

Crafting a 3D Assessment Task

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Modified by Iowa Science Writing team

Lesson / Activity / Line in Storyline: Why is the Arctic warming 2x faster than the rest of the globe?

Building Toward which Standard/Performance Expectation or What Students Are “Figuring Out”: [HS-ESS2-4](#)

STEP 1 —Select a DCI Component

What disciplinary core idea (DCI) component(s) (i.e., specific concepts) are the focus of this assessment?

- The foundation for Earth’s global climate system is the electromagnetic radiation from the sun as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy’s reradiation into space.

Step 2: Brainstorm possible scenarios for eliciting student understanding—and select one to use using criteria

| Possible Scenarios | Draft Language for the Selected Scenario |
|---|---|
| Create a mind map of the climate system. | Use data from albedo lab, heat capacity lab, and PhET simulation on greenhouse gases to identify climate system components. Write components on mini puzzle pieces. Use puzzle pieces to create a mind map: identify cause-and-effect relationships between system components by drawing arrows and writing explanations along the arrows. Mind map as a whole needs to show the interactions between energy and matter and the overall input/output of energy. |
| Evaluate the reliability of multiple articles about the Arctic and its changes. | Students read articles about the changing Arctic ice levels. Using an evaluation tool, determine the reliability of an article based on the following criteria: bias, author, date, scientific evidence. Students must use scientific information gained from the lab experiences done in class. Students choose one of the multiple articles provided and argue from evidence with their peers as to why they chose the article. |
| Develop a model of Earth’s stable and changing climate and from the model construct an explanation for why Earth’s climate is changing. | Use data from albedo lab, heat capacity lab, and PhET simulation on greenhouse gases to create two models of Earth. One model depicts Earth with a stable climate system and the other with a changing climate system (reality). Students show how energy is interacting with matter within the two systems. Must show what is different about the matter and energy that causes one to be stable and the other to change (differences in energy input and output). |

| | |
|--|---|
| Analyze graphical data, identify cause-and-effect relationships. | Students analyze graphical data of ice volume, sea level, greenhouse gas levels, atmospheric temperature, and reflectivity levels. Students construct an explanation of the cause-and-effect relationship between the data sets. From this explanation students identify why the climate is changing. Must link explanations to energy and matter interactions. |
|--|---|

Step 3: Select a Practice Element & a CCC Element

a) What Science and Engineering Practices lend themselves to the lesson/activity or the DCI element(s)? Use the foundation box(es) or Appendix F to identify the corresponding elements in your selected standard for this lesson/activity or line in storyline. *These can be supporting SEP(s) not in the selected standard or bundle of standards that would work with the student activity/lesson or identified piece of the storyline.*

| Science & Engineering Practice | Element of the Practice |
|--|---|
| Developing and Using Models Constructing Explanations | <p>Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.</p> <p>Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena.</p> <p>Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) 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.</p> |

b) Which Cross-Cutting Concept (CCC) element is related to the DCI(s) or practice elements? Use the foundation box(es) or Appendix G to identify the corresponding elements in your selected standard for this lesson/activity or line in storyline. *These can be supporting CCC(s) not in the selected standard or bundle of standards that would work with the student activity/lesson or identified piece of the storyline.*

| Crosscutting Concept | Element of the Crosscutting Concept |
|---|---|
| Stability and change System and system models Energy flow and interaction of matter | <p>Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.</p> <p>When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.</p> <p>Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.</p> |

STEP 4: Identify the Learning Target/ Purpose Statement/Success Criteria

This might be the PE (Performance Expectation) from NGSS or it will be the combination of the three dimensions selected in Steps 1-3 above.

Possible Templates:

"Students will ((practice verb clause)) to ((DCI element verb clause)) highlighting that ((CCC clause))."

"I can.. ((practice verb clause)) to ((DCI element verb clause)) and ((CCC clause))."

Students will **construct an explanation (using their constructed model)** to describe how **energy flows into and out of Earth's climate system** highlight that **variations in energy flow can result in stable and/or changing conditions**.

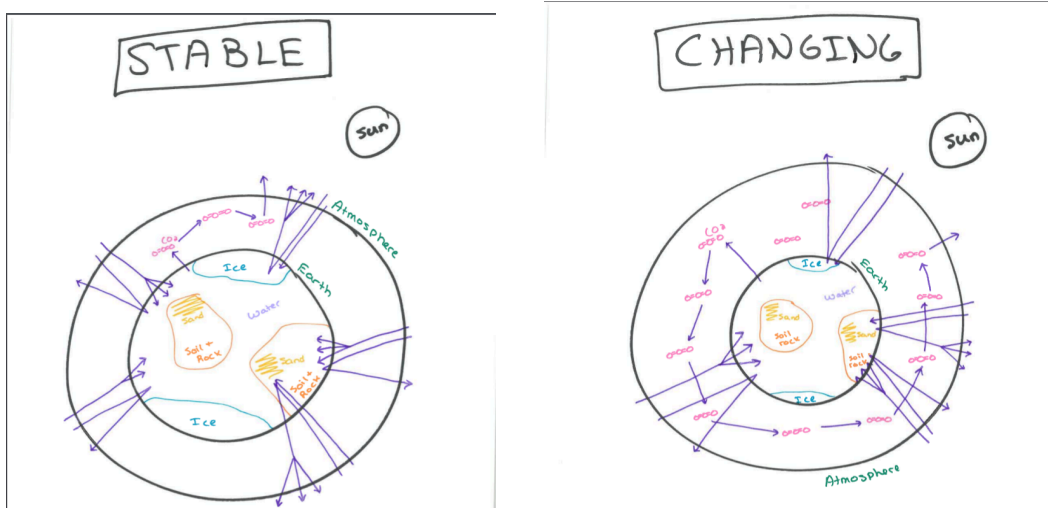
Step 5: Write 2D or 3D Questions

- Use the [Task Formats for Practices](#) to ask students to show their conceptual understanding. A series of questions should take students through a logical investigation sequence using multiple practices (e.g., analyze data followed by construct an explanation or refine a model).
- Think about how the Crosscutting Concept (CCC) would be observable in student responses. It may be implied by the phrasing of a DCI / Practice question (e.g., cause and effect), or you may need to [add a prompt for a CCC](#) if that is not the case.

- Use your climate models: **STABLE** and **CHANGING**.
- Explain how the amount of energy going into and going out of Earth's system differs between your models and **WHY**.
- Explain how the differences in energy flow cause Earth's climate to **CHANGE**.

Step 6: Imagine Student Responses

Include the key concepts for a proficient response



Step 7: Share, Review & Revise