

NGSS 8 Science Practices – Definitions and Examples

This tool presents concise definitions of each NGSS science practice and describes what students do to participate in each practice. Examples from classroom instruction are also included for each practice.

NGSS Science Practice Definition	What Students Do	Sample Performance Expectation from NGSS Classroom Example
<h3>Investigating Practices</h3>		
1. Asking Questions		
Scientific questions lead to explanations of how the natural world works and can be empirically tested using evidence	<ul style="list-style-type: none"> • Ask questions to develop or refine a model or explanation about the natural world. • Ask questions that can be answered using evidence from investigations or gathered by others 	3-PS2-3 Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. <i>Classroom Example:</i> How does the size of a magnet affect the number of paper clips it can pick up?
3. Planning and Carrying Out Investigations		
An investigation is a systematic way to gather data about the natural world either in the field or in a laboratory setting.	<ul style="list-style-type: none"> • Design investigations that will produce data that can be used to answer scientific questions. This includes determining the goal of the investigation, developing predictions, and designing procedures. • Identify and analyze experimental variables, controls and investigational methods (e.g., how many trials to do). • Conduct investigations to gather data (observations or measurements) using appropriate tools and methods. 	MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. <i>Classroom Example:</i> Students conduct an investigation using hot red water and cold blue water to observe the ways the water does and does not interact, similar to air masses.

5. Using Mathematical and Computational Thinking

Mathematical and computational thinking involves using tools and mathematical concepts to address a scientific question.

- Describe, measure, compare, and estimate quantities (e.g., weight, volume) to answer a scientific question.
- Organize data in graphs or charts.
- Use mathematical concepts (e.g., ratios) to answer scientific questions.
Use digital tools to accomplish these goals when appropriate.

MS-PS3-1

Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

Classroom Example:

Students create and analyze graphs of the data from an investigation about the relationship between a ball's mass and its speed down a ramp.

Sensemaking Practices**2. Developing and Using Models**

A model is an abstract representation of phenomena that is a tool used to predict or explain the world. Models can be represented as diagrams, 3-D objects, mathematical representations, analogies or computer simulations.

- Create and use models to explain and/or predict scientific phenomena, processes, or relationships.
- Evaluate the merits and limitations of models.

MS-LS3-1

Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

Classroom Example:

Students create a model of a strand of DNA. They then alter the base pairs (letters) to simulate a mutation. Students use their model to explain how changes in base pairs leads to changes in the proteins constructed.

4. Analyzing and Interpreting Data		
<p>Analyzing and interpreting data includes making sense of the data produced during investigations. Because patterns are not always obvious, this includes using a range of tools such as tables, graphs and other visualization techniques.</p>	<ul style="list-style-type: none"> Analyze and interpret data to determine patterns and relationships. Represent data in tables and graphs to reveal patterns and relationships. Consider the limitations of data analysis such as sources of error. 	<p>K-LS1-1</p> <p>Use observations to describe patterns of what plants and animals (including humans) need to survive.</p> <p><i>Classroom Example:</i></p> <p>Students use a class chart of what different animals eat and group the animals in different ways based on their food sources. Students discuss which animals would be affected if changes occurred to different food sources.</p>
6. Constructing Explanations		
<p>A scientific explanation is an explanatory account that articulates how or why a natural phenomenon occurs that is supported by evidence and scientific ideas.</p>	<ul style="list-style-type: none"> Construct an explanation for a natural phenomenon. Use evidence (e.g. measurements, observations) to construct or support an explanation. Consider the qualitative or quantitative relationships between variables to explain a phenomenon. Apply scientific ideas to construct or revise an explanation. 	<p>1-PS4-2</p> <p>Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.</p> <p><i>Classroom Example:</i></p> <p>Students write explanations about why a light source is needed for a person to see an object. Students utilize evidence from an investigation as well as scientific ideas to explain why this occurs.</p>

Critiquing Practices

7. Engaging in Argument from Evidence

Scientific argumentation is a process that occurs when there are multiple ideas or claims (e.g. explanations, models) to discuss and reconcile. An argument includes a claim supported by evidence and reasoning, and students engage in debates to evaluate and critique competing arguments.

- Construct and refine arguments based on evidence and reasoning (understanding of disciplinary core ideas).
- Critique arguments from peers and other sources by citing relevant evidence and providing scientific questions.
- Compare and critique two arguments based on the quality of their evidence and reasoning.

4-LS1-1

Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Classroom Example:

Students engage in a debate about whether a hypothetical organism could survive without several key anatomical features using evidence from common structures and their function in other animals.

8. Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating and communicating information occurs through reading and writing texts as well as communicating orally. Scientific information needs to be critically evaluated and persuasively communicated as it supports the engagement in the other science practices.

- Read appropriate texts and related features (i.e. graphs) to obtain scientific information.
- Evaluate the information gathered from texts and other sources.
- Communicate scientific information in various formats in different modalities (writing, speaking). This characteristic makes explicit the features of communication in the other 7 scientific practices.

5-ESS3-1

Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Classroom Example:

Students read in small groups three articles about different communities that have instituted plans to conserve energy. They evaluate the information to create a plan for how their own community can conserve energy.

The language in the definitions and "What Students Do" was adapted from Appendix F in the Next Generation Science Standards (NGSS) (NGSS Lead States, 2013) as well as informed by an upcoming NSTA book about the science practices (Schwarz, Passmore & Reiser, in press).