



University of Colorado Denver | Anschutz Medical Campus

NATURAL AND PHYSICAL SCIENCES GENERAL EDUCATION LEARNING OUTCOMES AND ASSESSMENT RUBRICS

The natural and physical sciences use a methodical approach, involving observation, testing and interpretation through logic to study the natural world.

The natural and physical sciences include the broad disciplines of biology, chemistry, geology, environmental science, and physics, as well as the areas where the aforementioned disciplines interface. The whole universe and any and all phenomena in the natural world are the purview of the natural and physical sciences, from subatomic particles interacting with a single photon of light to the expansion of the universe.

The natural and physical sciences use comparative critical thinking and require that conclusions be based upon empirical, observable and/or measurable, testable, verifiable and falsifiable evidence. Experimental results must be reproducible and explanations must be modifiable based upon new evidence, as well as predictive of future results and evidence.

The goal of coursework in the natural and physical sciences, as it applies to the General Education Core, is to provide students with a foundation in applying the scientific method, analyzing data and forming a conclusion, applying knowledge, and communicating science.

In the Natural and Physical Sciences core area, students will be able to:

- 1) *Applying the scientific method.* Apply the scientific method and understand the relationship among observation, experimentation, evidence, conclusions, and theory in the natural and physical sciences. They understand the value and need for experimental reproducibility and peer review.
- 2) *Analyzing data and forming a conclusion.* Analyze and interpret data using scientific and mathematical methods and models to understand the universe works. They understand sources of error, confounding factors, and outliers in the natural and physical sciences.
- 3) *Applying knowledge.* Organize and integrate their knowledge and apply the fundamental concepts, theories, or laws of the discipline, thereby demonstrating their deeper comprehension of the topic
- 4) *Communicating science.* Communicate effectively about science using the language and the tools of the discipline. Furthermore, students understand the importance of communicating effectively about science, whether it be with other students, professors, employers, or family.

Natural and Physical Sciences Assessment Rubric

Learning Outcome	Below Proficient	Proficient	Above Proficient
1. <u>Applying the scientific method</u>	Student is unable to identify a problem <u>or</u> write a testable hypothesis.	Student is able to identify a problem <u>or</u> write a testable hypothesis that is relevant.	Student is able to identify a problem, while addressing limits and conditions <u>or</u> write a clear, detailed, testable, and relevant hypothesis.
	Student is unable to design an experiment <u>or</u> set-up a problem that is relevant.	Student is able to design a reasonable experiment <u>or</u> set up a problem using a relevant formula or theory, both with few significant errors.	Student is able to design an elegant experiment <u>or</u> problem setup that is relevant with no significant errors.
2. <u>Analyzing data and forming a conclusion</u>	Student is unable to correctly analyze data <u>and</u> is unable to form a logical conclusion about the data.	Student is able to correctly analyze data <u>or</u> form a logical conclusion about the data.	Student is able to correctly analyze data, form a logical conclusion about the data, and explain sources of error, confounding factors, or outliers.
3. <u>Applying knowledge</u>	Student is unable to apply the fundamental concepts, theories, or laws of the discipline to solve a problem or answer a question.	Student is able to apply the fundamental concepts, theories, or laws of the discipline to solve a problem or answer a question.	Student is able to apply the fundamental concepts, theories, or laws of the discipline in a well-organized and integrated manner, thereby demonstrating a deep knowledge.
4. <u>Communicating science</u>	Student is unable to communicate clearly about science using the language and tools of the discipline, as evidenced by many significant errors or misinterpretations.	Student is able to communicate clearly about science using the language and tools of the discipline with few significant errors or misinterpretations.	Student is able to communicate clearly, accurately, and effectively about science using the language and tools of the discipline with no significant errors or misinterpretations.