Department of Chemistry & Biochemistry

The University of Toledo

Graduate Student Handbook

Academic Year 2024-2025

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Revised 07/22

THE MASTER'S PROGRAM

The master's program in chemistry increases the professional competence of the chemist beyond the bachelor's degree. Coursework, independent research and small group discussions are emphasized to achieve this goal. The Master of Science degree can be viewed as an important professional goal or as preparation for study toward the doctoral degree.

Requirements for the Research-Based Master's Program

For the degree of Master of Science or Master of Science and Education, students must meet the following departmental requirements:

a. Coursework must total at least 30 hours of graduate credit at the 6000-level or above, including at least four hours of credit in thesis research (CHEM 6960).

b. Registration for chemistry seminar (CHEM 6930) is typically required each term the student is enrolled in graduate research.

c. Each candidate must present a thesis.

d. Registration for chemistry colloquium (CHEM 6920) is typically required each term, but no more than four hours of credit may count within the required 30 hours.

e. Each candidate must demonstrate satisfactory performance on a comprehensive oral examination of thesis research, in addition to the public defense of the thesis at a colloquium presentation.

f. Upon choosing a Research Advisor, an advisory committee will be appointed to supervise the research, to administer the comprehensive oral examination of the thesis research, and to approve the thesis. Each student, in conjunction with the Director of Graduate Studies, the Research Advisor, and the student's advisory committee, will prepare a plan of study listing the courses and other requirements for the degree. Upon approval, the plan of study becomes the list of course requirements for the degree. Students are required to take four or more 6000-level courses covering at least three different subdisciplines of chemistry as part of the plan of study.

g. Each candidate must register and successfully complete CHEM 6940: *Scientific Communications*.

Master of Science and Education

For the degree of Master of Science and Education, students must meet requirements for the degree as stated in the College of Education graduate section of the University general catalog.

Department of Chemistry and Biochemistry Research-Based Master's Program Courses and Research

A minimum of four courses is required for each student. Students will be required to show breadth of knowledge in chemistry by passing advanced or specialized courses in three subdivisions. The Master's Program requires students to also demonstrate depth of knowledge by passing two specialized courses in one subdivision.
The courses are selected by the student in consultation with their Research Advisor and, when appropriate, the Director of Graduate Studies. Additional courses may be required as defined by the Research Advisor, the Advisory Committee and the Director of Graduate Studies.

Total Credits

A minimum of 30 credits is required of which no more than 4 may be colloquium. The completion of 30 credits is not in itself sufficient for the awarding of the M.S. degree; the other requirements listed in this section of the manual must also be satisfied.

Chemistry Colloquium

All full-time graduate students typically register for Chemistry Colloquium (Chemistry 6920) each term. Attendance at colloquia given either by students or by outside speakers is an important part of every chemist's training. For Masters' students, one colloquium presentation is required. The presentation must be based on the completed thesis. It is given immediately prior to or after successful completion of the final oral examination. Registration for Chemistry Colloquium (6920) is required for the semester in which a student plans to graduate. Registration for Research Seminar (6930) is typically required each term that the student is enrolled in Graduate Research (6960).

Advisory Committee

The student must have an advisory committee composed of at least three (3) members of the Graduate Faculty in Chemistry. The Research Advisor, who must be chosen by the student prior to the end of their first semester of study, is the Chair of the Advisory Committee. The other committee members are chosen by the student in consultation with the Research Advisor but must be approved by the Director of Graduate Studies, the Department Chair and the College of Graduate Studies. The committee must be established by the beginning of the second semester of graduate study. The first meeting of the committee to approve the plan of study will take place during the second semester of study.

Manuscripts of Graduate Thesis

A completed thesis acceptable to the Research Advisor and the student's advisory committee is required. Directions for preparing the thesis are available by obtaining information from the College of Graduate Studies. The College of Graduate Studies has a University of Toledo Handbook that provides the style in which the thesis is to be presented. It is important to obtain a current copy of the handbook in order to ensure that the thesis is styled properly.

Thesis Preparation and Defense

The student must describe the outcome of their graduate research in written form to meet both departmental and university requirements. This thesis is submitted to the student's advisory committee for approval. The committee will administer an oral examination, which will emphasize, but not be limited to, the thesis content. The committee members should be given a copy of the thesis ***at least fourteen (14) days*** before the thesis defense. After the committee accepts the thesis, the student must present the results of the research at a departmental colloquium.

Thesis Colloquium

The topic of the thesis colloquium is a public defense of the student's thesis and must describe the research performed. The thesis colloquium must take place immediately prior to or after the final oral exam is passed and the thesis is accepted by the Advisory Committee.

Department of Chemistry and Biochemistry Non-Thesis Based Master's Program

This degree option is intended for students with full-time employment whose current work responsibilities preclude the possibility of conducting the requisite research for the thesis-based M.S. degree. School teachers, non-traditional students, and employees of local industry who want to earn an M.S. degree for promotions and/or to meet eligibility requirements for teaching positions at regional community colleges may wish to pursue this option for a M.S. Chemistry degree.

Coursework

A minimum of five 6000-level courses in chemistry (20 hr) is required. Students must demonstrate breadth by taking one graduate course in each of four different subdivisions chosen from following list: analytical, biochemistry, green and environmental, inorganic, materials, organic, physical chemistry.

6000-level coursework in related disciplines (e.g., biology, chemical engineering, environmental sciences, medicinal chemistry, physics), with permission of the Director of Graduate Studies, may be applied toward the non-thesis M.S. degree. (8 hr max)

CHEM 6930 (Chemistry Seminar) and CHEM 6960 (Thesis Research) **cannot** be applied to the 30 hour minimum required for this degree option.

Required: CHEM 6940: *Scientific Communication* (2 hr)
Required: CHEM 6920: *Chemistry Colloquium* (2 hr)
Candidate must give a literature presentation in the semester when enrolled in CHEM 6920
Minimum Total Credit Hours: 30 hr

Professional Science Master's Program in Green Chemistry and Engineering

A Professional Science Master's (PSM) in Green Chemistry and Engineering option is available for students who want to concentrate their M.S. studies on green chemistry principles and incorporate aspects of green engineering, business, and other professional skills into their M.S. degree in chemistry. The PSM option is intended for students seeking jobs in industry, selected government agencies, or non-governmental organizations that require skills beyond those obtained in a traditional chemistry curriculum. The PSM Degree in Green Chemistry and Engineering is not a research-based M.S. degree.

Requirements for the Professional Science Master's Program in Green Chemistry and Engineering

For the professional science master's degree, students must meet the following departmental requirements:

a. The courses presented must total at least 36 hours of graduate credit.

b. Each student, in conjunction with the director of graduate studies and the director of the School of Green Chemistry and Engineering, will prepare a plan of study listing the courses and other requirements for the degree. Upon approval, the plan of study becomes the list of course requirements for the degree. Students are required to take CHEM 6200, CHEM 6210, CHEE 6010, CHEE 6110, BUAD 6600, either EFSB 6690 or 6590, and 12 credit hours of elective graduate coursework in traditional areas of chemistry or chemical engineering.

c. Each student must also complete a graduate industrial internship (CHEM/CHEE 6970). The graduate industrial internship must be completed at an industry, governmental organization, or non- governmental organization in an area relevant to green chemistry and engineering. The PSM program director will assist in identifying internship opportunities and must approve all placements. Students who are working or have worked part or full-time in a relevant job may request internship credit for this work experience. The director will evaluate all such requests and give credit if appropriate.

d. Up to 4 credit hours of 6000-level coursework in a related discipline (e.g., environmental sciences, physics) may be applied to the minimum 12 credit hours of electives if approved by the manager of the PSM program and Director of Graduate Studies. Up to 2 credit hours of independent research project (CHEM 6960) may also be applied if approved by the manager of the PSM program. Research seminar (CHEM 6930) and colloquium (CHEM 6920) cannot be applied towards the 36 hour minimum for the PSM degree.

Entry or reentry to the Doctoral Program

A student in the Master's Degree program at UT who would like to be considered for the Doctoral Program should consult with the Director of Graduate Studies regarding this possibility. Request for a direct transfer to the Doctoral Program can be initiated by the student by sending a memo to the Graduate Standings Committee. This should be accompanied by a supporting letter from the student's Research Advisor. Alternatively, a student completing a Master's Degree may wish to continue into the Doctoral Program. In this case, application for Ph.D. studies is accomplished via the normal graduate application mechanism through the College of Graduate Studies.

Forms Required (Available at http://www.utoledo.edu/nsm/chemistry/grad/forms.html and College of Graduate Study website)

1. *Faculty Interview* - to be used when selecting a Research Advisor within the 1st semester of study.
2. *Committee Selection* - to be used after selecting a Research Advisor and within the 2nd semester of study. This form is also used to change committee members, when necessary.
3. *Plan of Study* - to be completed before the end of the second semester of graduate study. This is approved by the student's selected advisory committee. A meeting of the committee is necessary by the end of the 2nd semester of study, https://www.utoledo.edu/graduate/forms/MasterPOS.pdf.
4. *Graduate Research Advisory (GRAD) Committee Approval and Assurances* - to be completed with the Plan of Study. The Graduate School has this form. https://www.utoledo.edu/graduate/forms/GRADform.pdf
5. *Record of Comprehensive General Examination and Oral Defense of the Thesis* - to be completed by the Research Advisor and signed by the committee after the final examination is successfully completed.
6. *Application for Academic Degree* - to be completed by the second week of the semester in which completion of the degree is anticipated; requires payment of a fee. The form is available at the College of Graduate Studies website, https://www.utoledo.edu/offices/registrar/graduation.html
7. *Defense Acceptance and Intellectual Protection Form:* to be completed with your research advisor upon scheduling your defense. https://www.utoledo.edu/graduate/forms/IntellectualProtection.pdf
8. *Approval of Thesis*: https://www.utoledo.edu/graduate/forms/ApprovalofThesis.pdf
9. *Check-Out* - to be signed off by the appropriate personnel in the department. The form is returned to the Director of Graduate Studies. https://www.utoledo.edu/nsm/chemistry/pdfs/R4_Checkout_2008.pdf

**FOLLOW INSTRUCTIONS ON EACH FORM. COPIES OF EACH FORM MUST BE SUBMITTED TO THE DIRECTOR OF GRADUATE STUDIES. A COPY OF THE FINAL THESIS IS REQUIRED FOR THE DEPARTMENT. ALSO, A FORWARDING ADDRESS IS REQUESTED UPON EXITING THE DEPARTMENT.

Courses Available

Principles:

5300 Principles of Analytical Chemistry
5400 Principles of Organic Chemistry
5500 Principles of Biological Chemistry
5600 Principles of Inorganic and Organometallic Chemistry
5700 Principles of Physical Chemistry
5800 Principles of Materials Chemistry

Green and Environmental Chemistry:

6200 Green Chemistry (3)
6210 Environmental Chemistry (3)

Analytical Chemistry:

6300 Advanced Analytical Chemistry (4)
6310 Separation Methods (3) with 6350 Separation Methods Laboratory (1)
6320 Electrochemistry (4)
6330 Spectroscopic Methods and Analysis of Spectra (4)
6340 Mass Spectrometry (4)

Organic Chemistry:

6330 Spectroscopic Methods and Analysis of Spectra (4)
6400 Advanced Organic Chemistry (4)
6410 Organic Synthesis (4)
6420 Topics in Modern Organic Chemistry (4)
6430 Medicinal Chemistry (4)
6440 Carbohydrate Chemistry (4)

Biological Chemistry:

6500 Advanced Biological Chemistry (4)
6510 Protein Chemistry (4)
6520 Enzymology (4)
6530 Nucleic Acid Chemistry (4)
6540 Macromolecular Crystallography (2) with 6550 Practical Protein Crystallography (2)
6570 Biophysical Chemistry (4)
6580 Bioinorganic Chemistry (4)

Inorganic Chemistry:

6580 Bioinorganic Chemistry (4)
6600 Physical Inorganic Chemistry (4)
6610 Chemistry of Transition & Post-transition Elements (4)

6620 Chemistry of Main Group Elements (4)
6800 Advanced Materials Chemistry (4)

Physical Chemistry:

6570 Biophysical Chemistry (4)
6700 Advanced Physical Chemistry (4)
6710 Quantum Chemistry and Spectroscopy (4)
6720 Modern Topics in Physical Chemistry (4)
6730 Molecular Modeling (4)
6800 Advanced Materials Chemistry (4)
6810 Materials Science I (4)
6820 Materials Science II (4)

Materials Chemistry:

6800 Advanced Materials Chemistry (4)
6810 Materials Science I (4)
6820 Materials Science II (4)
6830 Nanomaterials Science (4)
6850 X-Ray Crystallography (4)

Special Topics in Chemistry

Divisions may occasionally offer specialized courses. These courses can be applied to requirements with the approval of the Director of Graduate Studies. All special topics courses have the same course number and a subtitle will be added to indicate the course title. Current examples are:

6980 Special Topics in Chemistry: Homogeneous and Heterogeneous Catalysis (4)

Research

Once students select a research group, they are expected to enroll in CHEM 6960 for the appropriate number of credit hours. Each research advisor has a separate section of this course.

Interdisciplinary Courses in Materials Science:

BIOE 6810/EECS 6810 Solid State Electronics with Bioengineering Applications (3)
BIOE 6820/EECS 6820 Microelectronic and Micromechanical Fabrication (3)
PHYS 5620 The Physics of Lasers (3)

Interdisciplinary Courses in Biological Chemistry:

BIOL 6010 Advanced Molecular Biology (4)
BIOL 6090 Advanced Cell Biology (4)

THE DOCTORAL PROGRAM

Upon admission to the Graduate Program, it may be possible for a student either to proceed with the intention of first obtaining a Master's Degree or to immediately begin work toward a Doctoral degree. This decision will depend upon individual circumstances in each case. The Director of Graduate Studies and the student's Research Advisor will help each student to make a preliminary decision on the degree program to be followed.

At the end of the second academic semester, the Graduate Standings Committee will evaluate a student's progress and inform each of those who have indicated a desire to work for the doctoral degree whether he or she:

(i) may continue directly through doctoral studies,
(ii) must first earn a Master's Degree, or
(iii) may not continue as a graduate student in the Chemistry Program.

The doctoral program in chemistry is designed to ensure that the student has the basic foundation of knowledge and is equipped with the tools necessary to do independent research. The emphasis on research recognizes the power of original research to arouse the scientific curiosity of the student, to develop and stimulate creativity, and to encourage further discovery through independent study.

The doctoral program is divided into three stages for the typical student. The first stage establishes, through a set of prescribed courses, the foundation for further training. During this stage, a Research Advisor is chosen. During the second stage, the student will pursue research toward the dissertation and undertake a qualifying examination. After meeting the examination requirements, the student is admitted to candidacy in the third stage of the program. This stage is devoted to research and completion of the doctoral dissertation.

Requirements for the Doctoral Program in Chemistry

Candidates for the Doctor of Philosophy degree must meet the following requirements:

a. Each student, in conjunction with the Director of Graduate Studies, the Research Advisor, and the student's advisory committee, will prepare a plan of study for their doctoral program which lists their selected courses and other requirements for the degree. Students are required to take six or more 8000-level courses as part of the plan of study. To show breadth of knowledge in chemistry, students must pass advanced or specialized courses in four different subdivisions and to show depth of knowledge students must pass two specialized courses in one subdivision.

b. Successful completion of the qualifying examination (oral examination) for entry to doctoral candidacy.

c. Registration for chemistry colloquium (CHEM 8920) is typically required each term.

d. Registration for chemistry seminar (CHEM 8930) is typically required each term the student is enrolled in dissertation research.

e. Each student must satisfactorily complete two semesters in supervised, half-time teaching.

f. After admission to candidacy, each student is required to spend a minimum of two consecutive semesters in full-time study at The University of Toledo.

g. Dissertation research must be carried out primarily in laboratories of The University of Toledo.

h. Each candidate must demonstrate satisfactory performance on a comprehensive oral examination (dissertation defense) on his or her dissertation research and a public defense of the dissertation at a colloquium presentation.

i. Each student must register and successfully complete Chem 8940, *Scientific Communications.*

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Total Credits

A minimum of 90 credits is required. The completion of 90 credits is not in itself sufficient for the awarding of the Ph.D. degree; the other requirements listed below must also be satisfied.

Additional Requirements for the Doctoral Degree

By the end of the first academic semester, doctoral students must choose a Research Advisor. By the end of the second academic semester doctoral students must choose a Doctoral Advisory Committee and meet with the committee to approve the dissertation research and the plan of study. Doctoral students are also required to pass two additional examinations: the qualifying exam and the comprehensive exam. In the Department of Chemistry and Biochemistry, an oral examination is used as the qualifying exam and the dissertation defense is used as the comprehensive examination. Completion of the Doctoral degree involves the preparation of the dissertation, a private defense and a public defense. (Note: The College of Graduate Studies considers the summer as a semester when calculating support. The Department of Chemistry and Biochemistry considers the academic semesters, Fall and Spring, when scheduling requirements.)

Doctoral Advisory Committee and Dissertation Research

The student's Advisory Committee, and in particular the Research Advisor, is responsible for monitoring the progress and for judging whether the research is original and of acceptable quality. The Research Advisor, who must be chosen by the student prior to the end of his or her first semester of study, is the chair of the doctoral advisory committee.

There must be at least four members on the committee, all of whom are approved by the Research Advisor, the Director of Graduate Studies, the Department Chair and the College of Graduate Studies. No fewer than three members must be members of the Graduate Faculty in Chemistry and Biochemistry. One member must be from outside the department. The committee must be established during the second semester of graduate study. The first meeting of the committee to approve the doctoral program plan of study will take place during the second semester of study.

Each Ph.D. student must be a major contributing author on at least one accepted publication in an indexed, peer-reviewed journal prior to graduation.

Qualifying Examination - Proposal and Defense

Before the end of their fourth academic semester of enrollment, each student must present and defend a research proposal composed of both written and oral components. While there are no specific topic limitations on the material comprising this examination, there must be a significant component of the research proposal that has been conceived by the student, completely independent of their research advisor and their dissertation committee. For the remainder of the proposal, it is expected and encouraged that the student works with their advisor in preparing a well-written and thorough research proposal. As the qualifying examination for entrance into Ph.D. candidacy, the research proposal and oral defense must follow certain guidelines. The student is expected to: (1) demonstrate scientific understanding of the research topics and prior work involved in their research proposal at a high level of competency; (2) identify and develop an original and scientifically significant chemistry problem; (3) demonstrate and apply knowledge of chemistry learned in classes and the laboratory to all aspects of the research proposal; (4) implement a technically sound theoretical/experimental protocol for all proposed experiments; and (5) write and present a coherent proposal.

Students should be aware that they will be responsible for acquiring the necessary background knowledge to present and defend all aspects of their research proposal. This includes the portions of the proposal related to their current dissertation project, as well as the independently developed new directions incorporated within this proposal. All proposals are expected to include a section composed of ***original research*** that has been developed independently from the student's advisor and dissertation committee, although this section must be related to the main focus of the proposal and incorporated into the overall research narrative. The ***original research*** components of the overall proposal must be written as a separate section and denoted as such by appropriate headers (e.g., New Directions). **To ensure academic integrity of the entire research proposal examination process, the graduate faculty of the Department of Chemistry and Biochemistry considers plagiarism a serious violation of the Academic Honesty Policy** (see the Academic Honesty/Dishonesty section of the College of Graduate Studies Student Handbook for details). Evidence of plagiarism can result in **immediate dismissal from the doctoral program**.

The student's research proposal should clearly state the objectives of the proposed work and the suitability of the methods to be employed. The proposal must begin with a single-page summary of the proposal, followed by the project description. The project description is a detailed statement of the work to be undertaken and must include: the objectives and expected significance of the research, the relation of the proposed research to the present state of knowledge in the field, the design of the experiments to be undertaken, and the experimental methods and procedures to be utilized. Any special apparatus required should be justified; apparatus and instrumentation commonly available (even if not available at UT) do not require justification. The proposed research must have a definite goal and it should be possible to accomplish the defined goals in a reasonable period of time (3-5 years).

Ideas for research projects come from many sources but are all usually derived from knowledge of research being done as reported in the literature. Innovative or speculative projects may be proposed as long as the ideas are clear and scientifically sound, and the experiments are technically feasible.

Role of Research Advisor: During preparation of the proposal, the student is encouraged to consult regularly with their Research Advisor for advice and guidance. The student's Advisor must examine and approve the proposal prior to submission. Advisors are encouraged to assist in editorial aspects of the proposal, except for the section noted as ***original research*** (see above). For the ***original research*** section, Advisors can discuss general proposal writing strategy, give general comments on contents (e.g., where to elaborate, where to be concise and where to provide clarity), and help with spelling/grammar, but should NOT be involved in any way related to the identification and development of the research ideas that comprise this section. Assistance is also available from the University's Writing Center in the Center for Teaching and Learning.

Proposal Organization and Format: Proposal guidelines are modeled closely after those in the current NSF Grant Proposal Guide. Proposals must be organized using the following sections in the order provided:

- Cover Sheet (1 page)

  Include proposal title, student name, and date of submission.

- Project Summary (1 page)

  The summary is a single-page abstract of the proposed research giving a concise and thorough overview of the complete project. The summary should be written in third person and include the project title, a clearly defined hypothesis, project aims, and a summary of research plans and

methods.

- Project Description (15 pages maximum)

  This is the main body of the proposal and should be organized into the following subheadings. These subsections may be further subdivided or rearranged if doing so leads to a clearer presentation of the project description (given page numbers for each section are approximations and are listed for guidance only).

  - Introduction and background (2-3 pages): significance of the problem; relevant prior research in this area; unanswered questions to be addressed
  - Project aims and plans (3-5 pages): what do you intend to accomplish on this project; what hypotheses will be developed and tested
  - New directions (2-3 pages): devise some new ideas that you plan to explore that could lead to breakthroughs in your area of research; describe how you would implement and test these new ideas
  - Preliminary results (2-4 pages): experiments conducted to date to address your project aims; interpretation and analysis of results; problems encountered and planned alternative approaches
  - Experimental methods (2-4 pages): what experimental approaches will be needed to complete your specific aims; give experimental details (equipment, reagents, methods, analysis, etc.)
  - Expected outcomes (1 page): how will your proposed work lead to further developments
  -

  The Project Description must not exceed a total of 15 pages. Charts, graphs, data tables, photographs, diagrams, illustrations, figures, and other pictorial presentations are included in the 15-page limit.

- References Cited (no page limit; not included in page count)

  Include a representative sampling of the published research related to your project, cite the primary literature, not review articles (if possible), and limit your citations to the most relevant published work. References should be cited in the text of the Project Description with superscript numbers. Numbering should be in the order in which the references are introduced in the text. References must be collected in the "References Cited" section in numerical order. Reference citations must be in ACS format accompanied by titles. An example is given below:

  Barnard, T. S.; Mason, M. R. "Synthesis, Structure, and Coordination Chemistry of the Bicyclic π-Acid Phosphatri(3-methylindolyl)methane," *Organometallics* **2001**, *20*, 206-214.

  Appropriate references include articles in peer reviewed journals, books, reviews and textbooks. Web sites are not valid references if other primary sources are available. Provide a soft copy of any references requested, prior to the defense, by Oral Examination Committee members.

Proposal margins must be 2.5 cm at the top, bottom, and on each side. The type size must be clear and readily legible and no smaller than 11-point font. There is no mandatory line spacing (single-spaced, double-spaced, etc.), but page limits must be adhered to for the Project Summary (single page) and the Project Description (15-page limit). All proposal pages (including References Cited) should be numbered consecutively. Proposals submitted in violation of the set format will be returned without review. A single resubmission of the revised

proposal due to formatting errors is allowed. The Oral Examination Committee may decline to examine a resubmitted proposal that fails to meet the formatting guidelines, resulting in a failure of the Qualifying Examination.

Process for Proposal Submission and Examination: A student must submit a single-page summary of their research proposal to the members of their Dissertation Committee from the Department of Chemistry and Biochemistry (e.g., not the external committee member) by the end of the 3rd week of the semester in which they plan to undertake their oral examination (for most students, this will be near the end of January). **Additionally, for students who have undertaken previous graduate work, they must also submit one- page abstracts of their previous theses/dissertations.** A copy of the abstract should also be given to the Graduate Examinations Committee Chair. Following approval of these abstracts, the departmental Dissertation Committee members will elect an Oral Examination committee chair and constitute an oral examination committee for the student (including at least one additional faculty member). The membership of the committee will then be communicated to the student, who will subsequently be responsible for scheduling their oral defense time and date, as well as reserving a room for this event. It is recommended that this be scheduled for a 3-hour block of time.

The student will submit their final research proposal to their Oral Examination Committee at least two weeks prior to the examination date. Also provide a soft copy of any references requested, prior to the defense, by Oral Examination Committee members. Students should consult with the individual members of their Oral Examination Committee to determine whether to submit electronic or paper copies of their proposal. Upon receipt of the final proposal the Oral Examination Committee will check proposal content and format and, if the proposal meets the specified guidelines, will grant approval for the student to defend. A single resubmission of the proposal for formatting errors is allowed. Proposals that do not adhere to the guidelines noted above will be returned without further examination. For the oral examination, the student's research Advisor may be present solely as a non-voting, non-participating observer, but the Advisor will not be present during voting by the committee. Defense of the proposal and any revisions required by the Oral Examination Committee must be completed and approved by the end of the fourth academic-year semester of study. A hard or soft copy of the original proposal and all material related to any required revisions will be deposited with the office of the Chair of the Department of Chemistry and Biochemistry.

Examination and Results: The proposal will be judged on the following four criteria:

1. **Basic chemistry knowledge** – understanding of undergraduate level chemistry concepts
2. **Advanced chemistry knowledge** – understanding of the theory, instrumentation and experimental techniques needed to conduct the proposed research; knowledge of relevant previously published results
3. **Communication skills** – quality of the written proposal and oral presentation
4. **Scientific reasoning skills** – ability to design, present and defend ideas; potential for innovation

Each of these four areas will be scored independently, contributing to one's final score on the oral examination. There are three possible outcomes of the defense: 1) pass, 2) a single retest, or 3) failure, in which case the student will become a terminal M.S. candidate. (Note: Upon completion of the M.S. degree, the student must leave the program and will not be considered for readmission).

Chemistry Colloquium

All full-time graduate students must typically register for Chemistry Colloquium each semester. Attendance at colloquia given either by students or by outside speakers is an important part of every chemist's training. Doctoral students will present a colloquium on the completed dissertation research, given immediately prior to or after the final defense is passed.

All graduate students are required to attend student colloquia and department seminars to participate in discussion of the material presented, broaden their own chemistry and biochemistry knowledge, and to give their own oral presentations.

The chemist must be able to read the chemical literature critically, develop substantial understanding of the phenomena described and reasoning utilized, and communicate this understanding to a critical audience. The department colloquium provides a medium in which this capability is developed and demonstrated.

Courses Available

Principles:

7300 Principles of Analytical Chemistry
7400 Principles of Organic Chemistry
7500 Principles of Biological Chemistry
7600 Principles of Inorganic and Organometallic Chemistry
7700 Principles of Physical Chemistry
7800 Principles of Materials Chemistry

Green and Environmental Chemistry:

8200 Green Chemistry (3)
8210 Environmental Chemistry (3)

Analytical Chemistry:

8300 Advanced Analytical Chemistry (4)
8310 Separation Methods (3) with 8350 Separation Methods Laboratory (1)
8320 Electrochemistry (4)
8330 Spectroscopic Methods and Analysis of Spectra (4)
8340 Mass Spectrometry (4)

Organic Chemistry:

8330 Spectroscopic Methods and Analysis of Spectra (4)
8400 Advanced Organic Chemistry (4)
8410 Organic Synthesis (4)
8420 Topics in Modern Organic Chemistry (4)
8430 Medicinal Chemistry (4)
8440 Carbohydrate Chemistry (4)

Biological Chemistry:

8500 Advanced Biological Chemistry (4)
8510 Protein Chemistry (4)
8520 Enzymology (4)
8530 Nucleic Acid Chemistry (4)
8540 Macromolecular Crystallography (2) with 8550 Practical Protein Crystallography (2)
8570 Biophysical Chemistry (4)
8580 Bioinorganic Chemistry (4)

Inorganic Chemistry:

8580 Bioinorganic Chemistry (4)
8600 Physical Inorganic Chemistry (4)

8610 Chemistry of Transition & Post-transition Elements (4)
8620 Chemistry of Main Group Elements (4)
8800 Advanced Materials Chemistry (4)

Physical Chemistry:

8570 Biophysical Chemistry (4)
8700 Advanced Physical Chemistry (4)
8710 Quantum Chemistry and Spectroscopy (4)
8720 Modern Topics in Physical Chemistry (4)
8730 Molecular Modeling (4)
8800 Advanced Materials Chemistry (4)
8810 Materials Science I (4)
8820 Materials Science II (4)

Materials Chemistry:

8800 Advanced Materials Chemistry (4)
8810 Materials Science I (4)
8820 Materials Science II (4)
8830 Nanomaterials Science (4)
8850 X-Ray Crystallography (4)

Special Topics in Chemistry

Divisions may occasionally offer specialized courses. These courses can be applied to requirements with the approval of the Director of Graduate Studies. All special topics courses have the same call number and a subtitle will be added to indicate the course title. Current examples are:

8980 Special Topics in Chemistry: Homogeneous and Heterogeneous Catalysis (4)

Research
Once students select a research group, they are expected to enroll in CHEM 8960 for the appropriate number of credit hours. Each research advisor has a separate section of this course.

Interdisciplinary Courses in Materials Science:

BIOE 8810/EECS 8810 Solid State Electronics with Bioengineering Applications (3)
BIOE 8820/EECS 8820 Microelectronic and Micromechanical Fabrication (3)
PHYS 7620 The Physics of Lasers (3)

Interdisciplinary Courses in Biological Chemistry:

BIOL 8010 Advanced Molecular Biology (4)
BIOL 8090 Advanced Cell Biology (4)

Manuscripts of Graduate Dissertations

A completed dissertation acceptable to the Research Advisor and the student's advisory committee is required. Directions for preparing the dissertation are available by obtaining information from the College of Graduate Studies. The College of Graduate Studies has a University of Toledo Handbook that provides the style in which the dissertation is to be presented. It is important to obtain a current copy of the handbook in order to ensure that the dissertation is styled properly.

Dissertation Preparation and Defense

The student must describe the outcome of their graduate research in written form to meet both departmental and university requirements. This dissertation is submitted to the student's advisory committee for approval. The committee will administer an oral examination, which will emphasize, but not be limited to, the dissertation content. The committee members should be given a copy of the dissertation ***at least fourteen (14) days*** before the dissertation defense. After the committee accepts the dissertation, the student must present the results of the research at a departmental colloquium.

Dissertation Colloquium

The topic of the dissertation colloquium is a public defense of the student's dissertation and must describe the research performed. The dissertation colloquium must take place immediately prior to or after the final defense is passed and the dissertation is accepted by the Advisory Committee. A suitable abstract must be submitted to the department office at least one week in advance of the public defense for distribution to the department.

Other Requirements

Registration for Chemistry Seminar (8930) is typically required each semester the student is enrolled in Dissertation Research (8960). Each student must satisfactorily complete two semesters in supervised half- time teaching. After admission to candidacy, each student is required to spend a minimum of two consecutive semesters in full-time study at The University of Toledo.

Required Forms (Available at http://www.utoledo.edu/nsm/chemistry/grad/forms.html and College of Graduate Studies website)

1. *Faculty Interview* - to be used when selecting a Research Advisor within the 1st semester of study.
2. *Committee Selection* - to be used after selecting a Research Advisor and within the 1st semester of study. This form is also used to change committee members, when necessary.
3. *Doctoral Program Proposal* - to be completed before the end of the second semester of graduate study. This is approved by the student's selected advisory committee. A meeting of the committee is necessary by the end of the 2nd semester of study. https://www.utoledo.edu/graduate/forms/DocPOS.pdf
4. *Graduate Research Advisory (GRAD) Committee Approval and Assurances* - to be completed with the Doctoral Program Proposal. The College of Graduate Studies has this form. https://www.utoledo.edu/graduate/forms/GRADform.pdf

5. *Qualifying Examination (Oral Examination)* - to be completed by the Chair of the Examination Committee after the examination is administered (form below).
6. *Application for Academic Degree* - to be completed by the second week of the semester in which completion of the degree is anticipated; requires payment of a fee. The form is available at the College of Graduate Studies website, https://www.utoledo.edu/offices/registrar/graduation.html
7. *Defense Acceptance and Intellectual Protection Form:* to be completed with your research advisor upon scheduling your defense. https://www.utoledo.edu/graduate/forms/IntellectualProtection.pdf
8. *Dissertation Defense* - to be completed by the Research Advisor after the dissertation has been successfully defended before the Advisory Committee (department specific form and College of Graduate Studies form (https://www.utoledo.edu/graduate/forms/ApprovalofDissertation.pdf)
9. *Check-Out* - to be signed off by the appropriate personnel in the department. The form is returned to the Director of Graduate Studies. https://www.utoledo.edu/nsm/chemistry/pdfs/R4_Checkout_2008.pdf

**FOLLOW INSTRUCTIONS ON EACH FORM. COPIES OF EACH FORM MUST BE SUBMITTED TO THE DIRECTOR OF GRADUATE STUDIES. A COPY OF THE FINAL DISSERTATION IS REQUIRED FOR THE DEPARTMENT. ALSO, A FORWARDING ADDRESS IS REQUESTED UPON EXITING THE DEPARTMENT.

Thesis and Dissertation Colloquium Presentation

Questions relating to student colloquia should be directed to the faculty member in charge of Chemistry Colloquium (Chem 6920/8920).

Abstract and Announcements

1. An abstract must be distributed to all faculty members and graduate students at least **ONE CALENDAR WEEK** before the presentation.
2. The abstract should include an introductory section containing a concise statement or definition of the problem, definitive statements about the significance of the problem, and any appropriate background material.
3. The body of the abstract should present all major concepts, all logical steps in the reasoning, and a critical evaluation of the evidence to support these ideas. Illustrative examples should be used. The outline should clearly distinguish between background material and the major topic of the presentation.
4. Complete literature references should be given in a style used in journals published by the American Chemical Society. See the first issue of the most recent volume of J. Am. Chem. Soc. Under Instructions for Authors examples of format and see CASSI for the Chemical Abstracts listing of journal abbreviations.
5. The abstract is NOT to be a word-for-word transcript of the presentation. In general, photocopied material and massive tables of data are not appropriate. Any diagrams or structures should be neatly drawn. References should be superscripted in the text and collected at the end. The abstract should be typed, double-spaced with no more than three pages of text including references. No more than one additional page should be devoted to figures and diagrams.
6. Preparation and prompt publication of an acceptable abstract are the responsibility of the student. Prior to publication, **approval must be obtained from the student's Research Advisor and from the faculty member in charge of colloquia.**
7. The title of the talk and a statement of the time and place of the presentation should appear at the beginning of the abstract as well as on the usual announcement of the colloquium.

Presentation

1. The presentation should follow the format of the abstract; concepts and ideas should be developed in detail, effort should be made to clarify obscurities and evidence should be critically evaluated. The presentation of a thesis or dissertation colloquium should clearly distinguish between work of others and work of the student. A speaker must defend any statement that he/she makes: mere quotation of other authors is no defense. A clear, in-depth understanding of the available information is essential. A summary is appropriate at the end of the talk.
2. The presentation should be practiced so that it lasts about 45 minutes. Time for questions must be available. Topics and the scope of the presentation should conform to these time limitations.
3. Be sure to practice the presentation in its entirety at least twice, preferably in a seminar room and once before an audience.
4. The student is encouraged to use computer graphics software packages, such as Power Point, for the presentation. For a good reference on how to use visual aids, see p. 198-200 in the ACS Style Guide, A Manual for Authors and Editors, edited by J.S. Dodd.
5. For a thesis or dissertation colloquia, acknowledgements should be kept to a minimum, certainly not to exceed 2 minutes in duration.

Evaluation

Attending faculty (either in whole or in part) will receive a standardized form for evaluating various aspects of each student's performance. Comments by the faculty and recommended grades are also entered on these forms. The faculty member in charge will provide you with a summary to reinforce strong points and identify weak points in the colloquium so that future oral presentations may be better. The letter grade assigned will be entered for student’s final semester of study.

CHOOSING A RESEARCH ADVISOR

Each student will select potential Research Advisors before the end of the first semester of graduate study. The choice of a Research Advisor is an important step since research is an important part of a graduate student's training. In the process of doing research, the student learns to evaluate published results, devise experiments to be carried out to answer well-defined questions and the methods for doing them, interact with other chemists, write clearly, and more. Graduate research is more than just going into the laboratory and doing experiments. This is recognized by requiring each student doing research to also register for chemistry seminar. To be certain that the wisest choice is made in the selection of a Research Advisor the faculty has approved a procedure to ensure that each student makes the most informed choice possible, part of which will be as follows.

Faculty will be invited to present informal 25 minute seminars within the first 5 weeks (if possible) of the fall semester for graduate students on topics from their research activities. Entering graduate students **are required to attend all of these research seminars**. During the next few weeks of the fall semester, the graduate students will meet with faculty members for individual conferences to discuss projects available for student involvement. **The students will talk to at least 1/3 (and no less than 5) of the faculty members who presented research seminars.** Fulfillment of these requirements will be verified by faculty signatures on a form supplied by the Director of Graduate Studies (Faculty Interview Form). Each student will be required to return the signed faculty interview form to the Director of Graduate Studies by the second Monday of November. The student must attach to the signed interview form a **first, second** and **third** choice for Research Advisor. The graduate faculty will meet to evaluate students' choices of research groups before the end of the Fall semester. In general, the faculty will make every effort to give students their first choice. Consideration of a second or third choice becomes necessary when the group of first choice exceeds the maximum number of students allowed in a given academic year or when the chosen faculty declines to accept the student into his/her research group.

Graduate students who begin graduate study during the spring semester will meet with at least 1/3 (and no less than 5) of the faculty members who had previously presented research seminars, based on discussions with the Director of Graduate Studies and follow through the above procedures on an analogous schedule.

Each faculty member interacts with research students in a unique way and each student should feel comfortable with the Research Advisor chosen. Both students and faculty members are human beings and thus personal relations are important. A great deal of one's graduate education involves research. Thus, the importance of the choice of a Research Advisor is difficult to overstate. One should also recognize that doing research leads into the unknown and both student and Research Advisor will learn as the research progresses. It is possible that the student will become more knowledgeable in some areas than the Research Advisor. That is most appropriate since a goal of graduate education is to produce a mature scientist who is able to independently plan and conduct research.

Assignment to a Research Advisor is a professional agreement between the student and the Research Advisor. The Research Advisor can renounce their position as advisor if they deem that progress is unsatisfactory. The student may also wish to change Research Advisor for personal or professional reasons. Such a decision must be discussed with the Director of Graduate Studies to evaluate the serious consequences involved. In the unlikely event that either situation occurs, a request must be made in writing to the Department Chair and to the Director of Graduate Studies. They will provide the student with further instructions.

GRADUATE STANDINGS AND ASSISTANTSHIPS

Student Standings

The Graduate Standings Committee, chaired by the Director of Graduate Studies, is charged with continuously monitoring the progress and academic standing of each student in all required activities of the department's graduate program. At the end of each academic semester, each student will receive a graduate standings report from the Director of Graduate Studies, written in conference with each Research Advisor, detailing one's current status and future requirements. The Graduate Standings Committee takes action appropriate to each student's success or failure in meeting requirements of the graduate program. Written notification of each action is given to the student, the Research Advisor, and other appropriate University personnel. The Graduate Faculty of the department is the appellate body in actions involving deficiencies with respect to departmental requirements for chemistry graduate degrees. Any appeal must be made in writing through the Department Chair within two academic calendar weeks of the student's receipt of notice of Graduate Standings Committee action.

To be in good standing, a student:

1. Must maintain a minimum grade point average of 3.00 in Chemistry (CHEM) graduate courses, as well as a 3.00 GPA overall.
2. Must make satisfactory progress toward the degree for which they are studying. This includes:
   (i) satisfactory completion of all courses for which a student is registered,
   (ii) the timely completion of the requirements for the degree and
   (iii) adequate performance of the student's research project.
3. Must satisfactorily perform the duties designated for their financial support, i.e., teaching, research or fellowship.

For students with English as a second language:

> Students must successfully complete the English Screening Test in accordance with the requirements of the College of Graduate Studies to be in good academic standing. This exam is conducted by The American Language Institute and there will be three opportunities to pass. The first examination will be given during orientation. A grade of 3 is required for passing; a grade of 1 or 2 will require your daily attendance in the "International Teaching Assistants Seminar". A second examination will be given at the end of this course. Students who fail for a second time will be given a final opportunity during the second semester.

If a student is found to be **not** in *good academic standing* by the Graduate Standings Committee, the student is given written notification of the academic deficiencies by the Graduate Standings Committee and placed on *academic probation* for one semester. During that semester of probation, the student is required to remove any deficiencies. Two consecutive semesters of being found to be **not** in *good academic standing* can result in loss of assistantship support or dismissal from the Chemistry Graduate Program.

Procedure for Change of Status

The student should submit a written request to the Director of Graduate Studies. The request should list the courses taken at UT, grades received, GPA in chemistry graduate courses, and the reason for the requested change in program. Members of the Standings Committee and the Chair of the Admissions and Recruiting Committee will consider the request. The committee will consider the student's original application materials, the original letter of offer, and performance in coursework, teaching, and research at UT. Any comments in support of or against the petition by the student's Research Advisor will also be considered. Requests from students who are not in good academic standing (e.g., GPA below 3.00) will not be considered.

College of Graduate Studies Policies

In order to receive a graduate assistantship, a student must have regular admission to the College of Graduate Studies. If the grade point of a graduate assistant falls below 3.00, the student has one semester in which to raise the average to at least 3.00 or the assistantship is subject to termination. Tuition and tuition surcharges are paid for all graduate assistants through the College of Graduate Studies; the student must pay the general and other fees. Graduate assistants must register during each semester of their appointment; the number of credit hours allowed will be specified by the College of Graduate Studies for each given semester.

Teaching assignments are made by the Associate Chair of the department and, since the appointment is considered half time, the student is responsible for up to 20 hours per week including class time, grading, proctoring, and class preparation.

The student is expected to be working full-time toward a degree and therefore, ***no additional employment should be assumed by the student***. Exceptions to this policy must be supported by the student's Advisor and approved by the College of Graduate Studies Exceptions will be made only for assignments of short duration, which involve only a few hours of on campus work per week. **Employment outside the university is not allowed while a student holds a teaching or research assistantship.**

(https://www.utoledo.edu/graduate/forms/RequestForEmploymentOutsideOfGradAsstDuties.pdf).

Graduate assistants are eligible for a discounted parking permit. Students should bring proof of their appointment when purchasing a parking permit.

Academic Forgiveness

Graduate students may petition to retake up to eight credit hours to replace grades of C or lower under the Academic Forgiveness Policy for graduate students. In such cases, only the better grade will be used in the chemistry department GPA calculation to determine whether a student has a 3.0 GPA and is thus eligible for an assistantship.

In order to replace a grade, the student needs to petition the Graduate Standings Committee to do so, explaining the reasons for retaking the class, at least 6 weeks before the beginning of classes of the semester for retaking the class.

A student who chooses to retake a class to replace a grade are responsible for the payment for the credit hours of this class themselves. No tuition waiver will be granted for retaking a class. The additional credit hours during that semester are still covered by a tuition waiver if the student is eligible for an assistantship.

Students are reminded that the option of academic forgiveness is not to be taken lightly. It does not waive the requirement of maintaining a GPA of 3.0 or higher to remain eligible for an assistantship until the class in question is offered again.

Graduate Assistantships

Graduate assistantships may be awarded to full-time department of chemistry and biochemistry graduate students who are in good standing in the M.S. or Ph.D. program in chemistry. Students in their first academic year of studies who begin in the Fall or Spring semesters must be in good standing at the end of the Spring semester in order to qualify for further assistantship support.

Graduate assistants may be assigned to a variety of duties connected with the instructional program of the department. The usual classroom teaching assignments are discussion/recitation sections and laboratory classes. For each class, the faculty member in charge will give specific instructions and responsibilities. In addition, the graduate assistant will assist with proctoring and grading examinations. Other assignments include preparation of lecture demonstrations, instrument service and similar activities. Each graduate assistant with a classroom or laboratory teaching assignment will be assigned office hours. The department office will provide the necessary supplies for teaching such as paper, pens, pencils, etc. The department secretaries will type and duplicate quizzes, etc., but sufficient time must be allowed for this to be done.

The department may provide financial support (either teaching or research) for a student working for a **M.S. degree for no more than 8 semesters and for a Ph.D. for no more than 15 semesters** (this includes summer semesters). For a student who earns a M.S. degree at UT and then continues on to the Ph.D., total support will be for no more than 17 semesters. In unusual circumstances, graduate assistantships may be extended for an additional semester. Upon recommendation of the student's Research Advisor, the Department Chair may extend support in cases of unusual circumstances. To apply for this extension, the student's Research Advisor must petition the Department Chair on the student's behalf. The time limits for each degree are set by the Graduate School, but financial support is given only for the times specified above.

Accountability and Responsibility

Teaching assistants are important partners in the educational mission of the department. The department is committed to quality instruction at all levels. It is important to work together to provide an outstanding educational experience for students in our classes. The efforts of our teaching assistants are recognized and very much appreciated by the faculty and the students. Meritorious performance in teaching by a teaching assistant is recognized each year with an Award for Outstanding Teaching.

Teaching assistants are strongly urged to seek the assistance of members of the faculty if they believe that their instructional techniques can be improved. Teaching assistants who appear to be having difficulty with providing quality instruction to their students will be advised to seek the assistance of a person who can be of help with the particular problem they are experiencing. Teaching assistants have an important responsibility to address any issues raised by students and make progress toward improvement. A lack of progress in correcting any deficiencies in instruction will be considered inconsistent with the provisions of the assistantship contract and may require disciplinary action.

A teaching assistant is responsible for conducting all teaching duties in accordance with federal, state, university and department regulations. Specific course policies and requirements will be administered by the faculty member(s) in charge of the class.

Sickness and attendance at professional meetings are examples of valid excused absences as long as the department is properly notified and arrangements have been made in advance to cover any teaching duties. A

form is available from the department office to facilitate information exchange in the case of an absence due to travel. The department should also be notified in the case of sudden sickness and emergencies.

Disciplinary Action

Failure to satisfactorily perform teaching duties or neglect of duties or course policies will be dealt with in the manner outlined below. Each situation will be discussed with the teaching assistant prior to formal action. Infractions will accumulate throughout the student's course of study.

First Infraction

A written warning will be issued and placed in the teaching assistant's permanent file.

Second Infraction

A second written warning will be issued and placed in the teaching assistant's permanent file. The student will be notified that a third offense will result in the loss of their assistantship.

Third Infraction

The teaching assistant will be removed from his/her teaching duties and their assistantship will be terminated immediately.

At all points in the process, teaching assistants may submit written responses regarding the incident in question to the Associate Chair of the department. Written responses will be considered before any action is taken. All decisions may be appealed to the Chair of the department. The Chair's decision will be final.

Academic Honesty/Dishonesty

The faculty of the College of Natural Sciences and Mathematics expects students to do their part in maintaining their own integrity as well as the academic integrity and reputation of their institution's degree. Students who seek to better their records in dishonest ways demean themselves and show a lack of moral regard for others. Thus, students should neither indulge in nor condone academic dishonesty. Instead, students should take full advantage of the opportunities offered in the University to ensure that their academic time here is well-spent, their experience productive, and their academic credentials valuable. Such students will be better prepared for future endeavors and are likely to meet with success in a world in which their own performance will be the main criterion for recognition and advancement.

The College of Natural Sciences and Mathematics has issued the following policy statement on academic dishonesty:

Academic dishonesty will not be tolerated. Among the aims of education are the acquisition of knowledge and the development of the critical thinking skills necessary for independent learning. Activities inconsistent with these aims will not be permitted. ***IT IS THE STUDENTS' RESPONSIBILITY TO KNOW WHAT CONSTITUTES ACADEMIC DISHONESTY; IF STUDENTS ARE UNCLEAR, FOR EXAMPLE, ABOUT WHAT CONSTITUTES PLAGIARISM OR CHEATING THEY SHOULD SEEK THE ADVICE OF THEIR INSTRUCTOR AND RESEARCH ADVISOR.***

Examples of academic dishonesty include, but are not limited to:

1. *Plagiarism;*
2. *Giving or receiving, prior to an examination, any unauthorized information concerning the content of that examination;*
3. *Referring to or displaying any unauthorized materials inside or outside of the examination room, during the course of an examination;*
4. *Communicating, during an examination, in any manner with any unauthorized person concerning the examination or any part of it;*
5. *Giving or receiving substantive aid during the course of an examination;*
6. *Commencing an examination before the stipulated time or continuing to work on an examination after the announced conclusion of the examination period;*
7. *Taking, converting, concealing, defacing, damaging, or destroying any property related to the preparation or completion of assignments, research or examination.*

The penalty for academic dishonesty depends on the circumstances of the infraction but can be instant dismissal from the academic program. The college policy on academic dishonesty also applies to graduate students in their courses and during their research.

Teaching a Class

The purposes of a recitation class are to (1) permit students to ask questions about the subject matter, (2) observe and practice solving problems, (3) identify important concepts, and (4) take short quizzes. The ways in which these purposes can be accomplished differ from person to person and from class to class. The suggestions given here should serve as guidelines; one should apply common sense and adapt the suggestions to one's own style and the specific class.

The instructor should try to establish an attitude in the class that will encourage students to ask questions. This means being positive and reinforcing correct answers without being too critical of wrong answers or of "dumb" questions. There are times when it is necessary to say things like, "Did you read page xxx?" or "Did you try to do the problem?" when one suspects students are not trying. There will be students who just come to class and who are not prepared; even so, try to include as many students as possible in the discussion. Do not lecture to the class but teach by asking questions. When working a problem, write each step on the board, but get the students to contribute to what is written. Frequently when questions are asked to the class in general, the same students will often answer the questions. This limits the assistance to the other students. It is therefore good practice to call on different students for answers to specific questions. If a student does not know the answer, try to help that student figure out the answer before going on to another student for the answer. Once an answer is provided, ask a different student for confirmation of the answer. That way, two students get involved in answering one question.

In the process of working together with the class, demonstrate to the class how to work problems and how to think about chemical concepts. That is, try to serve as a role model, which is an important function. Make sure that you know how to work all the assigned homework problems. The goal is for students to like chemistry, but we must recognize that not everyone will like chemistry. However, the tools learned in chemistry are valuable in other courses and in other situations. So, we are also teaching more than chemistry; we are teaching how to learn, how to think, and how to analyze problems.

The faculty member in charge will give you appropriate instruction regarding quizzes. If you are unsure about the number of quizzes, the length of the quizzes, the content of the quizzes, etc., talk to the faculty member responsible for your particular section.

In order to keep up to date on the class materials, TAs for recitation sections are often required to attend the lectures of the course.

Since a faculty member is responsible for your teaching, any action in response to academic dishonesty that you may take must be cleared with that faculty member. The best approach to academic dishonesty is to take steps to prevent it in the first place. For example, when giving quizzes in a crowded classroom or laboratory, use two forms of the quiz so those students sitting next to each other have different quizzes. Do not sit at the front of the room during a quiz or exam but walk around and watch the students carefully. If you suspect a student of looking around, move the student to a seat at the front of the room without making any accusations. In cases where cheating is suspected, make photocopies of all papers and discuss the situation with the faculty member in charge of the course. If a student asks for an excused absence, request a signed written statement from the student detailing the reasons for the absence. While in the laboratory, watch for students who may be "dry-labbing" (not using their own data). If two students turn in identical reports, consult the faculty member for the course regarding the proper steps to take. If a student turns in a report using data other than that taken by the student during the regular lab period, an appropriate grade on the report is zero.

Teaching a Laboratory Class

The techniques in teaching a laboratory class are very different from those in teaching a recitation class. Exactly what is expected will vary from course to course; the faculty member in charge will give you specific directions. Not all of the suggestions here will apply to every laboratory class so adapt your approach to the particular course you are teaching.

There usually needs to be some sort of prelab lecture or instruction. The length of this will vary from course to course and even from experiment to experiment. You should focus the instructions on items that need to be particularly emphasized such as matters of safety or manipulations that are particularly difficult. The faculty member in charge will keep you informed of what concepts need to be covered and what background you should expect the students to have.

Safety in the lab is very important and this manual has a separate section on safety. In particular, you should insist that your students wear safety goggles at all times and appropriate clothing. Check to see that the goggles are of the approved types. Goggles designed for machine shops (they are full of holes) are unacceptable, as are safety glasses. If any student gives you difficulty about wearing goggles or their clothing, you may ask the student to leave the laboratory and only return when they have obtained the appropriate safety glasses or clothing. Safety goggles can be purchased from the Chemistry Stockroom. In severe cases or long delays in the student returning, consult with the faculty member in charge of the class whether the student should be given a grade of zero for the day. The faculty member may continue the punishment, if the situation warrants, by banning the student from the lab for the remainder of the semester.

The faculty member in charge will give you specific instructions regarding any quizzes to be given and how laboratory reports are to be graded. Careful and consistent grading according to the faculty members guidelines are extremely important to ensure all students are treated fairly. At the end of the term, you will be asked to recommend grades to the faculty member in charge. Remember that your grades are

recommendations only. The faculty member is ultimately responsible for the grades and will make the final assignments.

Some procedural suggestions for lab are as follows. Not all procedures apply to all lab courses, but the general idea is to plan ahead before lab and clean up and check things thoroughly after lab. It is important for all teaching assistants to make sure students clean their lab areas and the common areas before leaving the laboratory.

BEFORE LAB

1. If the experiment requires unknowns, have the unknowns ready at least one day in advance.
2. If there are papers to be returned, go to lab and distribute papers on the lab bench so that they will be ready for the students at the beginning of the period and no lab time will be lost.
3. If special equipment is to be borrowed from the stockroom, get the equipment and sign the sign-out list from the stockroom.
4. Check the chemical supply and refill bottles as needed, such as those that are less than half full.
5. If ovens or electronic equipment are used, be sure that they are turned on and are properly adjusted.
6. If you are giving a quiz that requires duplication, submit it to the department office **at least 3 days** prior to when you need it.

AFTER LAB

1. Clean up the lab including around the balances, around the chemicals and on the benches where students have not cleaned their working spaces. Check the sinks for solid waste.
2. Check all gas valves to be certain they all have been turned off.
3. Check all locks to be certain that none have been left unlocked. If you find one unlocked, hang the lock on the drawer backwards and then lock it; this will serve as a reminder to the student that the drawer was not locked.
4. Check the chemicals and refill bottles as needed. If the chemical bottles have become scattered, return them to their proper places.
5. If any equipment that should be in the drawers is left out by students, you may keep it until the next lab period or put it in the lost and found drawer if the lab has one.
6. Check laboratory equipment such as balances, pH meters, etc. to be certain they are left in proper condition. If the equipment can be moved, take faulty equipment to the stockroom, with the proper form completely filled out, immediately at the end of lab. For other equipment, inform the faculty/staff member in charge of the equipment.

Confidentiality

Federal law prohibits revealing grades of a student to anyone other than the student or to duly authorized university personnel. This means: 1) you should not post grades using names or student numbers, 2) papers may not be handed back by allowing students to get them from a pile, 3) scores may not be written on the first page of an assignment. Any sheets of paper, especially computer printouts, with scores or grades on them, should be kept confidential at all times and disposed of accordingly, i.e. shredded, when no longer needed. The list of grades, whether in a grade book or on computer printouts, should be stored out of sight and away from access of any and all students.

In a similar manner, answer keys, instructor's manuals, etc. are considered confidential and should not be left where students will have access to them.

ADDITIONAL REMARKS:

For the laboratory teaching staff:

Remember that as instructors, you set the standard for the students. **While in the teaching laboratory, you are required to follow the same rules as your students.** Failure to set the proper example on your part will cause unnecessary difficulties for the students and consequences for yourself. This means you must follow all the rules outlined in the document titled "**Dress Code for Undergraduates in Chemistry Laboratories"** (page 49). Failure to do so will result in action by the instructor in charge of the course, the Director of Graduate Studies, the Associate Chair, and the Chair of the Safety Committee. The action taken is described in the Department of Chemistry and Biochemistry Graduate Student Manual Section "Graduate Assistantships".

Graduate Students in the Research Laboratory:

University regulations regarding procedures in the research lab are given in the University of Toledo Laboratory Safety and Health Manual:
http://www.utoledo.edu/depts/safety/docs/HM-08-026%20Appendix%20B.pdf

UToledo LIBRARIES

http://www.utoledo.edu/library/

Most books and journals are in the Carlson Library or are available online. Please check the library catalog, UTMOST, (http://utmost.cl.utoledo.edu) to see the location and online availability of a particular title.

Graduate students have extended book loan privileges on books from the Carlson Library. Extended loan means that books may be checked out until the end of the current semester. For journals and reference books that never circulate, you may obtain photocopies of journal articles and reference materials.

Books not available in the Carlson Library may be obtained through OhioLINK. Books in other Ohio university libraries can be sent to Toledo in 3-5 business days and checked out with your ID card. Search the OhioLINK central catalog (http://olc1.ohiolink.edu/search/) to find a copy of the book in Ohio to be requested.

Books not available in Ohio or reprints (photocopies) of journal articles not available at UT may be obtained through Interlibrary Loan. This service takes longer than OhioLINK (above), usually 2-3 weeks for books, shorter for article reprints. Requests can be made through online forms at:
http://illiadvm00.utad.utoledo.edu/illiad/TOL/logon.html

An online version of Chemical Abstracts, known as SciFinder Scholar, is available for use at the Carlson Library information desk and can be downloaded and installed on your personal or laboratory computer. Many other article research databases are available from OhioLINK on the OhioLINK homepage: http://www.ohiolink.edu

Any questions about the library services can be directed to Wade M. Lee, Science Reference Librarian. He can be reached at wade.lee@utoledo.edu, by phone at (419) 530-4490, or in his office in 0100 H11 (Lower Level) Carlson Library.

THE GLASS SHOP

The Glass Shop will help in designing glassware to meet the research needs of the department. The functions of the Glass Shop are to advise on costs, assist in design, and fabricate and repair pieces.
Remember: If there is a question on repairing glassware, stop by the shop. Sometimes the cost of the parts is only a few dollars to salvage a piece worth hundreds of dollars. *The Laboratory Companion* by Gary S. Coyne is an excellent reference book with practical advice.

CLEANING AND HANDLING OF GLASS APPARATUS

Suggestions for Cleaning and Storing Glass Labware

Good laboratory technique demands clean glassware, because the most carefully executed piece of work may give an erroneous result if dirty glassware is used. In all instances, glassware must be physically clean; in most cases, it must be chemically clean; and in many cases, it must be bacteriologically clean or sterile.

All glassware must be absolutely grease-free. The safest criterion of cleanliness is uniform wetting of the surface by distilled water. This is especially important in glassware used for measuring the volume of liquids. Grease and other contaminating materials will prevent the glass from becoming uniformly wetted. This in turn will alter the volume of residue adhering to the walls of the glass container and thus affect the volume of liquid delivered. The same applies to the meniscus in pipettes and burets.

Cleaning

Wash labware as quickly as possible after use. If a thorough cleaning is not possible immediately, put glassware to soak in water. If labware is not cleaned immediately, it may become impossible to remove the material.

Do not allow glassware to soak for long periods of time (days/weeks) in alkaline cleaning solutions. This will leach out the glass surface and it will eventually turn cloudy and become more easily contaminated.

Glassware Cleaners

When washing, soap, detergent, or cleaning powder (with or without an abrasive) may be used. Cleaners for glassware include Alconox, Dural, M & H, Lux, Tide and Fab. The water should be hot. For glassware that is exceptionally dirty, a cleaning powder with a mild abrasive action will give more satisfactory results. The abrasive should not scratch the glass. During the washing, all parts of the glassware should be thoroughly scrubbed with a brush. This means that a full set of brushes must be at hand—brushes to fit large and small test tubes, burets, funnels, graduates and various sizes of flasks and bottles. Motor driven revolving brushes are available when a large number of tubes or bottles are processed. Do not use cleaning brushes that are so worn down that the spine hits the glass. Serious scratches may result. Scratched glass is more prone to break during experiments. Any mark in the uniform surface of glassware is a potential breaking point, especially when the piece is heated. Do not allow acid to come into contact with a piece of glassware before the detergent (or soap) is thoroughly removed. If this happens, a film of grease may be formed.

Abrasives should not be used on glassware. Surfaces will become marred in time, causing scratches that prevent proper drainage and collect contaminants.

Safe Use of Chromic Acid

If glassware becomes unduly clouded or dirty or contains coagulated organic matter, it must be cleansed with chromic acid cleaning solution. The dichromate should be handled with extreme care because it is a powerful corrosive.

When chromic acid solution is used the item may be rinsed with the cleaning solution or it may be filled and allowed to stand. The length of time it is allowed to stand depends on the amount of contamination on the glassware. Relatively clean glassware may require only a few minutes of exposure; if debris is present, such as blood clots, it may be necessary to let the glassware stand all night. Due to the intense corrosive action of the chromic acid solution, it is good practice to place the stock bottle, as well as the glassware being treated, in flat glass pans or pans made from lead or coated with lead. Extra care must be taken to be sure chromic acid solution is disposed of properly.

Special types of precipitates may require removal with nitric acid, aqua regia or fuming sulfuric acid. These are very corrosive substances and should be used only when required.

Removing Grease

Grease is best removed by boiling in a weak solution of sodium carbonate. Acetone or any other fat solvent may be used. Strong alkalies should not be used. Silicone grease is most easily removed by soaking the stopcock plug or barrel for 2 hours in warm decahydronaphthalene.

Drain and rinse with acetone or use fuming sulfuric acid for 30 minutes. Be sure to rinse off all of the cleaning agents.

Rinsing

It is imperative that all soap, detergents and other cleaning fluids be removed from glassware before use. This is especially important with the detergents, slight traces of which will interfere with serologic and cultural reactions.

After cleaning, rinse the glassware with running tap water. When test tubes, graduates, flasks and similar containers are rinsed with tap water, allow the water to run into and over them for a short time, then partly fill each piece with water, thoroughly shake and empty at least six times. Pipets and burets are best rinsed by attaching a piece of rubber tubing to the faucet and then attaching the delivery end of the pipets or burets to a hose, allowing the water to run through them. If tap water is very hard, it is best to run it through a deionizer before using. Rinse the glassware in a large bath of distilled water. Rinse with distilled water. To conserve distilled water, use a five gallon bottle as a reservoir. Store it on a shelf near your clean-up area.

Attach a siphon to it and use it for replenishing the reservoir with used distilled water.

For sensitive microbiologic assays, meticulous cleaning must be followed by rinsing 12 times in distilled water.

Additional Cleaning Solutions

Additional cleaning solutions and techniques can be found in *The Laboratory Companion* by Gary S. Coyne pages 234-251.

Beware of Scratched Glassware

Do not heat glassware that is etched, cracked, nicked or scratched. It is more prone to break. Use a rubber policeman on glass stirring rods or use TEFLON® rods to prevent scratching the inside of a vessel.

Care and Handling of Ground-Glass Surfaces

Ground-glass joints and stopcocks should never be used when dry. Although ground-glass surfaces seal well without the use of lubricants, it is advisable to lubricate them to prevent sticking and breakage. Ground surfaces must be cleaned prior to lubrication-dust, dirt and particulate matter may score the surface and cause leakage.

Different lubricants are used under different operation conditions:

- Silicone Grease – for high temperature and high vacuum
- Glycerin – for long term reflux or extraction
- Hydrocarbon Grease – for general laboratory use

Lubricating Ground-Glass Joints

1. Lubricate joints that must be airtight and when glassware contains strong alkaline solutions.
2. Lubricate only the upper part of the inner joint. A properly lubricated joint appears clear, without striations.
3. Do not allow grease to come in contact with vapor or liquid and cause contamination.

Lubricating Stopcocks

Spread two circular bands of grease around the stopcock plug. Insert the plug into the barrel and twist several times until the assembly is completely transparent. Be careful not to use too much lubricant or the bore will become plugged.

A more detailed description on the maintenance and care of joints, stopcocks and glassware can be found in *The Laboratory Companion* by Coyne on pages 192-208.

Care and Use of Kontes PTFE Stopcock Plugs

PTFE is the most chemically inert material for laboratory use. Few chemicals have any effect on it, and only at elevated temperatures and pressures. It is extremely durable and heat resistant with practically zero moisture absorption, and does not become brittle even at sub-zero temperatures.

For maximum performance of PTFE plugs, see the following:

1. To clean new plugs, rinse all parts of plug and barrel in acetone. Assemble after drying. (Do not use abrasive materials to clean plug or barrel).
2. For minimal friction, always place the PTFE washer adjacent to the end of the glass barrel.
3. When not in use, the plug should be loosened within the glass barrel. PTFE is softer than glass and has a tendency to expand into the hollow parts of the barrel's ground surface.
4. Avoid scoring the plug with particles that could lodge between plug and barrel. Once scored, the plug may leak.

Joining and Separating Glass Apparatus

When pieces are not in use for an extended period of time, take apart stopcocks, ground joints, flask stoppers and joints to prevent sticking. Remove the grease from the joints. TEFLON® stoppers and stopcocks should be loosened slightly.

For easy storage and reuse, put a strip of thin paper between ground joint surfaces.

Freeing Seized Ground Joints

If a ground joint sticks, this procedure will generally unstick it. Immerse the joint in a glass container of freshly poured carbonated liquid. You will be able to see the liquid penetrate between the ground surfaces. When the surfaces are wet (allow 5 to 10 minutes submersion), remove the joint and rinse with tap water. Wipe away excess water.

Then gently warm the wall of the outer joint by rotating it for 15 to 20 seconds over a low bunsen burner flame. Wear heat-resistant gloves to avoid burns. Be sure that 50% of the inner surface is wet before inserting the joint in the flame. Remove from the flame and gently twist the two members apart. If they do not come apart, repeat the procedure. Never use force when separating joints by this method.

If you are unable to separate the frozen joints without breaking, take the apparatus to the glassblower for removal.

If heat is required to separate stuck ground glass surfaces, the best place to do this is in the glass shop. The glassblower has the expertise to separate the glass.

The following form is departmental specific.

GLASS SHOP WORK REQUEST (example)

Department_____*Chemistry*_____Phone Number_____

Account Number_(*other than Chemistry*)__ Date_____

Name_____

Authorization_____*By Research Director or Advisor*_____

Description of work to be done:

To request work from the glassblowing shop you must pick up a work request, completely fill in the information required and include a rough sketch or information on the items required or work requested**. All glassware to be repaired or modified must be clean, dry and free of all inflammable and toxic materials**. Authorization for the work request must be obtained from the student's research director or advisor.

NOTE:

1. *Silicone stopcock grease when heated becomes part of the glass.*
2. *Chemicals and grease when heated into the glass causes devitrification thus weakening the glass.*
3. *Toxic chemicals could eliminate a friendly glassblower.*

Date Received_____

Materials_____

Labor_____

Total_____

DEPARTMENT INSTRUMENTATION AND FACILITIES

Instructions to Instrument Operators: Departmental instruments are to be operated only by those who have been authorized to do so by the appropriate faculty supervisors. The faculty supervisor for each instrument will be indicated on a notice posted by the instrument and in the back of the instrument log book.

When using an instrument, each operator must follow these rules:

1. Obtain sufficient instruction on the use of the instrument, with particular reference to any special requirements of your present project. Check the log book for any recent special instructions or notices.
2. Use the instrument properly and follow any instructions from the faculty supervisor.
3. Maintain and use auxiliary equipment, accessories, etc. properly.
4. Make major adjustments in instrument operation (interior settings, attachment or removal of auxiliary equipment, etc.) only with the consent of the faculty supervisor or the designated representative.
5. Post and enter in the log any major instrument changes so as to inform other operators.
6. Return the instrument to normal operation as soon as possible after the need for major adjustments has ended.
7. Report any malfunctions, breakage, shortage of components, and/or supplies to the faculty supervisor.
8. Record in the instrument log all pertinent operations, specifically including the following: Name of user, date, time and general purpose of usage; any malfunctions, repairs, and alterations, comments on the condition of the instrument, particularly including any indication of trouble that you observe, regular maintenance performed.

A list of authorized operators will be kept in the back of the instrument log book. The faculty supervisor may withdraw authorization at any time for improper use or misuse of the instrument.

Decontamination of Equipment Submitted for Repair.

All equipment to be repaired must be cleaned of any toxic, reactive, biological, or radioactive materials before repair. Cleaning procedures depend on the type of contamination and level of cleaning required. All biological materials must be removed and equipment thoroughly cleaned before repair. Instructions for equipment of specific interest are given below. When requesting repair, the user must very explicitly state on the repair form, as well as explain verbally to the staff member involved in the repair, the materials used with/in the equipment, the toxicity of the material(s), if any of the material was radioactive and finally, what was done to clean the equipment before requesting repair.

Biological Contaminants: Shakers, incubators and similar equipment must be thoroughly sanitized (sterilized) before requesting repair. They must also have any solid waste removed before submitting for repair.

Chemical Contaminants: These obviously must be removed before submitting equipment for repair. Cleaning procedures vary extensively depending upon the chemicals and equipment. Consult your research Advisor before starting decontamination procedures if you are unsure of what to do.

Vacuum Pumps:

All equipment that is to be repaired must be completely cleaned of any potentially hazardous materials before repair. Vacuum pumps are to be drained and must be flushed out at least one time with clean vacuum oil. Be sure to run the pump a minute (if possible) before draining the flush oil. If the pump has sludge or a high concentration of chemical contaminants in it the flushing procedure must be repeated until the pump oil runs out clear when drained. If the pump has seized and cannot be flushed, then this fact must be written on a tag and then secured to the pump. For a seized pump, a student from the group owning the pump may be required to dissemble the pump under the guidance of the repairperson.

If the pump is to be repaired, information must be filled out completely (clearly note that the pump has not been flushed out if it was not possible). Failure to perform these preliminary actions can result in the refusal of pump for repair. Also, the repair tag must be completely filled out including a list of possible toxic materials that may have been pulled through the pump.

Other Electrical Equipment: These pieces of equipment must also be thoroughly cleaned before requesting repair.

Glassware:
Glassware must be clean and free of stopcock grease and cleaning residue before submission for repair. The glass blower has provided procedures for cleaning glassware of stopcock grease. All glassware should be cleaned as needed, finishing with a wash using laboratory soap followed by several rinses in tap water ending with a thorough final rinse in distilled or RO water. Failure to completely remove silicone stopcock grease from glassware will result in failure of the glass due to a process known as devitrification. Further information is available in the glass shop and in the glass shop portion of this manual.

A **Decontamination Verification** form must be filled out and accompany the apparatus being repaired.

The following form is departmental specific.

Decontamination Verification Form

All instrumentation, equipment, or glassware in need of repair must be clean and decontaminated prior to its repair. All vacuum pumps must be drained and flushed with oil.

This document must accompany each piece of apparatus. (This includes small items such as hot plates and centrifuges.)

The faculty member/ lab supervisor must sign this form. Failure to provide all requested information will result in delays in repair of the instrument. Failure to decontaminate equipment prior to delivery to the shop will result in refusal to work on the apparatus until it is cleaned.

Date_____

Equipment in need of repair: _____

_____

Lab where apparatus is used: _____

List any chemicals or biological agents used with this apparatus

Describe the procedure you used to decontaminate the apparatus.

Faculty:
Please verify the agents used with this equipment, the decontamination procedure as well as visual inspection of the equipment.

Faculty signature_____

Name and Phone number of contact person:_____

POLICIES AND PROCEDURES IN CHEMISTRY TEACHING LABORATORIES

(PLEASE KEEP AND READ THIS)

*PERSONS ALLOWED IN LABORATORIES

While a laboratory course is in session, only students enrolled in the course, teachers and departmental staff may be present in the laboratory. Students can only attend the section registered unless special permission has been obtained from the faculty member in charge of the course.

*GOGGLES

Approved protective splash/impact goggles must be worn at all times in the laboratory. These may be purchased from the Bookstore or other sources, but it is your responsibility to obtain them. Goggles are not to be stored in your locker; they are to be put on before entering the laboratory. If you forget your goggles, a limited number of used goggles are available for purchase from the Chemistry Stockroom (billed to your University Rocket account). You must bring your ID to rent goggles from the stockroom. **ABSOLUTELY NO ONE IS PERMITTED IN THE LABORATORY WITHOUT GOGGLES AT ANY TIME!!!** This is good safety practice and it is the law of the State of Ohio.

*CHECK-IN

Upon assignment to a laboratory locker (i.e., drawer) you should examine the contents carefully. You will be given an ***"Equipment List"*** of all the items that should be in your locker. At the end of the semester, you will be required to return this complete assortment of items. Therefore, any items that are missing or broken must be obtained from the Stockroom via the TA. **NO CLAIMS FOR MISSING EQUIPMENT WILL BE ALLOWED AFTER THE LABORATORY PERIOD DESIGNATED FOR CHECK-IN!**

*BREAKAGE

For any items that are broken or missing from your drawer, you must fill out a Missing Equipment/Glassware form and give this to your TA during the designated check-out lab period. Replacement items will be billed to your UT Rocket account.

*LOCKER COMBINATION

It is your responsibility to keep the lock combination slip, which is given to you during check-in, safe and confidential. You will need to see your TA while in lab to obtain your combination if you lose it.

*REFILLS

You may occasionally need refills of chemicals, solutions, supplies, etc. during your laboratory period. Check with your TA to see if the item(s) are available elsewhere in the lab or prep room. If not, ask your TA if you should go to the stockroom to get the missing item(s). If you do so, you must take the empty container,

complete with cap, to the Stockroom in order to obtain a refill. **YOU ARE REQUIRED TO USE THE YELLOW CARRIER FOR CHEMICALS WHEN OBTAINING CHEMICALS FROM THE STOCKROOM.** No refills will be given without the safety carrier.

**HOUSEKEEPING*

Through good housekeeping we minimize accidents, increase organization and productivity, and are responsible for ourselves. You are responsible for your own work area. It must be clean when you leave the lab. All glassware you used must also be clean when you leave. This will either be cleaned with micro soap solution or acetone. If you use acetone it must be disposed of properly. You are responsible for returning borrowed equipment and items neatly to their proper locations. Your TA will assign each bench extra cleaning duties, which must be performed. Safety and housekeeping are part of your "technique".

Make sure you turn off the gas jets when you are done with the gas.

Be sure to inform your TA about any malfunctioning equipment so he or she can fill out the appropriate form to notify the Stockroom.

**CHEMICAL WASTE*

Waste containers are provided for most chemical waste. Acids: (hydrochloric, sulfuric, nitric and acetic) are to be washed down the drain with large amounts of water. Your TA will inform you of disposal procedures for other waste products. **Absolutely no chemicals will ever go into the regular trash!!! Improper disposal of chemical waste is a serious violation of the law and may result in a grade penalty.**

**CHECK-OUT*

At checkout your locker will be inspected by your instructor. Any missing or broken equipment must be purchased from the Stockroom and will be charged to your Rocket account. Failure to check out by the end of the semester will result in a $20.00 check-out charge (not including breakage or loss). **ONCE YOU CHECK IN, EVEN IF YOU DROP THE COURSE (OR ARE NOT REGISTERED), YOU MUST CHECK OUT OR BE CHARGED AS DESCRIBED!!! Failure to report any lost or broken items by the end of your last scheduled lab period will also result in a $20.00 charge in addition to the cost of the items.**

**DRESS REQUIREMENTS*

See Dress Code form on the following page.

**MSDS's AND OTHER CHEMICAL & SAFETY INFORMATION*

Material **S**afety **D**ata **S**heets are provided for all chemicals that you use (located in binders outside the Chemistry Stockroom).

**SINKS*

Absolutely **NO** trash is to be thrown into the sinks. If you notice a sink filling up with water, overflowing or leaking, inform your TA **immediately.**

**FIRE ALARM*

In the event of a fire alarm, shut off any gas, hot plates or other equipment quickly. Make sure you are leaving a safe situation.

**FIRST AID & OTHER INCIDENTS*

In case of an accident or incident (spill, fire, explosion, etc.), you absolutely must inform your TA immediately. Yell for his or her help, if necessary. Your TA will escort you to the Stockroom if you are injured. Rinse any chemicals from your skin with copious amounts of water immediately for at least 15 minutes. Any blood injuries must be cleaned up directly after you are treated. Inform your TA where you were cut in the lab and of any items you may have touched. **First Aid is available in the Chemistry Stockroom.** A laboratory incident/accident report form should be filled out within 24 hours and signed by your TA. These are available at the Stockroom.

Dress Code for Undergraduates in Chemistry Laboratories

Below is the dress code for undergraduate teaching laboratories, undergraduates performing research in faculty research groups, and undergraduate stockroom assistants.

1) Only long pants or dresses/skirts of a length such that they cover the legs down to the ankles and cover the tops of shoes are allowed; socks may be worn that cover the leg between the pants/skirt and shoes. It is strongly recommended that the garments not be so tight as to constrict movement or so loose so as to become a tripping hazard to the wearer or their neighbors. Pants cannot have holes of appreciable size, nor too many holes in them.
2) Shirts must provide coverage of the whole torso down to the pants. No "belly shirts" are allowed and shoulders must be covered (no spaghetti straps).
3) No open toed shoes, sandals, or "flip-flops" are allowed. Shoes must allow a firm footing.
4) No hats with brims.
5) It is recommended that contacts are not worn while in the laboratory.
6) Goggles approved by the State of Ohio must be worn while in the laboratory.
7) No headphones of any type, including earbuds, are to be worn in the laboratory.
8) Use of cell phones and pagers in the laboratory is not allowed.
9) It is strongly urged that jewelry or other items that dangle and could possibly get caught on a piece of equipment or could pull something off a bench not be worn. Also, be advised that many chemicals will react with the materials jewelry is made of and can lead to damage of the jewelry. Additionally, chemicals can also be trapped under jewelry causing chemical exposure and possibly chemical burns to your skin.

Students are required to wash their hands when leaving the laboratory. This minimizes the risk of, and spread of, chemical exposure.

Lab goggles will be worn before entering any laboratory environment. They must remain on during the period in the laboratory. If goggles become fogged, the student must leave the laboratory to clear them.

Additional safety protection may be required in a particular situation. The student must comply with all safety requirements as designated by their instructor or supervisor.

The first instance of failure to comply with these rules may result in expulsion from the laboratory and a grade of zero on the laboratory exercise for that day. The second violation will result with expulsion from the laboratory and the instructor may assign a failing grade for the course.

It is suggested that students wear older, less expensive clothes in laboratories to minimize the students' financial losses if clothes they are wearing are ruined by a chemical spill or another event in the laboratory.

Laboratory coats may be worn to protect expensive clothing. They may be purchased through the University Bookstore. They are not considered a substitute for long pants or long dresses unless they provide the same amount of coverage (to the ankle).

Gloves may be worn by students with demonstrated (documented) chemical sensitivity or in situations designated by the instructor. It is the responsibility of the student to ensure that the gloves provide adequate protection for the situation the student is in. The stockroom staff and instructor can show the student how to access resources to determine glove material compatibilities.

It is often the practice of an individual to place objects such as writing implements, fingers or other objects in their mouth while working or thinking. This action is very strongly discouraged. It places the individual at grave risk of chemical exposure via ingestion.

I Have Read, Understand and Agree to Follow the Rules and Information Provided in the Document Titled: **Dress Code for Undergraduates in Chemistry Laboratories.**

Name:_____ Date:_____