

## Sciences Learning Outcomes

University	Major/Dept	Learning Outcome	Source
University of California, Berkeley	Biology, Molecular and Cell	<p>Students who successfully complete this major will be able to:</p> <ul style="list-style-type: none"> <li>* Describe basic biological concepts and principles</li> <li>* Appreciate the different levels of biological organization, from molecules to ecosystems</li> <li>* Understand that Biology has a chemical, physical, and mathematical basis</li> <li>* Explain the importance of the scientific method to understanding natural phenomena</li> <li>* Effectively communicate scientific data and ideas, both orally and in writing</li> <li>* Critically evaluate data, develop a hypothesis, and design experiments to address an interesting and novel problem</li> <li>* Demonstrate advanced knowledge in a specialized field of molecular and cell biology</li> </ul>	<p><a href="http://mcb.berkeley.edu/undergrad/major/overview/usli/">http://mcb.berkeley.edu/undergrad/major/overview/usli/</a></p>
University of Colorado at Boulder	Mathematics	<p>The undergraduate degree in mathematics emphasizes knowledge and awareness of:</p> <ul style="list-style-type: none"> <li>• basic real analysis of one variable;</li> <li>• calculus of several variables and vector analysis;</li> <li>• basic linear algebra and theory of vector spaces;</li> <li>• the structure of mathematical proofs and definitions; and</li> <li>• at least one additional specialized area of mathematics.</li> </ul> <p>In addition, students completing a degree in mathematics are expected to acquire the ability and skills to:</p> <ul style="list-style-type: none"> <li>• use techniques of differentiation and integration of one and several variables;</li> <li>• solve problems using differentiation and integration;</li> <li>• solve systems of linear equations;</li> <li>• give direct proofs, proofs by contradiction, and proofs by induction;</li> <li>• formulate definitions;</li> <li>• read mathematics without supervision; and</li> <li>• utilize mathematics.</li> </ul>	<p><a href="http://www.colorado.edu/catalog/catalog09-10/download/catalog09-10.pdf">http://www.colorado.edu/catalog/catalog09-10/download/catalog09-10.pdf</a></p>

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<p style="text-align: center;">University of California, Berkeley</p>	<p style="text-align: center;">Mathematics</p>	<p>By the time of graduation, majors should have acquired the following knowledge and skills:</p> <ol style="list-style-type: none"> <li>1) Analytical skills             <ol style="list-style-type: none"> <li>1. An understanding of the basic rules of logic.</li> <li>2. The ability to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life.</li> <li>3. An understanding of the role of axioms or assumptions.</li> <li>4. The ability to abstract general principles from examples.</li> </ol> </li> <li>2) Problem-solving and modeling skills (important for all, but especially for majors in Applied Mathematics)             <ol style="list-style-type: none"> <li>1. The ability to recognize which real-world problems are subject to mathematical reasoning.</li> <li>2. The ability to make vague ideas precise by representing them in mathematical notation, when appropriate.</li> <li>3. Techniques for solving problems expressed in mathematical notation.</li> </ol> </li> <li>3) Communication skills             <ol style="list-style-type: none"> <li>1. The ability to formulate a mathematical statement precisely.</li> <li>2. The ability to write a coherent proof.</li> <li>3. The ability to present a mathematical argument verbally.</li> <li>4. Majors in Mathematics with a Teaching Concentration should acquire familiarity with techniques for explaining K-12 mathematics in an accessible and mathematically correct manner.</li> </ol> </li> <li>4) Reading and research skills             <ol style="list-style-type: none"> <li>1. Sufficient experience in mathematical language and foundational material to be well-prepared to extend one's mathematical knowledge further through independent reading.</li> <li>2. Exposure to and successful experience in solving mathematical problems presenting substantial intellectual challenge.</li> </ol> </li> </ol>	<p style="text-align: center;"><a href="http://math.berkeley.edu/undergraduate_learning_goals.html">http://math.berkeley.edu/undergraduate_learning_goals.html</a></p>
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University of Colorado at Boulder	Chemistry and Biochemistry	<p>The undergraduate degree in chemistry and biochemistry emphasizes knowledge and awareness of:</p> <ul style="list-style-type: none"><li>• the basic principles of chemistry—atomic and molecular theory, reactivities and properties of chemical substances, and the states of matter;</li><li>• the basic subfields of chemistry—organic, physical, analytical, and inorganic chemistry (and biochemistry for biochemistry majors);</li><li>• mathematics sufficient to facilitate the understanding and derivation of fundamental relationships and to analyze and manipulate experimental data;</li><li>• the basic principles of physics (and for biochemistry majors, knowledge of biology); and</li><li>• safe chemical practices, including waste handling and safety equipment.</li></ul> <p>In addition, students completing the degree in chemistry or biochemistry are expected to acquire the ability and skills to:</p> <ul style="list-style-type: none"><li>• read, evaluate, and interpret information on a numerical, chemical, and general scientific level;</li><li>• assemble experimental chemical apparatus, design experiments, and use appropriate apparatus to measure chemical composition and properties (for biochemistry students, this includes properties of proteins, nucleic acids, and other biochemical intermediates); and</li><li>• communicate results of scientific inquiries verbally and in writing.</li></ul>	<p><a href="http://www.colorado.edu/catalog/catalog09-10/download/catalog09-10.pdf">http://www.colorado.edu/catalog/catalog09-10/download/catalog09-10.pdf</a></p>
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<p>University of California, Berkeley</p>	<p>Chemistry</p>	<p>Knowledge-Based: All our graduates will be able to:</p> <ol style="list-style-type: none"> <li>1. Master a broad set of chemical knowledge concerning the fundamentals in the basic areas of the discipline (organic, inorganic, analytical, physical and biological chemistry).</li> <li>2. Solve problems competently by identifying the essential parts of a problem and formulating a strategy for solving the problem. They will be able to rationally estimate the solution to a problem, apply appropriate techniques to arrive at a solution, test the correctness of the solution, and interpret their results.</li> <li>3. Use computers in data acquisition and processing and use available software as a tool in data analysis.</li> <li>4. Employ modern library search tools to locate and retrieve scientific information about a topic, chemical, chemical technique, or an issue relating to chemistry.</li> </ol> <p>Performance/Skills-Based: All our graduates will demonstrate the ability to:</p> <ol style="list-style-type: none"> <li>5. Understand the objective of their chemical experiments, properly carry out the experiments, and appropriately record and analyze the results.</li> <li>6. Use standard laboratory equipment, modern instrumentation, and classical techniques to carry out experiments.</li> <li>7. Know and follow the proper procedures and regulations for safe handling and use of chemicals.</li> <li>8. Communicate the concepts and results of their laboratory experiments through effective writing and oral communication skills.</li> </ol> <p>Affective: All graduates will be able to:</p> <ol style="list-style-type: none"> <li>9. Successfully pursue their career objectives in advanced education in professional and/or graduate schools, in a scientific career in government or industry, in a teaching career in the school systems, or in a related career following graduation.</li> </ol>	<p><a href="http://chemistry.berkeley.edu/student_info/USLI/chemistry/index.php#slo">http://chemistry.berkeley.edu/student_info/USLI/chemistry/index.php#slo</a></p>
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<p>University of Colorado at Boulder</p>	<p>Physics</p>	<p>The undergraduate degree in physics emphasizes knowledge and awareness of:</p> <ul style="list-style-type: none"> <li>• the basic subfields of physics (classical mechanics, electricity and magnetism, quantum mechanics, statistical mechanics, and thermodynamics), as well as at least one specialty area of application (e.g., solid state physics or optics);</li> <li>• the major principles of physics, their historical development, and the roles they play in the various subfields of physics;</li> <li>• the interrelations between theory and observation, the role of systematic and random experimental errors, and methods used to analyze experimental uncertainty and compare experiment with theory;</li> <li>• physical phenomena and experience in the use of basic experimental apparatus and measuring instruments;</li> <li>• mathematics sufficient to facilitate the acquisition and application of physical principles; and</li> <li>• the importance of physics in other fields such as chemistry, biology, engineering, medicine, and in society at large.</li> </ul> <p>In addition, students completing the degree in physics are expected to acquire the ability and skills to:</p> <ul style="list-style-type: none"> <li>• apply physical principles to new situations;</li> <li>• construct and assemble experimental apparatus, conduct and analyze measurements of physical phenomena, analyze properly experimental uncertainty, and make meaningful comparisons between experiment and theory; and</li> <li>• communicate results of scientific inquiries verbally and in writing.</li> </ul>	<p><a href="http://www.colorado.edu/catalog/catalog09-10/download/catalog09-10.pdf">http://www.colorado.edu/catalog/catalog09-10/download/catalog09-10.pdf</a></p>
<p>University of California, Berkeley</p>	<p>Computer Science</p>	<ol style="list-style-type: none"> <li>1.An ability to configure, apply test conditions, and evaluate outcomes of experimental systems.</li> <li>2.An ability to design systems, components, or processes that conform to given specifications and cost constraints.</li> <li>3.An ability to work cooperatively, respectfully, creatively, and responsibly as a member of a team.</li> <li>4.An ability to identify, formulate, and solve engineering problems.</li> <li>5.An understanding of the norms of expected behavior in engineering practice and their underlying ethical foundations.</li> <li>6.An ability to communicate effectively by oral, written, and graphical means.</li> <li>7.An awareness of global and societal concerns and their importance in developing engineering solutions.</li> <li>8.An ability to independently acquire and apply required information, and an appreciation of the associated process of life-long learning.</li> <li>9.A knowledge of contemporary issues.</li> <li>10.An in-depth ability to use a combination of software, instrumentation, and experimental techniques practiced in circuits, physical electronics, communication, networks and systems, hardware, programming, and computer science theory.</li> </ol>	<p><a href="http://www.eecs.berkeley.edu/education/usli/EECS_USLI.pdf">http://www.eecs.berkeley.edu/education/usli/EECS_USLI.pdf</a></p>