

Learner outcomes for the graduate program in chemistry were derived through extensive discussion by faculty. In addition, as the department's undergraduate degree is accredited by the American Chemical Society (ACS), these learner outcomes which were written for both the undergraduate and graduate levels were also derived to meet ACS requirements.

Goal 1.) Each student shall receive the chemical knowledge base required for students graduating with an graduate degree that is consistent with the requirements of the accrediting organization, the American Chemical Society.

Learner Outcomes:

- 1 a.) Each student will be able to visualize, identify, and describe the composition of the atom and various types of matter
- 1 b.) Each student will be able to describe the relationship between the microscopic, macroscopic, and symbolic representations of matter and its changes.
- 1 c.) Each student will express the role of energy in: the changes of matter, the determination of the chemical structure, and the reactivity of molecules.
- 1 d.) Each student will be able to use quantitative calculations, and qualitative judgments to apply theoretical and mechanistic principles to chemical systems.
- 1 e.) Each student will be able to express and formulate the proper chemical nomenclature, chemical synthesis, and chemical characteristics of inorganic and organic compounds.

Goal 2.) Each student shall develop the written and oral communication skills required for proper dissemination of chemical information to colleagues and the public.

Learner Outcomes:

- 2 a.) Each student will be able to prepare and produce scientific written communications using the American Chemical Society style and format.
- 2 b.) Each student will demonstrate scientific oral communication skills through presentations and seminar discussions.

Goal 3.) Each student shall develop the analytical and critical thinking skills needed to acquire, analyze and interpret data.

Learner Outcomes:

- 3 a.) Each student will demonstrate a competency and proficiency with experimental skills involved in chemical synthesis, instrumental methods, quantitative measurements and statistical data analysis.
- 3 b.) Each student will be able to apply critical thinking and problem solving skills in the solution of chemical problems.
- 3 c.) Each student will be able to evaluate, examine, and apply chemical content knowledge found in chemical databases, chemical libraries, and chemical journals.

Goal 4.) Each student shall become aware of how chemistry affects society and the environment.

Learner Outcomes:

- 4 a.) Each student will be able to express the impact that chemistry has on society by demonstrating proper safe handling of chemical compounds and chemical waste according to governmental regulations.

Methods for assessment of the learning outcomes vary. Program goal number one is measured through course embedded assessments including regular quizzes, examinations, and problem sets. For students on the comprehensive examination track, program goal 1 is also measured by the comprehensive exam itself. The presentation of seminars, writing of papers, and a formal thesis defense (for those on the thesis track) measure student achievements on program goal 2. Program goal 3 is largely measured through course embedded assessment including writing of papers, and research (both the library research necessary to write papers as well as the final thesis for those on the thesis track). Program goal 4 is also assessed through course embedded assessment including exams and writing papers (specifically in CHE 560). Specific alignment of the learner outcomes in the core courses is addressed in the following table:

Course	Learner outcomes addressed
Advanced Organic Chemistry (CHE 500)	1a-e, 2a-b, 3
Advanced Physical Chemistry (CHE 520)	1a-d, 3
Advanced Inorganic Chemistry (CHE 532)	1a-e, 2a-b, 3
Advanced Analytical Chemistry (CHE 540)	1a-d, 2a, 3
Advanced Biochemistry (CHE 550)	1a-e, 2a, 3
Advanced Environmental Chemistry (CHE 560)	1a-d, 2a, 3, 4