Prompts to Enhance Grade-Level Science Learning

Crosscutting Concepts (CCC) and Science and Engineering Practices (SEP) help students to explore and explain Disciplinary Core Ideas (DCI). Enhance learning by connecting science concepts to real-world experiences through these practices.

1. Identify the CCC or SEP from the NGSS Performance Expectations.
2. Review Appendix G (CCC) or Appendix F (SEP) to focus on the descriptors for the appropriate grade level.
3. Use these descriptors to craft prompts that facilitate student thinking.

Here are some samples.

Crosscutting Concept Prompts

Patterns

Students use *patterns* to organize, classify, and identify relationships.

- **K-2:** What patterns do we observe?
- **3-5:** How can we make a prediction using a pattern?
- **6-8:** What patterns do we notice in the graphs and chart?
- **9-12:** How do the patterns we see change at different scales?

Cause and Effect

Students investigate and explain the *causes and effects* of events.

- **K-2:** How can we cause something to change?
- **3-5:** What evidence shows that one event causes another?
- **6-8:** How can we use data to determine if a correlation suggests causation?
- **9-12:** How can we use cause-and-effect in systems to predict behaviors?

Scale, Proportion, Quantity

Students understand how changes impact a system differently based on *scale, proportion, or quantity*.

- **K-2:** How can we measure to compare objects?
- **3-5:** How do we describe quantities using standard measurement?
- **6-8:** How do different scales help us understand a system?
- **9-12:** How can patterns at one scale help us predict patterns at another?

Systems and System Models

Students break *systems* into parts, look at how they interact, and use *models* to explain and predict what will happen.

- **K-2:** What are the parts of objects and environments?
- **3-5:** How do multiple parts work together to do what individual parts cannot?
- **6-8:** How do systems interact with each other?
- **9-12:** How can models help predict what will happen when the conditions change?

Energy and Matter

Students explain how and why *energy and matter* move and cause changes.

- **K-2:** How can we put a group of pieces together in different ways?
- **3-5:** How does matter or energy transfer as it moves through a system?
- **6-8:** How do energy and matter move into, out of, and within a system?
- **9-12:** How do conservation laws help us analyze energy and matter in systems?

Structure and Function

Students observe relationships between an object's *structure and function*.

- **K-2:** How does the shape of something help it do its job?
- **3-5:** How do the structures of living and non-living things help them function?
- **6-8:** How do we design a structure to serve a particular function?
- **9-12:** What are the structure-function relationships at the molecular level?

Stability and Change

Students examine the causes and effects of *stability and change.*

- **K-2:** What stays the same, and what changes?
- **3-5:** How do small changes affect a system over time?
- **6-8:** What factors determine whether a system is stable or changing?
- **9-12:** How do irreversible changes and feedback loops affect a system's stability?

Science and Engineering Practice Prompts

Ask Questions

Students *ask purposeful questions* that can be investigated empirically.

- **K-2:** What do you wonder about this topic? How could we find out more?
- **3-5:** Which questions can we test and use to describe relationships?
- **6-8:** How can we refine our questions so they clarify our argument?
- **9-12:** How can we challenge the current understanding or interpretation?

Develop and Use Models

Students *create and use models* to elaborate on and share their ideas.

- **K-2:** What can we draw or build to show a process?
- **3-5:** How can we change or improve our model to make it more accurate?
- **6-8:** How does our model help us explain what we cannot see?
- **9-12:** How can my model generate data to solve problems?

Plan and Carry Out Investigations

Students *investigate to explain* how the world works.

- **K-2:** How can we collect data to answer our question?
- **3-5:** What do we need to control in order to have a fair test?
- **6-8:** How can we refine our plan to include multiple variables?
- **9-12:** What are potential environmental, social, and personal impacts of our plan?

Analyze and Interpret Data

Students *interpret data to identify patterns* and draw conclusions.

- **K-2:** What types of observations should we record and share?
- **3-5:** How can we organize our data to help us understand what's happening?
- **6-8:** How do we determine if our data suggests correlation or causation?
- **9-12:** How can we analyze and compare multiple sets and types of data?

Construct Explanations

Students describe phenomena, predict future events, or infer about the past.

- **K-2:** Based on what we observed, what do we think is happening, and why?
- **3-5:** What evidence supports the points of our explanation??
- **6-8:** How do multiple pieces of evidence and scientific ideas help our explanation?
- **9-12:** How can we refine our explanation to make it more scientifically valid?

Use Math and Computational Thinking

Students *use mathematics and computational tools* to describe and predict.

- **K-2:** How can we use numbers to show what we observed?
- **3-5:** How can organize our data to see patterns and relationships?
- **6-8:** How can digital tools help us analyze very large data sets?
- **9-12:** How can functions be used to analyze and model data?

Engage in Argument from Evidence

Students *use reasoning and argument* to make a case for their ideas.

- **K-2:** What facts tell us that our idea is correct?
- **3-5:** How can I tell the difference between facts and opinions in an explanation?
- **6-8:** How can we compare the evidence in different arguments?
- **9-12:** How can we evaluate competing claims using reasoning and evidence?

Obtain, Evaluate, and Communicate

Students *acquire and communicate accurate scientific information.*

- **K-2:** What did we learn from what we read, and how can we share it?
- **3-5:** How can we decide if information from a source is reliable?
- **6-8:** How can we compare and synthesize information from multiple sources?
- **9-12:** How can we share complex scientific ideas with different audiences?