

University of Michigan College of Science and  
Technology - Biology/ Biomedical Sciences  
Major - BA, BS

Upon graduation, students earning any of these degrees should be able to:

- 1.1 describe and integrate conceptual levels of biological organization: molecules, genes, cells, organisms, and evolution.
- 1.2 describe structure-function relationships at each level of organization.
- 1.3 describe quantitative biological concepts, including statistical tests.
- 2.1 demonstrate scientific reasoning and problem-solving skills.
- 2.2 design experiments and evaluate experimental/clinical evidence.
- 2.3 solve problems requiring the integration of biological, chemical, physical and mathematical concepts.
- 3.1 demonstrate effective written communication skills.
- 3.2 demonstrate effective oral communication skills, including clearly explaining biomedical information to a lay person and speaking to an audience.

Measurable outcomes: students' performance in these can be measured by examination.

How will they demonstrate these?

To make this more specific, an area in which the communication skills will be used could be identified.

Compared to 3.1, this is more focused and measurable. The second part describes the outcomes. At the course level, the "biomedical" information will be specified.

From: <http://www.provost.cmich.edu/outcomes/outcomes/cst.htm#biomed>

University of Michigan College of Science and  
Technology - Chemistry Major - BA, BS

Upon graduation, student earning any of these degrees will be:

Goal/Objective # 1

knowledgeable about the factual and theoretical basis of chemistry. Specifically the students should be able to describe the structure and composition of matter, plan the synthesis and characteristics of inorganic and organic compounds, apply theoretical and mechanistic principles to the study of chemical systems employing both qualitative and quantitative approaches, use theories of microscopic properties to explain macroscopic behavior, and explain the role of energy in determining the structure and reactivity of molecules.

All of these goals/ objectives (except #7, #8) start with a general goal followed by specific objectives.

This goal/ objective is further elaborated with descriptions of what areas the students would be "knowledgeable" about; what the students can "describe", "plan", "apply", "use" and "explain".

#### Goal/Objective #2

competent to work in a laboratory situation. Specifically the student will be able to read and follow written experimental protocols, properly set up and safely manipulate laboratory equipment, plan and execute experiments (including the use of the chemical literature), perform accurate quantitative measurements, maintain accurate records of experimental work, and analyze data statistically and assess reliability of results.

The first sentence states the general goal. The rest (Specifically the student...) describes the specific objectives.

#### Goal/Objective #3

familiar with the use and application of modern instrumentation and computers. Specifically, students will be able to calibrate instruments, use them for the proper applications, verify results by independent techniques, and demonstrate the use of instruments to novices.

#### Goal/Objective #4

able to communicate effectively both orally and in written form, using correct chemical nomenclature and mathematical representations of physical phenomena.

#### Goal/Objective #5

able to access and retrieve specific chemical information from the chemical literature, including research articles, books, and databases; read and understand technical material; and comprehend and assimilate orally presented information.

#### Goal/Objective #6

able to anticipate, recognize, and respond properly to hazards of chemical manipulations, know where to find information on chemical hazards, and how to dispose of chemical wastes safely.

#### Goal/Objective #7

able to work cooperatively in problem solving situations.

Like some objectives stated in the previous examples, more specific description would help the target audience understand more clearly what precisely will be achieved.

#### Goal/Objective #8

able to identify benefits and problems of modern chemistry for society and be aware of career opportunities for persons with chemical training.

## University of Michigan College of Science and Technology - Mathematics Major - BA, BS

Upon graduation, students earning any of these degrees should:

1. Display mathematical breadth and demonstrate the ability to think logically by:
  - a. recognizing and using the logical steps and order of computations in calculus and linear algebra; and
  - b. applying legitimate math reasoning and discerning between legitimate and illegitimate mathematical arguments.
2. Demonstrate an understanding of the processes of mathematical inquiry and an appreciation for the beauty of mathematics. He/she should demonstrate an understanding of the value of the discipline by:
  - a. explaining the main concepts of calculus and their applications to modern society, science, and technology;
  - b. appreciating, understanding and explaining the principles of mathematics underlying the physical sciences;
  - c. identifying the common mathematical principles underlying the many difference fields of mathematics; and
  - d. distinguishing between computational issues and genuine mathematical principles, thus displaying appreciation for the importance of mathematical abstraction.
3. Demonstrate his/her preparation for a mathematical career or for graduate study in mathematics by:
  - a. displaying an awareness of the employment opportunities in mathematics;
  - b. demonstrating significant expertise in the main concepts of calculus, linear algebra, abstract algebra and advanced calculus; and
  - c. displaying elementary knowledge of the uses of common technology (hardware, software) in the mathematical sciences.

The objectives for this program are focused and closely related to the discipline of Mathematics. The three objectives are further elaborated in the sub-points.

## University of Michigan College of Science and Technology - Mathematics Major - BA, BS

Upon graduation, students earning any of these degrees should:

1. be competent in the methods of problem solving and experimental physics;
2. have a basic knowledge of physics;
3. develop those competencies in physics which are important for success as teachers.

These examples show where the balance between brevity and specificity is weighted to the former, leading to a lack of clarity.

From: <http://www.provost.cmich.edu/outcomes/outcomes/cst.htm#phys>

### More Examples and Useful Links

1. Harvard University: Engineering and Applied Sciences  
<http://www.deas.harvard.edu/undergradstudy/engineeringsciences/>
2. University of Wisconsin UW Milwaukee: ACCESS to Success First Year Initiatives  
[http://www3.uwm.edu/Dept/Acad\\_Aff/access/firstyr/advising/sba.cfm](http://www3.uwm.edu/Dept/Acad_Aff/access/firstyr/advising/sba.cfm)