SCIENCE AND ENGINEERING PRACTICES
PERFORMANCE EXPECTATIONS
PERFORMANCE INDICATOR
S.1A.8: OBTAIN, EVALUATE, AND COMMUNICATE INFORMATION

GRADE LEVEL PROGRESSIONS

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Performance Expectations</th>
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<tbody>
<tr>
<td>K.S.1A.8</td>
<td>Obtain and evaluate informational texts, observations, data collected, or discussions to (1) generate and answer questions about the natural world, (2) understand phenomena, (3) develop models, or (4) support explanations. Communicate observations and explanations using oral and written language.</td>
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<td>1.S.1A.8</td>
<td>Obtain and evaluate informational texts, observations, data collected, or discussions to (1) generate and answer questions, (2) understand phenomena, (3) develop models, or (4) support explanations, claims, or designs. Communicate observations and explanations using the conventions and expectations of oral and written language.</td>
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<td>2.S.1A.8</td>
<td>Obtain and evaluate informational texts, observations, data collected, or discussions to (1) generate and answer questions, (2) understand phenomena, (3) develop models, or (4) support hypotheses, explanations, claims, or designs. Communicate observations and explanations using the conventions and expectations of oral and written language.</td>
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<td>3.S.1A.8</td>
<td>Obtain and evaluate scientific information to (1) answer questions, (2) explain or describe phenomena, (3) develop models, (4) evaluate hypotheses, explanations, claims, or designs or (5) identify and/or fill gaps in knowledge. Communicate using the conventions and expectations of scientific writing or oral presentations by (1) evaluating grade-appropriate primary or secondary scientific literature, or (2) reporting the results of student experimental investigations.</td>
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<td>4.S.1A.8</td>
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<td>H.E.1A.8</td>
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SPECIFIC CHANGES PER GRADE

- Starting in grade 3, performance expectations expand to include supporting claims and designs as well as explanations.
- Starting in grade 3, performance expectations expand to include the use of the conventions and expectations of language.
- Starting in grade 5, performance expectations expand to include supporting hypotheses.
- Starting in grade 6, performance expectations expand significantly to include the use of scientific information to engage in the following: answer questions, explain or describe phenomena, evaluate hypotheses, explanations, claims or designs, identify and/or fill gaps in knowledge.
• Starting in grade 6, performance expectations expand to include *evaluating grade-
appropriate primary or secondary scientific literature* or *reporting the results of student experimental investigations*.
  • In this context, primary scientific literature refers to papers and articles from science journals and science media (e.g. the journal *Nature*) whereas secondary scientific literature refers to papers and articles that summarize research, data, and explanations first published in primary literature and media (e.g. *NPR.org*).

**DEFINING CHARACTERISTICS**

Science and engineering are ways of knowing that are represented and communicated by words, diagrams, charts, graphs, images, symbols, models, and mathematics. As part of the scientific and engineering processes, one must have the capacity to obtain the relevant information necessary to support claims and explanations, make predictions and inferences, and evaluate designs and solutions. Scientists and engineers evaluate information to make sure it is accurate. And they communicate information in a variety of ways so that others can understand and benefit from what has been learned and designed.

*This practice includes:*

• Reading, interpreting, and producing “texts”
• Spoken communication
• Critically evaluating science and engineering “products”
• Obtaining science and engineering information

*Types of multimodal texts*

• Traditional texts-- textbooks, primary (technical) literature, popular science articles
• Graphs
• Diagrams
• Tables
• Equations
• Symbols
• Adapted Primary Literature- a narrative is derived from technical literature to make it more accessible.

*Communicating*

• Presentations (both spoken and poster)
• Formal and informal modes of communication
• Discussions
• Teaching
• Digital publishing
• Digital media (videos, websites, blogs, social media networks, etc…)

The goals for this practice are for students to use words, diagrams, tables, and graphs to communicate their understandings or ask questions, to read and explain key ideas from scientific and technical sources of information, and to engage in critical reading of primary scientific literature or media reports of science and discuss the validity and reliability of what is being presented.
INSTRUCTIONAL GUIDANCE AND CONSIDERATIONS

Goals for the classroom.
- Consume information
  - textbooks
  - primary literature
- Create information
  - Communicate understandings
  - Share information (writing and presentation)

Challenges for students.
- Unfamiliarity with scientific jargon, academic vocabulary, and technical sentence structures
- Lack of foundation in this area
- Lack of a logical flow of information in expository texts
- Generate narrative when interpreting text as opposed to extracting information
- Accessing information through multimodal means (diverse media communicating information)

What we want our students to do
- Reading primary literature (not just textbooks or science “stories”)
- Producing multimodal science and engineering communications
- Science note books (drawings, numbers, words, inferences, predictions, experiences)
- Publishing formal reports (presentations, written reports, mini-posters, digital publishing, e-portfolios)
- Evaluate the validity and reliability of sources, claims, and data

In order to facilitate this, science and engineering teachers will need to provide explicit instruction and reading strategies for accessing a variety of primary and secondary sources of information. It will also be necessary to provide explicit instructions on reading tables, graphs, graphics, etc… Teachers cannot assume that they won’t have to teach reading.

Some specific examples--
- High School
  - Writing a research design plan
  - Presenting results and making claims
  - Writing abstracts
  - Analyzing and annotating research
- Middle School
  - Scientific debates
  - Evaluating and arguing claims using evidence from research
- Elementary School
  - Creating PSAs supported by evidence from research
  - Research days to address student interest questions about the natural world
  - Sharing information with peers through drawings, conversations, etc…
Students who show evidence of mastery in this practice will be able to:

- Obtain scientific information necessary to perform specific tasks (defined by specific grade-level the performance indicators) from a variety of sources. Scientific information includes information from scientific text and media, primary and secondary data and observations, models, discussions.
- Evaluate scientific information to determine its scientific accuracy.
- Generate and answer scientific questions using sources of information.
- Use scientific information to support claims, generate models, support reasoning, explanations, claims, and designs.
- Communicate scientific information in an appropriate manner (orally, written, visually, mathematically).

**CONNECTIONS WITH OTHER SCIENCE AND ENGINEERING PRACTICES**

- **Ask Questions (S.1A.1) and Plan and Carry Out Investigations (S.1A.3)**
  - Information provides context and prior knowledge to refine the process of developing a scientific question and planning an appropriate investigation.
- **Analyze and Interpret Data (S.1A.4) and Use Mathematics and Computational Thinking (S.1A.5)**
  - Information provides a context for interpreting data and attempting to make meaning of the evidence gathered through investigations.
  - It also involves the organization and representation of data and evidence.
- **Engage in Argument from Evidence (S.1A.7) and Construct Explanations (S.1A.6)**
  - Information provides context to frame a scientific claim and construct a viable explanation by allowing the evidence to be evaluated and understood in the context of the larger pool of information surrounding the disciplinary core ideas of the content.
  - It also involves how the claims and explanations developed from evidence are communicated out and evaluated by others.
- **Develop and Use Models (S.1A.2)**
  - The practice of obtaining information can include identifying and evaluating existing models to use as well as provide the content context for developing one’s own models based on evidence and understanding of scientific principles.
- **Construct Devices or Design Solutions (S.1B.1)**
  - Engineering is the application of scientific principles and concepts through the development of successful design and solutions to meet needs and solve problems. Engineers must obtain and evaluate information as part of the process of applying scientific principles to the design process. They also obtain and evaluate information about previous attempts to design solutions for similar needs or problems.
  - Engineers must be able to successfully communicate information about their designs.
The following are selected examples of performance tasks aligned with sample grade band content standards and performance indicators. The purpose of these examples are to illustrate what a performance task would look like that meets the performance expectations of both a given content performance indicator and the science and engineering performance indicator. Examples of performance tasks that do not meet the criteria of the science and engineering performance indicator are also provided for comparison. This list does not provide examples for every grade level.

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<tr>
<th>Grade</th>
<th>Subject</th>
<th>Example</th>
<th>Non-Example</th>
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<td>1</td>
<td>Physical Science</td>
<td>Students are challenged to find evidence that supports the claim that light is required to make objects visible. Students obtain information from both informational texts and investigations to construct a model that illustrates how light is necessary for humans to see things.</td>
<td>Students watch a video or read a book about light.</td>
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<td>4</td>
<td>Life Science</td>
<td>Students obtain information from primary (science journal articles) and secondary (textbooks) sources about different plants. Students sketch or model the different characteristics of the plants and use these models to classify the plants as flowering or non-flowering based on their characteristics. Students communicate the results in class.</td>
<td>Students are shown pictures, and the teacher explains how different plants are classified.</td>
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<td>5</td>
<td>Life Science</td>
<td>Students obtain information from primary sources (science journal articles) and secondary sources (textbooks) about the biotic factors of different terrestrial and aquatic ecosystems. Students use this information to develop models of terrestrial and aquatic ecosystems that accurately incorporate the different biotic factors, comparing the factors of one ecosystem with another.</td>
<td>Students read about and take notes on the biotic factors of different ecosystems.</td>
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<td>7</td>
<td>Life Science</td>
<td>Students obtain information about the relationship between genes and chromosomes from age-appropriate primary references (science journals). Students reason with this information to construct an explanation for the role</td>
<td>Students take notes from textbooks and presentations about genes and chromosomes and how they are related to an organism’s inherited characteristics.</td>
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<td>High School</td>
<td>Chemistry</td>
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<td>Students obtain information about technological applications of alpha, beta, and gamma radiation from primary sources (science journals), including details about mass, charge, and penetrating power. Students reason with this information to support claims about the benefits and risks associated with nuclear power and radiation, comparing the different types of radiation.</td>
<td>Students conduct research from textbooks and notes about the different types of radiation and write a report about their findings.</td>
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