Good luck gaining a better understanding of basic chemistry. Remember if you get stuck trying to solve a problem, or in trying to understand a “fundamental principle”, locate help immediately either from your instructor, the campus Learning Center (TLC), or go On-Line using the [MasteringChemistry](#) tutorials. Since this is a Montana Tech (Go ‘Diggers) Honors course...we will include weekly research/writing/discussion assignments...which we hope

you will Get Into...

CHMY 151H Prerequisites and Co-requisites

M 151 (Pre-calculus or higher course) is a co-requisite for Chemistry 151H. Since algebra is required in many chemical calculations you need to have a good, fundamental working knowledge of algebra and some calculus-based method will be discussed.

Two years of algebra is a high school graduation requirement in the State of Montana so we will assume that you have working knowledge of algebraic methods. If you are taking a lower-division MATH course than M 151, you should NOT be in CHEM 151H. In addition, **high school chemistry or other introductory chemistry courses (e.g. CHMY 121 (Introductory Chemistry) are strongly recommended.** If you are confused about whether or not you are academically prepared for this class please talk with your instructor and take the Math Self-Test included in this syllabus. Most of the algebraic methods (e.g. quadratic equations, logarithmic functions, etc.) used in the text should be familiar to you.

Online Homework

There will be no formal homework assignments to be turned in as “hard copy” for grading. However, learning chemistry is all about learning to solve chemical and physical type problems, so in this syllabus, and often in class, we will assign problems of a type that you are certain to encounter on an up-coming exam. Therefore, the best way to study and prepare for an exam is by learning to solve these types of problem. The homework assignment all together will count the same (100 points) as one exam. Access to each chapter’s online homework will be allowed for a fixed amount of time; however you will usually have multiple attempts to answer each question.

Chapter problems will be assigned using an online homework/tutorial system called, **MasteringChemistry** (<http://www.masteringchemistry.com/>). The registration information and registration codes for this should have come packaged with the copy of the text you purchased from the bookstore. Please see the instructor if this is not the case. Also, someone from the text publisher will be available the first class meeting to give you an overview of the software and registration process.

Text

Chemistry: The Central Science; 11e, Brown, LeMay, Bursten, Murphy. Pearson/Prentice Hall Publishers, 2009. You can find a “hard copy” of the text in the Montana Tech Bookstore that is bundled with the **MasteringChemistry** registration as well as access to the eText...an electronic version of the text.

Blackboard, Blogs and other course information sites

To find the course site on Blackboard go to: <http://www.mtech.edu/>
Select MYMTECH and this will take you to the Blackboard login page. **NOTE: Blackboard will only be used for post raw scores from homework, quizzes and tests. Most of the class material will be posted on my class Blog.**

Quizzes

Unannounced quizzes will be given periodically in class. The points earned from these quizzes will be included as a part of your regular total points. There will be no makeup for these quizzes (remember that class attendance is required). We will drop one quiz at the end of the semester.

Regular Exams

There are four regular exams worth 100-points each. Your final grade will be based on your regular exams (4), your homework, your quizzes, and the final exam.

All regular exams are currently scheduled *outside of regular class meeting times*. Generally, the exam will be offered at two different times during the day and evening (5-6:50 PM & 7-8:50 PM) in the Library Auditorium along with students taking the general chemistry exam (CHMY 141). The reasons for this are so that we may permit more time for students to work the exam. This should help to remove stress as a factor in taking the exams. Exam dates and material covered by the exams are subject to change.

Proposed Exam Dates are:

<i>Exam I</i>	<i>Chs. 1, 2 & 3</i>	<i>Tuesday, September 15th</i>
<i>Exam II</i>	<i>Chs. 4, 5 & 6</i>	<i>Tuesday, October 13th</i>
<i>Exam III</i>	<i>Chs. 6, 7 & 8</i>	<i>Tuesday, November 10th</i>
<i>Exam IV</i>	<i>Chs. 9 & 10</i>	<i>Tuesday, December 8th</i>

If you are aware of any potential conflicts with these exam times, you must notify the instructor *by email* as soon as possible. Make-up exam times can then be arranged, but ONLY with prior approval of the instructor.

Each of the four regular exams will consist of a mix of short answer and mathematical problem type questions. Some of the exam questions will be taken from the end of chapter problems for those chapters covered by the exam. In some cases the numbers, the types of substances, and/or the phrasing in the question may be changed slightly from the way the question appeared in your text. In many cases there will be no changes. This should encourage you to work the end-of the chapter problems, using MasteringChemistry, or additional problems you think applicable.

Since most *real world* problems will require you to apply your knowledge in unfamiliar settings, we also believe that it is important that you learn how to approach and solve these types of problems. As part of our strategy for accomplishing this, one or more questions on each exam will be designed to test your creative problem solving ability.

Calculators

“Graphing” calculators capable of storing and displaying text and formulas will not be allowed during the exams or final. You should acquire a calculator with the functions $1/x$, 10^x , e^x , $\ln(x)$, $\log(x)$ for use during the exams. Appropriate calculators available in the Tech Bookstore or even Wal-Mart, and generally cost less than \$15-20. Some examples of acceptable calculators are: Sharp EL-509G and EL-506G, Texas Instruments TI-30X, and the CASIO *fx-300MS* (*my favorite*).

Because it is impossible for us to get to know all of the ~250 students taking the exams, **we will check validated Montana Tech IDs at each exam.**

Final Exams

The final exam is worth 100 points and will be comprehensive, i.e. covering the entire semester (Chaps. 1-10). The exam will consist mostly of short answer or multiple-choice questions. This exam will be (tentatively) held in the regular class lecture hall on:

Sec. 1: Friday, December 18th 3 – 5 PM, CBB 102

Grading

Ten (10) MasteringChemistry homeworks	100 points
Quizzes (in class, approx. 10 @ 5 pts each)	50
Four 100-point regular exams	400 points
<u>Final Exam.</u>	<u>100 points</u>
Total points	650 points

We do not assign letter grades to individual quizzes or exams, but rather we keep track of the percentage of the total available points that you have earned. The total points may vary slightly from 650, but the following percentages will guarantee the letter grades shown:

90% to 100%	A
80% to 89%	B
69% to 79%	C
60% to 69%	D

Depending upon the test averages these percentages may be lowered. However, to pass this class you must demonstrate proficiency in a majority of the material.

Honesty

Exams (and quizzes) are expected to be a measure of your own effort and ability. A single incident of cheating will result in a grade of zero for that exam. A second incidence of cheating will result in removal from the class roll. Incidences of academic dishonesty are recorded on your permanent academic record.

Obtaining Help

If you are having trouble understanding the material, keeping up with the class, or working the assigned problems you can:

1. *Ask questions in class and take good notes.* Even though class time is limited, there will be some opportunity to ask questions in class.
2. *Ask your fellow students for help.* This is a great way to study any subject and we encourage you to form study groups for working on chemistry and your other courses as well. Your fellow students may know how to do a problem or understand a concept that you don't and vice versa and by working together you can save yourselves lots of time. Study groups work best if all members contribute to the group.
3. *Ask questions (or just come and listen) at any scheduled exam help-sessions.* These sessions are your chance to ask questions for which there just wasn't enough time in class. The dates and times for these sessions will be announced in class.
4. *Ask the chemistry tutors in the campus learning center (TLC) during the regularly scheduled tutorial sessions.* Dates and time when the tutors will be available will be posted and announced in class. Tutors may also be available through other programs. Ask.
5. *Make use of the online resources.* Some things are more easily learned by inquiry and others depend on seeing things like chemical structure in three-dimensions. [MasteringChemistry](#) has many tools to help you solve chapter problems.
6. *Ask us personally, during our office hours, or when we are not immediately occupied with something else.* If you are across campus and want to be sure that we are available before you trudge over to our offices, give us a call. *Email is also an excellent mean of getting hints or help.*

About These Objectives:

There is much more material in the text than you will be able to absorb during the term. These study objectives are your guide to what we feel is important in the text. With many of the objectives we have listed figures, examples, or end-of-chapter problems that illustrate that objective.

As you read the each chapter, try to work the examples and practice problems listed in the Chapter Review in the text as a guide to how to work the MasteringChemistry problems. If there are other problems suggested by the instructor or text, try to work several of these answered problems to increase your experience in working problems of this type. If you can't work the suggested or homework problems associated with a particular objective, seek help from the instructor, the Tech Learning Center (TLC, located in Eng. Hall), or use of the tutorial problem assigned in MasteringChemistry.

This is not a high school class. You are much more responsible for your learning, success and progress in this course than in high school.

SUCCESS HINTS:

1. Go to class!! Be an active learner!! Stay involved with the lecture!! Take notes in class!! Ask questions!! Read the current chapter material *before* class!!
2. Work several homework problems every day. Don't wait until the night before the homework, quiz or exam to study. Work as many of the problems as you can at the end of each chapter.
3. Come to Help/Problem sessions!! Ask questions!!!
4. See the tutors or COME TO THE OFFICE HOURS LISTED FOR THE INSTRUCTORS (yours or a different instructor, it doesn't matter) Ask questions!!
5. Work more problems, ask more questions. Work the problems on the old exams found at the end of the syllabus.
6. Go over the answer keys for the homework sets and tests on reserve in the Library. Make sure you learn how to work problems you didn't get the first time.
7. Work more problems, ask more questions. Attend another instructor's lecture if you find it helps your understanding.

Complete **all** suggested problems and take **all** quizzes. This material will show up on the exams.

Significant Figures

Significant figures provide an indication how precisely a number is known. You need to be able to recognize how many digits in a number are significant and how many significant figures should be reported as a result of a calculation. Since the treatment of significant figures varies somewhat depending on whom you are talking to, we will give you our version (the correct version) of how to deal with significant figures.

- Integers, numbers obtained by counting, and defined numbers have an infinite number of significant figures, i.e., they are known with infinite precision:

<u>Number or Relationship</u>	<u>Number of Significant Figures</u>
the integer 5	∞
3 apples	∞
1000 g = 1 kg	∞ (defined relation)
453.6 g = 1.000 lb.	4 (measured relation)

- All other numbers have a number of significant figures equal to the number of digits to the right of the first non-zero digit including that digit:

<u>Number</u>	<u>Number of Significant Figures</u>
18.2	3
18.20	4
0.0051	2
0.501	3
0.50100	5
$501.00 \cdot 10^{-3}$	5
320.000	6
320.	3
320	2
$3.2 \cdot 10^{+2}$	2

Note: trailing zeros to the left of the decimal place are not significant unless a decimal follows the rightmost zero (see the examples for 320. and 320 given above).

- When rounding a number that is exactly 5, round to the nearest even integer. This procedure will result in your rounding up ~ half of the time, while rounding down the other half of the time and thus on average no bias due to rounding will be introduced into the calculations:

$$\begin{array}{cc}
 3.275 = 3.28 & 3.28500 = 3.28 \\
 \text{rounded to } \overline{\text{hundredths}} \text{ place} & \text{rounded to } \overline{\text{hundredths}} \text{ place}
 \end{array}$$

- In addition or subtraction the number with the *largest* uncertainty determines the uncertainty in the result:

$$\begin{array}{r}
 4.010 \\
 + 200.2 \\
 \hline
 204.2
 \end{array}
 \qquad
 \begin{array}{r}
 1.100 \\
 - 0.3522 \\
 \hline
 0.748
 \end{array}
 \qquad
 \begin{array}{r}
 0.900 \\
 + 0.376 \\
 \hline
 1.276
 \end{array}$$

Note: In the middle example both numbers involved in the calculation have four significant figures, but the answer has only three! In the right example both numbers involved in the calculation have three significant figures, but the answer has four!

- When adding or subtracting numbers that are expressed in scientific notation, first express both numbers to the same power of 10:

$$\begin{array}{r}
 3.70 \cdot 10^3 \\
 - 454 \\
 \hline
 \end{array}
 \quad \implies \quad
 \begin{array}{r}
 3.70 \cdot 10^3 \\
 - 0.454 \cdot 10^3 \\
 \hline
 3.25 \cdot 10^3
 \end{array}$$

- In a multiplication or division the number with the smallest number of significant figures determines the number of significant figures in the result:

$$(2.1)(3.06) / (5.9987) = 1.1$$

- A significant figure is gained when taking the logarithm of a number, while a significant figure is lost when taking the antilogarithm of a number:

$$\ln(3.69) = 1.306 \qquad e^{+1.306} = 3.69$$

- For complex calculations the number of significant figures is carried through each step of the calculation in the same order that the calculation is performed:

$$(1.99) [\log (88.3)] / (3.82 - 3.63) = (1.99) (1.946) / (0.19) = 20$$

Note: When performing complex calculations, mental track of the correct number of significant figures should be kept as the calculation is carried out. At least one more than the correct number of significant figures should, however, be carried through the calculations to avoid cumulating rounding errors. The final answer can be expressed to the correct number of significant figures.

Mathematical Self Test

It has been our experience that one of the stumbling blocks for some students in general chemistry has been weak math, particularly algebra, skills. This is the reason why CHEM 1256 has a MATH 1056, College Algebra, co-requisite. To help you better assess your math skills, as they relate to this course, we have included the following self test, that makes use of some of the more challenging math skills that will be required in general chemistry. If you get less than half of these problems correct, you should consider enrolling in MATH 1056, if you are not already enrolled in it. The answers are given following the quiz. **Answers should always be reported to the correct number of significant figures (see the Significant Figures section).**

1. Add the two numbers:

$$10800 \cdot 10^{-3} + 0.00904840 \cdot 10^{+4} = ?$$

2. Simplify the exponent in this expression:

$$10^2 10^{-4} / (10^{+3} / 10^{-5}) = ?$$

3. Simplify the units in this expression:

$$\text{kg m}^2 \text{ sec}^{-1} / (\text{kg m/sec}) = ?$$

4. 1.5 % (0.5 metric tons) of all declassified weapons grade plutonium in the U.S. is stored at the Idaho National Engineering Laboratory outside of Idaho Falls, ID. How many total metric tons of declassified weapons grade plutonium are stored at other sites in the U.S.

5. Solve this expression for W:

$$\log W = -5.60$$

6. What value of N satisfies the equation:

$$\log (1/N^{-5}) - \log (N^{-2}) = 7$$

7. Solve this expression for n:

$$-1 / (4.86 \cdot 10^{-7}) = (1.097 \cdot 10^{+7}) [1/n^2 - 1/2^2]$$

8. What is E in this equation:

$$1.370 \cdot 10^{+8} = (5.230 \cdot 10^{+12}) e^{-E / (0.5924)}$$

9. Solve this expression for y:

$$y^2 = (0.10 - y) (6.8 \cdot 10^{-4})$$

10. Solve this set of equations for x and y:

$$x / y = 3$$

$$x = y + 0.10$$

Answers to Math Self-Test

1. 101.284
2. 10^{-10}
3. m
4. 32.8 tons
5. 2.5×10^{-6}
6. $N = 10$
7. $n = 4$
8. $E = 6.250$
9. $y = + 0.0079$ and $y = - 0.0088$
10. $x = 0.15$ and $y = 0.05$

Periodic Table of the Elements:

Metal
 Semimetal
 Nonmetal

6
C
12.01
Atomic number
Symbol
Atomic weight

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18												
1 H 1.008	2 He 4.003	3 Li 6.941	4 Be 9.012	5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18	11 Na 22.99	12 Mg 24.31	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95												
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80												
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc 98.91	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3												
55 Cs 132.9	56 Ba 137.3	57 Lu 175.0	58 Hf 178.5	59 Ta 180.9	60 W 183.8	61 Re 186.2	62 Os 190.2	63 Ir 192.2	64 Pt 195.1	65 Au 197.0	66 Hg 200.6	67 Tl 204.4	68 Pb 207.2	69 Bi 209.0	70 Po 209.0	71 At 210.0	72 Rn 222.0												
87 Fr 223.0	88 Ra 226.0	89 Lr 262.1	90 Rf 261.1	91 Db 262.1	92 Sg 263.1	93 Bh 264.1	94 Hs 265.1	95 Mt 268	96 Uun 269	97 Uuu 272	98 Uub 277	99 Uut 289	100 Uuq 289	101 Uup 289	102 Uuh 289	103 Uus 289	104 Uuo 293												
57 La 138.9	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm 146.9	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 174.9	72 Hf 178.5	73 Ta 180.9	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po 209.0	85 At 210.0	86 Rn 222.0
89 Ac 227.0	90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np 237.0	94 Pu 244.1	95 Am 243.1	96 Cm 247.1	97 Bk 247.1	98 Cf 251.1	99 Es 252.0	100 Fm 257.1	101 Md 258.1	102 No 259.1	103 Lr 262.1	104 Rf 261.1	105 Db 262.1	106 Sg 263.1	107 Bh 264.1	108 Hs 265.1	109 Mt 268	110 Uun 269	111 Uuu 272	112 Uub 277	113 Uut 289	114 Uuq 289	115 Uup 289	116 Uuh 289	117 Uus 289	118 Uuo 293

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