Welcome to CH1111. Chemistry is a laboratory science and experimentation is the foundation of chemical knowledge. This lab is designed to provide you with practical experience in conducting tests and making observations. As you progress through this course you will develop and enhance the skills needed to collect meaningful data, interpret the results and draw conclusions.

CH1111 is separate from your first year chemistry lecture course (CH1110). Because of the nature of individual experimentation and the equipment it involves, the course is divided into many sections that include up to 24 students. Lab instructors are teaching assistants (TAs) selected by the Chemistry Department and are well educated in the field of chemistry. In addition to giving you an introduction to each experiment, your instructor is responsible for overseeing your safety while in the lab and for assisting you in your lab work. Your instructor can be your biggest asset in this course. Don't hesitate to ask your instructor questions. The instructor is not a substitute for preparation, however, and will not do your experiment for you or give you answers to complete your reports.

Although your primary source of information will be your instructor, you may also come in contact with the lab supervisor. The lab supervisor is responsible for course design and administration and assists instructors and students as needed. You will need to contact your lab supervisor if you cannot be present in your regularly scheduled section or if you have questions concerning your final grade. You may also see your lab supervisor if you have a problem that you don't wish to discuss with your instructor. Please note that the coaches at the Chemistry Learning Center (CLC) are prepared to assist with the lecture material, but may not be able to assist with the lab material.

What you will need for this course beginning week 3:


Eye protection: Visorgogs (available at Chem Stores, B002, in basement of Chem Sci Bldg). Splash proof safety goggles are also acceptable.

Proper attire: Wear clothing that provides the most protection. Shorts, skirts or dresses must be knee length or longer. Open shoes (sandals) are not allowed. You will be required to go home and change if you are dressed inappropriately for lab.

| Week 2  
| (21-25 Jan) | Introduction, Safety, Check In |
| Week 3  
| (28 Jan-1 Feb) | Techniques of Measurement & Observation, #27 |
| Week 4  
| (4-8 Feb) | No CH1111 Lab Scheduled. Enjoy Winter Carnival! |
| Week 5  
| (11-15 Feb) | Sequence of Copper Reactions, #24 |
| Week 6  
| (18-22 Feb) | Determination of an Empirical Formula by Titration, #6 |
| Week 7  
| (25-29 Feb) | Chemistry of Toys (handout distributed week 6) |
| Week 8  
| (3-7 Mar) | Calorimetry, #5 |
| Week 9  
| (17-21 Mar) | Qualitative Analysis, #22 |
| Week 10  
| (24-28 Mar) | Finish Qualitative Analysis |
| Week 11  
| (31 Mar-4 Apr) | Valence Electrons & Lewis Structures, #28 |
| Week 12  
| (7-11 Apr) | Molecular Geometry, VSEPR Theory (handout distributed week 11) |
| Week 13  
| (14-18 Apr) | $\text{H}_2\text{O}_2$ Decomposition- Determination of R, #13 |
| Week 14  
| (21-25 Apr) | Evaluations, Clean up, & Check out |
ABSENCES: To report an absence, email ABSENTFYCLAB@mtu.edu, put “CH1111 Absence Request” in the subject line. If contacted in ample time, the lab supervisor will reschedule you into another lab session the same week. All makeup labs must be performed within one week of the absence.

You may make up work for excused absences only. The lab supervisor decides whether an absence is excused, not your instructor. Excused absences include those due to university sponsored field or athletic trips, or illness. Students may be required to present written confirmation of the reason for the absence.

In the event of a university sponsored activity, the student is responsible for reporting the absence before the missed lab session.

In case of illness, the student should report the absence as soon as he or she knows the lab session will be missed.

If you miss more than two experiments and you do not make them up, you will automatically fail CH1111.

LAB GRADING: 172 lab points total, see following point distribution:

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental (graded primarily on effort)</td>
<td>120 pts (70 %)</td>
</tr>
<tr>
<td>Quizzes (4 each, unannounced, graded on correctness)</td>
<td>52 pts (30 %)</td>
</tr>
</tbody>
</table>

Experimental: Each experiment is worth 12 points and will be graded as described below:

- Three points for the following:
  - Effort in preparing for each lab (coming to lab on time, with approved eye protection and drawer combination, properly dressed, and prelab assignments completed)
  - Effort during lab (knowledge and understanding of the procedure and chemistry involved; organization and ability to budget time, common equipment check in/out procedures followed, cooperation and attitude)
  - Safety rules followed (approved eye protection worn at all required times, proper waste disposal, clean work areas, labware cleaned at completion of experiment)

- Six points for effort in completing the report sheet (data and observations recorded correctly and comprehensively, one example of each calculation performed shown in detail, appropriate graphs, inclusion of units and labels on data, data recorded in ink, one single line through mistakes). Grading criteria for these points will differ for each experiment.

- Three points for effort in completing the postlab questions (clear, concise and comprehensive answers)

Lab Quizzes: Four unannounced lab quizzes will be given and will be graded on correctness. You will need a calculator and may use a pencil.
SAFETY: Chemistry as an experimental science is an exciting subject, however, experimentation in a chemistry lab has an element of danger and risk associated with it. This is particularly true if the surroundings, tools, or techniques are unfamiliar to you. It is important to be prepared and to think safety - both for yourself and others in the lab. If in doubt about the safety of any procedure, ASK the instructor before proceeding. To keep the risk to a minimum, you are expected to adhere to the following rules, regulations and safe techniques. This information applies to laboratory students in all chemistry teaching labs.

RULES, REGULATIONS AND SAFE TECHNIQUES

1. Do not enter the teaching laboratory until an instructor or supervisor is present. Guests are not allowed in the lab. The Prep Room, Rm. 514, is off limits to students.

2. On the first day of lab, determine the location and use of all emergency and safety equipment: safety shower, eye wash and fire extinguisher. Ask your instructor if you are uncertain. Locate the nearest emergency exit. Know the emergency evacuation route (posted on the lab door).

3. Wear approved eye protection at ALL times while in the lab, even during clean up. Contact lenses are not recommended.

4. Wear clothing that provides the most protection - a lab coat or apron is recommended. Shorts, skirts or dresses must be knee length or longer. Open shoes (sandals) are not allowed. Confine long hair and sleeves when working. Do not wear your favorite clothing to lab.

5. Do only the assigned experiment.

6. In case of chemical contact with skin or eyes, flush affected area with running water for 15 minutes. Use faucets, safety showers or eye wash, as necessary. Remove all contaminated clothing immediately.

7. Never eat, drink or taste anything (food or chemicals) while you are in the laboratory. Do not place fingers, pencils, pipets, etc. in your mouth. Never rub your eyes.

8. Report all accidents or injuries to your instructor immediately, even seemingly minor ones.

9. Always avoid unnecessary hazards. Keep working surfaces clean at ALL times. Do not sit or lean on bench surfaces. Keep the floor clear of tripping hazards. Jackets and bookbags should be stored on the coat racks. Stools and chairs are not permitted in the aisles. Drawers should be closed except when removing equipment.

10. Wash your hands and arms thoroughly before leaving the lab.
11. Read the labels on reagent bottles to make sure you have the right reagents. (Report empty reagent bottles to your instructor.)

12. Do not return excess reagents to stock containers; share with others or dispose of it.

13. Dispose of waste properly. This means:
   a. Broken glass - glass disposal container (EXCEPTION: broken mercury thermometers must be reported to your instructor for proper disposal. See #14.)
   b. Water-soluble liquids - flush down sink
   c. Paper products - waste basket
   d. Solid wastes and water-insoluble waste - properly labeled waste containers. Do not throw solid materials into sinks.
   e. If you are uncertain of the proper waste disposal, consult your instructor.

14. Report all chemical spills immediately and clean up the spill as directed by your instructor. Acid spills should be neutralized with sodium bicarbonate (baking soda) before wiping up with a damp sponge. Base spills should be neutralized with citric acid before wiping up with a damp sponge. Broken mercury thermometers are treated as a chemical spill and must be reported to your instructor for proper disposal.

15. Do not test odors by direct inhalation from the container. Fan the vapors gently towards your nose.

16. Always add concentrated acid to water and acids to bases. Pour slowly while stirring the mixture constantly.

17. Always use a suction bulb (never your mouth) when filling a pipet.

18. Do not insert pipets directly into reagent bottles. Transfer an approximate amount into a beaker or other container.

19. Do not force glass tubing and/or thermometers into rubber stoppers. Always lubricate the hole in the stopper with glycerin or soapy water and protect your hand with a towel when inserting tubing or thermometers.

20. Never use an open flame (gas burner) in the vicinity of flammable materials and never leave a lighted burner unattended.

21. Return all equipment clean and to its proper location. Do not put common equipment in your drawer.
Remember that simple tasks, often regarded as safe, can be dangerous if done improperly. The majority of accidents reported in the laboratory involve cuts from handling broken or chipped glassware and burns from touching hot objects. Always use good judgment and care when working in the lab.

HAZARD COMMUNICATION STANDARD

By signing the Laboratory Worker Safety Agreement on your check in card, you are stating that you are aware that you have a "right to know" all safety information contained in the manufacturers Material Safety Data Sheet (MSDS) for any chemical. You can obtain this information by requesting a copy of the MSDS from Chem Stores, in Room 8002, Chemical Sciences Building.

EMERGENCY RESPONSE

1. Telephone 1 2 3 for fire, ambulance, medical assistance or police.

2. Occupational Safety & Health Services: phone 7-2118
   Department of Chemistry Office: phone 7-2048
   CH1111 Lab Supervisor: phone 7-2044

EMERGENCY BUILDING EVACUATION PROCEDURE

1. The signal to evacuate the building in case of emergency is the building fire alarm. Prepare to evacuate the building when you hear the alarm. Shut off heat sources (hot plates and gas burners), turn off lights and electricity, and close windows and doors before you depart.

2. Leave the building in an orderly manner via the evacuation route posted on the door inside the laboratory. Walk, do not run or push. Do not use the elevators. Elevators are only for the use of rescue personnel during a building evacuation. The building attendant brings the elevators to the first floor once the alarm is activated and anyone inside could become trapped.

3. Once outside, meet with your instructor at your designated meeting place. This location is different for each of the laboratories and is announced during the first lab session. If you do not meet your instructor, he or she will assume that you are trapped in the lab and send rescue workers into the building to look for you. You must stay 100 feet away from the building to enable rescue personnel to get to the site of the emergency.

4. In the event of an evacuation drill or false alarm, you may re-enter the building only when the Public Safety Officer at the scene of the emergency gives the "All Clear" on a megaphone.
DRAWER EQUIPMENT: On the first day of lab you will be assigned a drawer containing some of the equipment that you will use, and be responsible for, during the semester. The contents of your drawer should be inspected and compared to the equipment list on the following page to determine that all items are present and in acceptable condition. If you are uncertain of the identity of any piece of equipment on the list, see the illustrations posted on the bulletin board in the lab. If an item is broken or missing, list it on an equipment replacement form (available from your instructor). After you have finished checking all of the equipment, bring the equipment replacement form to your instructor for replacement glassware. No replacements will be made after the first day. Sign and return the check in card when you have all the equipment. Once you sign the check in card you are responsible for this equipment and will be charged for any breakage or loss. You must check out of your drawer at the end of the semester or if you drop the course. At that time, every item on the list must be in the drawer. Replacement supplies can be purchased from Chem Stores, Room B002 of the Chemical Science and Engineering Building. Prices shown on the following list are approximate. Actual costs are subject to change without notice. Failure to check out results in a $25 fine in addition to charges for missing or broken equipment.

COMMON EQUIPMENT: In addition to drawer equipment, you will also need to use common equipment. Common equipment, as the name implies, is equipment also used by other students. Before using any equipment, inspect it carefully to determine that all pieces are in satisfactory condition. Do not accept equipment if there is something wrong with it, instead notify your instructor.

Once you have accepted the equipment, you are responsible for returning it in clean and satisfactory condition at the end of the lab session. If you have broken or misplaced the equipment, tell your instructor immediately. You will receive equipment replacement instructions the following week. You are responsible for the cost of replacing such equipment. Lab fees cover the cost of expendable items such as chemicals, not breakage.
## DRAWER EQUIPMENT LIST

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Drawer Equipment</th>
<th>Stock #</th>
<th>Cost, Each</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Beaker, 50 mL, Pyrex</td>
<td>00537</td>
<td>$ 3.19</td>
</tr>
<tr>
<td>1</td>
<td>Beaker, 100 mL, Pyrex</td>
<td>00538</td>
<td>$ 2.10</td>
</tr>
<tr>
<td>2</td>
<td>Beaker, 150 mL, Pyrex</td>
<td>00539</td>
<td>$ 2.41</td>
</tr>
<tr>
<td>1</td>
<td>Beaker, 250 or 400 mL, Pyrex</td>
<td>00540 or 541</td>
<td>$ 2.22 or 2.35</td>
</tr>
<tr>
<td>1</td>
<td>Beaker, any size, Pyrex</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** You need 6 beakers total.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Drawer Equipment</th>
<th>Stock #</th>
<th>Cost, Each</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Erlenmeyer flask, 50 mL</td>
<td>00791</td>
<td>$ 3.35</td>
</tr>
<tr>
<td>1</td>
<td>Erlenmeyer flask, 125 mL</td>
<td>00792</td>
<td>$ 3.30</td>
</tr>
<tr>
<td>2</td>
<td>Erlenmeyer flask, 250 mL</td>
<td>00793</td>
<td>$ 3.78</td>
</tr>
<tr>
<td>1</td>
<td>Graduated cylinder, 10 mL</td>
<td>00685</td>
<td>$ 4.46</td>
</tr>
<tr>
<td>1</td>
<td>Graduated cylinder, 25 mL</td>
<td>00686</td>
<td>$ 4.14</td>
</tr>
<tr>
<td>1</td>
<td>Funnel, long stem</td>
<td>00179</td>
<td>$ 4.76</td>
</tr>
<tr>
<td>1</td>
<td>Large test tube, 25 x 150 mm</td>
<td>01115</td>
<td>$ 0.96</td>
</tr>
<tr>
<td>11</td>
<td>Small test tubes, 13 x 100 mm</td>
<td>01112</td>
<td>$ 0.22</td>
</tr>
<tr>
<td>1</td>
<td>Test tube rack</td>
<td>00981</td>
<td>$ 14.03</td>
</tr>
<tr>
<td>1</td>
<td>Test tube holder</td>
<td>00106</td>
<td>$ 3.00</td>
</tr>
<tr>
<td>1</td>
<td>Test tube brush</td>
<td>01121</td>
<td>$ 1.30</td>
</tr>
<tr>
<td>2</td>
<td>Medicine droppers</td>
<td>00227</td>
<td>$ 0.18</td>
</tr>
<tr>
<td>1</td>
<td>Spatula</td>
<td>00233</td>
<td>$ 3.76</td>
</tr>
<tr>
<td>2</td>
<td>Stirring rods, glass</td>
<td>00244</td>
<td>$ 0.48</td>
</tr>
<tr>
<td>1</td>
<td>Watchglass, 3 &quot; diameter</td>
<td>01101</td>
<td>$ 2.51</td>
</tr>
<tr>
<td>1</td>
<td>Evaporating dish, ceramic</td>
<td>00715</td>
<td>$ 4.84</td>
</tr>
<tr>
<td>1</td>
<td>Crucible bottom, ceramic</td>
<td>00665</td>
<td>$ 2.48</td>
</tr>
<tr>
<td>1</td>
<td>Crucible cover, ceramic</td>
<td>00673</td>
<td>$ 2.50</td>
</tr>
<tr>
<td>1</td>
<td>Triangular pipetem</td>
<td>01002</td>
<td>$ 3.76</td>
</tr>
<tr>
<td>1</td>
<td>Wire gauze square</td>
<td>00312</td>
<td>$ 0.82</td>
</tr>
<tr>
<td>1</td>
<td>Tongs, crucible</td>
<td>00270</td>
<td>$ 6.05</td>
</tr>
<tr>
<td>1</td>
<td>Wash bottle, 250 mL, plastic</td>
<td>00584</td>
<td>$ 1.14</td>
</tr>
<tr>
<td>1</td>
<td>Storage bottle w/ cap, plastic</td>
<td>00582</td>
<td>$ 1.02</td>
</tr>
</tbody>
</table>

**PREPARATION:** Meaningful lab experiences require pre-laboratory preparation. Refer to your experiment schedule to determine which experiments will be performed at each session. A scientist ordinarily begins with a literature search. You should begin by reading the introductory information provided with each experiment. Additional reading may be assigned within the introductory material or by your instructor.

*Continued...*
You must answer the prelab questions before coming to lab, otherwise you will not be permitted to begin the experiment. The prelab will help clarify your understanding of the reading. If you have any questions concerning the prelab, seek help from the lab supervisor. When you arrive in lab, turn in your prelab immediately, then check your answers with the posted key. The answer key is a useful tool if used properly. You may use it to check your answers, but not to get your answers.

Read through the experimental procedure and review the postlab questions before coming to lab. This will help you use your time more efficiently in the lab and minimize the frustration associated with not knowing what is going on. The experiments can be completed in the allotted amount of time if you come to lab prepared.

It is important that you come to lab on time. Your instructor will give a brief introduction before you begin to work, noting key points about the experiment and special safety considerations.

Do not hesitate to ask your instructor questions. Your instructor is well educated and knowledgeable in the field of chemistry and is there to assist you in the laboratory. Your instructor is not a substitute for preparation, however, and will not do your experiment for you or give you answers to complete your reports.

Remember that some experiments must be extremely precise while others need only be approximate. Scientists and engineers must always keep in mind that unnecessarily careful measurement can steal time from other work. On the other hand, the results of rough measurement can be misleading. It is important, therefore, to select the correct instrument and operate it skillfully to have a successful outcome.

University chemistry laboratory does not require a high degree of mathematical sophistication, but reasonable skill in problem solving is necessary to complete the calculations and reports. The math skills required include: algebraic manipulations, dimensional analysis (factor-label method), manipulation of exponents, scientific notation, graphing and significant figures. You should review these topics and seek assistance as needed.

REPORTS AND RECORD KEEPING: A report form comes with each experiment. Responses should be clearly and completely written. Accurate reporting of experimental results is very important in laboratory work. Laboratory reports must comply with the following criteria. Failure to follow these guidelines will result in points being deducted from your report.

- Completed prelab questions are due at the beginning of each lab session and will be returned to you with your completed report the following session. After you have turned them in, check the prelab answer key to see if you were on the right track before you start the experiment.
- Each data and postlab page must be completely blank before you begin work.
- Reports must be written in permanent ink and must be written legibly.
• Record all your data and observations directly on the report sheet at the time they are obtained. Tables are provided to help you organize your numerical data. Blank spaces are provided for observations. Record initial and final observations whether a change has occurred or not. All observations are important!

• Data should be reported to the correct number of significant figures.

• No erasures are to be made on the report sheet. White-out (liquid paper) should not be used either.

• Corrections must be made by drawing a single line through the erroneous data and entering the correct data next to it. Complete obliteration of the erroneous data is not acceptable. See the examples posted in the laboratory of acceptable and unacceptable work.

• Reports and postlab questions are due the day the experiment is completed and must be turned in to your instructor before leaving the lab.

• Where calculations using data are involved, show one example of each type of calculation using data from your first trial. Always use units and labels in your calculations and pay attention to significant figures.

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**ACADEMIC INTEGRITY AND HONESTY:** One of a scientist’s (person’s) most prized possessions is integrity. A scientist records all data and observations exactly as they occur, even if the unexpected is observed. Do not change data or observations to what you think they should be, but rather, try to explain the unexpected. Scientists learn by discussion with one another. You may also profit by discussion with your classmates, but not by copying from them.

Cheating is considered a serious offense and is not tolerated in the laboratory. Examples of cheating in the lab include: turning in a report for work not done, changing data to fit what you think it should be, copying old reports and possessing old reports in the laboratory.

Except for those experiments where you work with a partner or in a group, you are expected to collect data and observations and answer questions independently. Even in a team experiment, your report should be prepared independently, in your own words.

The departmental policy on academic integrity and honesty follows. Read this and be aware of the consequences, as ignorance is not a defense.

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**Department of Chemistry Policy on Academic Integrity and Honesty**

In the preparation of students for responsible professional careers, Michigan Technological University expects honesty and integrity to be the ordinary way of life in all university activities. Plagiarism, cheating, fabrication, and facilitating academic dishonesty are forms of academic dishonesty and are defined in the university policy (see Definitions of Academic Dishonesty in the university policy). Although group study and group projects are often appropriate, it is expected that individual assignments and examinations will be the private efforts of the particular student.
The following are specific problems of academic dishonesty that pertain to classes in the Department of Chemistry:

- Copying raw data for a lab without actually participating in the work resulting in the raw data, or without the permission of the instructor in charge of the course.
- Inventing raw data.
- Filling in parts of lab reports that require the raw data for calculations or interpretation before the data is collected.
- Holding discussions so thorough that they result in identical methods and numbers for problems for lab reports, homework assignments, and computer programs.
- To use old lab reports for anything more than format purposes without the permission of the instructor in charge of the course. (Because there is no need for formatting lab reports in this course, old lab reports are forbidden in the laboratory. Possession of old reports will be construed as an intent to cheat.)
- Allowing anyone to copy a lab report, homework, assignment, test, computer program, either now or in the future, without the permission of the instructor in charge of the course.

A student detected cheating, beyond any reasonable doubt, in the preparation of any individual assignment will be handled according to the following guidelines. A minor offense is defined as a lab report or assignment counting for less than 10% of the final lab grade. A major offense is defined as a lab report, assignment, or test counting for 10% or more of the final lab grade.

**Minor Offense:**

- The grade for the particular assignment or lab report will be scored as a zero.
- The final grade for the laboratory component of the class will be dropped one full grade (10%).
- The Office of Student Affairs (OSA) will be notified and a record will be kept. The OSA will handle it as a major offense if the offender has any prior offense.

**Major Offense or Second Minor Offense:**

The OSA will be notified, who will take action consistent with procedures set forth in the university's Academic Integrity and Honesty policy.

MTU complies with all federal and state laws and regulations regarding discrimination, including the Americans with Disability Act of 1990 (ADA). If you have a disability and need reasonable accommodation for equal access to education or services at MTU, please call Dr. Gloria Melton, Associate Dean of Students (487-2212). For other concerns about discrimination, you may contact your advisor, department head, or the Affirmative Action office (487-3310).