Maine Department of Education

HIGH SCHOOL

Maine Science Assessment

Released Items (2025)

Teacher Version

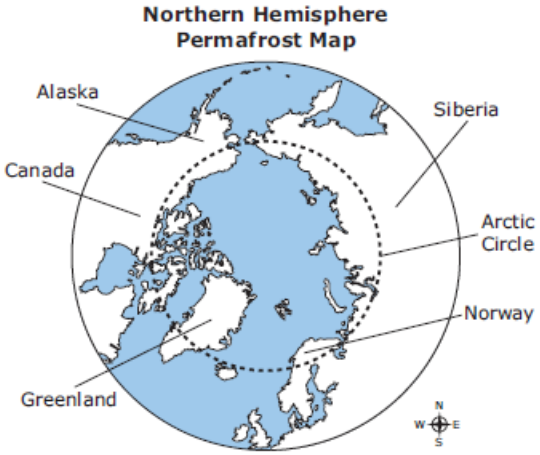
New Meridian

Included in this document are items and their associated stimuli that were administered on the Maine Science Assessment. For each item, the correct answer is provided, along with the Next Generation Science Standards (NGSS) to which it aligns. This includes the disciplinary core idea (DCI), science and engineering practice (SEP), and cross-cutting concept (CCC). In some cases, one of these dimensions may not apply. The number of points the item is worth is also provided, along with the correct answer.

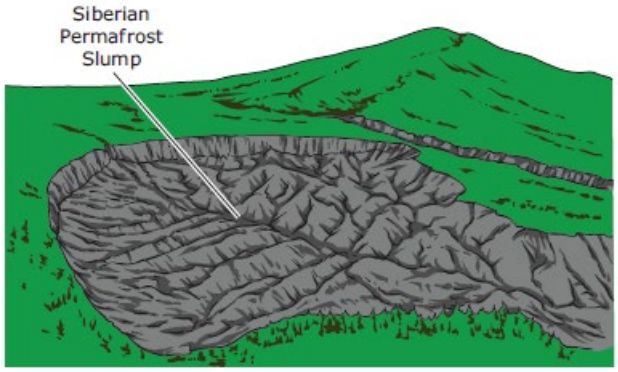
Use the information from Permafrost Slumps to answer **questions 1–4**.

Permafrost Slumps

Samantha researches the Arctic and learns about areas of solid ground which are sinking by almost 90 meters. These areas are known as permafrost slumps. In the Arctic, this sinking is happening more frequently. Samantha learns that the majority of the land circling the Arctic Ocean is made up of permafrost. Permafrost is a layer of Earth's surface and consists of gravel, soil, and sand, held together by ice.

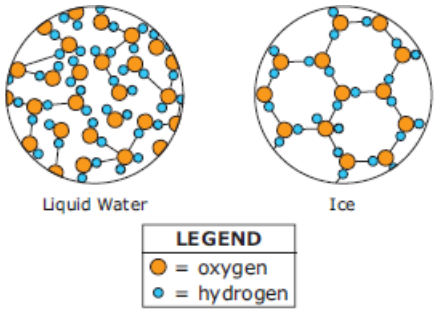


Permafrost slumps can be as large as a football stadium. One permafrost slump in Siberia measures 86 meters deep and 900 meters wide.



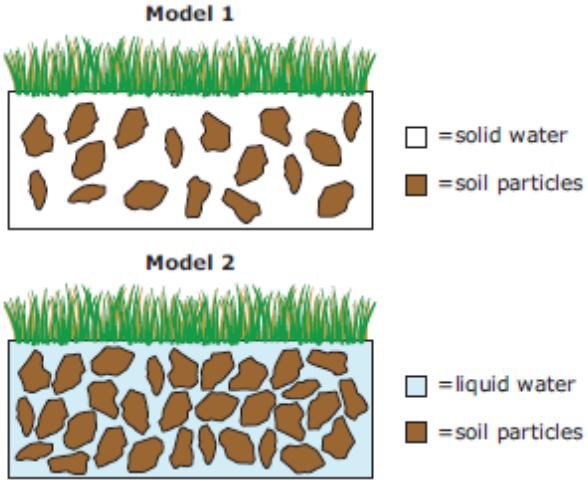
There is concern that these slumps are impacting the overall global temperature and contributing to climate change. Samantha wonders about the connection between these permafrost slumps and climate change.

1. Samantha wants to know what is causing the land to sink. She hypothesizes that the land slumps connect to the structure of water molecules both in liquid and solid forms.



Samantha builds identical models. Both models contain the same amount of soil, saturated with the same amount of water. She measures and records the volume of both models. She then places Model 1 in the freezer and leaves Model 2 on the counter.

The next day, Samantha measures the volume of both models. She notices that the volume of Model 1 has increased, now that it is frozen. The diagrams below show the models on the second day, after Model 1 has frozen.



Why does Samantha include Model 2 in her investigation?

1 pt

(A) It allows her to average the results of both models.

(B) It ensures that the water fully dissolves the solid materials.

It acts as a control, which allows her to compare it to Model 1.

(D) It serves as a backup in case Model 1 does not produce the results she is expecting.

Standard Alignment for Item 1

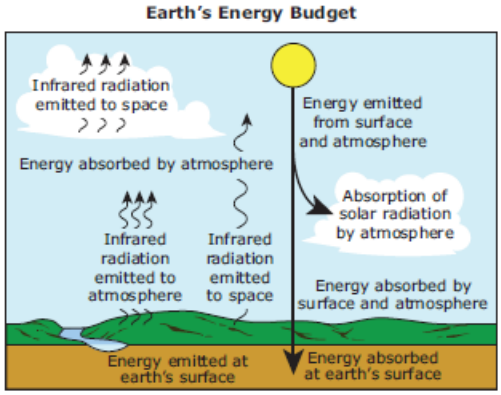
Discipline: Earth and Space Science
NGSS Topic: Weather and Climate

DCI: ESS2.C
The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit Sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.

SEP3: Planning and Carrying Out Investigations

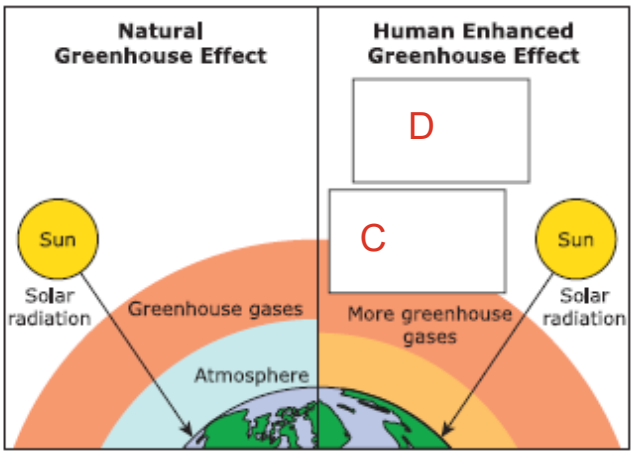
CCC6: Structure and Function

2. Samantha knows that if the permafrost is melting, the air in the Arctic must be warmer than normal. Earth's energy budget accounts for both the total amount of energy that comes into Earth's atmosphere and the total amount of energy that leaves Earth's atmosphere.



As greenhouse gases in the atmosphere increase, Earth's energy budget becomes unbalanced.

How does Earth's energy budget change? Select from the answer bank to complete the model. Write the letter of one description in each box.



1 pt for both boxes correct

Answer Bank:

A. ↑ More heat than normal escapes into space.

B. ↑ The same amount of heat than normal escapes into space.

C. ↑ Less heat than normal escapes into space.

D. ↓ More heat than normal is re-emitted.

E. ↓ The same amount of heat than normal is re-emitted.

F. ↓ Less heat than normal is re-emitted.

Standards Alignment for Item 2

Discipline: Earth and Space Science
NGSS Topic: Weather and Climate

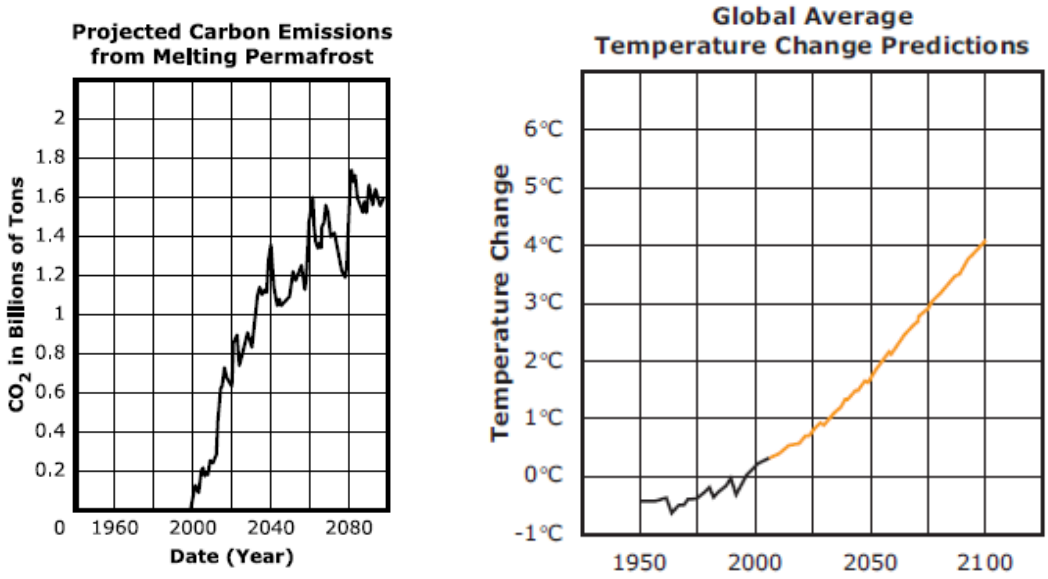
DCI: ESS2.D
The foundation for Earth's global climate systems is the electromagnetic radiation from the Sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space.

SEP2: Developing and Using Models

CCC5: Energy and Matter: Flows, Cycles, and Conservation

3. Samantha learns that permafrost is a type of carbon sink. Carbon sinks absorb more carbon from the atmosphere than they release, such as what happens with forests and oceans. Inside the permafrost are the remains of plants and animals that will release carbon when they thaw and decay. Scientists estimate that approximately 1,400 to 1,700 billion tons of carbon are stored in frozen organic matter in the Arctic permafrost.

Samantha wonders how melting permafrost will affect climate change. She finds computer model projections of carbon emissions from melting permafrost and average global temperatures over time.



Part A

Predict how the cycling of carbon in the permafrost will contribute to climate change. Select from the answer banks to complete each sentence. Write the letter of the answers in the blanks.

The heated atmosphere transfers 1. B_____ to the frozen permafrost. When the thawed organic matter breaks down, the carbon released into the atmosphere will be 2. C_____ than the current amount, causing 3. E_____ of change to Earth's climate.

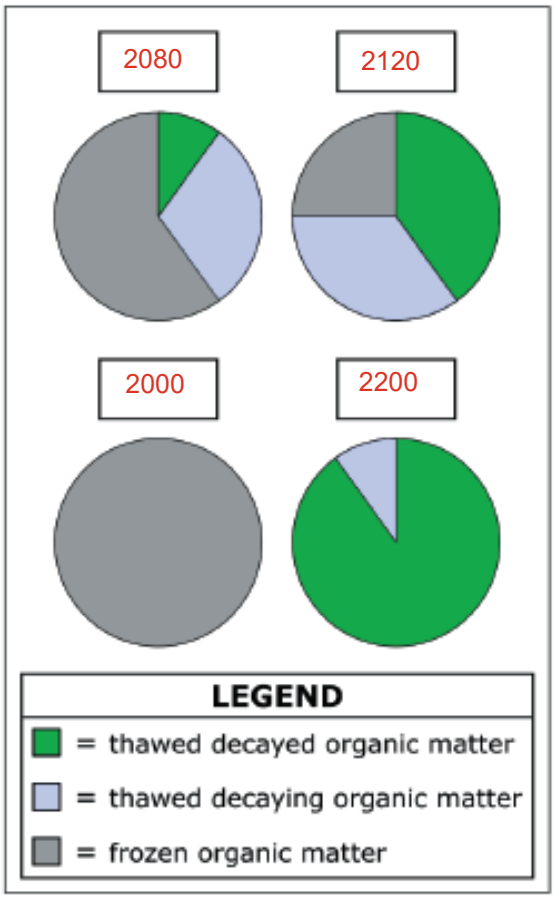
Answer Bank 1:	Answer Bank 2:	Answer Bank 3:
A. matter	C. more	E. an increased rate
B. energy	D. less	F. a decreased rate

1 pt for all 3 correct

Part B

The Arctic permafrost system contains frozen organic matter, thawed and decaying organic matter, and thawed organic matter which has already decayed. The pie graphs below represent the organic matter contained in the Arctic permafrost.

How do the ratios of this organic matter change over the years? Using information from the computer model projections, write a year from the answer bank into the box above each pie graph.



Answer Bank:

2000

2080

2120

2200

1 pt for all 4 correct

Standards Alignment for Item 3

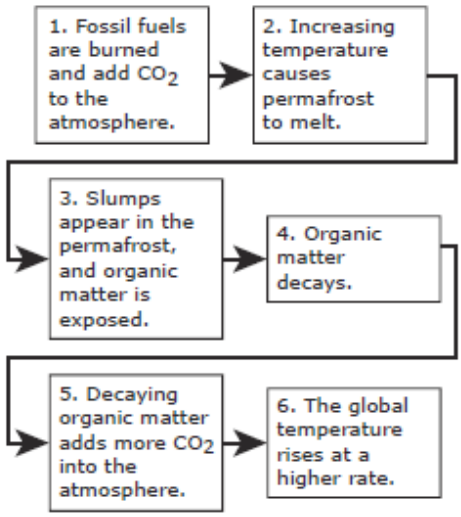
Discipline: Earth and Space Science
NGSS Topic: Weather and Climate

DCI: ESS2.A Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.
SEP4: Analyzing and Interpreting Data

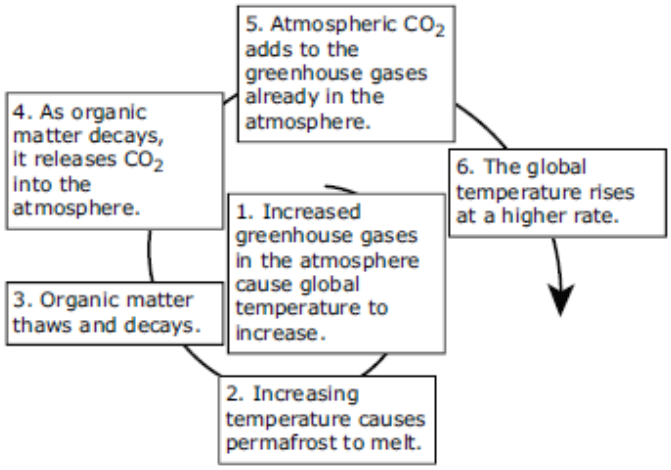
CCC5: Energy and Matter: Flows, Cycles, and Conservation

4. Samantha creates models to show the relationship between permafrost slumps and climate change.

Model A:



Model B:



After examining both models, Samantha now understands how they represent the relationship between the permafrost slumps and climate change. She investigates the spiral pattern in Model B.

Part A

Which statement **best** explains the spiral pattern in Model B?

1 pt

- (A) The pattern shows that there is no relationship.
- (B) The pattern shows that there is a linear relationship.
- The pattern shows that this is a positive feedback loop.
- (D) The pattern shows that this is a negative feedback loop.

Part B

Which **two** pieces of information should be added to Samantha's model to show the relationship between permafrost slumps and climate?

1 pt

- (A) Slumps are similar to sinkholes.
- Melting permafrost causes slumps.
- (C) Canada has permafrost 500 meters thick.
- (D) The Siberian permafrost slump is 86 meters deep.
- Slumps expose organic matter that is buried in the soil.
- (F) A permafrost slump can cause the collapse of an oil pipeline.

Standards Alignment for Item 4

Discipline: Earth and Space Science
NGSS Topic: Weather and Climate

DCI: ESS2.A
Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.

SEP2: Developing and Using Models

CCC7: Stability and Change