**MSU Denver Natural and Physical Science Rubric**

Description: The Natural and Physical Sciences involve discovering knowledge in natural or physical sciences, applying scientific thinking and reasoning, and critically thinking about the use of scientific information.

*Evaluators are encouraged to assign a zero to any work, sample, or collection of work that does not meet introductory (1) level performance.*

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| **Student Learning Outcome** | **0** | **Introductory**  **1** | **Developing**  **2** | **Advancing**  **3** | **Capstone**  **4** |
| **Understand foundational knowledge**— Explain the *foundational knowledge* of a particular field of natural or physical science | Not  Evident | Can recall or identify *a few aspects of the* basic foundational knowledge in the course. | Accurately explains or identifies *most* basic foundational knowledge in the course. | Demonstrates foundational knowledge and theoretical framework of a scientific course and *shows some use of* this information to correctly solve problems and describe phenomena. | Demonstrates a *detailed* and *deep* understanding of the foundational knowledge of a course and properly uses this foundation to correctly answer questions related to the analysis and prediction of observed phenomena. |
| **Apply scientific principles**—Apply principles and techniques of scientific thinking | Not  evident | Attempts to explain information presented in mathematical forms (including text, tables, graphs, or symbols) and/or constructs a rudimentary hypothesis, but draws somewhat incomplete or simple conclusions about what the information means. | Provides accurate explanations of information presented in mathematical forms and/or constructs a hypothesis. States a conclusion focused solely on the findings. | Organizes evidence to reveal important patterns, differences, similarities, limitations, and/or implications related to focus. States a conclusion that is a logical extrapolation to support a broader context as a direct result of findings. | Designs a methodology or theoretical framework that is skillfully developed and/or synthesized. Organizes and synthesizes evidence to reveal insightful patterns, similarities, differences, limitations, and/or implications. States a conclusion that is a logical extrapolation to support a broader context as a direct result of findings. Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information. |
| **Think critically**—Evaluate the credibility of scientific information and interpret the impact of its use or misuse in society | Not  Evident | *Attempts to* determine the credibility of scientific information *but does so somewhat inaccurately*.  **AND/OR** Recognizes and distinguishes the ethical use from the misuse of scientific information in society, *but doesn’t discuss the ramifications*. | *Begins to* determine the credibility of scientific information *through moderate interpretation and evaluation*.  **AND/OR** Recognizes and distinguishes the ethical use from the misuse of scientific information in society. Can explain *on a basic level* what might be at stake when scientific information is used or misused in society. | *Accurately recognizes* and distinguishes credible from non-credible scientific information *through deep evaluation and interpretation*.  **AND**  Recognizes and distinguishes the ethical use from the misuse of scientific information in society. Can explain *on an advanced level* what might be at stake when scientific information is used or misused in society. | Demonstrates an informed scientific skepticism when presented with scientific information and applies critical thinking techniques to analyze and evaluate the validity of information or artifacts before accepting or formulating a conclusion.  **AND** Can accurately *explain at a capstone level* how the use or misuse of this information impacts (historical, observed, or future) society and/or how society has impacted science due to the use/misuse of information. |

**Rubric and SLO Guide:**

For the “Apply Scientific Principles” SLO we are asking professors to have their students *do science*. Each course will do this in different ways depending on the level of the course and the course topic. We want students to get beyond understanding content and be able to draw conclusions from evidence given to them or collected themselves, and at a capstone level, design their own methodology, then use it to gather data and analyze it.

The critical thinking SLO might be a worthy challenge! The SLO really has two parts, but they are interconnected. It would be hard to interpret the impact of the use or misuse of scientific information in society without first evaluating the credibility of that information. We’d like to push you to get creative and eventually integrate both parts into your courses. Imagine a society filled with critical thinkers who don’t trust everything they see on social media, but instead ask questions and dig deeper before forming opinions, making decisions, or voting. At the higher achievement levels, students are doing BOTH parts of the SLO well, so an AND instead of an AND/OR is indicated for a 3 or 4. Examples of earning a 0-Not Evident on this SLO include: Cannot consistently distinguish credible from non-credible scientific information, doesn’t question claimed experts, easily falls victim to pseudoscience or has a naïve trust for information or sources undeserving of such trust, or entertains conspiracy theories or falls for logical fallacies **AND/OR** cannot distinguish ethical use of scientific information from the misuse of scientific information in society, or doesn’t understand the impact of the use or misuse of science in society.

**Glossary:**

**Scientific Methodologies**: principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses.

**Scientific Reasoning**: includes the thinking skills involved in inquiry, experimentation, evidence evaluation, inference and argumentation that are done in the service of conceptual change or scientific understanding

**Skepticism**: the process of applying reason and critical thinking to determine validity. It's the process of finding a supported conclusion, not the justification of a preconceived conclusion

**Critical thinking:** the objective analysis and evaluation of an issue in order to form a judgement

**Pseudoscience**: a collection of beliefs or practices mistakenly regarded as being based on scientific method

**Conspiracy theory**: a belief that some covert but influential organization is responsible for a circumstance or event

**Logical fallacy**: an error in reasoning that renders an argument invalid