

# Introduction to Chemistry 101

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# Active Learning

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Learning chemistry is not a passive event in which you simply absorb facts given by the teacher like a sponge absorbs water. Learning chemistry requires you to take an active role. In fact, in a very real sense you must construct your own version of chemistry and store it away in a form that is meaningful to you.

We are here to help you in every way we can, but ultimately you bear the responsibility for learning chemistry and making it your own. To do this you must go beyond simple memorization of facts to a real understanding of the concepts of chemistry. We want you to learn to “think like a chemist”—to understand the concepts of chemistry in a way that enables you to solve problems because you understand the fundamental ideas not because you have memorized a particular solution. This is a lofty goal—it is not easy to achieve this kind of understanding. So how do you do it? You do it by

1. listening to (not just hearing) the overview of the concepts given in lecture
2. reading the appropriate sections of the textbook and lecture notes (several times)
3. struggling with homework problems
4. having discussions with your peers and your teachers
5. studying to *learn* instead of studying just to get an “A”



The purpose of **lecture** is not to give a detailed account of a particular topic. Rather the lecturer will give an overview of a topic, showing how a particular topic fits in with previously learned material and why the concept is important. Typically a lecturer will not go over detailed solutions to particular problems but will talk in general terms about how to think through the problems associated with that topic. The lecturer “paints with a broad brush.” Even though there are a lot of other students in lecture with you, you will still be required to take an active role.

The **textbook** is a source of detailed information about a particular concept and about the problems associated with that concept. Understanding the material in the textbook requires repeated readings and thorough study. The text is dense with ideas that require slow, careful consideration. It is a good idea to read the text before coming to lecture, or at least skim the headings and bolded terms in each section.

The **homework** in this course requires you to provide the overall strategy for solving the problems. This will show whether you understand the concepts well enough to think your way through an entire problem with no or minimal hints along the way. Your goal is to master solving each problem with no help by the time you take your exam. If you cannot do this, you are not ready and have not mastered the concepts.

The **discussion** section provides an opportunity for you to interact with other students and the teaching assistant. **This is not a session in which the TA does the homework while you listen.** In fact you should have your homework completed **before** you go to class. You will be expected to assume an active role in your discussion section and collaborate with other students.

The **lab** section provides an opportunity for you to apply some of the chemistry concepts you are learning in lecture and from the text. Through your lab write-ups you have a chance to demonstrate your understanding of chemistry by providing thorough, detailed explanations and answers to lab questions. Your lab TA is there to monitor safety in the lab and help you to fine tune points. **It is not the lab TA's job to provide you with explanations or answers to lab questions that are part of your write-up.** Many of the lab days are actually discussion days, allowing you to interact with others in the class to come to a better understanding of the concepts covered in lecture and in your reading. The TA will be there to facilitate your group discussions, not giving you answers as much as helping you and those in your group ask the right questions as you proceed.

In summary, to learn chemistry effectively requires that you must take an active role. You must take responsibility for participating in the activities described above. We are anxious to help you but we cannot do it for you. We believe in you, now believe in yourself and go for it!

# Chemistry 101 Course Policies

## CHEMISTRY 101A

**Instructor** Gretchen M. Adams  
**Office** 210A Chemistry Annex  
**E-mail** gadams4@illinois.edu  
**Phone** 217.244.8279  
**Office hours** Tuesdays and Thursdays from  
3–4 P.M. (after lecture) and by appointment  
**Website address** www.chem.illinois.edu

## CHEMISTRY 101B

**Instructor**  
**Office**  
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## COURSE INFORMATION

### Times:

#### CHEMISTRY 101A

**Lecture** Tuesday and Thursday:  
2:00–2:50 P.M., 100 NL  
**Lab** Wednesday  
**Discussion** Friday

#### CHEMISTRY 101B

**Lecture** Tuesday and Thursday:  
8:00–8:50 A.M., 100 NL  
**Lab** Wednesday  
**Discussion** Friday

### Required Materials:

**Textbook:** *Introductory Chemistry*, 7th Ed., S. S. Zumdahl and D. J. DeCoste

**Lab manual:** *Chemistry 101 Syllabus and Lab Book*, Fall 2012

**Calculator:** A simple calculator that performs scientific notation.

**Safety goggles:** These can be purchased in the bookstore.

**Lab apron:** This can be purchased in the bookstore.

**Lab notebook:** Any notebook designated for the lab, or college-ruled theme paper.

**Usage fee card:** This can be purchased at the Illini Union bookstore.

**iClicker:** This can be purchased in the bookstore.

### Grading:

Hour exams (3)	300
Final exam	300
Lab write-ups	200
Electronic HW	140
Clicker questions	20
Stoichiometry Workshop	20
TA Evaluation	20
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**Exam Dates:**

There will be three hour exams during the semester. These will be given from 7:00 P.M. to 8:15 P.M. on:

Tuesday, September 25	(Chapters 1, 2, 3.1–3.5, 4, 5, 8, 13.1–13.9)
Tuesday, October 30	(Chapters 6, 7.1–7.4, 9.1–9.4, 13.10, 15.1–15.2, 15.4–15.7)
Thursday, December 6	(Chapters 10.1–10.3, 11, 12, 14.1, 14.3–14.4)

Conflicts for exams must be arranged ahead of time by signing up outside of 105 Chem Annex.

**Final Exam:**

**101A:** Friday, December 14, 7:00–10:00 P.M.

**101B:** Wednesday, December 19, 8:00–11:00 A.M.

The final exam will be cumulative. There is no scheduled conflict for the Final Exam. **Do not** make plans to leave campus before the Chemistry 101 final.

**COURSE DETAILS****Lectures:**

**101A:** Lectures meet each Tuesday and Thursday from 2:00–2:50 P.M. in 100 Noyes Lab.

**101B:** Lectures meet each Tuesday and Thursday from 8:00–8:50 A.M. in 100 Noyes Lab.

The purpose of the lecture is to present main concepts and ideas. The emphasis is on how to think about chemistry. Active participation (asking and answering questions) is required.

**Discussions:**

Discussion sections meet each Friday. This is the time to ask questions of a teaching assistant and to be asked conceptually challenging problems. Active participation is required.

**Laboratory:**

Labs meet each Wednesday. Always bring your textbook, lab manual and calculator to lab. You will perform the experiment or activity and complete as much of the lab write-up as you can before leaving the lab. If you decide to leave the lab early, you must turn in your lab write-up (anything not completed will be given a score of zero). Lab write-ups are due within the first five minutes of your Friday discussion section (or in one case next lab section) or else **NO CREDIT** is given. The exceptions are the Review Questions before each exam. These are due online by the specified due date. We also encourage you to turn lab write-ups in early! Furthermore, you will often perform your lab experiments with at least one other person. While this collaboration is important and helpful, you will submit your *own* lab write-up and write it in your own words. The only way to assess what you learned as an individual is to grade your *own work*! Turning in identical lab write-ups is considered cheating.

**You must be present in lab to receive credit for the lab write-up. Late lab write-ups will not be accepted.**

**Office Hours:**

**101A:** Office hours are on Tuesdays and Thursdays from 3–4 P.M. (after lecture). You can also make appointments to meet with me by seeing me after lecture or sending me an e-mail.

**101B:**

TAs will have at least 2 hours of office hours each week. Your TA will discuss these with you in class in both lab and discussion.

**Regrade Policy:**

Regrades on any lab write-ups must be submitted within *one week* of receiving the graded lab. Regrades on exams must be submitted by the *end of that class period* in which the exam is returned.

**Learning Center (212 Chem Annex):**

General chemistry TAs will usually be available for assistance in the Learning Center from 9 A.M. to 5 P.M. Monday–Friday during the weeks classes are in session. Additional texts and study aids are available.

**The hours of operation for the Learning Center are:**

Monday–Thursday	8:30 A.M.–9:00 P.M.
Friday	8:30 A.M.–5:00 P.M.
Saturday	CLOSED
Sunday	3:00 P.M.–9:00 P.M.

**CALENDAR—FALL 2012**

Week	Month	M	T	W	Th	F
1	August	27	<b>28 S</b>	29	30	31
2	September	3	4	5	6	7
3		10	11	12	13	14
4		17	18	19	20	21
5		24	<b>25 HE I</b>	26	27	28
6	October	1	2	3	4	5
7		8	9	10	11	12
8		15	16	17	18	19
9		22	23	24	25	26
10		29	<b>30 HE II</b>	31	1	2
11	November	5	6	7	8	9
12		12	13	14	15	16
<b>13</b>	<b>Thanksgiving Break</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>
14		26	27	28	29	30
15	December	3	4	5	<b>6 HE III</b>	7
16		10	11	<b>12 F</b>	13	<b>14 (Final 101A)</b>
17		17	18	<b>19 (Final 101B)</b>	20	21

HE = Hour Exams

S/F = Classes start/finish in Chemistry 101

101A Final Exam Date = Friday, December 14 (7:00–10:00 P.M.)

101B Final Exam Date = Wednesday, December 19 (8:00–11:00 A.M.)

## LECTURE SYLLABUS—FALL 2012

DATE	TOPIC	CHAPTER
8/28, 8/30, 9/4	Atoms, Molecules, and Ions	4 (plus 1, 2, 3, 5)
9/6, 9/11	Chemical Composition	8
9/13, 9/18, 9/20	Gases	13.1–13.9
<b>9/25 (Tuesday)</b>	<b>EXAM I: 7:00–8:15 P.M.</b>	
9/27, 10/2, 10/4	Chemical Equations and Reactions in Aqueous Solutions	6, 7.1–7.4
10/9	Solutions	15 (Sections 1, 2, 4, 5)
10/11, 10/16, 10/18, 10/23	Stoichiometry	9.1–9.5, 13.10, 15.6–15.7
10/25	Stoichiometry Workshop	
<b>10/30 (Tuesday)</b>	<b>EXAM II: 7:00–8:15 P.M.</b>	
11/1	Energy	10.1–10.3
11/6, 11/8, 11/13, 11/15, 11/27	Modern Atomic Theory and Chemical Bonding	11, 12
11/29, 12/4	Liquids and Solids	14 (Sections 1, 3, 4)
<b>12/6 (Thursday)</b>	<b>EXAM III: 7:00–8:15 P.M.</b>	
<b>12/14 (Friday)</b>	<b>101A FINAL EXAM: 7:00–10:00 P.M.</b>	
<b>12/19 (Wednesday)</b>	<b>101B FINAL EXAM: 8:00–11:00 A.M.</b>	



## LABORATORY SCHEDULE

	<b>Meets On:</b>	<b>Lab Write-up Due:</b>
Introduction and Check-in	August 29	—
<b>Activity 1:</b> Measurements	September 5	September 7
<b>Lab 1:</b> Explorations with Gases	September 12	September 19
<b>Review Questions for Exam I</b>	September 19	September 21
<b>NO LAB</b>	September 26	—
<b>Lab 2:</b> Precipitation Reactions	October 3	October 5
<b>Activity 2:</b> Nuts & Bolts and Stoichiometry	October 10	October 12
<b>Lab 3:</b> Limiting Reactants	October 17	October 19
<b>Review Questions for Exam II</b>	October 24	October 26
<b>NO LAB</b>	October 31	—
<b>Lab 4:</b> Weak Acid Unknown	November 7	November 9
<b>Lab 5:</b> Modern Atomic Theory	November 14	November 16
<b>Activity 3:</b> Making Models of Molecules	November 28	November 30
<b>Review Questions for Exam III</b>	December 5	December 5
Final Lab Day and Check-out	December 12	—

## ELECTRONIC HOMEWORK SCHEDULE

Generally speaking, you will have two types of electronic homework due throughout the semester. **Type 1** homework will usually be due on Mondays, and you will have an unlimited number of attempts to complete these problems. **Type 2** homework will usually be due on Wednesdays, and you will receive a *limited* number of attempts to complete these problems. Exact due dates will be posted online as the semester progresses.

## SUGGESTED TEXTBOOK HOMEWORK FOR CHEMISTRY 101

This homework is in addition to the electronic homework. Your TA will tell you the specific due dates for the particular problems they assign, and collect them at the beginning of Friday discussion sections. You are expected to understand all of the concepts in these problems. Each problem is found under the *Questions and Problems* section at the end of the chapter.

**Note: Chapter 2 and Chapter 3 homework is due Friday, August 31.**

### Text Homework for Exam I

**Chapter 2:** 5, 7, 11, 24, 29, 31, 32, 33, 37, 60, 92

**Chapter 3:** 15, 18, 19, 20, 27, 28, 29, 31, 39, 57

**Chapter 4:** 9, 10, 13, 14, 19, 39, 42, 43, 53, 60, 74, 77, 83, 84, 91, 93, 104

**Chapter 5:** 9, 10, 13, 14, 17, 19, 22, 33, 35, 36, 39, 41, 43, 45, 50, 57, 60, 73, 77, 78, 83, 84, 91, 93

**Chapter 8:** 6, 8, 11, 14, 16, 18, 19, 22, 27, 29, 32, 34, 37, 46, 50, 52, 55, 58, 59, 66, 70, 77, 81, 92, 100, 118, 124

**Chapter 13:** 17, 21, 24, 31, 36, 37, 42, 43, 52, 56, 60, 69, 75, 77, 78, 81, 82, 105, 138, 146

### Text Homework for Exam II

**Chapter 6:** 2, 6, 13, 16, 18, 19, 21, 24, 29, 34, 38, 40, 41, 43, 73, 76

**Chapter 7:** 11, 15, 18, 21, 22, 26, 40, 74

**Chapter 15:** 34, 35, 37, 41, 47, 55, 56, 58, 62

**Chapter 9:** 5, 12, 14, 16, 19, 24, 29, 35, 37, 45, 48, 52, 56, 90

**Chapter 13:** 85, 87, 113

**Chapter 15:** 64, 65, 67, 70, 71

### Text Homework for Exam III

**Chapter 10:** 6, 8, 13

**Chapter 11:** 3, 5, 6, 12, 16, 19, 25, 26, 29, 31, 35, 39, 45, 47, 50, 51, 56, 58, 61, 63, 73, 74, 76, 95, 116

**Chapter 12:** 1, 7, 8, 11, 14, 16, 19, 23, 25, 33, 38, 40, 43, 44, 45, 48, 60, 65, 66, 67, 77, 78, 80, 81, 86, 110, 116, 119

**Chapter 14:** 5, 7, 8, 9, 10, 11, 19, 21, 25, 27, 31, 74, 75, 76, 80

# Laboratory Conduct and Safety

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## PREFACE

This Lab Book contains laboratory experiments, activities, and review questions. All of these have the same goal—to get you to actively think about the chemical principles involved. The emphasis is not on memorization of the “what’s” but on understanding of the “how’s” and the “why’s” of chemistry.

Something you should take note of immediately is that the procedure sections of the labs in this book are quite short and do **not** list steps for you to follow. This requires you to read and think about the experiments **before** coming to lab.

In general, before coming to lab, you should:

1. Read about the experiment.
2. Think about the procedure you will follow and write this in your notebook.
3. Read the background material (in the text and your lecture notes).
4. Write any tables you will need for your data/observations in your notebook. Give some thought to the organization of the tables.
5. Read and think about the questions.

The questions asked of you for the lab write-ups often ask for the significance of your results. This requires that you not only understand **what** you did, and **how** you did it, but **why** you did it. It is best to think about all of this before coming to lab.

Also, the discussion questions (or “Additional Questions”) **cannot** be answered adequately by merely copying words or phrases from the text. These questions require that you apply the knowledge you are getting from the text, lectures, and discussion sections. You will find that you will not be able to answer all of the questions immediately, but that is the point; **you should think about these questions for an extended period of time.** Take advantage of your time in the lab to discuss these questions with others in the class. You will have sufficient time to think about these questions, and to complete your lab write-ups.

In general, the lab write-ups should include a discussion of your procedure (when appropriate) along with your observations. Finally, you should discuss the significance of your findings by answering the questions. When you are asked to include observations and data, make sure they are presented neatly, and in a format that makes sense. Also, be sure to show all of your work for your calculations.

The concepts in the lab will coincide with what you are learning about in lectures and discussion sections, but will also add to these. **It is to your advantage to understand the labs, activities, and discussion questions as these ideas will appear on the exams.**

## LABORATORY SAFETY PROCEDURES

1. Goggles and safety aprons must be worn for the experiments performed. This is a state law. On those days in which you are doing activities or answering questions, goggles and aprons are not necessary.
2. Clothing must cover your legs and feet. No sandals, open-toed shoes, skirts, capris or shorts are allowed. Boots that go over your pants are also not allowed.
3. Broken glass must be discarded only in the designated “sharps” containers.
4. Report all injuries to the lab instructor immediately no matter how minor you think the injury is.
5. There is no smoking, eating, drinking, or chewing gum in the lab, even on activity and review days.
6. Properly dispose of all waste material. Your TA will advise you of the procedure for each experiment.
7. It is strongly suggested that you do not wear contact lenses to the lab. They absorb solvents that are detrimental to the eye, even when you are wearing goggles.
8. Know the location of the fire extinguishers, showers, and eye washes in the lab.

## LABORATORY EQUIPMENT

You are expected to know the following equipment in the lab room.

If you are requested to use an item of equipment not on your list: first, look around the lab for the item, then ask your TA.