Supporting Cross-cutting Concepts 6-12

The cross-cutting concepts span all science courses K-12. This document contains a short explanation of each cross-cutting concept and ideas that can be used to support students when building knowledge around each CCC in the science classroom. Students may need a support to allow them to be successful in interacting with the science content and the cross-cutting concepts are one part of providing that support to students. This document is designed to provide suggestions for how students can interact with the science and engineering practices. This document also provides support suggestions to assist students as they interact with the CCCs.

Tips for including the Cross-cutting Concepts

- Start every lesson with a phenomenon that students can "figure out" as they work though the lesson
- Include a science and engineering practice in every lesson to assist students in "figuring out" a phenomena
- The crosscutting are designed to assist students in organizing information. It is essential that students be aware of the cross-cutting concept so that it becomes part of their toolkit when examining any science concept.
- Include the cross-cutting concept within the lesson as a lens that students are viewing the material through.
- Always use the cross-cutting concepts in context with a science and engineering practice and a disciplinary core idea.
- The cross-cutting concepts should be used to deepen student understanding of the disciplinary core ideas.
- Obtain, evaluate, and communicate will easily align with all of the cross-cutting concepts.

Patterns

Cross-cutting concept	Prompts to elicit student thinking about various phenomena	Science and engineering practices that most easily align
Patterns Observed repeated similarities in the world around us. This cross-cutting concept can be used to organize the information about the world and universe around us.	• What relationships did you notice in your observations? • What patterns did you notice in the material that you were observing? • What do the relationships or patterns that you noticed mean for the science concept that the lesson is focused on? • Do you expect this pattern to be stable over time? Why or why not?	• Analyzing and interpreting data • Mathematical and computational thinking **Sentence Frames for Student Use** • The pattern that I noticed is _____ because _____. • If the pattern continues then _____ _____.

Causality

Cross-cutting concept	Prompts to elicit student thinking about various phenomena	Science and engineering practices that most easily align
Cause and Effect Events have causes and effects on the world around them. The causes and effects of an event can be used to link occurrences together and predict what will occur after an event.	• What happened? Why did it happen? • Did one event change or cause something else? • What relationships did you notice about these two events? • What evidence supports the cause-and-effect relationship?	• Planning and carrying out investigations • Engaging in argument from evidence **Sentence Frames for Student Use** • One cause of _____ could be _____ because _____ _____. • _____ caused _____. The evidence to support this is _____ _____.
Structure and Function Connecting the structure of an object/system with the function. This can include looking at the structures, substructure and shapes of an object or system to determine how or why it functions within a given environment.	• How does the way this object/living thing is put together help with its job? • What structure performs _____ (function)? Why? • What about this structure allows it to do _____ (function)? • Can more than one structure perform the same function? Why or why not?	• Ask questions and identify problems • Develop and use models • Construct and explanation **Sentence Frames for Student Use** • _____(structure) performs _____ (function) because _____ _____. • I observed the (structure) _____ and noticed_____ which helps with its function. • _____(structure) and _____(structure) have the same function because _____ _____.

Systems		
Cross-cutting concept	**Prompts to elicit student thinking about various phenomena**	**Science and engineering practices that most easily align**
Scale, Proportion and Quantity Everything in the universe has an element of scale, proportion, or quantity. This may be related to energy, size, time, or measurement.	• Why is scale important in this science idea? • How can we measure _____? Why? • Why might quantity be important with this science concept? • How can proportion make it easier to understand this science idea?	• Analyzing and interpreting data • Mathematical and computational thinking • Developing and using models **Sentence Frames for Student Use** • Scale is important to this concept because _____. • _____ was used to measure _____. • Proportion is important to this concept because_____.
Stability and Change Make sense of why some natural and human-designed systems are stable and why some change.	• What evidence is there that the system is stable? • What changes appear to be happening in the system? • What will happen to the system over time? Will the system remain stable? Why or why not?	• Develop and use models • Construct an explanation **Sentence Frames for Student Use** • The system appears stable because _____ _____. • _____ appears to be changing within the system. • The system (will/will not) remain stable over time because _____ _____.

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<tr>
<td>Energy and Matter
All things in the universe require energy to function or move. All things in the universe are made of matter. Energy and matter meet when matter is used to make energy.</td>
<td>• Where is energy and matter used in this system?
• What is energy used for in this system? Is it converted or does it remain the same?
• What happens to matter in this system?
• Do energy and matter interact within this system? Why or why not?</td>
<td>• Develop and use models
• Construct an explanation
• Construct an argument
Sentence Frames for Student Use
• Energy and matter are used in this system by _____.
• Energy is important to this system because _ _____.
• Energy or matter in this system changes from _____ to _____.</td>
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<td>Systems and System Models
This crosscutting concept is about examining smaller pieces of the whole to make sense of larger connections in the universe.</td>
<td>• What are the connections between the parts of the system?
• What is the result of the system?
• What is each part of the system responsible for?
• How can this system be modeled to show the parts, the process, and the connections? Why did you choose this model?</td>
<td>• Developing and using models
• Analyzing and interpreting data
• Constructing an explanation
• Plan and carry out investigations
Sentence Frames for Student Use
• The system parts are connected by _____ _____.
• The model of the system that I choose is ___ _____ because __ _____.
• The system parts such as _____, _____, _____ work together to _____.</td>
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