

**DEPARTMENT OF CHEMISTRY**  
College of Letters and Sciences  
University of Madison, Wisconsin

**Plan for Assessment**  
**of the**  
**Undergraduate Major in Chemistry**

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**Introduction**

The Chemistry Department offers two degree programs in Chemistry, the BS in Chemistry and the Chemistry Course degree. The two degrees are similar enough and the number of students in the Chemistry Course program small enough that we do not plan to differentiate the two in the assessment process.

Chemistry majors have three main career objectives: graduate study in chemistry or related areas, employment in industry and government, or medical/dental school. A few use their chemistry background for further education and careers in teaching, law and business.

**Educational Objectives of the Chemistry Major**

*Conceptual Objectives:*

1. Understanding and prediction of structure and bonding of molecules and knowledge of the techniques used to determine structures.
2. Understanding of physical properties of molecules (states of matter and phase changes, solution properties, etc.)
3. Knowledge of basic molecular transformations (chemical reactions, chemical equilibria, effect of light and heat), and the ability to predict the basic chemical properties of simple molecules.
4. Understanding of the basis of chemical measurements.
5. Basic understanding of the theoretical underpinnings of chemical sciences.

*Skills Objectives:*

1. Basic skills in synthetic and analytic laboratory procedures.
2. Mathematical and computational skills to address chemical problems.
3. Ability to utilize and read the chemical literature.
4. Basic skills in oral and written presentation of chemical subjects.

To meet these objectives Chemistry majors take a series of lecture and laboratory courses in each of the subdisciplines of chemistry (analytical, inorganic, organic, and physical), as well as several courses in mathematics and physics to prepare them for the work in chemistry. None of these courses are restricted to Chemistry majors.

The freshman and sophomore courses are mostly taught as large sections taken by many non-majors, and there is currently not a course sequence aimed at the Chemistry majors. Thus these courses cannot be easily tailored to meet the specific needs of the small fraction of Chemistry majors in them. There are several honors sequences available for the Chemistry majors, but these are not restricted to, nor required for the Chemistry degree.

The upper level classes taken by juniors and seniors are smaller and more directly targeted at the Chemistry majors. Our assessment activities will emphasize these courses. Several of them require the students to prepare substantial written reports, and present oral reports of the results of library or laboratory work. A significant fraction of the majors join individual research groups (either as part of scheduled laboratory courses, or as senior thesis or independent study). Since many of them will eventually go to graduate school in chemistry, this exposure to research activities and direct interaction with graduate students in chemistry is an important part of their education.

### **Methods of Assessment**

The Department of Chemistry is in the midst of several major assessment activities conducted under the auspices of the New Traditions project funded by the National Science Foundation which will provide much detailed information about the way the courses in freshman and sophomore chemistry (taken by more than 6000 students every year) are functioning. These studies are probing the effectiveness of various special course sequences and will provide information about the course choices and performance of those students who eventually become chemistry majors. This project also involves a number of controlled educational experiments to test alternative teaching strategies. Parallel to the New Traditions project, the Undergraduate Curriculum Committee is in the midst of a major redesign of the course offerings in Chemistry, both for the general student group and for the Chemistry majors. Since the Department also provides much of the coursework for the Biochemistry and Chemical Engineering majors, we are engaging in discussions with these departments to ensure that we are meeting their objectives also. This document will not describe these efforts, but they will lead to valuable information for the assessment of the undergraduate major.

To become better informed about the Chemistry majors as a group the Assessment Committee will collect and analyze general information: GPA, course sequences taken, level and duration of undergraduate research activities, time to graduation, and post graduation career goals and achievements. For a more specific assessment of the extent to which the educational goals are being met, we plan to use the following tools:

1. Embedded questions.

We plan to select two or three courses taken during the junior and/or senior year by all Chemistry majors (for example, Inorganic Chemistry (Chem 511) and Physical Chemistry Laboratory (Chem 564)) and place standard questions prepared by the instructor and the Assessment Committee on one or more of the examinations. These questions will be designed to probe the general understanding of qualitative and quantitative chemical phenomena at a

time well after the specific course work was completed. The answers will be rendered anonymous and analyzed by the Assessment Committee.

## 2. Surveys

We plan to conduct a survey of senior Chemistry majors intended to probe their satisfaction with a number of aspects of their educational experiences within the Department of Chemistry, and to determine their plans for the future. These surveys will be done in one of the junior or senior courses taken by all Chemistry majors. Although a survey of students who have graduated would provide valuable information, we feel we cannot effectively perform such a survey since we do not have current addresses for enough of them.

## 3. Interviews

Oral interviews can provide valuable insights into the way students have assimilated and generalized the many pieces of information encountered in the various courses. We plan to explore several alternatives to conduct interviews of senior Chemistry majors without excessive use of faculty time. One possibility is to utilize existing oral examinations in Chemistry 346 (Intermediate Organic Chemistry Laboratory) and Chemistry 564 (Physical Chemistry Laboratory) in part for general assessment purposes, another is to conduct interviews of a random sample of the senior chemistry majors.

These assessment activities will provide information about the strengths and weaknesses of the Chemistry major program. The Assessment Committee will analyze the information and, if important objectives are not being met, recommend changes in curriculum, pedagogy and/or administrative structure to the Department.