CHEM 115
General Chemistry I
Spring 2004

CH115-1A
Monday, Wednesday, and Friday
8:00-8:50 AM in CHEM 101

Dr. Joe March
Office: CHEM 286
Email: march@uab.edu

Co-Registration in a recitation section (CH115R) is required.

All sections meet in CHEM/GA 259/260

CH 115R-H5	Tue, 2:00PM-3:00PM
CH 115R-H6	Tue, 3:30PM-4:30PM
CH 115R-K2	Wed, 9:30AM-10:30AM
CH 115R-K3	Wed, 11:00AM-12:00PM
CH 115R-N5	Thu, 2:00PM-3:00PM
CH 115R-Q2	Fri, 9:30AM-10:30AM
CH 115R-Q3	Fri, 11:00AM-12:00PM

Office Hours: Open. If I am unavailable when you stop by, please email to set an appointment.

Goals of the General Chemistry Program

1. Develop in the student an understanding of the methodology of science.
2. Generate a basic understanding of the fundamental concepts of atomic structure, chemical bonding, chemical periodicity, and properties of the states of matter that result from aggregate structure.
3. Impart in students the ability to utilize the periodic table in understanding and explaining chemical behavior and properties.
4. Ensure that students can read (qualitative/quantitative) a chemical equation, predict chemical reactions, and understand the energetics and kinetics associated with chemical reactivity.
5. Develop quantitative skills that permit the student to solve real problems, which exemplify the basic chemical concepts, *i.e.* numerical and conceptual problem solving.
6. Reinforce the teaching of basic chemical concepts by giving the students a feeling of the way chemistry impacts the world about them and their future careers.
7. Provide the tools that the student will need to function as a chemically literate person in a technological world.

Required Material

Textbook: *Chemistry The Molecular Science*, 1st Edition, Moore, Stanitski, Jurs

Calculator: An inexpensive calculator is required. The calculator should have capabilities for square roots, logarithms, and exponentiation (antilogarithms), and exponential notation (scientific notation). The calculator will be used on homework assignments, quizzes, exams, and in the laboratory.

Class Handouts: You should obtain a copy of each handout when distributed in lecture, discussion, or laboratory. If you miss one, you should print a copy of the handout from the CH 115 Web page.

Prerequisites: Completed CH 100 or 1 year of High School Chemistry with C or higher; completed MA 106 with C or higher or concurrent enrollment in MA 106 or MA 125. Students that do not meet the prerequisites for this course will be administratively dropped. You should be concurrently enrolled in CH 116 (General Chemistry I Lab), although this is not mandatory.

Prior to enrollment in CH 115, the student must be able to

1. Solve algebraic equations.
2. Solve problems involving area, volume, speed, average, or percentage.
3. List the basic Metric units for mass, volume, and length.
4. List the common prefixes used in the metric system with the appropriate numerical meaning.
5. List the basic English units for weight, volume, and length.
6. Convert between English measurements and Metric measurements using dimensional analysis.
7. List the SI units of measurement.
8. Determine the number of significant figures in a measurement or in a calculated value.
9. Write a numerical value in scientific notation. Use the appropriate rules for scientific notation to perform calculations.
10. Use the appropriate rules for rounding-off numbers in all calculations.
11. Know the formula for the determination of the density of an object from mass and volume data.
12. Use the temperature conversion formulas to convert Fahrenheit temperature to Celsius, and Celsius temperature to Fahrenheit.
13. Use the method of dimensional analysis along with appropriate conversion factors to express a measurement given in one specific unit to another unit.
14. Work basic stoichiometry problems that deal with chemical formulas and balanced chemical equations.

Optional Material

*Chemistry I***,** Thinkwell. This packet of 6 CD covers all of General Chemistry I with streaming video lectures and demonstrations for personal review of course material.
Mastering Chemistry Practice Problems; and *General Chemistry*, Falcon Software, Inc. These two CD-ROMs contain a large number of practice problems for use with this course. The software provides hints and suggestions about how to solve problems.
JCE: Software General Chemistry Collection CD, by the Editors of Journal of Chemical Education: Software, Madison, WI. This software package has several different simulations and tutorials that will help you understand the material better.
How to Survive (and Even Excel in) General Chemistry, by Kean and Middlecamp, McGraw-Hill, 1994.

Grades

This course has many features designed to help you learn chemistry, however, none of these activities or materials can learn for you. Learning is something only you can do. You should plan on thinking about chemistry every day and the structure of this course should help you do this.

Activity	*Points*
In-Class Assignments (6 @ 5 pts)	30
Workshop Activities (14 @ 10 pts)	130
Power Point Presentation (1 @ 20 pts)	20
Homework (10 @ 10 points each)	100
Exams (4 @ 100 pts, 1 Final Exam @ 150 pts)	550
Total	**830**

Grade Assignments

Final grades will be assigned on the scale shown below.

A	90% and above	750 points and above
B	80 – 89%	665 – 749 points
C	70 – 79%	580 – 664 points
D	60 – 69%	500 – 579 points
F	0 – 59%	0 – 499 points

If you earn 755 points, you are guaranteed an "A" regardless of how many other students earn an "A". The process is similar for the other point totals. You are competing against this scale, not against your classmates. Therefore, you may work with other students to learn the material covered in this course.

Withdrawing From This Course

You may withdraw from a course and receive a grade of W up to and including March 9. After that date you may not withdraw. See the 2003-2004 Undergraduate Catalog (http://www.catalog.uab.edu/show.asp?durki=58298) for the full text of this policy.

Students with Disabilities

Students with disabilities should contact their course Professor as soon as possible at the beginning of the semester to make arrangements to accommodate their disabilities. This applies to lecture, recitation, and laboratory aspects of this course.

The Parts of the Course

Textbook

You should read the textbook prior to lecture (use the course schedule as a guide for chapters to read before class). After a lecture, you should reread the assignment and study the appropriate pages in the textbook. For each chapter, the textbook contains an outline, a list of objectives, a summary of keywords, example problems, and exercises. You should use this resource to complete your understanding of the material outlined in the lecture.

CH 115 Home Page

This course home page can be accessed from http://www.chem.uab.edu/march/GenChemWeb/instruct.htm. This site includes all the course information and links to other sites. It will also contain PDF files of activity sets, sample exams, current exams, and other materials for the course as the course progresses during the term. Monitor the home page for the latest course information.

Lectures

During lectures, I will discuss principles, outline goals, and present illustrations and demonstrations. You will want to take notes during the lecture. This process should be an active process where you think about what you hear, see, and do during class. Your notes should reflect your understanding of the material and should not be a repetition of what I said. I have several different strategies to help you become an active participant in the lecture. You will be asked to discuss parts of the lecture with your classmates and summarize the discussion or you will be given a short problem to solve for which you will have to vote on the correct answer. Your participation in the lecture is expected and required.

Recitation/Workshop Sessions

You **must be concurrently enrolled** in a Recitation/Workshop Session. Recitation/Workshop sections are small groups of students (up to 40 students per section) that are supervised by Teaching Assistants. These sessions will be used primarily to complete the Workshop Activities, but your Teaching Assistant will also lead discussions related to lecture, homework, quizzes, exams, or the laboratory. All sessions take place in the Lower Division Chemistry Undergraduate Technology Facility, CH/GA Annex-259/260. The room contains computers with printers, Internet access, and software for use in this class.

You should be prepared when you arrive at the Technology Facility. Being prepared means that you should have at least tried to work out the homework problems assigned for the most recent lecture, and you should expect to be called upon by your Teaching Assistant to answer questions or discuss the concepts on which they are based. You should also be prepared to ask specific questions of your Teaching Assistant. Your Teaching Assistant is not expected to present a new lecture in recitation or solve homework problems, but rather to lead discussion and interaction among all students present.

Workshop Activities

Workshop Activities will be assigned in each recitation/workshop section. These are longer and more involved than a traditional homework problem. They require that you work in small groups to answer a question that involves more than one concept. A group report will be turned with all members of the group receiving the same grade for the assignment. ***All workshop activities are due at the end of the recitation session for the week indicated in the CH 115 Course Schedule. Exceptions will be announced in class for the entire class.***

In-Class Assignments

There will be short assignments given during the lecture period. These assignments are designed to help you become an active member of the classroom. These assignments will require you to describe material you read in the textbook before coming to class, to restate a concept presented in the lecture in your own words, or to solve a simple problem as part of a group. Thus, you are expected to come to class prepared and ready to participate. ***You must turn in your in-class assignment before you leave. No late papers will be accepted.***

Homework

Problems and problem solving are very important aspects of this course. Studying chemistry (or any science) involves trying to solve both numeric and conceptual problems. There are two types of homework problems included in the course schedule included with this syllabus: graded and suggested.

On-line homework will be submitted over the Internet with a browser-based grading program (WebCT). You may submit your homework for grading any time prior to the due date. You may access the on-line homework by entering the WebCT site (see directions on page 6) and clicking on the "Homework/Quiz" link. The next page will list the available homework and the due dates. Due dates are firm and will not change. ***It is your responsibility to complete these assignments before the due date***, no exceptions. **Note:** You will not have time during recitation to complete the homework set; there are other assignments to be done in recitation.

You are encouraged to form a study group to work on the homework sets. Still, it is important to realize that although you may collaborate with a study group on an assignment, the work you turn in must be your own. The computerized homework sets will generate each student a unique homework set. Thus, your partner's homework will be similar, but not identical.

You may contact Dr. March if you feel that any on-line homework is not being graded properly. When you email Dr. March, you MUST include the name of the on-line homework, the attempt number, the problem number, and any relevant information regarding the problem that makes you think your answer is better than the one given in the on-line homework.

Other suggested homework has been listed in the course schedule at the end of this syllabus for you to practice your problem solving ability. *Suggested problems are typical of those that you should master; similar problems are likely to appear on exams and quizzes regardless of whether or not the material has been covered in the lecture.*

Examinations

There will be five exams given during class period in CHEM 101 **on the following dates: Monday, January 26; Monday, February 16; Monday, March 8; Monday, April 5; and Monday, April 19.** Each exam is worth **100 points**. Examinations will include questions based upon lecture, homework, and recitation workshop material. The course grade is based on the best four hour exams (out of the five given). However, you can earn a 5 pt bonus if you take all five hour exams and score above 60% on all five exams.

The CH115-1A Final Exam is scheduled for **Friday April 30** at 8:00-10:30 AM in CHEM 101. The Final will cover all of the material covered in your class and is worth **150** points.

You must take the exams in the lecture section that you are registered, no exceptions. No make-up exams will be given.

Power Point Presentations

The last recitation/workshop/laboratory session will be devoted to a PowerPoint presentation that will focus on a visual and oral presentation by each learning team of some aspect of your work in general chemistry that has positively impacted your learning of chemistry. The topic of the presentation can be that team's favorite (a) laboratory activity, (b) concept learned, (b) processes developed, (c) web sites used, or (d) skills acquired during the current semester of General Chemistry.

It is *not acceptable* to simply state an equation or concept. You should present a topic that it is interesting to your classmates and instructor. The presentation should communicate one of the following aspects of the topic you have chosen:

- Why is the topic important to your health, to the development of new products, to your everyday comfort?
- Is there an interesting historical account of the discovery of the relationship or concept?
- Did you have a unique approach to understanding the topic (or solving the problems associated with the topic)?
- Any other interesting approach is encouraged.

You should limit the topic to one that can easily be covered in less than 10 minutes. Many topics are too large to be covered in a short presentation, but do not limit the topic so much that you do not provide any interesting information. Discuss your topic with your Teaching Assistant and other groups to ensure that the topic is interesting, relevant, and focused.

The presentation must be done in PowerPoint. This program is available in the Chemistry Technology Center. You may develop your topic at home if you have PowerPoint and bring the presentation to class on a disk. A projector is available in the Technology Center for class presentations.

A well focused presentation will generally follow the outline shown below:

Title(include your names)
Abstract (short synopsis of the content of the poster)
Introduction (presents the reason for selecting the poster topic, orients the reader to the problem or topic, and outline background information including any relevant equations)
Discussion
References (cite literature, textbooks, web sites, etc. used)

Classmates, teaching assistants, and course instructor will review the posters and presentations, ask questions, and assign a grade using the following grading scheme.

Chemical Content (4 points possible)
(2) very little chemistry is presented
(3) underlying chemical principles are introduced, but not explained
(4) underlying chemical principles are used to clearly, and throroughly explain subject

Level of Material (2 points possible)
(1) average
(2) high (the topic covers material that required extensive research into the *chemistry* presented)

Accuracy of information presented (3 points possible)
(2) some errors in the chemistry (or in the presentation of the chemistry)
(3) no errors are present

Appearance of the Presentation (3 points possible)
(1) attractive, but too many distracting noises or effects
(2) attractive and organized
(3) professional-looking

Amount of Material on Presentation Slide (2 points possible)
(1) amount of content on each screen was inappropriate
(2) amount of content on each screen is acceptable

Oral Presentation (3 points possible)
(2) read from poster, sheet, or notecard
(3) overview and highlights presented in a professional manner

Ability to Answer Questions (2 points possible)
(1) additional knowledge was demonstrated, but explantion was not clear
(2) additional knowledge was clearly demonstrated

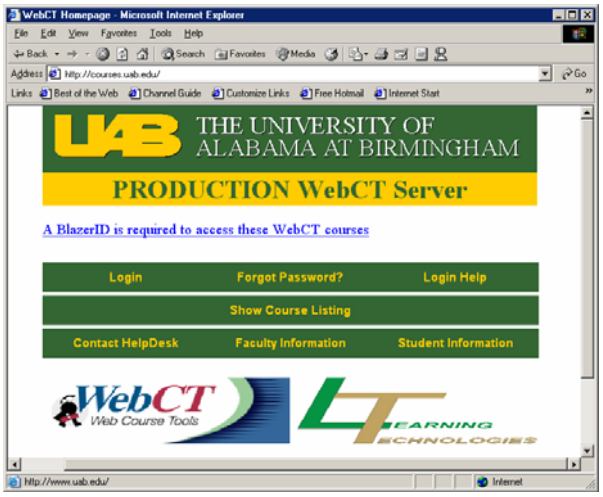
Evidence of a Team Effort (1 point possible)
(0) unclear how well the group worked together
(1) clear evidence of a team effort

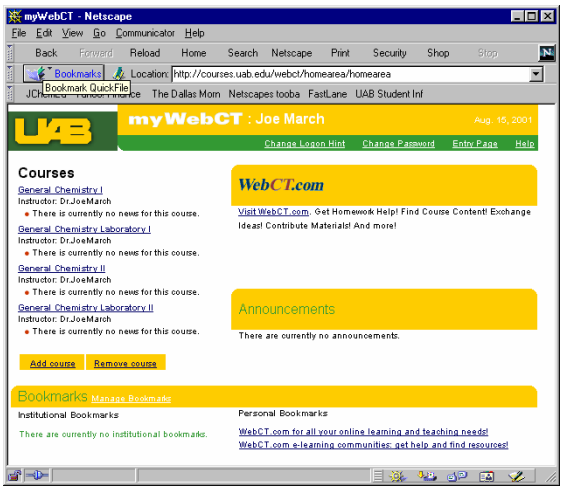
WebCT

To access the WebCT site for CH 115. You can access the On-line Quizzes by using a browser (Internet Explorer or Netscape) at http://courses.uab.edu and following the instructions defined on the courses' web site. Your WebCT accounts are administered through the Learning Technologies Division of Lister Hill Library, not by the Department of Chemistry. Please contact the Lister Hill help desk at 205.934.0422 or HelpDesk@lister2.lhl.uab.edu for help gaining access to WebCT. A frequently-asked-questions page is also available at http://www.uab.edu/learntech/faqwebct.

You should log on to WebCT as soon as possible to ensure that you have access to course materials.

When you access http://courses.uab.edu you should see the PRODUCTION WebCT Server screen (left screen-shot below). To begin, just click on Login. Your Login ID is the same as your BlazerID, and your password is the password that is associated with your BlazerID (probably the same login and password you use to register with on ACCESS). You will then be presented with "myWebCT" screen (right screen-shot below). All of the courses for which you are registered that use WebCT will be listed on the left. You will need to click on General Chemistry I to find on-line homework and grades.





Tutors

Some students may want to hire a tutor for one-on-one or small group assistance outside of regularly scheduled class periods. A list of people willing to provide additional paid assistance with your studies in this course will be available from the Chemistry Department office. If you make an "A" in this course, you can add your name to this list for the following semester.

E-mail

The University administers a course email address for instructors to send email messages to an entire class. These messages are sent to your email account "blazerID@uab.edu". It is not a requirement that you use this uab.edu account, but you should make sure that you let the university know which email account you use on a regular basis. You can do this by looking yourself up going to the UAB Electronic Phonebook at http://www.dpo.uab.edu/cgi-bin/bp/main.cgi and selecting "Change Information." Input the email address you normally check into the field "Real, host-based e-mail address:"

Student Board of Directors

I would like to form a Student Board of Directors for this course so that I can obtain feedback from students. The Board will meet with me on a weekly schedule to discuss course policies and content.

The board will consist of volunteers from each section. There will be no extra credit given for serving on the Board. If you are interested in participating on the Board, please indicate when you are available to meet with me on your student information sheet.

Working with Your Classmates*

You will be assigned to a work group during the first lecture. You will work within this group during the recitation periods to complete challenge problems and assignments.

Education research has shown that group experience has these benefits:

- both you and the other members of your group will understand the material better.
- cooperative group work is an effective means for teaching/learning science (and almost any other subject) and can help increase the depth of your understanding.
- the more often you explain something to a group mate, the better you understand the concept yourself.
- for those times when you find yourself clueless (it happens to all of us from time to time), group work gives you the opportunity to have someone besides your teaching assistant or professor explain the concept to you. Sometimes your group mates will have a common experience that will make a great memory association or analogy for you that none of the staff have access to. This means there are benefits for all group members if the group is functioning properly.

Although most humans are by nature social creatures, cooperative group work is not something that comes without effort. Such group activities require that a sense of trust be built between members, as well as a feeling of shared responsibility. This means a responsibility to carry your own weight in the group, as well as a responsibility to all of the other members of the group. In such a case, no one group member gets frustrated and rushes on ahead of the group and the group NEVER leaves any of its members behind. This may not always be easy. What do you do when you have someone in your group that you don't like? Or who doesn't like you? How do you deal with group members who refuse to help you out when you are confused?

Some words of advice:

- Slow down and remember that your group members are just as new at this as you are. Learning to be a member of the group, rather than a competing individual, in the learning process is a new experience for nearly everyone in this group.
- Secondly, group work should be seen as a professional experience, not a time for making social contacts. It does not matter whether or not your group mates are the kind of people you would most likely choose to spend a Friday night with. You will find that you can still work with these individuals.
- Finally, remember that in group work we expect all group members to take responsibility for keeping all of their group mates up to speed and to take personal responsibility for contributing everything they are capable of. "The whole is equal to the sum of its parts;" this is especially true when working in groups.

Very rarely do we find a group that actually cannot work. What we do find are groups with members who are not communicating effectively. If you think your group is having problems, sit down and talk things over as a group. Agree on some basic rules of conduct and responsibility within your group, and make a commitment to each other. Then try again. If you find you are still having problems, you may need help from someone with an "outside" perspective. Make an appointment when your entire group can meet with your TA or professor to talk things over. Don't let problems linger or fester, but do try to work things out among yourselves first.

Most of all, relax and enjoy interacting with some new kinds of people. Think of this as preparation for the "real" world. You will be required to work closely with people in many different settings. You will not always like all of those people, but you may find that you enjoy interacting with people who are very different from you. Relax, enjoy yourself, and have fun exploring the world around you.

Group Work vs. Individual Responsibility

At certain times you will be requested to hand in group reports. It is your responsibility as a group to ensure that everyone whose name is on the report participated equally in preparing it.

Collaboration is encouraged. After all, two (or more) heads really are often better than one. However, ***simply copying a friend's or classmate's ideas or answers is not acceptable.*** In order to distinguish between collaboration and copying, unless the assignment specifically states that a group report can be turned in, when you study/work with a group write the answers in your own words. Do not have a standard answer that everyone writes down. This will avoid confusion on the part of the graders.

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* The "Groups in the Laboratory" section is adapted from "Comments on Working In a Group," Experiences in Cooperative Learning, Institute for Chemical Education. Originally adapted from a biology lab manual by Dave Eichinger, Purdue University.

CH 115 Course Schedule

Week (beginning date)	Lecture Material	Recitation Workshop	Homework
1 (January 5)	Atoms and Elements (Ch. 2)	Comprehensive Chemistry: General Chemistry: Elements and Nomenclature	Chapter 2- 18,20,27,29,33,37,42,46,48,50,56,59,69,73, 78,82,84,91,97,99
2 (January 12)	Chemical Compounds (Ch. 3)	**Workshop 1**: Chemical Compounds and the Mole Concept	Chapter 3 - 3,6,10,16,17,20,22,28,31,33,34,38,41,44,48, **On-Line Homework 1** (Ch. 2) (due January 18th)
3 (January 19)	Monday, Jan. 19 –Martin Luther King, Jr. Holiday; NO CLASS Chemical Compounds (Ch. 3)	**Workshop 2:** MOCK EXAM	Chapter 3-50,54,57,62,66,70,73,78,82,94,95,99,105, 107,111,115,120,122,124 **On-Line Homework 2** (Ch. 3) (due January 25th)
4 (January 26)	Monday, Jan. 26 **– EXAM 1** (Ch. 2 & 3) Quantities of Reactants and Products (Ch. 4)	**Workshop 3**: Reactants and Products Comprehensive Chemistry: General Chemistry: Chemical Reactions	Chapter 4 - 1,4,8,9,16,20,22,27,30,32,39,41,45,49,51, 54,56,59,63,65,67,69,70,73,75,79,85,88,90,91
5 (February 2)	Quantities of Reactants and Products (Ch. 4) Chemical Reactions (Ch. 5)	**Workshop 4**: Common Types of Chemical Reactions Comprehensive Chemistry: General Chemistry: Chemical Reactions	Chapter 5 – 2,8,12,18,19,21,23,27,31,33,34,37,39 **On-Line Homework 3** (Ch. 4) (due February 8th)
6 (February 9)	Chemical Reactions (Ch. 5)	**Workshop 5**: MOCK EXAM	Chapter 5 – 41,43,44,47,48,51,56,60,64,66,68,72 77,80,83,85,88,89,93,96,101,105,107 **On-Line Homework 4** (Ch. 5) (due February 15th)
7 (February 16)	Monday, Feb. 16 – **EXAM 2** (Ch. 4 & 5) Energy and Chemical Reactions (Ch. 6)	**Workshop 6**: Energy and Chemical Reactions	Chapter 6 – 3,14,16,24,27,29,33,36,40,44,48,51,54,58, 62,63,66,69,74,76,78,82,86,88,92,95,99,104,115,123,128 **On-Line Homework 5** (Ch. 6) (due February 22nd)
8 (February 23)	Energy and Chemical Reactions (Ch. 6) Electron Configurations and the Periodic Table (Ch.7)	**Workshop 7**: The Structure of Atoms and the Periodic Table Comprehensive Chemistry: General Chemistry: Orbitals and Electrons	Chapter 7 – 1,2,6,8,9,12,14,19,27,29,33,38,41,45, 51,53,57,61,64,65,67,73,75,77,81,83,87,89,92,93,99
9 (March 1)	Electron Configurations and the Periodic Table (Ch.7)	**Workshop 8**: MOCK EXAM Comprehensive Chemistry: General Chemistry: Solutions and Solubility	Chapter 7 – 101,103,11015,108,111,113,117,119,121 124,128,131,135,137,141,143,144 **On-Line Homework 6** (Ch. 7) (due March 7th)
10 (March 8)	Monday, Mar. 8 – **EXAM 3** (Ch. 6 & 7) Covalent Bonding (Ch. 8)	**Workshop 9**: Covalent Bonding	Chapter 8 – 1,3,4,5,6,7,8,13,15,21,23,27,29,33,35,41,43, 46,49,53,55,57,60,65,67,68,72,78,80,86

	March 9 – **Last Day to Drop with a W**		
11 (March 15**)**	Covalent Bonding (Ch. 8) Molecular Structures (Ch. 9)	**Workshop 10**: Molecular Structures	Chapter 9 – 1,2,4,5,7,8,10,11,14,16,17,19,21,25,27,33, 35,37,39,40,45,47,49,51 **On-Line Homework 7** (Ch. 8) (due March 28rd)
12 (March 22)	**SPRING BREAK**		
13 (March 29)	Molecular Structures (Ch. 9)	**Workshop 11**: MOCK EXAM	Chapter 9 –53,55,56,58,59,64,67,68,75,86,88,89,92, **On-Line Homework 8** (Ch. 9) (due THURSDAY, April 1)
14 (April 5)	Monday, April 5 – **EXAM 4** (Ch. 8 & 9) Gases and the Atmosphere (Ch. 10)	**Workshop 12**: Gases and the Kinetic Molecular Theory Scheduled Power Point Presentations	Chapter 10 – 1,2,5,6,8,12,14,21,23,27,35,36,41,45,48,50, 55,57,66,69,72,77,100,102,107,108,110 **On-Line Homework 9** (Ch. 10) (due April 11th)
15 (April 12)	Liquids, Solids, and Materials (Ch. 11)	**Workshop 13**: Liquids, Solids, and Materials Scheduled Power Point Presentations	Chapter 11 – 1,2,3,5,6,8,9,12,14,15,19,24,25,31,32, 35,43,45,47,52,60,63,65,74,78,82,86,90 **On-Line Homework 10** (Ch. 11) (due April 18th)
16 (April 19)	Monday, April 19- **EXAM 5** (Ch. 10 & 11) Fuels, Organic Chemicals and Polymers (Ch. 12)	Scheduled Power Point Presentations	Chapter 12 – 1,15,16,17,22,32,35,37,39,45,47,49,53, 60,62,71,80,83,85,86,90,92
17 (April 26)	**CH 115-1A** on **Friday, April 30, 8:00-10:30 AM in CHEM 101**; Comprehensive		

CHAPTER LEARNING OBJECTIVES

Chapter 2 – Atoms and Elements

Once this chapter material has been covered, the student should be able to:

1. Calculate the atomic weight of an element from isotopic abundances
2. Cite Avogadro's number and relate this number to the mole concept
3. Using the molar mass and Avogadro's number, calculate the mass of an atom in grams.
4. Calculate the number of atoms or moles present in a sample of an element.
5. Given the percent purity and mass of a sample, calculate the amount of pure element present.
6. Given a Periodic Table, identify groups and periods of elements.
7. Given a Periodic Table, classify given elements as metals, nonmetals or semimetals (metalloids).
8. Given a Periodic Table and a symbol of an element, locate the atomic number of any element and calculate the number of protons and neutrons in a neutral atom of that element.
9. Determine the number of electrons, protons, and neutrons in an atom or ion, given the atomic number and mass number of that atom or ion.
10. Define isotope and give the mass number and number of neutrons for a specific isotope.
11. Define the term *ion*. Given an ion of any element, calculate the number of protons and electrons in that ion.
12. Explain the difference between an atom and an ion.

Chapter 3 - Chemical Compounds

Once this chapter material has been covered, the student should be able to:

1. Distinguish between molecular, condensed, and structural formulas
2. Name binary molecular compounds.
3. Write structural formulas for and identify alkane constitutional isomers.
4. Determine whether an element will form a positive ion or a negative ion.
5. Memorize the symbols, charges, and names of the common polyatomic negative ions and common positive ions and be able to write the name and formulas of the ionic compounds formed by combinations of these ions.
6. Define the terms *ionic compound* and *molecular compound* and describe their properties.
7. Given the formulas of a cation and an anion, write the formula for the ionic compound of these ions.
8. Given the formula of a substance, determine its formula weight or molecular weight.
9. Using the molar mass and Avogadro's number, calculate the mass of an atom or molecule in grams.
10. Calculate the number of atoms, ions, or molecules present in a sample, given the molecular formula or formula unit of the sample.
11. Given the percent purity and mass of a sample and the formula of the compound contained in the sample, calculate the amount of pure compound or specified element present.
12. Given the formula of a compound, determine the percent composition of the compound.
13. Given the masses of elements in a known mass of compound, or given its percentage composition, determine the empirical formula of the compound.
14. Determine the molecular formula, given the empirical formula and the molecular weight of that substance.
15. Name simple binary compounds.
16. Name simple binary acids.
17. Name the common oxoacids and their corresponding ternary salts.

Chapter 4 – Quantities of Reactants and Products

Once this chapter material has been covered, the student should be able to:

1. Balance simple chemical equations by inspection.
2. Use the techniques of stoichiometry, including percent purity and percent yield, to calculate the mass of a particular substance produced or used in a chemical reaction when given the amount of one other substance.
3. Identify general reaction types: combination, decomposition, displacement, and exchange
4. Determine the limiting reagent in a reaction.

Chapter 5 - Chemical Reactions

Once this chapter material has been covered, the student should be able to:

1. Given a molecular or formula unit equation, write the corresponding net ionic equation and *vice versa*.
2. Given a chemical equation, classify it as metathesis, acid-base (neutralization), or displacement (oxidation-reduction).
3. Given a chemical formula, classify the compound as either a strong, weak, or non-electrolyte.
4. Given the formula of an acid or base, classify it as strong or weak.
5. Given the formula of a substance, classify it as soluble or insoluble in water.
6. Write a balanced chemical equation and identify soluble and insoluble products when two solutions are mixed, given a table of solubility rules for ionic compounds in water.
7. Given the chemical equation for a possible metathesis reaction, predict whether the reaction will proceed as written.
8. Given the reaction between a carbonate, sulfide, or sulfite and an acid, write the molecular and net ionic equations.
9. Given an acid and a base, write the molecular equation and then the net ionic equation for the neutralization reaction.
10. Given a compound and the Periodic Table, apply the rules and conventions used for assigning oxidation numbers to each atom in the compound.
11. Given the chemical equation for a possible displacement reaction and an Activity Series Table, predict whether the reaction will proceed as written.
12. Calculate the concentration of the solute in units of molarity when given the mass of solute and mass or volume of solution.
13. Calculate the volume of solution of known molarity required to make a specified volume of solution with different molarity.
14. Given the chemical equation, calculate the volume of solution of known molarity of one substance that just reacts with a given volume of solution of another substance.
15. Calculate the mass of one substance that reacts with a given volume of known molarity of solution of another substance.

Chapter 6 – Energy and Chemical Reactions

Once this chapter material has been covered, the student should be able to:

1. Discuss the difference between kinetic and potential energy
2. Recognize and use the thermodynamic terms: system, surroundings, heat, work, temperature, thermal equilibrium, exothermic, endothermic, and state function.
3. Use specific heat capacity and the sign conventions for energy transfer.
4. Distinguish between the change in internal energy and the change in enthalpy for a system.
5. Use thermochemical equations and derive thermostoichiometric factors from them.
6. Use the fact that the standard enthalpy change for a reaction, ΔH^{o}, is proportional to the quantity of reactants consumed or products produced when the reaction occurs.
7. Understand the origin of the enthalpy change for a chemical reaction in terms of bond enthalpies.
8. Apply Hess's law to calculate the enthalpy change for a reaction.
9. Use standard molar enthalpies of formation to calculate the thermal energy transfer when a reaction takes place.

Chapter 7 – Electron Configurations and the Periodic Table

Once this chapter material has been covered, the student should be able to:

1. Explain electromagnetic radiation in terms of wavelength (**8**), frequency (**<**), and energy.
2. Explain why macroscopic principles do not apply to atomic systems.
3. Distinguish between orbits and orbitals.
4. Draw and identify the characteristic shapes for s, p, and d orbitals.
5. Define the quantum numbers n, l, m_l, and m_s and relate these to energy, size, and shapes of orbitals.
6. Given an orbital diagram or electron configuration, decide whether it is permissible according to the Pauli exclusion principle.
7. Draw ground state energy level diagrams for hydrogen and non-hydrogen atoms.
8. Given a Periodic Table, determine the electron configurations in the nl^x form for atoms and ions of the elements in the first three periods.
9. Given the symbol for an atom, the symbol and charge for an ion, and the Periodic Table, write the valence shell electron configuration and orbital diagram for that species.
10. Explain the aufbau "building-up" principle.
11. Distinguish between paramagnetic and diamagnetic elements.
12. Correlate electron configurations of the elements with their placement within the Periodic Table.
13. Explain the concept of chemical periodicity.
14. Define the terms groups and periods.
15. Explain the trends in atomic size as one traverses a period and as one descends a group of elements.
16. Define the energy process associated with ionization.
17. Explain the trends in ionization energy as one traverses a period and as one descends a group of elements.
18. Differentiate between first, second, and third ionization energies and processes.
19. Explain the trend in ionic size of cations.
20. Define the energy process associated with electron affinity.
21. Explain the trend in electron affinity as one traverses a period and as one descends a group of elements.
22. Explain the trend in ionic size of anions.
23. Define the concept of electronegativity.
24. Explain the trends in electronegativity exhibited in periods and in groups.

Chapter 8 - Covalent Bonding

Once this chapter material has been covered, the student should be able to:

1. Define the term covalent bond.
2. Given the formula for a molecule or polyatomic ion, determine the number of regions of high electron density about the central representative element atom.
3. Given the formula for a molecule or polyatomic ion, write an acceptable Lewis dot structure for that species.
4. Recognize molecules that can have *cis-trans* isomerism
5. Predict bond lengths from periodic trends in atomic radii
6. Relate bond energy to bond length.
7. Use bond enthalpies to calculate the enthalpy of a reaction.
8. Define the term *resonance hybrid.*
9. Given the formulas for simple polyatomic ions or molecules that exhibit delocalized bonding, write the resonance structures.
10. Define the term *polarity.*
11. State the general rule that classifies the bond between two atoms as nonpolar, polar, or ionic based upon the difference of electronegativity, ΔEN, of the two atoms.
12. Given the electronegativities of the atoms, arrange a series of bonds in order by polarity.
13. Explain why there are exceptions to the octet rule.
14. Use formal charges to compare Lewis structures.
15. Describe bonding and constitutional isomerism in aromatic compounds.

Chapter 9 - Molecular Structures

Once this chapter material has been covered, the student should be able to:

1. Recognize the ways that the shapes of molecules are represented by models and on a printed page.
2. Explain the basic idea of the *valence-shell electron-pair repulsion* (VSEPR) model.
3. Given the formula for a molecule or polyatomic ion, predict the geometrical shape of that molecule or ion using VSEPR theory.
4. Given the structural formula for a complex molecule or polyatomic ion, predict the approximate bond angles about specified atoms in the species.
5. Given the formula for a molecule or polyatomic ion, predict the relative polarity of the species.
6. Assign hybrid orbital type to the central atom in a given representative element compound.
7. Use noncovalent interactions to explain melting and boiling points.
8. Discuss the nature of chiral molecules and enantiomers.

Chapter 10 – Gases and the Atmosphere

Once this chapter material has been covered, the student should be able to:

1. Discuss the general properties of gases
2. Discuss the relationship between V, P,T, and n of a gas
3. Use the combined gas law to determine V, P, or T given the values for the other variables.
4. Carry out calculations based on the ideal gas equation, i.e. manipulation of PV = nRT to incorporate molecular weight determination and density of a gas.
5. Calculate the quantities of gaseous reactants and products involved in chemical reactions.
6. Carry out calculations using partial pressures of gases in gas mixtures.
7. Determine the partial pressure of a gas collected over water at a given temperature.
8. Interpret the bulk properties of ideal gases in terms of the kinetic molecular theory.
9. Discuss how real gases differ from ideal gases.
10. Describe the main chemical reactions occurring in the atmosphere.

Chapter 11 – Liquids, Solids, and Materials

Once this chapter material has been covered, the student should be able to:

1. Describe viscosity, surface tension, cohesive and adhesive forces, evaporation, vapor pressure of a liquid and its boiling point, normal boiling point, evaporation, and condensation in terms of the kinetic molecular theory and the concept of intermolecular forces of attraction.
2. Define specific heat, Joule (calorie), heat of vaporation, and heat of condensation.
3. Calculate the energy associated with vaporization and fusion.
4. Describe the changes of phase that occur between solids, liquids, and gases.
5. Classify intramolecular and intermolecular forces in solids and liquids.
6. Given a phase diagram for a substance, identify the phase present at a specified T and P.
7. Explain the unusual properties of water.
8. Do calculations based on knowledge of simple unit cells and the dimensions of atoms and ions that occupy positions in those unit cells.
9. Explain metallic bonding and how it results in the properties of semiconductors.
10. Explain the bonding in network solids and how it results in their properties.
11. Explain how the lack of regular structure in amorphous solids affects properties.

Chapter 12 – Fuels, Organic Chemicals, and Polymers

Once this chapter material has been covered, the student should be able to:

1. Identify major organic chemicals of industrial and economic importance.
2. Name and draw the structures of three functional groups produced by the oxidation of alcohols.
3. Name and give examples of the uses of some important alcohols.
4. List some properties of carboxylic acids, and write equations for the formation of esters from carboxylic acids and alcohols.
5. Explain the formation of polymers by addition or condensation polymerization; give examples of synthetic polymers formed by each type of reaction.
6. Draw the structures of the repeating units in some common types of synthetic polymers and identify the monomers that form them.
7. Identify or write the structures of the functional groups in alcohols, aldehydes, ketones, carboxylic acids, esters, and amines.
8. Illustrate the basics of protein structures and how peptide linkages hold amino acids together in proteins.
9. Differentiate among the primary, secondary, and tertiary structures of proteins.

CH 116
General Chemistry Laboratory I
Spring 2004

Laboratory Coordinator

Dr. Joe March
CHEM 286
205.934.8788
march@uab.edu

Teaching Assistants

(Write down your TAs' names and email addresses.)

Materials

Required

- **Laboratory Experiments for Chemistry 116/118, Department of Chemistry, Thomson Learning**
- **Carbon-less copy notebook**
- **Materials packet (purchased from stockroom)**

Suggested

- **General Chemistry textbook**. You should have a General Chemistry textbook available to you. Many of the experiments encountered will not have a complete background included because you are expected to either know the material or easily find the material in a General Chemistry text.
- **Basic scientific calculator**

Weekly Schedule

1. Read the Experiment for the Week.
2. Outline the experiment and discuss the schedule of work with your lab group.
3. Take the Pre-Lab Quiz.
4. Pay attention and take notes during the Pre-Lab Lecture.
5. Complete the Data Collection.
6. Outline responsibilities for reporting your work.
7. Show the outline to your Teaching Assistant.
8. Work outside of laboratory on the report.
9. Submit the report to the Laboratory Instructor and receive a grade.

Laboratory Experiences

The laboratory can be an interesting and enjoyable experience for everyone. It is an opportunity to discover a little bit of knowledge about how the universe works. It is also a place to practice using common laboratory equipment and developing important inquiry and communication skills.

You will be using a laboratory manual that should help you throughout the semester. The manual does not provide a great deal of detail about the upcoming experiment. Instead, it is intended to lead you to design or adapt an experiment to achieve an outcome. Thus, you will need to come to laboratory prepared.

Each week you will be evaluated on a 20-point scale. This scale is described below.

5 pts ***Pre-Lab Preparation/QUIZ:*** You should prepare a summary of the procedure you are going to use in the laboratory in your notebook. This summary should include sample calculations that are representative of those you will have to perform in the laboratory. You are not bound to this procedure—you may adapt the procedure as the experiment proceeds and you see the need to change your plans. You can use your notebook during this quiz (but NOT the laboratory handout).

Immediately at the beginning of the laboratory period you will take a quiz on the upcoming laboratory. Students who miss the quiz at the beginning of the laboratory period for ANY reason will receive a zero (NO make-ups, NO exceptions). The quiz will ensure that you are able to efficiently perform the laboratory.

10 pts ***Participation:*** You will be awarded these points when you arrive to the laboratory on time and actively participate during the laboratory period. Leaving early or passively watching others work will not earn these points. As part of your participation you will be required by the TA to turn in a carbon-copy of data collected during the lab. Failure to turn in a copy of your work will result in a deduction of these points.

5 pts ***Post-Lab Report:*** You are expected to type a report. Reports are due at the beginning on the next laboratory period. ***No late reports will be accepted, no exceptions.*** Points will be awarded using a low-resolution scale. The TAs will read the report and provide comments, and finally assign a *whole* number grade: 5 (excellent), 4 (good), 3 (poor), 2 (submitted but unacceptable). MOST reports will receive a grade of 4. Your report must be *excellent* to receive a 5. If you receive a 3 or 2, you should discuss your report with your TA immediately to identify ways that you can improve your communication skills.

Laboratory Exams

You will be required to take two written exams during your scheduled laboratory time during the weeks of March 1 and April 19. The exam will cover material related directly to the laboratory and may cover specific calculations, concepts, or procedures. You may be asked to predict the outcome of a proposed experiment on the basis of your experiments in the laboratory. Therefore, it is suggested that you maintain a laboratory notebook throughout the semester. The notebook should outline the procedures and calculations, plus include relevant observations about how different variables affect the outcome of your experiments. Take notes during the laboratory experience that will help you remember what went on and what you observed.

If you miss a laboratory exam you must notify your TAs of your absence by email within 24 hours of the beginning time of your scheduled lab section if you plan to take a make-up exam. To be eligible to take a make-up exam you must present proof for a valid absence at the scheduled make-up exam times listed below.

Mid-Term: Monday, March 8 6:45 a.m. CHEM 307
Final: Monday, April 26 6:45 a.m. CHEM 307

If you miss the scheduled make-up exam, you will receive a zero, no exceptions.

Safety

Your safety in the laboratory is very important to everyone involved in administrating this course. A large amount of effort goes into making each experiment safe for all of the students in the laboratory. Still, unexpected problems occasionally arise--a beaker is dropped, a hot piece of glass is picked up, or the wrong reagent is poured into a reaction flask. These events can cause serious injury to anyone close to the accident.

Note that the last sentence says "anyone close to the accident." This statement implies three things. First, any accident you have can cause injury to yourself; second, any accident you have can injure someone else; and third, any accident your neighbor (or TA, or instructor) has can injure you. While some of these accidents cannot be prevented, most accidents can be prevented if simple precautions are taken. Even if the accidents are not prevented, the precautions should protect you from becoming injured.

The precautions and guidelines for safe laboratory practice that are included in the laboratory manual are expected from you every time you enter the lab. Additionally, there will be more specific instructions within each experiment written in the manual and from your Teaching Assistant, the Laboratory Coordinator, or the Instructor.

You will be dismissed from the laboratory when you do not observe any precaution or instruction listed here or given by any of the course administrators. A grade of zero will be recorded for any work not completed prior to the ejection.

Grading Scheme

There will be 11 laboratory assignments and two laboratory exams. Your grade will be based on the best 10 laboratory scores and the two exams. You can earn a 10 point **bonus** by scoring above 70% (14/20) on **all** 11 assignments.

You must attend the laboratory section for which you are registered, no exceptions.

Absence Policy— Due to the grading policy, it is possible that you may miss one laboratory period with no penalty. You will not be eligible for the 10 point bonus if you miss a laboratory period (no exceptions). Students who miss a second laboratory period **for any reason** will receive a zero for the missed work. Students who miss three or more laboratory periods for any reason will receive an F in CH 116.

Week of…		Points
January 5	NO LAB	
January 12	Check-in, Lake Study	20
January 19	NO LAB, MLK Holiday Mon. January 19	
January 26	Density and Graphing	20
February 2	Sugar Solutions	20
February 9	Binary Chemical Reactions	20
February 16	Acid Content of a Commercial Soda	20
February 23	Heat of Reaction	20
March 1	Mid-Term Exam	50
March 8	Determination of Alcohol Content in Wine	20
March 15	Solids and Liquids	20
March 22	NO LAB, Spring Break	
March 29	Colorimetry	20
April 5	Chromatography	20
April 12	Gas Laws	20
April 19	Final Exam	50
Point Total		**300**

Letter Grade Assignments

Letter grades will be assigned according to point totals. A ≥ 270, B ≥ 240, C ≥ 210, D ≥ 180, F < 180. Grades will be available on ACCESS (http://www.uab.edu/access) May 9.