

**NGSS Science and Engineering
Practices with Corresponding
ELD Standards
4th Grade**

1. Asking questions and defining problems

Students will inquire, identify, predict, describe, and define

- Ask questions about what would happen if a variable is changed.
- Identify scientific (testable) and non-scientific (non-testable) questions.
- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.
- Use prior knowledge to describe problems that can be solved.
- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (NGSS Appendix F)

General Strategies for All Students

- Provide an engaging context that peaks student curiosity (discrepant event, interesting scenario, hands-on activity, relevant situation, authentic problem)
- Keep class chart for student questions and/or students record questions in their science notebooks.
- Encourage student to use the crosscutting concepts to formulate questions, e.g. *Is there a pattern? What is the cause of this effect? How does this system work? What is the function of this structure?* (See a complete list at <http://crosscutsymbols.weebly.com/>)
- Recast students' incomplete or flawed questions, *So what you're asking is...? You're question then is ...?*
- Brainstorm with students a list of questions based on a shared experience and then together sort them into "testable" and "non-testable" questions.

Corresponding ELD Standards

Part 1. Interacting in Meaningful Ways: A. Collaborative: 1. Exchanging information/ideas; B. Interpretive: 5. Listening actively

Emerging

P1.A.1 Contribute to conversations and express ideas by asking *yes-no* and *wh-* questions.

P1.B. 5 Demonstrate active listening to read-alouds and oral presentations by asking and answering basic questions, with prompting and substantial support.

Expanding

P1.A.1 Contribute to class, group, and partner discussions, including sustained dialogue, by asking relevant questions.

P1.B.5 Demonstrate active listening of read-alouds and oral presentations by asking and answering detailed questions, with occasional prompting and moderate support.

Bridging

P1.A.1. Contribute to class, group, and partner discussions, including sustained dialogue, by asking relevant questions

P1.B.5. Demonstrate active listening of read-alouds and oral presentations by asking and answering detailed questions, with minimal prompting and light support.

<p>Emerging</p> <p>Sentence frames:</p> <p><i>What is ..?</i> <i>What does ..?,</i> <i>Where is ...?</i> <i>When I ... why does...?</i> <i>When does ... ?</i> <i>How does ..?</i> <i>Why is ..?</i> <i>Why does...?</i> <i>I predict ...</i></p> <p>Questions/Prompts:</p> <p><i>Which of these questions are you wondering about?</i> <i>Which variable do you want to change?</i> <i>Could ... be the problem?</i> <i>Is ... a criterion?</i> <i>Could ... be a constraint?</i></p>	<p>Expanding and Bridging</p> <p>Sentence frames:</p> <p><i>I wonder...</i> <i>What would happen if...?</i> <i>What causes...?</i> <i>What are the effects of...?</i> <i>How does ... affect ...?</i> <i>What would change if ...?</i> <i>I predict ... because ...</i> <i>The problem we will solve is ...</i> <i>Based on what I know about ..., I think ...</i></p> <p>Questions/Prompts:</p> <p><i>What questions do you have about...?</i> <i>What questions do you have about the variables?</i> <i>What questions could you ask to find out...?</i> <i>What would be an alternative question?</i> <i>What is the problem we are trying to solve?</i> <i>What are the criteria? What are the constraints?</i></p>
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2. Developing and using models

Students develop, represent, predict, describe, explain, revise, and test

- Identify limitations of models
- Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.
- Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.
- Develop and/or use models to describe and/or predict phenomena.
- Develop a diagram or simple physical prototype to convey a proposed object, tool, or process.
- Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system. (NGSS Appendix F)

General Strategies for All Students

- Model for students how to develop and use models to explain their thinking.
- Regularly have students draw a model to use as an artifact for discussion. Encourage students to revise their models based on new information.
- Have students work together in small groups to develop a model on chart paper or white boards. Conduct a gallery walk for students to observe each other's models and provide feedback. Use one of the students' models to add on to or revise with new information.
- Provide supports for students to share their models and ask each other questions in pairs or small groups:

Student A. What does your model show/predict/explain?

Student B. My model shows/predicts/explains...

Student A. What does ... mean?

Student B. It shows ...

Corresponding ELD Standards

Part 1. Interacting in Meaningful Ways: A. Collaborative: 2. Interacting via written English; C. Productive 9. Presenting

Emerging

P1.A.2 Collaborate with peers on joint writing projects of short informational texts, using technology where appropriate for publishing, graphics, etc.

P1.C.9 Plan and deliver brief oral presentations explaining a science process, with substantial support.

Expanding

P1.A.2. Collaborate with peers on joint writing projects of longer informational texts, using technology where appropriate for publishing, graphics, etc.

P1.C.9 Plan and deliver longer oral presentations explaining a science process with moderate support.

Bridging

P1.A.2 Collaborate with peers on joint writing projects of a variety of longer informational texts, using technology where appropriate for publishing, graphics, etc.

P1.C.9 Plan and deliver oral presentations explaining a science process with light support.

Emerging	Expanding and Bridging
<p>Sentence frames:</p> <p><i>The model shows/explains/predicts ...</i> <i>The model doesn't explain ...</i> <i>The parts of my model are ...</i></p> <p>Questions/Prompts:</p> <p><i>Make a drawing in your notebook to explain ...</i> <i>What could you add to you model to show...?</i> <i>Does this part mean ...?</i></p>	<p>Sentence frames:</p> <p><i>I revised my model based on ...</i> <i>My model shows how ... affects ...</i></p> <p>Questions:</p> <p><i>What does the model explain? What doesn't it explain?</i> <i>What is the relationship between ... and ...?</i> <i>What ideas could you add to your model?</i> <i>What changes could you make?</i></p>

3. Planning and carrying out investigations

Students design, sequence, predict, evaluate, describe, organize, compare, classify, draw, label

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
- Evaluate appropriate methods and/or tools for collecting data.
- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
- Make predictions about what would happen if a variable changes.
- Test two different models of the same proposed object, tool, or process to determine which better meets criteria for success. (NGSS Appendix F)

General Strategies for all Students

- Model the process for planning an investigation.
- Teach a mini-lesson on ways to record and organize data in student science notebooks (e.g., T-charts, lists, technical drawings, labeling)
- Introduce equipment and procedural words beforehand (*separate, pour, measure, etc.*) and post on a class word wall or chart with images.
- After coming to a class or group consensus on a procedure for an investigation, document the steps on the board with illustrations so that all students have access to them.
- Have students work in small groups. Encourage and make collaboration a focus.

Corresponding ELD Standards

Part 1. Interacting in Meaningful Ways A. Collaborative: 1. Exchanging information/ideas; C. Productive 10. Writing

Emerging	Expanding	Bridging
<p>P1.A.1 Contribute to conversations and express ideas by asking and answering <i>yes-no</i> and <i>wh</i>-questions and responding using short phrases.</p>	<p>P1.A.1 Contribute to class, group, and partner discussions, including sustained dialogue, by following turn-taking rules, asking relevant questions, affirming others, and adding relevant information.</p>	<p>P1.A.1 Contribute to class, group, and partner discussions, including sustained dialogue, by following turn-taking rules, asking relevant questions, affirming others, adding relevant information, building on responses, and providing useful feedback.</p>
<p>P1.C.10 (b) Write brief summaries of experiences using complete sentences and key words (e.g., from notes or graphic organizers).</p>	<p>P1.C.10 (b) Write increasingly concise summaries of experiences using complete sentences and key words (e.g., from notes or graphic organizers).</p>	<p>P1.C.10 (b) Write clear and coherent summaries of experiences using complete and concise sentences and key words (e.g., from notes or graphic organizers).</p>

Emerging	Expanding and Bridging
<p>Sentence frames:</p> <p><i>First, we will ...</i> <i>Next, we will ...</i> <i>Then, we will ...</i> <i>If we change ... then ...</i> <i>I predict ... because ...</i> <i>I observe ...</i></p> <p>Questions/Prompts:</p> <p><i>Are you trying to find out if...?</i> <i>Have you considered ...?</i> <i>What will you do first?</i> <i>Second?</i> <i>Will you need ...?</i> <i>Is this the variable you will control?</i> <i>Does ... meet the criteria?</i></p>	<p>Sentence frames:</p> <p><i>Based on what we know about ... we predict ...</i> <i>If we ... we expect ...</i></p> <p>Questions/Prompts:</p> <p><i>What are you trying to find out?</i> <i>How could you find out...?</i> <i>Is there another way?</i> <i>What materials will you need?</i> <i>How could you determine ...?</i> <i>Which variables are controlled?</i> <i>How will you test ...?</i> <i>How will you know if ... meets the criteria?</i></p>

4. Analyzing and interpreting data

Students compare, represent, classify, sequence, analyze

- Represent data in tables and/or various graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.
- Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.
- Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.
- Analyze data to refine a problem statement or the design of a proposed object, tool, or process.
- Use data to evaluate and refine design solutions. (NGSS Appendix F)

Strategies for All Students

- Model ways of organizing data in class charts and student science notebooks (graphs, charts, Venn Diagrams, graphic organizers)
- Provide sentence frames for oral and written discourse.
- Chart the data from each group on a class chart for students to analyze.

Corresponding ELD Standards

Part 1. Interacting in Meaningful Ways B. Interpretive 6. Reading/Viewing closely;

Part 2. Learning about How English Works A. Structuring Cohesive Text 1. Understanding Text Structure

Emerging	Expanding	Bridging
<p>P1.B.6 (a) Describe ideas, phenomena (e.g., volcanic eruptions), and text elements (main idea, events) based on close reading of a select set of grade-level texts, with substantial support.</p>	<p>P1.B.6 (a) Describe ideas, phenomena (e.g., animal migration), and text elements (main idea, central message, etc.) in greater detail based on close reading of a variety of grade-level texts, with moderate support.</p>	<p>P1.B.6 (a) Describe ideas, phenomena (e.g., pollination), and text elements (e.g., main idea, event sequence, etc.) in detail based on close reading of a variety of grade-level texts with light support.</p>
<p>P2.A.1 Apply understanding of how different text types are organized to express ideas (e.g., how data is organized within a text*) to comprehending texts and writing basic texts.</p>	<p>P2.A.1 Apply increasing understanding of how different text types are organized to express ideas (e.g., how data tables and charts relate to text*) to comprehending texts and writing texts with increasing cohesion.</p>	<p>P2.A.1. Apply understanding of how different text types are organized to express ideas (e.g. compare the different ways data is organized and analyzed in a text*), to comprehending texts and writing cohesive texts.</p>

**Modified to align with NGSS*

Emerging	Expanding and Bridging
<p>Sentence frames:</p> <p><i>My data show...</i> <i>A pattern I see is...</i> <i>... and ... are similar because they both...</i> <i>... and ... are different because</i> <i>...</i></p> <p>Questions/Prompts:</p> <p><i>Is this a pattern?</i> <i>Are these the same or different?</i> <i>Organize the data by ...</i> <i>Make a diagram to show ...</i> <i>If you change ... , will that improve the design?</i></p>	<p>Sentence frames:</p> <p><i>From the data, I can infer that ...</i></p> <p>Questions/Prompts:</p> <p><i>Is there a pattern to these data?</i> <i>How is ... related to ...?</i> <i>How does ... compare to ...?</i> <i>How will you organize the data?</i> <i>Based on the data, how will you change your design?</i></p>

5. Using mathematics and computational thinking

Students enumerate, measure, graph, estimate, describe, organize

- Decide if qualitative or quantitative data are best to determine whether a proposed object or tool meets criteria for success.
- Organize simple data sets to reveal patterns that suggest relationships.
- Describe, measure, estimate, and/or graph quantities (e.g., area, volume, weight, time) to address scientific and engineering questions and problems.
- Create and/or use graphs and/or charts generated from simple algorithms to compare alternative solutions to an engineering problem. (NGSS Appendix F)

General Strategies for all Students

- Use opportunities in science to engage in math practices when appropriate
- Help students see the connections between what they are learning in math to how it is applied in science.
- Mini-lessons on graphing, measurement

Corresponding ELD Standards

Part 1. Interacting in Meaningful Ways A. Collaborative: 4. Adapting language choice; C. Productive 10. Writing

Emerging

P1.A.4 Adjust language choices according to social setting (e.g., playground, classroom) and audience (e.g., peers, teacher) with substantial support.

P1.C.10.b. Write brief summaries of experiences using complete sentences and key words (e.g., from notes or graphic organizers).

Expanding

P1.A.4. Adjust language choices according to purpose (e.g., persuading, entertaining), task (e.g. telling a story vs. explaining a science experiment), and audience with moderate support.

P1.C.10.b. Write increasingly concise summaries of experiences using complete sentences and key words (e.g., from notes or graphic organizers).

Bridging

P1.A.4 Adjust language choices according to purpose, task (e.g., facilitating a science experiment), and audience, with light support.

P1.C.10.b. Write clear and coherent summaries of experiences using complete and concise sentences and key words (e.g., from notes or graphic organizers).

Emerging	Expanding and Bridging
<p>Sentence frames:</p> <p><i>Our results are ...</i> <i>The graph/table shows ...</i> <i>We measured ...</i></p> <p>Questions/Prompts:</p> <p><i>Read the graph (table).</i> <i>Would ... represent this pattern?</i> <i>Is this a way to show ... ?</i> <i>Do the numbers mean that ...?</i> <i>Does the change in ... mean that ...?</i></p>	<p>Sentence frames:</p> <p><i>Based on ... the results show ...</i> <i>We measured ... in order to ...</i> <i>We can use math in order to ...</i></p> <p>Questions/Prompts:</p> <p><i>What does this represent?</i> <i>Show in a graph or table.</i> <i>How would you organize ... to show ...?</i> <i>How did numbers and patterns help us understand what is going on?</i> <i>Do the numbers support your explanation?</i></p>

6. Constructing explanations and designing solutions

Students infer, explain, provide evidence, design, identify, apply, solve, compare

- Construct an explanation of observed relationships (e.g., the distribution of plants in the back yard).
- Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.
- Identify the evidence that supports particular points in an explanation.
- Apply scientific ideas to solve design problems.
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (NGSS Appendix F)

General Strategies for all Students

- Mini-lesson on language structures and norms for engaging in academic discussions
- Writing frames for explanatory writing
- Start with diagrams and graphic organizers to formulate ideas
- Think-Pair-Share to generate ideas
- Review engineering design process
- Concept Maps
- Use crosscutting concepts to think about science ideas with another lens.

Corresponding ELD Standards

Part 1. Interacting in Meaningful Ways A. Collaborative: 1. Exchanging Information/Ideas, 4. Adapting language choice; C. Productive 10. Writing

Emerging

P1.A.1 Contribute to conversations and express ideas by asking and answering *yes-no* and *wh*-questions and responding using short phrases.

P1.A.4 Adjust language choices according to social setting (e.g., playground, classroom) and audience (e.g., peers, teacher) with substantial support.

Expanding

P1.A.1 Contribute to class, group, and partner discussions, including sustained dialogue, by following turn-taking rules, asking relevant questions, affirming others, and adding relevant information.

P1.A.4. Adjust language choices according to purpose (e.g., persuading, entertaining), task (e.g. telling a story vs. explaining a science experiment), and audience with moderate support.

Bridging

P1.A.1 Contribute to class, group, and partner discussions, including sustained dialogue, by following turn-taking rules, asking relevant questions, affirming others, adding relevant information, building on responses, and providing useful feedback.

P1.A.4 Adjust language choices according to purpose, task (e.g., facilitating a science experiment), and audience, with light support.

4th Grade NGSS Science and Engineering Practices with Corresponding ELD standards

Emerging P1.C.10.b. Write brief summaries of texts and experiences using complete sentences and key words (e.g., from notes or graphic organizers).	Expanding P1.C. 10. b. Write increasingly concise summaries of texts and experiences using complete sentences and key words (e.g., from notes or graphic organizers).	Bridging P1.C.10. b. Write clear and coherent summaries of texts and experiences using complete and concise sentences and key words (e.g., from notes or graphic organizers).
<p>Sentence frames:</p> <p><i>I observed ...</i> <i>I think ... because...</i> <i>We think ... is the best solution because ...</i></p> <p>Questions/Prompts:</p> <p><i>Are you saying ...?</i> <i>Does ... mean that ...?</i> <i>Is ... an example of ...?</i> <i>Do you think ... is a result of ...?</i> <i>Which ... caused ...?</i> <i>Does ... relate to this new situation?</i> <i>Is ... the same or different from ...?</i></p>	<p>Sentence frames:</p> <p><i>Based on ..., I think...</i> <i>The relationship between ... and ... shows that ...</i> <i>The evidence to support ... is ...</i> <i>There is a pattern that shows ...</i> <i>Both these solutions ...; however, ... is better because ...</i> <i>What evidence do you have that ...?</i></p> <p>Questions/Prompts:</p> <p><i>Explain in your own words.</i> <i>What ideas show that ...?</i> <i>What does ... mean?</i> <i>Give an example.</i> <i>What is the effect of ...?</i> <i>What would result if...?</i> <i>What approach did you use to ...?</i> <i>How is ... an example of ...?</i> <i>Why is ... significant?</i> <i>How can you apply what you learned about ... to ...?</i> <i>How does ... compare to ...?</i></p>	

7. Engaging in argument from evidence

Students discuss, persuade, synthesize, negotiate, suggest, critique, evaluate, reflect

- Compare and refine arguments based on an evaluation of the evidence presented.
- Distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation.
- Respectfully provide and receive critiques from peers about a proposed procedure, explanation, or model by citing relevant evidence and posing specific questions.
- Construct and/or support an argument with evidence, data, and/or a model.
- Use data to evaluate claims about cause and effect.
- Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (NGSS Appendix F)

General Strategies for all Students

- Provide norms and structures for students to discuss in pairs, small group, and whole class.
- Model and discuss expectations for argumentation.
- Encourage divergent ideas for discussion topics
- Use common misconceptions as starting points for argumentation topics
- Concept Cartoon
- Class debates
- Provide both evidence for and against a claim
- Claim, Evidence, and Reasoning Framework

Corresponding ELD Standards

Part 1. Interacting in Meaningful Ways: A. Collaborative: 3. Offering Opinions;
B. Interpretive. 7. Evaluating language choices; C. Productive. Supporting Opinions

Emerging	Expanding	Bridging
<p>P1.A.3. Negotiate with or persuade others in conversations using basic learned phrases (e.g., <i>I think ...</i>), as well as open responses, in order to gain and/or hold the floor.</p> <p>P1.B.7 Describe the specific language writers or speakers use to present or support an idea (e.g., the specific vocabulary or phrasing used to provide evidence), with prompting and substantial support.</p>	<p>P1.A.3. Negotiate with or persuade others in conversations using an expanded set of learned phrases (e.g., <i>I agree with X, but...</i>), as well as open responses, in order to gain and/or hold the floor, provide counterarguments, etc.</p> <p>P1.B.7 Describe how well writers or speakers use specific language resources to support an opinion or present an idea (e.g., whether the vocabulary used to provide evidence is strong enough), with prompting and moderate support.</p>	<p>P1.A.3. Negotiate with or persuade others in conversations using a variety of learned phrases (e.g., <i>That's an interesting idea. However,...</i>), as well as open responses, in order to gain and/or hold the floor, provide counter-arguments, elaborate on an idea, and so on.</p> <p>P1.B.7. Describe how well writers and speakers use specific language resources to support an opinion or present an idea (e.g., the clarity or appealing nature of language used to provide evidence), with prompting and light support.</p>

4th Grade NGSS Science and Engineering Practices with Corresponding ELD standards

Emerging P1.C.11 (a) Support opinions by expressing appropriate/accurate reasons using textual evidence (e.g., referring to text) or relevant background knowledge about content, with substantial support.	Expanding P1.C.11 (a) Support opinions or persuade others by expressing appropriate/accurate reasons using some textual evidence (e.g., paraphrasing facts) or relevant background knowledge about content, with moderate support.	Bridging P1.C.11 (a) Support opinions or persuade others by expressing appropriate/accurate reasons using detailed textual evidence (e.g., quotations or specific events from text) or relevant background knowledge about content, with light support.
<p>Sentence frames:</p> <p><i>I claim...</i> <i>My evidence is ...</i> <i>I agree/disagree with ... because...</i> <i>What about...?</i> <i>I used to think... but now I think...</i> <i>My models shows...</i> <i>My data shows...</i></p> <p>Questions/Prompts:</p> <p><i>Do you agree or disagree?</i> <i>Do you think ... supports the idea that...?</i> <i>Which piece of evidence supports the claim ...?</i></p>	<p>Sentence frames:</p> <p><i>Based on ... I would argue that ...</i> <i>Have you considered ...?</i> <i>I agree/disagree that ... causes ... because</i> <i>... meets the criteria, because it ...</i></p> <p>Questions/Prompts:</p> <p><i>Why do you think that is so ...?</i> <i>What is your evidence?</i> <i>Please explain why you disagree that...</i> <i>Why do you think ... supports the idea that ...?</i></p>	

8. Obtaining, evaluating, and communicating information

Students read, summarize, describe, compare, combine, explain, communicate

- Read and comprehend grade-appropriate complex texts and/or other reliable media to summarize and obtain scientific and technical ideas and describe how they are supported by evidence.
- Compare and/or combine across complex texts and/or other reliable media to support the engagement in other scientific and/or engineering practices.
- Combine information in written text with that contained in corresponding tables, diagrams, and/or charts to support the engagement in other scientific and/or engineering practices.
- Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.
- Communicate scientific and/or technical information orally and/or in written formats, including various forms of media and may include tables, diagrams, and charts.

General Strategies for all Students

- Reinforce vocabulary using pictorials (review key concepts by illustrating and labeling on chart paper in front of students)
- Provide ample opportunities for students to talk, write, and read about their science experiences.
- Use reading and multimedia to deepen students' understanding of phenomena
- Model and provide scaffolds, (Use reading strategies such as: close reading, jigsaw, guided reading, graphic organizers, and visual literacy strategies.)

Corresponding ELD Standards

Part 1. Interacting in Meaningful Ways: All

Part 2. Learning How English Works: All