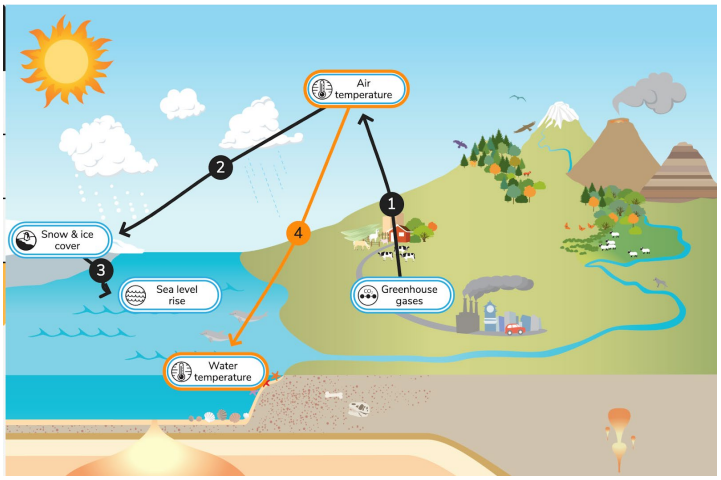
Setting the Stage

Scientific models are representations of ideas or processes used to explain phenomena. Scientists use models to visualize an explanation, test and revise ideas, and make predictions. In this lesson, students work in pairs to construct initial descriptive models and explanations for the unit driving question, “why might the Arctic be warming twice as fast as the rest of the world?”



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Lesson Overview

- *Part 1 – (10 minutes) Global Temperatures on the Rise*
  Access students' prior knowledge about climate change.
- *Part 2 – (20 minutes) Not All Warming is Equal*
  Students are introduced to the anchoring phenomenon after watching a data visualization showing changes in global temperature anomalies from 1880 to 2017.
- *Part 3 – (50 minutes) Initial Model Construction*
  Students work in groups to construct their initial models (annotated sketch) to explain the unit driving question, “why might the Arctic be warming twice as fast as the rest of the world?”
- *Part 4 – (10 minutes) Next Steps*
  Students create a list of questions they have related to the unit driving question.

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Instructional Overview	
Grade Level	Middle/High School
Instructional Time	90 minutes
Standards Alignment	**NGSS Disciplinary Core Ideas:** • ESS2.A: Earth Materials and Systems • ESS2.D: Weather and Climate **NGSS Science and Engineering Practices:** • Asking Questions • Developing and Using Models **NGSS Crosscutting Concepts:** • Patterns • Systems and System Models
Unit Driving Question	• Why might the Arctic be warming twice as fast as the rest of the world?
Driving Question(s) For This Lesson	• Why should we care about the Arctic?
Learning Goals	• Elicit student ideas related to the anchoring phenomenon
Materials	❑ Eliciting PPT ❑ Eliciting Student Worksheet (1 per student) ❑ Summary Table Student Worksheet (1 per student) ❑ Initial Model Construction Worksheet (1 per student-pair) ❑ Answer Key ❑ Video: Global temperature anomalies from 1880-2018 ❑ Video: The Polar Vortex, Explained ❑ Video: Polar vortex: -46°C temperatures as Chicago River turns to ice ❑ ❑ Butcher paper (1 per class period -- to be used for initial idea public record - Part 2) ❑ Colored pencils ❑ Markers
Material Preparation	❑ Cue and test web links ❑ Print student worksheets ❑ Review presenter notes in the Eliciting PPT ❑ Be prepared to tape butcher paper in a location easily visible to students
Vocabulary	• Phenomenon - An observable event

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	• Scientific Model - Representation of ideas or processes used to explain a phenomenon • Anomaly - something that deviates from what is normal, standard, or expected

Part 1 - Global Temperatures on the Rise (10 minutes)

Refer to Part 1 slides included in the Eliciting PPT. See PPT presenter notes for additional information.

1. Students complete their warm-up, "How do you think rising temperatures might be impacting our planet?" and share their ideas with the class.
    a. Emphasize that people and places are impacted by rising global temperatures in different ways.

Part 2 - Not All Warming is Equal (20 minutes)

Refer to Part 2 slides included in the Eliciting PPT. See PPT presenter notes for additional information.

1. Watch the "Global temperature anomalies from 1880-2018" video
    a. Students observe and record patterns in global warming

2. Students work in pairs to create a bulleted list of 2-3 possible explanations (initial ideas) for the patterns they observed in global temperature anomalies video.
    a. Note: The video represents the anchoring phenomenon -- amplified warming in the Arctic

3. Facilitate a discussion in which students share their initial ideas about the phenomenon (amplified warming in the Arctic) with the class.
    a. Create a public record of student-generated initial ideas.
        i. Display and use this public record in each lesson thereafter to add or cross off ideas as new evidence arises.

4. Introduce the unit driving question, "Why might the Arctic be warming twice as fast as the rest of the world?"

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5. Connect the students to the unit driving question. Why should students care? Refer to the Eliciting PPT (slides #6-8) to describe how amplified warming in the Arctic could affect the climate at lower latitudes.
    a. Watch videos, 1) The Polar Vortex, Explained and 2) Polar vortex: -46°C temperatures as Chicago River turns to ice

Part 3 - Initial Model Construction (50 minutes)

Refer to Part 3 slides included in the Eliciting PPT. See PPT presenter notes for additional information.

1. Use Part 3 of the Eliciting PPT to introduce students to scientific models

2. Students work in **pairs** to identify and list relevant parts/components they'd like to include in their model (these parts/components will likely come from the initial ideas public record).

3. Students work in pairs to construct their initial models.

4. Students share their initial models.
    a. Model sharing can be facilitated as a gallery walk, in small groups, or as a whole class.

Part 4 - Next Steps (10 minutes)

Refer to Part 4 slides included in the Eliciting PPT. See PPT presenter notes for additional information.

1. Students reflect on the lesson by creating a list of questions they still have related to the unit driving question, and proposing investigations that may address questions raised in this lesson.

2. Describe the Model-Based Inquiry unit framework say,

    The goal of this unit is to construct an evidence-based model and explanation of a real-world phenomenon: amplified warming in the Arctic. We will work together to identify information/evidence from each lesson that helps explain this phenomenon. We will keep track of new information/evidence throughout the unit in a summary table."

3. Distribute the summary table worksheet (hard copy or digitally) to students.

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