CHEMISTRY 101: MOLECULAR STRUCTURE AND PROPERTIES
Fall 2010

Prof. Juliane Fry
318 Chemistry, x7951, fry@reed.edu
Office Hrs: Mon 2-4 PM; Tues 2-4 PM

Prof. Margret J. Geselbracht
309 Chemistry, x7865, mgeselbr@reed.edu
Office Hrs: Sun 8-10 PM; Mon 1:30-3 PM; Fri 1:30-3 PM

LECTURE F01: MWF 10-10:50 AM (PSYCH AUD)
AFFILIATED CONFERENCE SECTIONS

F11	Wed: 1:10–2:00 PM (Chem 105)
F12	Wed: 2:10–3:00 PM (Chem 105)
F13	Thurs: 11:00–11:50 AM (Chem 105)
F14	Thurs: 3:10–4:00 PM (Chem 105)

LECTURE F02: MWF 11-11:50 AM (VLH)
AFFILIATED CONFERENCE SECTIONS

F21	Wed: 3:10–4:00 PM (Chem 105)
F22	Wed: 4:10–5:00 PM (Chem 105)
F23	Thurs: 1:10–2:00 PM (Chem 105)
F24	Thurs: 2:10–3:00 PM (Chem 105)

Lab coordinator: Dr. Wendy Breyer
308A Chemistry, x7893, breyerw@reed.edu
Office Hrs: Tues 11-noon; Thurs 3-4

LABORATORY SECTIONS
Labs will begin in the rooms listed below.

FL1	Mon: 1:10–4:00 PM (Chem 301)
FL2	Tues: 9:00–11:50 AM (Chem 105)
FL3	Tues: 1:10–4:00 PM (Chem 301)
FL4	Wed: 1:10–4:00 PM (Chem 301)
FL5	Wed: 6:10–9:00 PM (Chem 301)
FL6	Thurs: 9:00–11:50 AM (Phys 122)
FL7	Thurs: 1:10–4:00 PM (Chem 301)
FL8	Fri: 2:10–5:00 PM (Chem 301)

SAFETY LECTURES (Week 2)
Please sign up on the Moodle and attend ONE session.
These will last ~90 minutes.

Tues Sept 7: 10:45 AM (Vollum Lecture Hall)
Wed Sept. 8: 1:10 PM (Bio 19)
Thurs Sept. 9: 1:10 PM (Bio 19)
Fri Sept. 10: 2:10 PM (Bio 19)

REQUESTS FOR SECTION CHANGES:
Your choice of conference section must match the lecture section listed above it! If you need to change conference and/or lecture sections, ***please see Maggie or Julie*** (the instructor that you wish to switch to). If you need to change lab sections, ***please contact Wendy***. We will do our best to accommodate your requests, but please bear with us as we do have a maximum cap allowed per section. If approved, we will notify you, and the changes will be forwarded directly to the Registrar.

TEXT:
***Chemistry: The Science in Context,* 2nd Edition by Gilbert et al.** (Required)
There are 5 copies of the text on the reserve shelf in the library.

MODULE STUDENT MANUALS (Required)
Throughout the semester, we will be relying heavily on two "Module Student Manuals" as companion texts. The module pdf files can be purchased and downloaded from the WW Norton website for $5 each. There is a link on the Chem 101 moodle that will take you directly to the order form (credit card required). **Please purchase the "What's in a Star?" module immediately**. Note that this module is 87 pages. *You do not need to print it all*, just what you need. There are also 9 copies on reserve. The other module we will use is entitled "Would You Like Fries With That?"

***Chemical Bonding* by Mark I. Winter** (Recommended)
This thin, economical, paperback book in the Oxford Chemical Primers series is a nice companion text that reviews atomic structure, Lewis structures, VSEPR, molecular geometry, and simple bonding models. There are 5 copies on reserve.

ADDITIONAL TEXTS ON RESERVE:

Student Solutions Manual for Chemistry by Gilbert. This resource is handy for working through end-of-chapter problems on your own. There are 3 copies on reserve.

***Principles of Chemistry*, by Michael Munowitz**
An elegantly written book that offers a different style of presenting the material: more prose and few interruptions for practice problems and sidebars. We would be happy to suggest parallel readings in this book that present the material in a bit more depth, particularly in the area of the quantum mechanical model of the atom. There are 5 copies on reserve.

***A Basic Math Approach to Concepts of Chemistry* by Leo Michels**
There are 3 copies on reserve. This self-paced workbook provides lots of sample problems and their solutions that allow you to build the problem-solving skills you need to succeed in Chemistry.

LABORATORY:
We have designed activities for the Chem 101 laboratory that complement the topics that we will be covering in lecture. Labs will meet weekly **beginning this week, Monday, August 30**. Attendance at lab is mandatory. *If illness or another emergency prevents you from attending lab, please contact your lab instructor by phone or e-mail as soon as possible*. If your reason for missing lab is deemed a valid excuse, we will try to arrange a make-up lab during the same week if possible.

CHEM 101 LAB MANUAL:
The Chem 101 lab manual will be available for purchase from the Chemistry stockroom (Chem 212) for a nominal fee ($4-5). Each week, please read the experiment and complete the pre-lab preparation before coming to lab. Remember to bring the lab manual and your lab notebook with you to your lab section.

SAFETY LECTURE: Everyone must sign up to attend one of the safety lectures next week; times and locations are listed on the front page and sign-up is on the Chem 101 Moodle. Additionally, you must pick up a **SAFETY MANUAL** (available from the Chemistry stockroom, Chem 212) **and read Chapters 1–3 and 6–9.** *You must complete the safety quiz and sign the form* before you can participate in the lab.

CONFERENCE:
Conference is a crucial component of this course. It is an opportunity to engage the course material more actively through discussion, small group problem solving, computer modeling, and hands-on activities. It is also a great place to interact with faculty and to get help when you are having difficulties. We **expect** regular attendance and participation.

CLICKERS IN CHEM 101:
This year, we are introducing the use of course response systems or "clickers" in Chem 101 lecture. Our goals in using this technology are: (1) to provide a more active and engaged experience for students in lecture, (2) to gain real-time assessment of your learning in the course, and (3) to provide immediate feedback to faculty on which concepts need more discussion. Each student will be expected to purchase and register their clicker and bring it with them to every lecture. Several clicker questions will be distributed throughout each lecture and you will receive participation points for registering your answers. Not choosing to participate or repeatedly forgetting your clickers may have a detrimental effect on your semester grade. These are points that are entirely under your control. Take charge of your learning!

Each student must purchase a clicker for use in Chem 101 by Thursday, September 2. You can pay for the clickers in advance using a credit card at Reed's online computer store. There will be a Clicker pickup station (bring your receipt) at the ETC Help Desk, available Monday (8/30) thru Thursday (9/2) from 1-4 pm. You may also pay in person with cash or a check. The initial cost of the clicker will be $20. If you bring it back at the end of the semester in full working order, you will be refunded $10. Students who drop the course and return the clickers by the drop deadline (Oct 4) will get a full refund.

THE CHEM 101 MOODLE: https://moodle.reed.edu/course/view.php?id=609
You will be automatically enrolled in the Chem 101 Moodle (use the same login as for e-mail). The Moodle will be used to both deliver content (reading assignments, electronic copies of handouts, problem sets etc.) as well as provide a number of social networking tools (discussion forums, wikis, and informal surveys) to enhance faculty-student interaction and build a sense of community in Chem 101. Use Firefox as your browser to gain the most functionality on the Moodle.

A FEW WORDS ABOUT OUR GOALS FOR CHEM 101:
We recognize that you are an extremely diverse group of students in Chem 101. You have a wide range of backgrounds and prior experience with chemistry. You vary in the reasons for taking this class. Some of you are potential science majors, some of you have ambitions of medical school, some are motivated by a basic curiosity about chemistry, and yes, some of you just need the credit for Group C. Because of this, you all have different goals for what you would like to take away from this course.

Our goals for Chem 101 are simple. We hope that all of you succeed and that you enjoy the experience!

Learning Goals. *By the end of Chem 101, you should be able to:*

- Make connections between observations of the macroscopic natural world to atomic and molecular level behavior.
- Use theories and models as unifying principles to understand and make predictions about natural phenomena.
- Analyze complex, multi-step problems that connect symbolic quantitative relationships with atomic and molecular level descriptions of chemical behavior and determine appropriate problem-solving strategies
- Collect and analyze observations and quantitative data in the laboratory and communicate findings in appropriate scientific format.
- Describe the fundamental chemical principles behind astronomy, global warming, and health concerns about fats in our diet and understand the unique perspective a chemist contributes to these multidisciplinary fields of interest.
- Evaluate the credibility, use, and misuse of scientific and quantitative information in reports to the general public on scientific research and public-policy issues.

EVALUATION:
To *succeed* in this course, you need to exhibit sustained effort in all of the following areas:

In-Class Exams (Friday, **September 24,** Friday, **October 29,** and Friday, **December 3**)
These will be 50 minutes long to be taken in class with closed books and notes.

Final Exam (TBA)
This will be a comprehensive exam reviewing the entire semester (again closed book, closed notes).

Module Culminating Activities – The first two modules this semester (Stars and Global Warming) will end with a culminating activity, designed to provide a non-exam method of assessing your understanding of the material. Details about these activities and due dates will be provided later.

Problem Sets – Handed out on Wednesdays, due in lecture on Wednesday the following week or to the box in Kathy Kennedy's office (Chem 303) by 1 pm. **No late problem sets (after 1 pm) will be accepted without a medical excuse**. So, hand in whatever you have done even if it is incomplete. Some credit is better than no credit!

Clicker Participation and Clicker Quizzes – Regular attendance at lecture and participation in clicker questions is expected. In some cases, the number of points you accrue will depend on the right answer.

Lab Reports – Lab reports will consist of less formal worksheets and more formal lab reports. Instructions for each lab report are provided in the Lab Manual. Reports and/or worksheets will be due on your scheduled lab day, typically one week after completion of the experiment. There is a 5% per day penalty for late reports, and no reports will be accepted more than one week past the due date. *Note:* **If you do not turn in a *majority* of the laboratory reports, you will not pass this course, regardless of your exam scores.**

Practice Problems On Your Own – Most people learn Chemistry, not by reading the book, but by working problems. *For most students*, just working the problem sets each week will ***not*** provide enough practice for you to succeed under the time pressures of an exam. We recommend that you work *many* more practice problems on your own to build and refine your skills. In lecture, we will be suggesting end-of-chapter problems to work through on your own. These will not be collected. You should plan to set aside ***several hours per week*** to work extra problems.

ACADEMIC SUPPORT: (http://web.reed.edu/academic_support/)

At any point in the course, if you feel you need some extra help, there is a wide range of support available. We encourage you to come to office hours for help or arrange another time to meet with one of us that fits with your schedule. Individual tutors for Chem 101 are available (through Student Services) and drop-in tutoring will be available at the Dorothy Jo House at various times from 2-11 pm on most days. (For details, see http://dojo.reed.edu/schedule)

ACADEMIC COLLABORATION:

All work submitted for this course is expected to reflect the effort of the individual whose name appears on the top of the page.

You are encouraged to work with friends, tutors, and instructors on problem sets and lab reports. However, when the time comes to write this work up for submission, it must be your work, written in your own words and reflecting your understanding of the problems at hand. In lab, you will be working with a lab partner to complete the experiments. We hope you will discuss the meaning of the data you collect and the observations you make together with your partner. However, you will write up *individual* lab reports, reflecting your understanding of the experiment. Composing the lab report at the computer together with your lab partner and printing two copies with different names at the top is not acceptable and is considered to be a case of academic dishonesty. ***Please note: Our policy on laboratory reports is different from that of Bio 101/102.***

All exams are to be taken closed book, closed notes and without any collaboration. In using a calculator, you may only use it for arithmetic and for simple algebraic and trigonometric functions. You may not use programmed equations or graphing functions during the exam period. Remember that credit is given for demonstrating the thought process that leads to a correct response, not for simple answers without any demonstrated logic.

CHEM 101 COURSE OUTLINE:

The content of Chem 101 will be organized into 3 thematic modules. The purpose of each module is to place the chemistry content within the overall context of larger questions that may reach across several disciplines and/or have societal impact. Each module will be driven by a series of questions, and the chemistry will be taught on a need-to-know basis. The main consequence of this approach is that we will not move through the textbook in a linear fashion. The textbook will not guide the organization of the course; rather the modules will. The underlying chemical theme of the fall semester is molecular structure and properties. Here is the contextual motivation and development of this theme:

1. WHAT'S IN A STAR?

What is starlight?
- Electromagnetic spectrum, dual nature of light

What do star colors tell us?
- Blackbody radiation, color, and temperature

What do stellar spectra tell us?
- Periodic trends in atomic properties and basic atomic structure
- Quantum mechanical wave model of atomic structure
- Using atomic spectroscopy to identify elements

What is the energy source behind a star?
- Mass and energy, fission, fusion

What is the origin of the universe?
- The Big Bang, nucleosynthesis

2. WHAT SHOULD WE DO ABOUT GLOBAL WARMING?

Is the climate changing?

What is the relationship between CO_2 and temperature?

The global carbon cycle

What determines whether a gas is a greenhouse gas?
- Lewis structures, VSEPR, polarity, and infrared activity

How much are greenhouse gas concentrations changing?
- Atmospheric concentrations, global warming potentials

Why are greenhouse gas concentrations rising?
- Chemical equations and stoichiometry

3. WOULD YOU LIKE FRIES WITH THAT? THE FUSS ABOUT FATS IN OUR DIET

Is it unhealthy to eat fat?

What makes fats different from other nutrients?

Chemical structures and properties of nutrients

Why is fat a necessary nutrient?
- Molecular polarity and solubility

How is fat a concentrated energy source?
- Thermochemistry

What kind of fat should we eat?
- Macroscopic consequences of microscopic structure

Should we eat fake fat?
- Chemistry of fat substitutes

4. BONUS MATERIAL: FROM BLUE JEANS TO BODY ARMOR

Why are blue jeans made out of cotton and not polyester?
- Natural and synthetic polymers

How do I use chemistry to stop a speeding bullet?
- Polymer structure/property relationships

BUT WHAT WILL WE COVER IN THE TEXTBOOK?

This semester, we will cover Chapters 1, 2, 7, 20, 3, 4, 8, 9, 12, 19, and 5 in Gilbert. As you can see, we will <u>not</u> move through the text in a linear fashion but will jump around a lot! This simply highlights the fact that generally we do not read chemistry textbooks in the same way that you might read the texts in another discipline. Each week, we will update the moodle with specific reading assignments and suggested practice problems that match the topics and the storyline of each thematic module.

LABORATORY SCHEDULE FALL 2010

Week of:	Experiment:	Report Due:
8/30	Exp 1: Introduction to Light, Color, and Spectroscopy	In-class worksheet due at the end of lab
9/6	***SAFETY LECTURES***	Exp 1 Take-home worksheet
9/13	Exp 2: Atomic Spectroscopy	
9/20	Exp 3A: Discovering Beer's Law	Exp 2 Take-home worksheet In-class worksheet due at end of the lab
9/27	Exp 3B,C: Discovering Beer's Law	
10/4	Exp 4: Phosphate in the Willamette	Exp 3B,C plots
10/11	Discussion of Exp 4 Set-up for Exp 5	Exp 4 plots and data tables
10/18	***FALL BREAK***	
10/25	Exp 5: Quantifying CO_2 production from Leaf Decay	
11/1	Exp 6: Separation and Identification of Leaf Pigments	Exp 5 worksheet
11/8	Exp 7: Hydrogenation of Canola Oil, Part I	Exp 6 report
11/15	Exp 7: Hydrogenation of Canola Oil, Part II	
11/22	***THANKSGIVING WEEK – NO LAB***	
11/30	Exp 8: Synthesis of Indigo	Exp 7 report
12/6	***NO LAB***	Exp 8 report due by 12/8 at 5pm