Science (6-8)
Graduation Standards and Essential Outcomes

NGSS - Next Generation Science Standards

Science Graduation Standard 1

ASKING QUESTIONS AND DEFINING PROBLEMS: Students will design and refine empirically testable questions in order to describe and explain the natural world or to clarify criteria and constraints for solving problems about the designed world as demonstrated through the integration of cross-cutting concepts within the disciplines of earth/space science, biology, chemistry, and physics. (NGSS Practice 1)

6-8 Essential Outcomes

A. Ask questions:

   a. That arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

   b. That arise from examining models or a theory, to clarify and/or seek additional information and relationships.

   c. To determine relationships, including quantitative relationships, between independent and dependent variables.

   d. To clarify and refine a model, an explanation, or an engineering problem.

B. Ask questions that require sufficient and appropriate empirical evidence to answer.

C. Ask questions that can be investigated within the scope of the classroom, or outside of school and when appropriate, frame a hypothesis based on observations and scientific principles.

D. Ask questions that challenge the premise(s) of an argument or the interpretation of a data set.

E. Define a design problem that can be solved through the development of an object, tool, process or system.

Science Graduation Standard 2

DEVELOPING AND USING MODELS: Students will use and construct different types of models as tools for representing ideas and explanations, as demonstrated through the integration of cross-cutting concepts within the disciplines of earth/space science, biology, chemistry, and physics. (NGSS Practice 2)

6-8 Essential Outcomes

A. Evaluate limitations of a model for a proposed object or tool.

B. Develop and/or modify a model—based on evidence – to match what happens if a variable or component of a system is changed.

C. Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena.

D. Develop and/or use a model to predict and/or describe phenomena.

E. Develop a model to describe unobservable mechanisms.

F. Develop and/or use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales.

Science Graduation Standard 3

PLANNING & CARRYING OUT INVESTIGATIONS: Plan and carry out safe, ethical, systematic field and laboratory investigations, as demonstrated through the integration of cross-cutting concepts within the disciplines of earth/space science, biology, chemistry, and physics. (NGSS Practice 3)

6-8 Essential Outcomes

A. Plan an investigation individually and collaboratively, and identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.

B. Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.

C. Evaluate the accuracy of various methods for collecting data.

D. Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design.

E. Collect data about the performance of a proposed object, tool, process, or system under a range of conditions.

ANALYZING AND INTERPRETING DATA: Students will use a range of tools to identify the significant features and patterns in data, and calculate the degree of certainty in the results, as demonstrated through the integration of cross-cutting concepts within the disciplines of earth/space science, biology, chemistry, and physics. (NGSS Practice 4)

A. Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships.

B. Use graphical displays of large data sets.

C. Analyze and interpret data to provide evidence for phenomena.

D. Apply concepts of statistics and probability to analyze and characterize data.

E. Consider limitations of data analysis, and/or seek to improve precision and accuracy of data.

F. Analyze and interpret data to determine similarities and differences in findings.

USING MATHEMATICS AND COMPUTATIONAL THINKING: Students will use mathematics and computation to represent physical variables and their relationships, to predict the behavior of systems, and to test the validity of such predictions, as demonstrated through the integration of cross-cutting concepts within the disciplines of earth/space science, biology, chemistry, and physics. (NGSS Practice 5)

A. Decide when to use qualitative vs. quantitative data.

B. Use digital tools (e.g., computers) to analyze very large data sets for patterns and trends.

C. Use mathematical representations to describe and/or support scientific conclusions and design solutions.

D. Create algorithms (a series of ordered steps) to solve a problem.

E. Use digital tools and/or mathematical concepts and arguments to test and compare proposed solutions to an engineering design problem.

CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS: Students will construct explanations for scientific investigations that describe phenomena in the natural world and design solutions for engineering problems that are based on scientific knowledge, as demonstrated through the integration of cross-cutting concepts within the disciplines of earth/space science, biology, chemistry, and physics. (NGSS - Practice 6)

A. Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena.

B. Construct an explanation using models or representations.

C. Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

D. Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real- world phenomena, examples, or events.

E. Apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion.

F. Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system.

G. Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.

H. Optimize performance of a design by prioritizing criteria, making tradeoffs, testing, revising, and re-testing.

ENGAGING IN ARGUMENT FROM EVIDENCE: Students will develop the ability to engage in argumentation based on evidence and reasoning and leads to evidence-based conclusions and solutions as demonstrated through the integration of the other science & engineering practices and cross-cutting concepts within the disciplines of earth/space science, biology, chemistry, and physics. (NGSS Practice 7)

A. Compare and critique two arguments on the same topic and analyze whether they emphasize similar or different evidence and/or interpretations of facts.

B. Respectfully provide and receive critiques about one's explanations, procedures, models and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail.

C. Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.

D. Make an oral or written argument that supports or refutes the advertised performance of a device, process, or system, based on empirical evidence concerning whether or not the technology meets relevant criteria and constraints.

E. Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION: Students will use oral and written skills to communicate, evaluate and critique ideas and methods generated via research and experimentation, as demonstrated through the integration of cross-cutting concepts within the disciplines of earth/space science, biology, chemistry, and physics. (NGSS Practice 8)

A. Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s).

B. Integrate qualitative and/or quantitative scientific and/or technical information in written text with that contained in media and visual displays to clarify claims and findings.

C. Gather, read, synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.

D. Evaluate data, hypotheses, and/or conclusions in scientific and technical texts in light of competing information or accounts.

E. Communicate scientific and/or technical information (e.g. about a proposed object, tool, process, system) in writing and/or through oral presentations.