

## ADVANCED GENERAL CHEMISTRY

**Instructor:** Dr. Andrew C. Price  
Room 313B Pfahler Hall  
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**Lectures:** M W F 9:00 – 9:50 A.M. Pfahler 210

**Office Hours:** M W F 10:00 – 10:50 A.M.; M W 3:00 – 4:00 P.M., and by appointment

**Description:** A study of the principles of chemistry. Topics include structure, bonding, stoichiometry, states of matter, inorganic reactions, thermochemistry, and solutions. The mathematical solution of chemical problems will be emphasized. This course must be taken concurrently with CHEM-105LQ.\* Three hours of lecture per week plus one hour of recitation per week at the discretion of the instructor. *Three semester hours.* Note: If you drop CHEM-151, you must also Drop CHEM-151L (the lab course).

**Course Goals:**

- To further develop your general problem-solving skills, especially with the use of the scientific method.
- To increase your knowledge of the basics of chemistry. You will deepen this knowledge in later chemistry courses and will apply it in your study and practice of other areas of science.
- To develop your ability to make connections between the behavior of groups of chemical species at the atomic (molecular) and macroscopic levels.
- To further develop your ability to use chemical concepts to explain everyday phenomena as well as phenomena in other areas of science.
- To further develop your ability to acquire information from a lecture (meeting) format.

**Textbook:** **Required:** Atkins, Peter; Jones, Loretta. *Chemical Principles – The Quest for Insight*, 4<sup>th</sup> Edn., W. H. Freeman & Co., New York, 2008. ISBN-13: 978-0-7167-7355-9

**Suggested:** Krenos, John; Potenze, Joseph; Lavelle, Laurence; Ma, Yinfa; Hoeger, Carl. *Student's Study Guide and Solutions Manual*, W. H. Freeman & Co., New York, 2008. ISBN-13: 978-1-4292-0099-8

## Grading and Approximate Grades:

	<u>Points</u>
Quizzes (5 x 20 pts. each)	100
Exams (3 x 100 pts. each)	300
Final Exam	200
TOTAL	600

<u>Grade</u>	<u>%</u>	<u>Points</u>
A	90 - 100	540 - 600
B	80 - 89	480 - 539
C	70 - 79	420 - 479
D	60 - 69	360 - 419
F	0 - 59	0 - 359

**Attendance:** The following is taken from page 42 of the 2007-08 *Ursinus College Catalog*:

“In keeping with a strong liberal arts tradition that encourages active learning and complete participation in the education process, the college expects students to attend class. Specific attendance policies are set by individual instructors and indicated on the course syllabus at the beginning of each term. Academic warnings will be issued by instructors for all students failing to meet the stated course attendance policies. Excessive absences by first year students and students on academic probation will be reported to the Dean’s office. Students may be dropped from a course with a grade of F for failing to meet the stated policy.”

I will allow 6 absences without a valid excuse from the Dean’s office. However, after your fourth, fifth and sixth absence I may start asking questions and you may receive an academic warning if your performance is below average. Students who miss 7 or more classes without an excused absence will be excluded from the course with a grade of F. In this course we cover a lot of difficult material over a short period of time. You cannot afford to cut class!

**Inclement weather:** In the event of inclement weather that might necessitate the cancellation of a class, please call my office phone and listen carefully to my message machine and/or check your email. In the event of a cancellation, the class will discuss a suitable time to make up the missed material.

**Quizzes and Exams:** There will be 5 quizzes given during the semester, each worth 20 points, which are designed to help you prepare for the exams. Quizzes will be held during the first 20 minutes of the pre-lab lectures starting at 1:30 pm. Failure to take the quiz during this time will result in a score of zero. There are no make-up quizzes.

There will be 3 exams during the semester, each worth 100 points. These will take place in Olin Auditorium at 7:00 – 8:30 pm on the dates indicated on the schedule. These dates will not change. You have 90 minutes to complete each exam. The comprehensive final examination (worth 100 points) covers the work of the entire semester along with an exam (worth 100 points) that will cover the material of last few weeks of the semester.

**Attendance at examinations is required. Make-up examinations will NOT be administered.** Anyone who is absent from an examination will receive the grade “zero” for that exam, except in the

case of an excused absence. A student who is legitimately ill must present a physician's excuse, stating not only that the student was seen by the physician but also that the student's illness made it impossible for her or him to sit for the examination. If a death in the immediate family occurs, documentation must be provided. In cases of excused absence, those sections of the final examination that pertain to material covered in the missed examination will be weighted more heavily. Illness before an exam is generally not considered to be a legitimate excuse as you are expected to keep up-to-date with the material and not allow the bulk of your studying to be done immediately before the exam.

**Regrades** will only be considered during the five days after the exam has been distributed to the class.

**Grades:** Individual exams will not be curved. Instead, you will be assigned an approximate grade based on your cumulative total during the semester. For example, after Exam II, your grade will be based on 260 points (Quizzes I, II, and III and Exams I and II). Before the final exam you will be given an approximate grade based on 400 points. This will give a much better idea of your performance in the course throughout the semester. Please feel free to discuss your grade with Dr. Price at any time during the semester.

**Homework:** Homework assignments will be given on a weekly basis and will be posted on the course website. You are expected to do the homework but it will not be collected nor graded. It has been my experience that students who do not attempt homework problems, or who leave them until the night before a quiz or exam, will not do well in the course! Remember that there is a solutions manual for you to purchase.

**Help:** Although I have regularly scheduled office hours, there may be some of you who have a class at this time and therefore unable to come to them. Don't worry! I will make every effort to help you. You may either make an appointment with me ahead of time, or just show up at my door. If my door is open and I'm not too busy, then I would be more than happy to assist you on the spot! Alternatively, you may e-mail me at [aprice@ursinus.edu](mailto:aprice@ursinus.edu), but please bear in mind that it may be difficult to explain something via e-mail. Although I have 24/7 access to my e-mail, I tend not to use it during the weekends, and I may not have time to access it prior to this class. During the first few weeks of the semester, the Chemistry Department will set up a **Chemistry Help Room** in Pfahler 102. This will be staffed by students (chemistry, biochemistry and biology majors) who have already taken general chemistry and done well in the course. More details about this will be announced soon. Please take the time to look at "Some Friendly Advice on How to Succeed in General Chemistry" that you will find at the end of this syllabus.

**The Fundamentals Section:** I will quickly cover the material in the Fundamentals Section that appears at the beginning of the textbook. It has been my experience that the majority of students have already been exposed to most of these topics in high school chemistry courses. Many of the experiments that you will do in the laboratory course (CHEM-151LQ) require that you review the appropriate sections. Furthermore, we will also have short review pre-lab lectures on the material, and I expect you to do some of the exercises at the end of each section. **Questions on this material will appear on quizzes and exams throughout the semester in this course**, so it is vital that you are familiar with these topics as you prepare for quizzes and exams and prior to writing your lab reports.

**Academic Honesty:** Ursinus College is a small community, which functions on a social contract among students, faculty, administration, and alumni. In order for the spirit of community to endure and thrive, this agreement, based upon shared values and responsibilities and a sense of mutual respect, trust, and

cooperation, must be preserved. Students have an obligation to act ethically concerning academic matters and the faculty has a responsibility to require academic honesty from students and to be vigilant in order to discourage dishonesty. Lying, cheating, stealing, plagiarism, and other forms of academic dishonesty violate this spirit of mutual respect and collaboration and corrode the atmosphere of openness and free inquiry upon which the educational process is based. Such activities are demeaning and potentially damaging to those who undertake them. Moreover, academic dishonesty is damaging to the student body as a whole, in that it cheapens the achievements of the honest majority of students and subverts the integrity and reputation of the institution with which they will be identified for the rest of their lives. Students should be aware that there are many legitimate sources of help available on campus. Several departments, s provide help sessions. There is a writing center run by the Department of English, and the Library provides research help. Tutorial services are coordinated through the Unity House for all disciplines and peer mentoring services are arranged by the Dean's office. The student body, faculty, and administration of Ursinus College therefore unanimously condemn academic dishonesty in all its forms and affirm that it is the responsibility of all members of the college community to prevent such activity.

## **STATEMENT ON PLAGIARISM**

Plagiarism is the act of taking the words--written or spoken-- or the ideas of someone else and passing them off as one's own. You are plagiarizing if you copy exactly a statement by another and fail to identify your source. You are plagiarizing if you take notes from a book, an article, or lecture, express those materials in your own words, and present the result as your work without identifying your source. You are plagiarizing if you copy part or all of a paper written by a friend, another student, or a writing service and offer it as your own work. You are plagiarizing if you take material verbatim from a source (even though the source is acknowledged) without identifying it as quoted material by means of quotation marks. Plagiarism is easy to avoid by using common sense and following the advice and directions for acknowledging sources. Such forms and methods are available from professors and style sheets provided by departments as well as by a composition textbook. Never take notes verbatim or in your own words without using appropriate quotation marks and noting exact sources, including page number of the material. It is the policy of Ursinus College to reject and punish the act of plagiarism. The above has been adapted from, and credit is given to Millward, *Handbook for Writers*, pp. 354-355.

### **For example, you are cheating if you:**

1. Copy answers or use information from a fellow student's paper during a quiz, test, or examination.
2. Divulge answers or information, or otherwise give improper aid to another student during a quiz, test, or examination or accept such aid.
3. Relay or receive any improperly obtained or confidential information concerning a quiz, test, or examination. (Example: if one sees the test before it is to be given and transmits information concerning its contents or whereabouts to other students.)
4. Use or refer to any unauthorized notes, books, calculators, problem solving aids such as "cheat sheets" during a quiz, test, or examination.
5. Collaborate improperly with another student on an open-book or take-home quiz, test or examination; or obtain information from an unsuspecting fellow student during such an exercise.
6. As a proctor or student assistant, divulge confidential information or aid any student in an improper manner during a laboratory exercise, quiz, test, or examination.
7. Commit an act of plagiarism in any form.
8. Borrow under false pretenses, steal or otherwise improperly obtain lecture or research notes,

laboratory data, or any information gathered by another student and presents it as your own work (examples: term papers; laboratory reports or experimental yields; computer programs or assignments; English composition themes), or knowingly collaborate with another student by making such material available to him/her.

9. Falsify laboratory data, notes, results, or research data of any type in any course and present it as your own work.

10. Steal or intentionally damage or destroy notes, research data, laboratory projects, library materials, computer software (including the intentional passing of a computer virus), or any other work of another student (or faculty member), out of malice, or for the purpose of sabotaging that person's work and thereby gaining an unfair advantage to yourself.

11. Knowingly and willingly violate any special rules concerning research procedures, group assignments, or inter-student collaboration, which may be established by an instructor in any course.

12. Submit the same work including oral presentations for different courses without the permission of the instructors involved. Since it is expected that different courses offer different learning experiences, students are depriving themselves of an educational opportunity by submitting the same or similar work for more than one course. Examples include but are not limited to submitting a partial or complete paper previously handed into another class, superficially reworking one assignment for submissions to another class. (Example: submitting a sociology paper as an English 100 paper.)

13. Misrepresent yourself to an instructor or an administrator for the purpose of gaining special favors or extensions for academic work missed. Examples include but are not limited to lying about your health or the health of a relative, forging doctor's notes.

14. Forge signatures on forms, documents, or letters pertinent to College business. This may include but is not limited to course of study sheets, drop/add forms, or doctor's notes.

**You are an accessory to cheating, and penalties may be applied, if you:**

1. Witness or have direct knowledge of any of the aforementioned forms of cheating and fail to inform an authorized person (faculty member, administrator, proctor, or student assistant).

2. You bring unauthorized materials into a testing area and fail to or refuse to remove them when instructed to do so.

3. You fail to or refuse to comply with admonitions from a faculty member or authorized proctor to cease any activity, which might aid other students in cheating.

## **SOME FRIENDLY ADVICE ON HOW TO SUCCEED IN GENERAL CHEMISTRY**

- ❖ Chemistry is a difficult subject for most people: it has always been this way and will always be so.
- ❖ Everyone has the potential, but not necessarily the motivation, to do well in CHEM-151. To receive a good grade in chemistry requires a great deal of hard work and dedication.
- ❖ You cannot afford to miss class, even though you think you may have covered most of the material in high school.
- ❖ Learning chemistry on your own, or by copying from other people's notes, just does not work for many students. You must listen attentively and take notes from your instructor who will probably explain difficult concepts better than the text. He or she may even have a different way of approaching certain topics.
- ❖ Having an instructor go through a problem step by step, pausing periodically to make sure that everyone is following, is far more desirable than struggling through a worked example from the text on your own.
- ❖ It is probably impossible to write down everything that the instructor says or writes on the blackboard, and to understand every piece of information that is presented.
- ❖ For many students the instructor usually goes too fast (or sometimes too slow). Don't worry if you have trouble keeping up! You have a text to refer to, and perhaps friends whose notes you might want to borrow.
- ❖ The notes you take in class may be rough and scribbled, and therefore may be impossible for you to study from. After each class (and remember that you should plan to do 3 or more hours of study for every hour you spend in class) read over your rough class notes and then read carefully the relevant sections in the text. Do not attempt more than 2 or 3 sections at a time.
- ❖ Many students read over the text and use a high-lighter to emphasize definitions, equations, laws, etc. This may work, but you may find that you end up high-lighting most of the text – you may as well soak the entire book in fluorescent yellow ink! There are other ways to study, review and memorize important material from a text book.
- ❖ If your class notes turn out to be messy, why not try re-writing them into a format that you can follow, understand and study from? Use different colored pens for formulas, equations and definitions. This might sound like a waste of time, but by re-writing a chemical equation, re-drawing a diagram, re-working a problem, things will begin to sink in. You are learning as you

go.

- ❖ Why not set up your note book so that the left hand page is for rough notes taken in class, and the right page for “neat” re-written notes prepared on your own with help from the text?
- ❖ After finishing a section, or part of a section, you must attempt some of the suggested homework problems. Do not wait until you have covered the entire chapter. Do as many problems as you have time for, including ones that were not assigned. The more practice you have doing problems, the better you will perform on an exam.
- ❖ There will be times, no matter how hard you try, when some topics will just not make sense. This is the time to seek help from your instructor during their office hours, or from someone in the Chemistry Help Room, or by studying with other students in the class. Learning from one another can be very productive.
- ❖ Before you begin to study for a quiz or exam, make sure you know exactly which chapters and sections you will be tested on. Read over your neat notes again and again, re-do some of the problems, particularly those that you may have got wrong the first time. Make sure you understand everything!
- ❖ There may be an optional review session before each exam. These are designed to help you. However, do not expect to learn everything during one of these sessions and do not use them as a substitute for studying. Don't expect the instructor to go over all the material that will be on the exam. Come prepared to ask and answer questions. You will not get anything out of a review session simply by sitting there writing down everything that the instructor writes on the blackboard, hoping it will be on the exam!
- ❖ Attempt a back exam a few days before the scheduled exam. Do it under exam conditions, in a quiet place where you won't be disturbed, don't take a break, and time yourself. It should take you about an hour. Don't look at the answers until you have completed the entire exam! Grade it yourself and estimate your score. If your score is low and/or you ran out of time, then you need to be better prepared and your time-management skills should be improved.
- ❖ During the “real” exam spend a minute or two looking over the entire exam. Don't dive head first into the first question. It may be the most difficult one on the exam. If you spend too long on it and struggle through it, you will start to panic and you may not do well on the rest of the exam and perhaps run out of time. Find a question that you know you can answer well first. Get off to a good start. Leave difficult questions to the end. If you have time, check over all your work before handing in your exam.

# TENTATIVE SCHEDULE FOR FALL 2007

	<b>Date</b>	<b>Topics</b>	<b>Chapter/Section</b>
Aug.	M 27	Introduction to Advanced General Chemistry	F1 – F5
	T 28	Fundamentals of Chemistry (after lab intro and check-in)	A.1 – A.3; B.1 – B.4
	W 29	Fundamentals of Chemistry	C.1 – C.3; D.1 – D.4 E.1 – E.2; F.1 – F.3
	F 31	Fundamentals of Chemistry	G.3 – G.4; H.1 – H.2 L.1 – L.3; M.1 – M.2
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Sept.	M 3	Atomic structure; EM radiation; atomic spectra	1.1 – 1.3
	T 4	<b>QUIZ I</b> (1:30 pm in pre-lab)	
	W 5	Quanta; photons; wave-particle duality, uncertainty principle; Schrodinger equation; wavefunctions	1.4 – 1.7
	F 7	Wavefunctions; quantum numbers; atomic orbitals; spin	1.8 – 1.10
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	M 10	Orbital energies; electron configurations; periodicity	1.11 – 1.15
	W 12	Periodic properties; inert pair effect; diagonal relationships	1.16 – 1.20
	F 14	Ionic bonding; lattice energies	2.1 – 2.4
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	M 17	Covalent bonding; Lewis structures; resonance	2.5 – 2.7
	T 18	<b>QUIZ II</b> (1:30 pm in pre-lab)	
	W 19	Formal charge; radicals, expanded valence shells; electronegativity	2.8 – 2.12
	Th 20	<b>EXAM I – 7:00 - 8:30 pm – Olin Auditorium</b>	
	F 21	No Class	
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	M 24	VSEPR theory and shapes of molecules	3.1 – 3.2

W	26	Polar molecules; valence-bond theory	3.3 – 3.7
F	28	Molecular Orbital theory	3.8 – 3.11

	<b>Date</b>	<b>Topics</b>	<b>Chapter/Section</b>
Oct.	M 1	Intermolecular forces	5.1 – 5.5
	W 3	Work and energy; heat; 1 <sup>st</sup> law of thermodynamics; enthalpy	6.1 – 6.8
	F 5	Enthalpy changes; reaction enthalpies	6.12 – 6.15

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	M 8	Hess's law; enthalpies of formation; Born-Haber cycle; bond enthalpies	6.16 – 6.20
	T 9	<b>QUIZ III</b> (1:30 pm in pre-lab)	
	W 10	Entropy and disorder; entropy changes; 2 <sup>nd</sup> and 3 <sup>rd</sup> laws	7.1 – 7.4
	F 12	Statistical entropy; standard molar and reaction entropies; Global entropy changes; equilibrium; Gibbs free energy	7.5 – 7.12

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	M 15	<b>FALL BREAK</b>	
	W 17	Gibbs free energy; spontaneity; temperature effects	7.13 – 7.15
	Th 18	<b>EXAM II – 7:00 - 8:30 pm – Olin Auditorium</b>	
	F 19	No class	

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	M 22	Vapor pressure; boiling, freezing and melting	8.1 – 8.5
	W 24	Solubility; enthalpy of solution	8.8 – 8.12
	F 26	Colligative properties	8.14 – 8.17

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	M 29	Binary liquids; distillation	8.18 – 8.20
	T 30	<b>QUIZ IV</b> (1:30 pm in pre-lab)	
	W 31	Equilibrium; extent and direction of reactions	9.1 – 9.5

Nov. F 2 Equilibrium calculations 9.6 – 9.8

Date	Topics	Chapter/Section
M 5	Le Chatelier's principle	9.9 – 9.11
W 7	Acids and Bases; pH	10.1 – 10.6
F 9	Weak Acids and bases; $pK_a$ , $pK_b$	10.7 – 10.12

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M 12	Solubility equilibria	11.8 – 11.10
W 14	Kinetics; rates; rate laws; reaction orders	13.1 – 13.3
F 16	Integrated rate laws; half-lives	13.4 – 13.6

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M 19	Reaction mechanisms; chain reactions; equilibrium	13.7 – 13.10
W 21	<b>THANKSGIVING</b>	
F 23	<b>THANKSGIVING</b>	

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M 26	Temperature effects; collision theory; transition states	13.11 – 13.13
T 27	<b>QUIZ V</b> (1:30 pm in pre-lab)	
W 28	Catalysis	13.14 – 13.15
Th 29	<b>EXAM III – 7:00 - 8:30 pm – Olin Auditorium</b>	
F 30	No class	

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Dec. 18.1 M 3 Aliphatic hydrocarbons; naming alkanes

W 5 Isomers 18.2

F 7 Properties and reactions of alkanes 18.3 – 18.6

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T 11 **FINAL EXAM – 9:00 - Noon – Pfahler 210**