

# CHEMISTRY 1220 – SPRING 2013

## GENERAL CHEMISTRY



Lecture: 1000 McPherson MW 6:30 – 7:50 pm • TTh 8:00 – 9:20 am (5 credit hours)

Course Website: [www.drufus.com](http://www.drufus.com) and <https://carmen.osu.edu/>

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Textbook: Chemistry, The Central Science (12<sup>th</sup> Edition), by Brown, LeMay, Bursten, Murphy & Woodward

Mastering Chemistry: MW Class Course ID: MWCHEM1220SP13; TTh Class Course ID: TTHCHEM1220SP13

Lab Manual: Chemistry 1220 General Chemistry Laboratory Manual, Hayden-McNeil Publishing, Inc.

Lab Notebook: Student Lab Notebook, Hayden-McNeil Publishing, Inc.

Prerequisite: 1210, 1250, 1610, 1910H, or 121/161/201H + 1215, and eligibility to enroll in Math 1150.

### Requirements Fulfilled

Chemistry 1220 is a Physical Science course in the Natural Science category of the GE, which has these goals and objectives:

**Goals:** Students understand the principles, theories, and methods of modern science, the relationship between science and technology, the implications of scientific discoveries and the potential of science and technology to address problems of the contemporary world.

### Learning Objectives:

1. Students understand the basic facts, principles, theories and methods of modern science.
2. Students understand key events in the development of science and recognize that science is an evolving body of knowledge.
3. Students describe the inter-dependence of scientific and technological developments.
4. Students recognize social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.

**Student Responsibility:** Each student receives this information in the first lecture section. It is your responsibility to read this material and be familiar with the course content, procedures, and grading. You are also responsible for any announcements concerning course procedures which are made in class. (If you are absent, you are expected to get notes, announcements, etc. from another student in the class.)

**Calculator:** For quizzes and examinations, the use of a calculator is restricted to a TI-30 (any, except XS Multi view), Sharp EL-509 (any), Sharp EL-531 (any) or Casio FX-250 (any). No other calculators are permitted. See <http://undergrad-ed.chemistry.ohio-state.edu/calculators/>

**Disability Services (ODS):** All students with documented disabilities, who need accommodations, should see the instructor privately. If your disability requires materials in alternative formats, please contact the Office for Disability Services (ODS) at 292-3307, Room 150 Pomerene Hall.

***IF YOU ARE UNABLE TO ATTEND THE FIRST LAB SESSION,  
Email [gc\\_office@chemistry.ohio-state.edu](mailto:gc_office@chemistry.ohio-state.edu) immediately to reserve your seat.***

Week of	Reading	Topics
Jan. 7 <sup>th</sup>	Ch. 13	<b>Properties of solutions (Ch. 13.1-13.4):</b> The solution process, solubility and saturated solutions, factors affecting solubility, ways of expressing solution concentration.
Jan. 14 <sup>th</sup>	Ch. 13, 14	<b>Properties of solutions (Ch. 13.4-13.6):</b> Colligative properties, colloids. <b>Chemical Kinetics (Ch. 14.1-14.4):</b> Reaction rates, Concentration and rate laws, Concentration vs. time, Temperature and rate
* Jan. 21 <sup>st</sup>	Ch. 14	<b>Chemical Kinetics (Ch. 14.6-14.7):</b> Reaction mechanisms, Catalysts. Review of Kinetics.
Jan. 28 <sup>th</sup>	Ch. 15	<b>Chemical Equilibrium (Ch. 15.1-15.6):</b> The concept of equilibrium, Equilibrium constants, Heterogeneous equilibrium
Feb. 4 <sup>th</sup>	Ch. 15, 16	<b>Chemical Equilibrium (Ch. 15.7):</b> Calculating equilibrium constants (ICE tables), Le Châtelier's principle <b>Acid Base Equilibria (Ch. 16.1-16.4):</b> Acid-Base Equilibria, Bronsted-Lowry acids and bases, the pH Scale
Feb. 11 <sup>th</sup>	Ch. 16	<b>Acid Base Equilibria (Ch. 16.5-16.9):</b> Strong acids and bases, Weak acids and bases, Relationship between $K_a$ and $K_b$ , pH of salt solutions
Feb. 18 <sup>th</sup>	Ch. 16, 17	<b>Acid Base Equilibria (Ch. 16.10-16.11):</b> Chemical structure and acidity/basicity, Lewis acids and bases. <b>Additional Aspects of Acid-Base Equilibria (Ch. 17.1-17.4):</b> Common ion effect, Buffered solutions, Acid-Base titrations
Feb. 25 <sup>th</sup>	Ch. 17	<b>Additional Aspects of Acid-Base Equilibria (Ch. 17.5-17.6):</b> Solubility equilibria and $K_{sp}$ , Factors that affect solubility, Selective precipitation of ions
Mar. 4 <sup>th</sup>	Ch. 19	<b>Chemical thermodynamics (Ch. 19.1-19.7)</b> Spontaneous processes, Entropy and the 2 <sup>nd</sup> law of thermodynamics, Molecular interpretation of energy, Gibbs Free Energy, Free Energy Equilibrium
Mar. 11 <sup>th</sup>		<b>SPRING BREAK</b>
Mar. 18 <sup>th</sup>	Ch. 20	<b>Electrochemistry (20.1-20.6)</b> Oxidation states & balancing oxidation-reduction reactions, Voltaic cells, Cell potentials, Free energy, the Nernst equation.
Mar. 25 <sup>th</sup>	Ch. 20, 18	<b>Electrochemistry (20.7-20.9)</b> Batteries and fuel cells, Corrosion, Electrolysis. <b>Chemistry of the Environment (18.1-18.2)</b> Overview of air, water, soil, anthropogenic impact, Earth's atmosphere.
Apr. 1 <sup>st</sup>	Ch. 18, 22	<b>Chemistry of the Environment (18.3-18.4)</b> Earth's water, Global warming, greenhouse gases and spectroscopy. <b>Chemistry of the Non-Metals (22.10)</b> Silicates and silicate minerals, soil chemistry, lead in the environment.
Apr. 8 <sup>th</sup>	Ch. 23	<b>Transition metals and coordination chemistry (23.1-23.3, 23.5-23.6)</b> The transition metals, coordination complexes, Ligands, Color and magnetism of transition metal compounds, Crystal field theory
Apr. 15 <sup>th</sup>	Ch. 21	<b>Nuclear chemistry (21.1-21.8)</b> Energy changes in nuclear reactions, Radioactivity, Patterns of nuclear stability, Nuclear transmutations, Rates of radioactive decay, Fission and fusion, Radiation in the environment and living systems
§Apr. 22 <sup>nd</sup>		<b>Last Lecture:</b> The Chemistry of Cancer Research

\*No class on Monday, January 21<sup>st</sup> due to MLK Jr. holiday. §Monday, April 22<sup>nd</sup> is the last day of classes.

**Requirements in this syllabus (assignments, due dates, etc.) may be altered ONLY by the lecturer or Lab Supervisor.**

## Grading

Your performance in the course will be evaluated on the basis of total points earned for the entire semester. There is **NO** extra credit. The distribution of points is as follows:

Graded Assignments	150	◀ 50 points each for pre-lecture assignments, lecture questions, and graded homework.
Midterm I	125	Thursday, February 14, 8:15 - 9:30 pm
Midterm II	125	Thursday, March 7, 8:15 - 9:30 pm
Midterm III	125	Thursday, April 11, 8:15 - 9:30 pm
Final	275	MW class: Friday, April 26 <sup>th</sup> 8:00 - 9:45 pm TTh class: Monday, April 29 <sup>th</sup> 8:00 - 9:45 am
Laboratory	200	◀ A minimum of 50% of the total lab points are required to pass the course.
Total	1000	

There are **two** mandatory quizzes to be taken that are on Carmen - <https://carmen.osu.edu>. One quiz deals with Academic Misconduct and the other with the Syllabus. Neither of these quizzes contribute to your final grade, but unless you receive perfect scores on both quizzes, you will not receive a **passing** grade in this course. You **MUST** complete the quizzes before the end of the **second** full **week** of the semester or you will receive an E for the semester.

**GRADED ASSIGNMENTS:** You must register for a Mastering Chemistry and Polleverywhere account. Instructions to do so will be e-mailed to the class and found on [www.drfus.com](http://www.drfus.com). Mastering Chemistry Pre-lecture assignments will be due before every lecture and due dates are given on the course checklist. Each question will be worth one point and at the end of the semester the point total will be scaled to 50 points. Lecture Questions will be administered using poll-everywhere in class and one point is awarded for each correct response. If you incorrectly answer a poll-everywhere question in lecture you have to opportunity to earn a point by completing a question with the same learning objective on Mastering Chemistry. These questions will be posted on Mastering Chemistry and must be completed before your next lecture to receive credit. Graded Homework assignments will be announced in lecture and are due at midnight on Wednesday's on Mastering Chemistry. The content of these assignments are cumulative/integrative exercises and the questions are chosen to challenge you. The graded homework will be scaled to 50 points of your final grade.

**RECITATION:** Consists of one 55 minute session per week. You and your classmates will work through old exam questions in recitation and provide wrong-answer feedback to the multiple choice questions. These materials will then be posted for the entire class to study for each exam.

**LABORATORY:** Consists of one 3-hour session per week; **YOU MAY WORK IN THE LABORATORY ONLY DURING YOUR SCHEDULED LABORATORY PERIOD!** Any time remaining in a lab period and the last lab (checkout) period can be used to complete a previous experiment - *discuss this with your TA first*. **A minimum of 50% of the total lab points are necessary for a passing grade in the course.**

**MIDTERM EXAMS:** These exams are given only at the times shown in the grading table above. Exams are a scheduled part of this course and attendance is required (exam location is based on lab section). Answers will be posted. The make-up exam date is during the week of April 15<sup>th</sup> - 19<sup>th</sup> and will only be given for documented medical reasons or a preapproved university conflict. Students with **University** conflicts should consult the lecturer.

**FINAL EXAM:** The final exam must be taken at the University scheduled time as assigned by the registrar's office: <http://registrar.osu.edu/scheduling/SchedulingContent/SP13Finals.pdf>. This means the MW class has their final on April 26<sup>th</sup> at 8:00 pm and TTh on April 29<sup>th</sup> at 8:00 am. You must attend the final for the class you are registered for and cannot take the other classes final exam. OSU ID cards will be collected at the final exam. Final exams will not be returned.

## LAB ACTIVITIES

Week	Week of	Lab	Points*
1	Jan 7 <sup>th</sup>	Check in #14 Variation of Solubility with Temp and Solvent	100
2	Jan 14 <sup>th</sup>	#15 Freezing Point Depression	110
3	†Jan 21 <sup>st</sup>	#16 Determining a Rate Law and Rate Constant†	110
4	Jan 28 <sup>th</sup>	#17 Variation of Reaction Rate with Temperature	110
5	Feb 4 <sup>th</sup>	#18 Equilibrium and Le Chatelier's Principle	110
6	Feb 11 <sup>th</sup>	#19 Analysis of a Solution of Two Acids	110
7	Feb 18 <sup>th</sup>	#20 Acid-Base Titration Curves: Determining pKa	110
8	Feb 25 <sup>th</sup>	#21 Determining a Solubility Product Constant	110
9	Mar 4 <sup>th</sup>	#22 Solubility and Determination of $\Delta G$ , $\Delta H$ and $\Delta S$ of $\text{Ca}(\text{OH})_2$	110
10	Mar 11 <sup>th</sup>	<b>SPRING BREAK – No labs</b>	---
11	Mar 18 <sup>th</sup>	#23 Voltaic (& electrolytic) Cells + begin research synthesis	110
12	Mar 25 <sup>th</sup>	Research project (1)*	30
13	Apr 1 <sup>st</sup>	Research project (2)*	30
14	Apr 8 <sup>th</sup>	Research project (3)*	30
15	Apr 15 <sup>th</sup>	Make up, Poster and check out	50
16	Apr 22 <sup>nd</sup>	Monday lab Make up, poster and check out	
		Peer Grading due on 4/22/13 by 4:30pm	30
		Group Research paper due on 4/22/13 by 4:30pm	140

The total lab points add up to 1400. This will be factored down to 200 points for your total course grade (e.g. if you receive 1200 lab points that would be  $(1200/1400) \times 200 = 171$  points toward your final grade. †No lab on Monday Jan 21<sup>st</sup>, Monday labs will be one-lab behind on this schedule from this date on. \*The order of labs 1-3 of the research project will vary from one lab section to another.

Lab reports are normally due at the **beginning** of the lab session **ONE** week after the **completion** of the experiment. Lab Reports for Experiments 14-20 will not be accepted later than 4:30 PM, Monday, March 18th (in CE 110). No Lab Reports will be accepted after 4:30 PM, Monday, April 22nd (in CE 110)

**LABORATORY SAFETY REQUIREMENTS:** Students are required to read, understand, and implement the safety precautions indicated in the laboratory manual and laboratory handouts. The precautions are summarized on a safety form which must be signed by all students during their first laboratory period. The following are selected instructions from the safety form:

1. You must wear Department-authorized ANSI code goggles in the laboratory. You are expected to use the goggles that were issued to you in Chemistry 1210. If this pair is lost, goggles may be borrowed from CE 231 or 331 (if available); otherwise, they must be purchased from CE 180. Not wearing goggles will result in the loss of 10% of the grade for the experiment. For any subsequent violation, an additional loss of 10% of the grade will result. Continued violations may result in dismissal from the course. The wearing of contact lenses is NOT recommended.
2. Each student must adequate clothing to reduce the possibility of injury from chemicals or broken glass. Students who wear **sandals** or **shorts** will be **sent home** – **NO** make-up time will be provided.
3. Familiarize yourself with the location of the fire blanket, fire extinguisher, and eye wash in the lab.
4. Promptly report all accidents, no matter how small, to your lab instructor.
5. Your work area should be cleaned before you leave lab. After putting your equipment away, wipe down your work area with a wet sponge or towel. This ensures that you, and other students who use the space, will not be harmed by chemicals left on the desktop. Also clean up spills in the balance room by brushing chemicals into a weighing dish.
6. No unauthorized experiments are allowed. No chemicals may be removed from the lab.

**LABORATORY GRADES:** Each lab is worth 110 points (except for #14 and the research project). The breakdown of points is usually as follows: Pre-lab assignment (12 points), notebook grade (10 points), lab report including data (80 points), and post-lab assignment (8 points). A detailed point breakdown may be found on the grading rubric, which can be found on Carmen. You should print the rubric for each lab and staple it to the back of your lab report before turning it in.

**PRE-LAB ASSIGNMENTS:** The pre-lab assignments are to be completed online. Links to each pre-lab assignment can be found on Carmen in the content section. They must be completed **prior** to the start of your lab each week. No credit will be given if the pre-lab assignment is late. Videos for most labs are online and should be viewed prior to completing each pre-lab assignment. These videos may be found at this website <http://go.osu.edu/genchemlabvideos>

**LABORATORY NOTEBOOK:** You are required to keep a lab notebook following the guidelines described in Appendix A of your laboratory manual. You are required to use the Student Lab Notebook, and record all entries in ink. Note that some parts must be completed prior to coming to lab and the notebook grade will generally be assigned near the beginning of lab. The notebook should be sufficiently neat and organized so that another person can follow what you did. At the end of each lab, sign your data pages and submit the copies to your lab instructor in order to receive credit for the lab.

**LABORATORY REPORT:** You will be required to submit a report for each lab following the guidelines described in Appendix B of your laboratory manual. The lab report is normally due at the **beginning** of the lab session **ONE** week after the **completion** of the experiment. *Photocopies of the report sheets are not acceptable.* Late reports (even if on the same day) will be penalized 10% per day. If you submit a late report to 110 CE, you must notify your TA by email within one day after submission. **NO** credit will be given after 2 weeks or past the due dates shown on the first page. You are expected to print out the grading rubric (posted to Carmen) as the cover page for each lab. **If you do not check-out, you will receive a zero for your last lab report.**

**The data** will be included in the lab report for most labs and graded by the TA. For select labs (#15 and #19) you will be asked to enter your data online as well as complete an online prelab. Use this website to do so: <http://go.osu.edu/genchemlabreport>

**POST-LAB ASSIGNMENTS:** The post-lab assignments are to be completed online. Links to each post-lab assignment can be found on Carmen in the content section. They must be completed on Carmen before the start of your next regularly scheduled lab (in most instances this means you will have 1 week to complete the post lab assignments). No credit will be given if the post-lab assignment is late.

**MEDICAL INSURANCE COVERAGE:** Due to the potentially dangerous nature of laboratory work, you are reminded to maintain medical insurance coverage through OSU health service or a private agency when enrolling in Chemistry laboratory courses.

#### **Additional Assistance:**

1. Lab Supervisor – Dr. Tatz ([rjtatz@chemistry.ohio-state.edu](mailto:rjtatz@chemistry.ohio-state.edu), 280D CE) will help with lab problems.
2. Research coordinator – Dr. Clark ([clark.789@osu.edu](mailto:clark.789@osu.edu)) 0109 Newman and Wolfrom Laboratory) help with research questions.
3. Extra copies of course handouts are available in the General Chemistry Office, 110 Celeste Lab.
4. You are strongly encouraged to make use of the Learning Resource Center (170 CE) frequently.
5. Chemistry 1220 lab web site: <http://go.osu.edu/chem1220lab>

## **Learning Resource Center (TA Aid Room) - 170 CE**

The Center is open Monday through Friday during posted hours. Computers that have instructional programs for the General Chemistry classes are available on a first come, first served basis. These programs involve only single-concept problems that must be understood in order to deal with the more difficult multi-concept questions on examinations.

Teaching assistants spend some time each week in the Center to provide contact time with their students and to answer specific questions about their course as well as general questions in any course. A schedule is posted which lists the time each T.A. is available as well as their course assignment. For over 40 hours per week, teaching assistants are available for help with general chemistry questions. Stop by when convenient to your schedule and take advantage of the resources. You do not need to make an appointment. Teaching assistants wear a name tag which indicates the course for which they are responsible. The Center has limited space and is not designed as a library or study hall, but as a place where students can come for individual help and instruction.

## **Notes on assigning final Grades ( is there a “curve”?)**

To insure consistent grading between parallel sections as well as from one semester to the next grades in all 1000-level chemistry courses are assigned by the Vice chair for Undergraduate Studies in consultation with your instructor. While the full details of the grading scheme are too lengthy to describe here, the following points may help you better understand the procedure that will be used to determine your grade:

- The starting point for assigning grades is to arrange students in order of descending number of **total points** (see point breakdown given on page 2). No adjustment or “curve” is made to the scores earned on individual exams, quizzes or labs.
- The average (mean) score of all students who finish the course is usually in the C grade range. This means that if you finish near the class average your grade will very likely be C+ or C. On rare occasions, the grade for an average score could fall outside of this range if performance dictates.
- If you receive more than 900 total points your grade will not be worse than A-.
- If you receive less than 500 total points there is an extremely high probability that you will fail the course (i.e. receive a grade of E).
- Remember that while exam averages typically fall between 55-75%, the lab and quiz averages (which together amount to 35% of the course grade) are often much higher. All components of the course figure into the total score.

## STANDARDS OF ACADEMIC CONDUCT IN GENERAL CHEMISTRY

**Any material submitted in General Chemistry must represent your own work. Violations of this standard will be referred to the University Committee of Academic Misconduct (COAM) as required by Faculty Rules.**

It is the responsibility of COAM to investigate all reported cases of student academic misconduct; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations, quizzes, and graded assignments. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information see the Code of Student Conduct, [http://studentaffairs.osu.edu/pdfs/csc\\_12-31-07.pdf](http://studentaffairs.osu.edu/pdfs/csc_12-31-07.pdf).

Copying, use of "crib" material, or use of stored constants and formulas in calculators on quizzes, midterm examinations or the final exam is regarded as a severe violation of academic standards no matter how small the action. The Department of Chemistry will recommend as the **minimum penalty a grade of E for the course for any such violations**. The use of improper calculators (those NOT listed on the syllabus as approved) may constitute academic misconduct. The staff will inspect calculators used in quizzes and exams. During exams, students are seated with their lab section to facilitate proctoring of the exam.

Students supplying materials for others to "look at" may be charged with academic misconduct. Never allow another student access to your pre-laboratory exercises or lab reports even after completion of the course. You should not assist others in violations of academic standards. "I didn't know that the person was going to copy my work" is not an acceptable excuse.

Laboratory work is the essence of the science of Chemistry; therefore, laboratory work in General Chemistry is to be an individual effort. You are expected to perform all parts of the experiments with your own equipment, chemicals and unknowns. The accumulation of data, calculations derived from that data and any conclusions or answers to questions associated with that experiment are to be your own work. Examples of academic misconduct involving lab work include but are not limited to the following activities:

- Laboratory data may not be altered or "made up". All laboratory work must be done in your assigned laboratory room during your scheduled time period and be supervised by your assigned teaching assistant. You are required to have the data sheet/notebook signed by your teaching assistant during lab. Some courses require the submission of carbon copies of the lab notebook every lab period. **Violations will be prosecuted with the minimum recommended penalty of a zero for the entire laboratory portion of the course.**
- Group efforts by students, use of another student's pre-laboratory or laboratory material, or assistance from individuals who already have taken the course will place you in jeopardy of violation of the standards of General Chemistry. Identical answers indicate copying or unacceptable group efforts - always answer questions in your own unique words.
- Plagiarism or the submission of work based on old material is considered to be academic misconduct no matter how small the infraction. Possession of another student's lab report(s) will raise immediate concerns about academic misconduct.
- Evidence of copying or "working together" will be submitted to COAM. The **minimum penalty** recommended by the Department of Chemistry will be a **zero for the pre-laboratory exercise and the accompanying experiment**.
- **Individuals retaking the course must complete all work for the course during the current semester and may not submit any parts of pre-labs or lab work or reports performed in a previous semester** (see item #6 in "Ten Suggestions for Preserving Academic Integrity", <http://oaa.osu.edu/coamensuggestions.html>).

Remember that a minimum total score in laboratory is required, as stated on the syllabus of the course. A zero on a lab report may result in an E for the entire course.