

Textbook: Chemistry, The Central Science (Eleventh Edition), by Brown, LeMay, Bursten and Murphy
 Lab Manual: General Chemistry Laboratory Experiments, Volume 3 (2009-10), by Casey and Tatz
 Lab Notebook: Student Lab Notebook, Hayden-McNeil Publishing, Inc.
 Prerequisite: Chemistry 122.
 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/>.

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

<u>Week of</u>	<u>Lecture Topic</u>	<u>Chptr</u>	<u>Quiz</u>			<u>Laboratory</u>		
			<u>W/R</u>	<u>M/T</u>	<u>W/R</u>	<u>W/R</u>	<u>M/T</u>	<u>W/R</u>
Mar 30	Aqueous Equilibria, Common Ion Effect, Solubility and pH, Complex Ions,	Ch. 17	---		Ckin,21			22
Apr. 6	Selective Precipitation, Simultaneous Equilibria, Intro to Qualitative Analysis, Groups I and II	Ch. 17 CT 25 ⁺⁺	I		23			24
Apr. 13	Qualitative Analysis, Groups II and III, Chemical Thermodynamics, Entropy	CT 25, ⁺⁺ 19	II		25 I			25 I,II
Apr. 20	Simple Salts, Free Energy, Free Energy, Temperature and K	CT 26 ⁺⁺ , Ch. 19, 20	III		25 II			25 II,III
Apr.27	Balancing Redox Equations, Voltaic Cells, Nernst Equation, Electrolytic Cells,	Ch. 20	---		25 III			25 III

FIRST MIDTERM EXAMINATION - Monday, April 27th, 6:30 – 7:48 PM

May 4	Chemistry of Non-Metals	Ch.20, 22	IV		26			26
May 11	Chemistry of Non-Metals, Metallic Bonding, Alloys	Ch.22, 23 18.3-18.4	V		27			28
May 18	Transition Metals, Nomenclature, Isomerism,	Ch.23, 24	---		29			30

SECOND MIDTERM EXAMINATION - Monday, May 18th, 6:30 – 7:48 PM

May 25*	Coordination Compounds, Chelates, Crystal Field Theory, Radioactivity, Nuclear Stability, Rates of Decay,	Ch.24, 21	---		X			30,31
June 1	Energy Changes, Fission and Fusion	Ch.21	VI		FCO			FCO

FINAL EXAMINATION - Monday, June 8th, 11:30 AM – 1:18 PM

* May 25th is a University holiday. No classes will be held. University offices are closed. ** Ckin = Check-in. FCO = Finish, Check-Out. x = lab closed. ⁺⁺ "General Chemistry Laboratory Experiments, Vol. 3: Casey/Tatz. Experiments 25, 26.

Lab Reports for Expts. 24 through 25 II can not be submitted after Friday, May 22nd. (See reverse for late penalty details.)
All other Lab Reports are due no later than 4:30 PM, Friday, June 5th. (See reverse for late penalty details.)

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.

ACADEMIC MISCONDUCT: Any material submitted in General Chemistry must represent your own work. Apparent violations of this standard will be referred to the University Committee of Academic Misconduct (COAM) as required by Faculty Rules. *Please read the attached statement on Standards of Academic Conduct carefully and take the quiz in Carmen.*

IF YOU FAIL TO ATTEND THE FIRST LAB SESSION - CHECK IN AT 100 CE WITHOUT DELAY

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, whether you are present or not! (If you are absent, you are expected to get notes, announcements, etc. from another student in the class.)

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

Quizzes	150	
Laboratory	250	◀ A minimum of 50% of the total lab points is required to pass the course.
Midterm I	175	
Midterm II	175	
Final	<u>250</u>	
Total	1000 pts.	

QUIZZES: Will be given in lab in the weeks indicated on the front of the syllabus. There are **NO** make-up quizzes but you are allowed to miss one quiz without receiving a penalty or needing permission from your instructor. If you take all of the quizzes, your lowest quiz score will be dropped. **ALWAYS SHOW YOUR WORK ON QUIZZES** to receive full credit. Bring your **approved calculator** to quizzes and exams. Calculator covers must be removed and put away.

MIDTERM EXAMS: These exams are given only at the times shown on the Schedule of Assignments. Make-up exams will be given **only** in the **last** week of regularly scheduled classes for medical reasons (documented) or a preapproved university conflict. Exams are a scheduled part of this course and attendance is required (exam location is based on lab section). Students with **University** conflicts should consult the lecturer. Answers will be posted.

FINAL EXAM: The final exam must be taken at the University scheduled time. OSU ID cards will be collected at the final exam. Final exams will not be returned.

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.

LABORATORY NOTEBOOKS: Will be graded. You are required to use the Student Lab Notebook, and record all entries in ink. Record procedures followed, observations made and data collected, calculations, and results. 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 REPORTS: are normally due at the **beginning** of the lab session **ONE** week after the **completion** of the experiment. Late reports (even if on the same day) will be penalized 10% per day. If you submit a late report to 100 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. **If you do not check-out, you will receive a zero for your last lab report.** The lab score will be factored to 200 points. *Photocopies of the report sheets are not acceptable.*

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. Goggles will be issued during check-in. After the first free pair, goggles may be borrowed, if available, from CE 231 or 331; 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 wear 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 laboratory.
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.

HOMEWORK: Homework will not be graded; however, doing assigned problems is often the best way to determine how well you understand the material. All homework sets will be posted on carmen.

OFFICE HOURS: I will be available in my office Mondays, Wednesdays and Fridays from 1:30 – 3 pm; Tuesdays and Thursdays from 10-11:30 am.

ADDITIONAL ASSISTANCE

1. Lab Supervisor - Dr. Tatz (rjtatz@chemistry.ohio-state.edu, 292-8096, 280D CE) will help with lab problems.
2. Extra copies of course handouts are available in the General Chemistry Office, 100 Celeste Lab.
3. **You are strongly encouraged to make use of the Learning Resource Center (160 CE) frequently.**
4. All students with documented disabilities, who need accommodations, should see the instructor privately to schedule an appointment as early as possible. If your disability requires materials in alternative formats, please contact the Office for Disability Services at 292-3307, Room 150 Pomerene Hall.
5. Undergraduate chemistry web site: <http://www.chemunder.chemistry.ohio-state.edu>

LEARNING RESOURCE CENTER (TA Aid Room) - 160 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 two hours a 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 outside the door which lists the time each T.A. is available as well as their course assignment. Teaching assistants wear a name tag which indicates the course for which they are responsible. There are also two side rooms, 160A and 160C where T.A.'s may be present. 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 instruction and help.

LABORATORY VIDEO INSTRUCTION

Laboratory videos are shown at the start of the laboratory. Students must view the entire video prior to starting the experiment. Students who are late for laboratory will have to view the video on the computers in the **Learning Resource Center - 160 CE**. A form will be printed in 100 CE which should be picked up and given to the TA in lab.

The videos are designed to supplement the instructions in the laboratory manual. Students will be better prepared to assimilate the video instructions if they have read the laboratory manual prior to the laboratory. The videos are short and there is insufficient time to take detailed notes if you are not already familiar with the experiment. You are encouraged to view the tapes at your own pace either before or after laboratory. The list of videos for this course and run times are as follows:

<i>Expt. #</i>	<i>Title of Video for Chemistry 163</i>	<i>Time</i>
CKIN	Safety in the Laboratory	07:48
21	Complex Titration	05:15
22	Ion Exchange Chromatography	05:50
23	Acid-Base Titration Curves	----
24	Determining a Solubility Product Constant	----
25-I	Qualitative Analysis - Group I	07:55
25-II	Qualitative Analysis - Group II	09:54
25-III	Qualitative Analysis - Group III	09:01
26	Qualitative Analysis of a Simple Salt	----
27	An Oxidation-Reduction Titration	----
28	Voltaic Cells	05:18
29	Electrolytic Cells	07:25
30	Preparation of a Coordination Complex	----
31	Absorption Spectra	04:11

Chem 163 is a Physical Science course in the Natural Science category of the GEC, which has these goals and objectives:

Goals/Rationale: Courses in natural sciences foster an understanding of the principles, theories and methods of modern science, the relationship between science and technology, and the effects of science and technology on the environment.

Learning Objectives:

1. Students understand the basic facts, principles, theories and methods of modern science.
2. Students learn key events in the history of science.
3. Students provide examples of the inter-dependence of scientific and technological developments.
4. Students discuss social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.

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.

If you need assistance, check with the staff of the Department of Chemistry. Group efforts by students, use of another student's pre-laboratory or laboratory material, or assistance from individuals who already have taken the course may place you in jeopardy of violation of the standards of General Chemistry. Possession of another student's lab report(s) will raise immediate concerns about academic misconduct. Plagiarism or the submission of work based on old material is considered to be academic misconduct no matter how small the infraction. Identical answers indicate copying or unacceptable group efforts - always answer questions in your own unique words. **Individuals retaking the course must complete all work for the course during the current quarter and may not submit any parts of pre-labs or lab work or reports performed in a previous quarter (see item #6 in "Ten Suggestions for Preserving Academic Integrity", <http://oaa.osu.edu/coam/ten-suggestions.html>).**

Pre-laboratory exercises are designed to make you prepare for the laboratory. Copying answers from other individuals or from old copies of the exercises does not prepare you properly for the laboratory. 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.

Laboratory work is the essence of the science of Chemistry; therefore laboratory work in General Chemistry is to be an individual effort. You will have your own locker/work space and 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. 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. If a minimum grade in laboratory is required as stated on the syllabus of the course, the zero can result in an E for the entire course.

Copying, use of "crib" material or use of stored constants and formulas in calculators on quizzes, midterm examinations or the final exam, no matter how small the violation, is regarded as a severe violation of academic standards. 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 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.

There is a mandatory quiz on Academic Misconduct to be taken on Carmen - <https://carmen.osu.edu> Unless you receive a perfect score on the quiz, you will not receive a passing grade in this course. Please complete the quiz before the end of the first week of the quarter.

1. Distribution dates for Prelaboratory Problems:

<i>Expt. #</i>	<i>Distribution Date</i>	<i>Collection Date</i>
26	Page 91, Ques 2, 4	Feb. 9, 10

2. Prelaboratory Problems are due at the BEGINNING of their respective lab sessions (except for Expt. 21).

Pre-labs submitted after the lab is started will receive zero credit.

3. Summary of Totals for the Laboratory Grades

<i>Expt. #</i>	<i>Report</i>	<i>Notebook</i>	<i>Prelab</i>	<i>Total Lab Points*</i>	<i>Grading**</i>
24	100	10	--	110	B
25-I	100	10	--	110	C
25-II	120	10	--	130	C
25-III	120	10	--	130	C
XRD	100	10	--	110	B
26	70	10	18 pts. prelab 12 pts. report	110	C
POGIL	100	10	--	110	B
28/29	100	20	--	120	B
30	100	10	--	110	B
31	100	10	--	110	B
32	100	10	----	<u>110</u>	B
				1260	

The laboratory points are factored by 250/1260 to give 250 course points.

** Grading Reports: B - TA grades (full report similar to 121/122), C - graded by storeroom (flow chart/small report form; no reanalysis).

Notebooks - "Student Lab Notebook" (Hayden-McNeil Publishing). Must be written in ink.

<i>Before lab:</i>	Experiment number and title Purpose (one or two sentences) Procedure (reference to pages in lab manual and brief outline)
<i>During lab:</i>	All numerical data (must include label and units) --- <i>Recorded in Notebook first</i> Other observations --- <i>Recorded in Notebook first, Not the lab manual</i>
<i>At home:</i>	Calculations (<i>using your own data</i>) Chemical equations Results

Notebooks are graded each week as the experiment is being performed. Calculations, chemical equations and results will usually not be complete when the notebook is graded. Your TA will sign your work, write down your grade, and tell you how your notebook could be improved. The copy will be collected each lab period.

Report Due Dates - Reports graded by your TA are due one week after completion of experiment. Late penalty is 10% per day, 50% per week. You are also expected to submit reports graded by the storeroom at the laboratory session one week after the completion of an experiment. Report sheet are torn out of lab manual (*Photocopies are not acceptable.*) Reports must be submitted by the following dates or they will not be graded:

Friday, Feb. 13 (4:30 PM)	Experiments 24, 25-I, II, III
Friday, Mar. 6 (4:30 PM)	Experiments XRD, 31, 32
Friday, Mar. 13 (4:30 PM)	ALL Reports due by this time.

Reports should be graded and returned ten days after submission - notify your lecturer if they are not.

HOMEWORK ASSIGNMENTS

We will not collect your homework assignments. This does not mean they are optional. Be aware that these problems are a guide to your learning.

Just “doing” the homework does not guarantee success in this course. Read the problem carefully and determine what information is being asked and what is provided. Write down and clearly label all the information you will use to solve the problem. Using the necessary equations and constants, calculate the answer. Carry at least one extra significant figure in intermediate calculations. If you struggle (be honest with yourself), you probably need to review and practice more. The expectation – you will apply what you have learned to new situations

Chapter 17: 47, 48- 62 even; 64, 67, 68; 91-93, 96-98; 108

Need to Review? Chapter 2: 64, 66, 68; Chapter 4: 22-28 (even)

Lab 25: all the Prelab and Report questions for Groups I, II and III. You need to know the confirmation reagents, reactants and balanced chemical equations for the 12 cations in this lab. You also need to know the separation reagents – on the group level as well as within the group.

Chapter 19: 10-16, 18, 20; 21, 22-28 even; 30, 32, 34-36, 40-42; 43, 46, 48, 50; 51, 52, 54, 56, 58, 61, 62-68 even; 74-78 even; 84, 86, 91, 95, 103,108

Chapter 20: 11, 12, 14, 16; 18-22 (for 22 do as many as you need); 23, 24, 26; 27, 28, 30, 31, 32-40 even; 42-48 even; 50-56 even; 57, 58-68 even, 69, 72, 74-78; 79-82; 85, 86-88, 90; 93d, 96, 98, 102, 105,113, 118

Chapter 22: 12-18 even; 19, 20-40 even; 41, 42-54 even; 56-68 even; 70-82 even; 83, 86-88, 90, 103.

Chapter 23: 37, 42, 46, 51, 53, 54, 63

Chapter 24: 9-11, 14, 16; 17- 22, 24, 26; 28-30, 32; 33- 40, 42-48; 56; 78; 80

Chapter 21: 8-10, 12, 14, 16; 25, 26, 28, 30; 31, 32, 34, 36; 43, 44, 46; 53, 55, 56, 58, 59, 61, 73

Text for Problems Worked in Lecture

Use your textbook to find the values of the K_{sp}/K_f constants.

1. Solid Ag_2CrO_4 is added to pure water at 25°C . Some remains undissolved. The mixture is stirred several days to ensure equilibrium is reached. Analysis shows $[\text{Ag}^+] = 1.3 \times 10^{-4} \text{ M}$. What is the K_{sp} ?
2. Calculate the molar solubility of CaF_2 at 25°C in a solution containing $0.010 \text{ M Ca(NO}_3)_2$. What if the solution contained 0.010 M F^- ?
3. What is the molar solubility of Mg(OH)_2 in 0.10 M NaOH ? (pH?)
4. What happens when you add strong acid (H^+) to a solution of CaF_2 ? Will CaF_2 become more or less soluble?
5. Calculate the $[\text{Ag}^+]$ at equilibrium when 0.220 M concentrated ammonia, NH_3 , is added to 0.010 M AgNO_3 .
6. What is the molar solubility of AgCl in 15 M NH_3 ?
7. Will a precipitate form when $25 \text{ mL } 0.020 \text{ M Pb(NO}_3)_2$ and $40 \text{ mL } 0.0054 \text{ M KI}$ are mixed together?
8. Which silver salt will precipitate first when 0.10 M silver nitrate is added to a solution containing 0.025 M NaCl and $0.0025 \text{ M Na}_2\text{CrO}_4$?
9. What is the $[\text{Cu}^{2+}]$ in a solution that is 0.050 M CuSO_4 and 3.0 M NH_3 ? Will a precipitate remain?

Realize questions may be asked for any salts having K_{sp}/K_f .

Look at trends by using Excel and a graph:

- For #2, vary the concentration of $\text{Ca(NO}_3)_2$: 0.0010 M , 0.0050 M , 0.010 M , 0.015 M and 0.020 M
- For #3, vary the pH of NaOH from 8.00 to 13.00 .
- For #6, vary the concentration of ammonia: 3 M , 6 M , 9 M , 12 M and 15 M

READ and outline the sections to be covered BEFORE each lecture

Week of	Monday	Wednesday	Friday	
Mar 30	17.4	17.4-17.5	17.5-17.6	
Apr 6	17.6-17.7	Lab 25 Intro, Group I	Lab 25-Group I, II	Quiz 1
Apr 13	Lab 25 - Group II	Lab 25 - Group III, 19.1	19.1-19.3	Quiz 2
Apr 20	19.4-19.6	19.6-19.7, 20.1	Lab 26, 20.2-20.3	Quiz 3
Apr 27	20.4-20.6	20.6-20.7	20.7-20.9	MT1
May 4	20.9, 22.1	22.2-22.4	22.4-22.5	Quiz 4
May 11	18.3-18.4, 22.5-22.7	22.7-22.9	22.10-22.11, 23.1-23.4	Quiz 5
May 18	23.4-23.7	24.1-24.2	24.3-24.4	MT2
May 25	OFF	24.4-24.6	24.6, 21.1	
June 1	21.2-21.4	21.4-21.7	21.7-21.9	Quiz 6

Quizzes are given the first 20 minutes of lab so be on time and ready to begin

Quiz 1: April 8/9 (WTh) on 17.4-17.5

Quiz 2: April 15/16 (WTh) on 17.4-17.6, Group I

Quiz 3: April 22/23 (W/Th) on Lab 25, 19.1-19.3

Quiz 4: May 6/7 (WTh) on 20.1-20.8

Quiz 5: May 13/14 (WTh) 20, 22.1-22.5

Quiz 6: June 3/4 (W/Th) 23 and 24

MT1: Chapter 17.4-17.6, Lab 25, Chapter 19, Chapter 20.1-20.3

MT2: Lab 26, Chapters 20, 22, 23.1-23.4

Final: CUMULATIVE 1/3 MT1, 1/3 MT2, Chapters 23, 24 and 21