Extreme Living

Unit 2

Sharing and Use

This slide deck is intended to help guide you and your students through the sequence of this unit. While you may choose to use these slides as a helpful tool to prompt and facilitate students, all detailed information for each unit is in the student and teacher unit booklets.

Unit Essential Question

How do people use technology to survive in regions with different climates?

Extreme Conditions

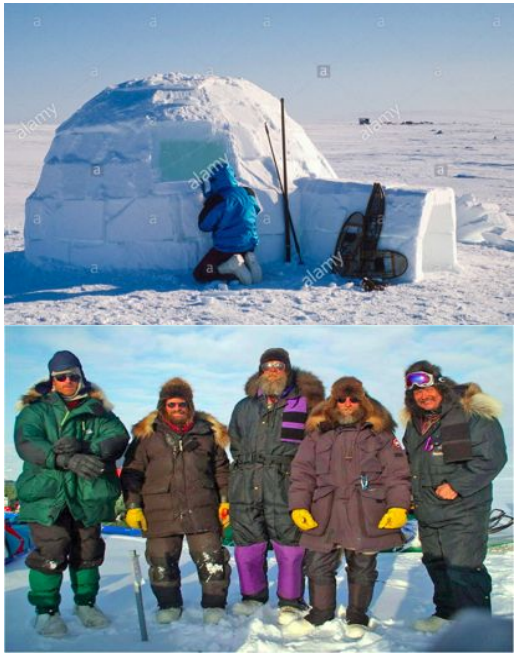
Lift-Off Task

Humans Surviving in Extreme Climates

Compare the Photos on the Left to Those on the Right

Generate Questions!

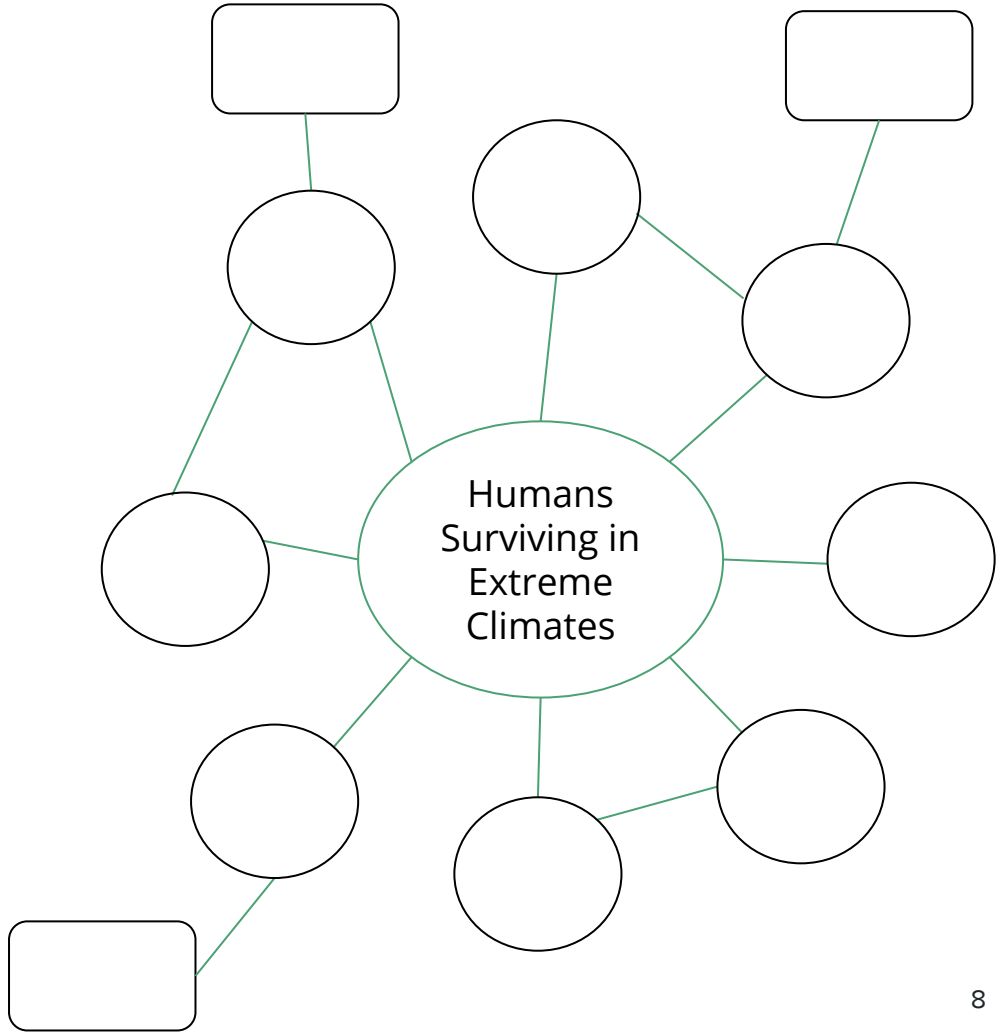
If you wanted to know more about humans surviving in extreme climates, what questions would you ask?



Group Concept Map

As a group, create a concept map that shows:

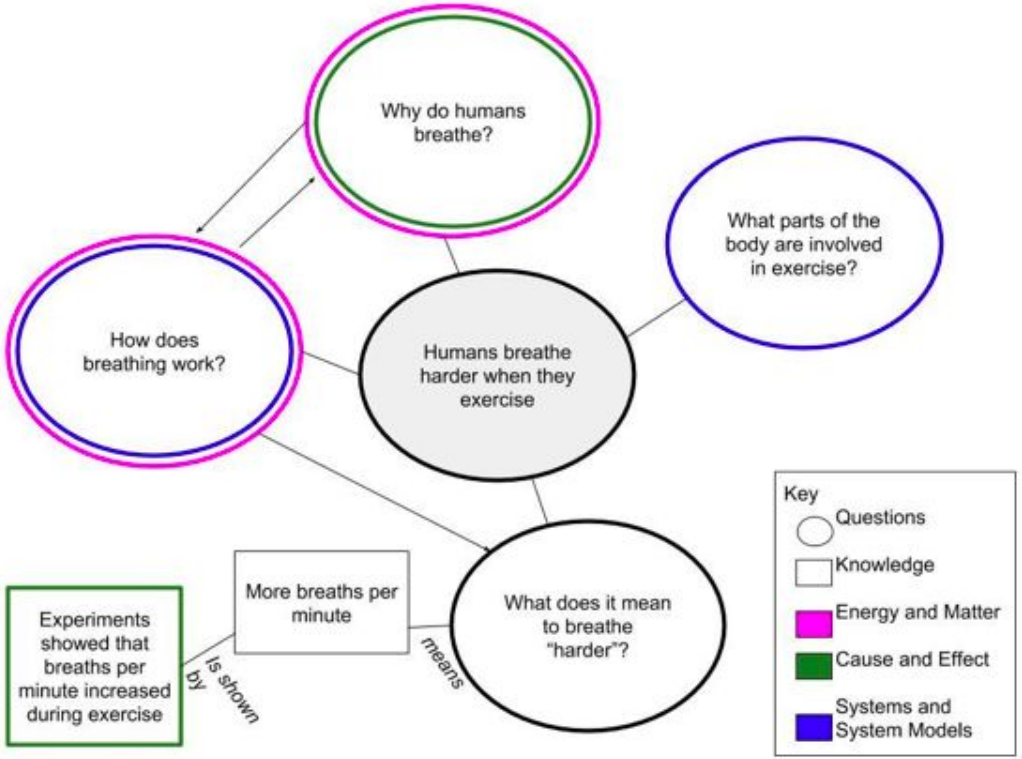
- Questions your group members had in common (circles)
- Possible answers to some questions (squares)
- Connections between related questions (lines)



Class Concept Map

As a class, create a concept map that shows:

- Key questions (circles)
- Possible answers to some questions (squares)
- Connections between related questions (lines)
- Crosscutting concepts used (trace in color)

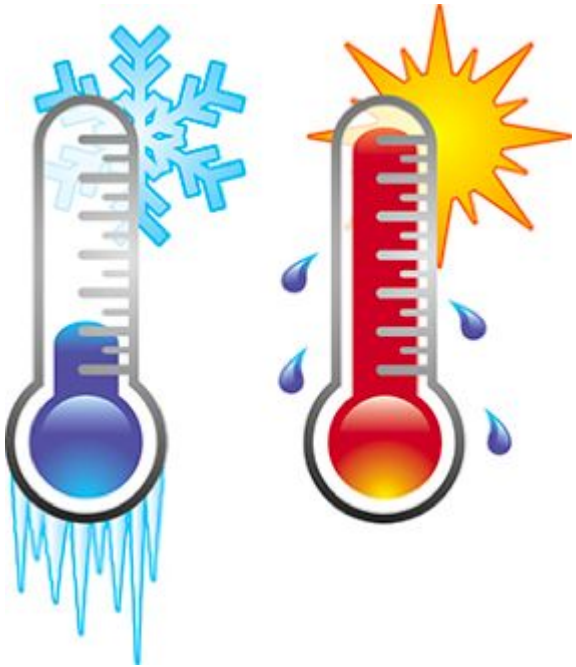


Introduction to the Culminating Project

Help make it possible for people to live in regions with an extremely hot or extremely cold climate!

Group Project - Present a thermal product for enhanced comfort in extreme weather regions

Individual Project - Write a consumer report that reviews the thermal product and the science behind it



Presentation Format Options

- Poster
- Powerpoint
- Prezi
- Product Demonstration
- Other

Connecting to the Culminating Project

You have been asked to design a product that makes it more comfortable for people to live in a region with an extreme climate. Research a few different regions with an extreme climate (too hot or too cold). As a group, choose one of these regions to focus on for your culminating project and describe the extreme climate there. Then individually,

- Define the **problem**: Why is it difficult to live in this region?
- Identify the **criteria** for a successful solution: How will you know your product has solved the problem?
- Identify the **constraints** of solving this problem: What might make it hard to solve this problem?

Complete this **individually** in your Project Organizer.

Reflection

Complete the questions at the end of your student guide to reflect on what you have learned in the Lift-Off Task.

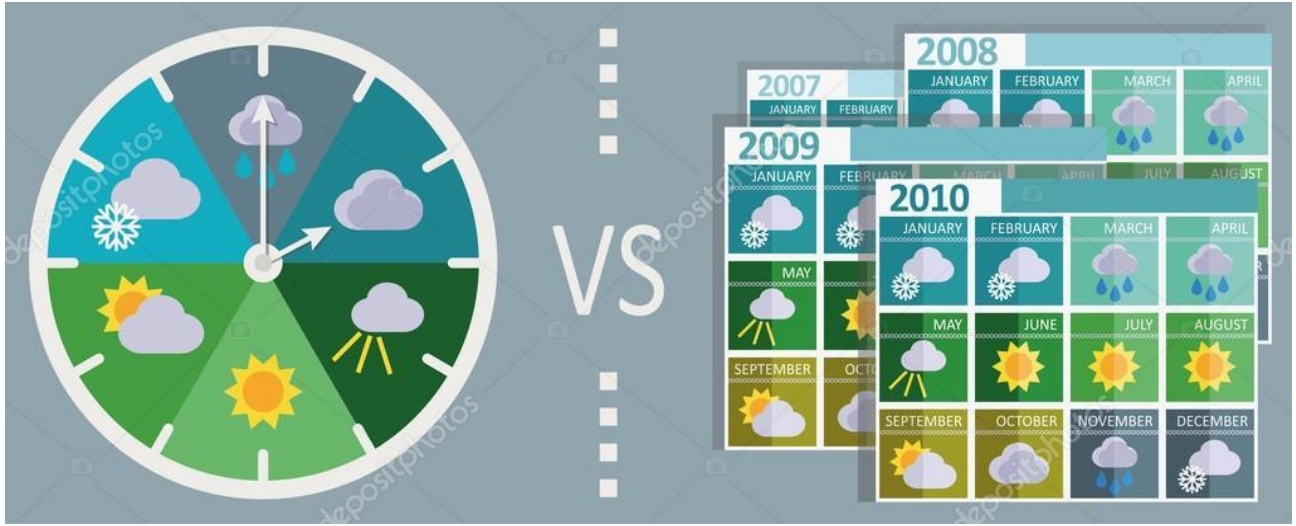
Climate, Part 1 - Heating the Planet

Task 1

What questions do you still have?

Engage

What do you already know about weather and climate?

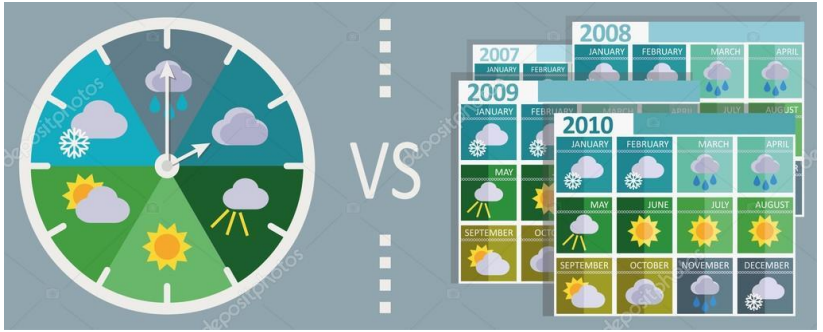


With a partner, discuss: What is the difference between weather and climate?

Weather vs. Climate

For each statement, move to either the “Weather Corner” or “Climate Corner” of the room, depending on whether you think the statement is describing weather or climate.

Be prepared to give a reason for why you are in that corner!



It rained on May 8.

Germany is a cold country.

Summer is hot.

The news says it is supposed to rain this weekend.

Florida is hotter than Alaska.

That was an amazing lightning storm last night.

Cities near the ocean tend to be wet.

It might snow in Tahoe tomorrow.

Today it was colder than usual.

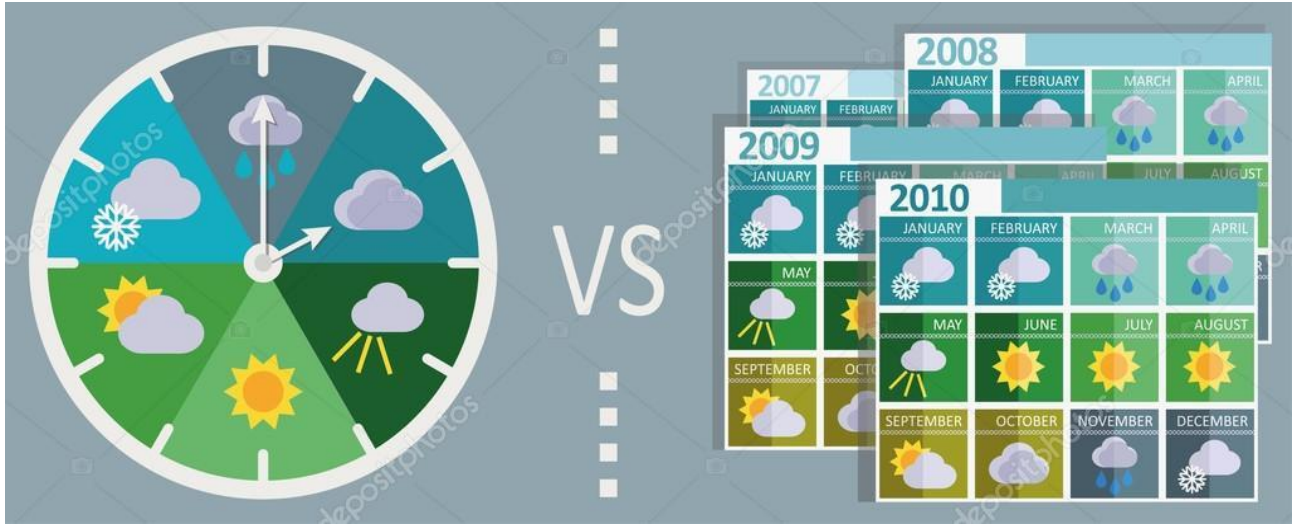
1992 was one of the coldest summers on record.

There is a hurricane predicted to hit tomorrow.

The highest recorded temperature of all time was 136 degrees Fahrenheit in Libya.

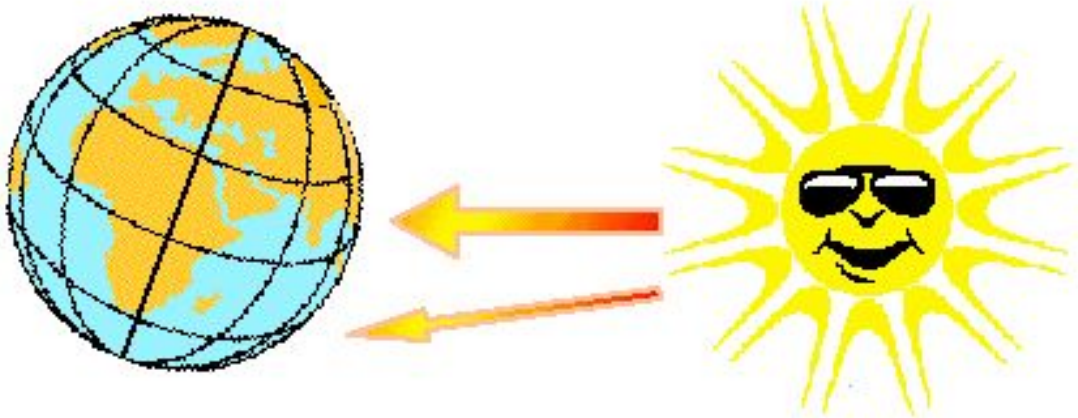
It rains every October.

Define the difference between weather and climate



Explore

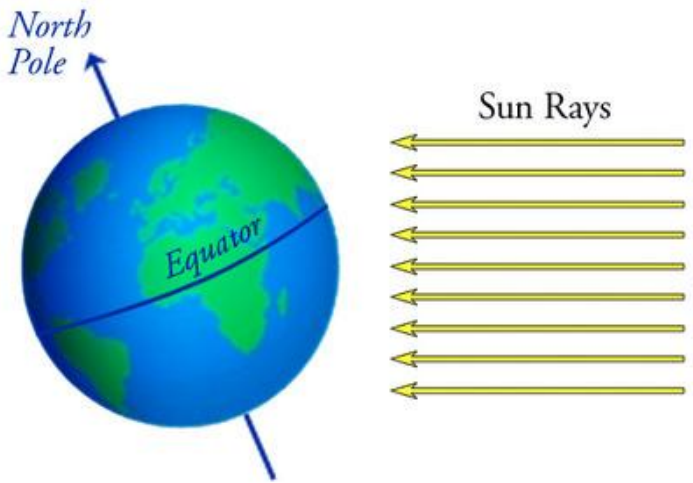
You already know that the Sun warms the Earth. But does every part of Earth get the same amount of energy from the Sun all the time?



Systems and System Models

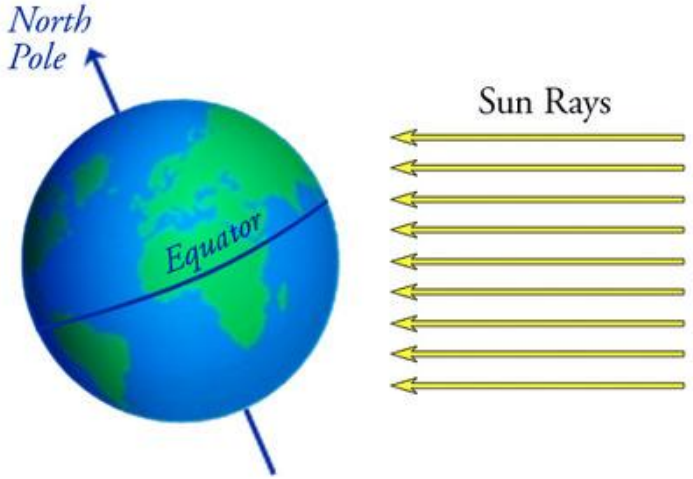
Use the materials below to make a model that represents the Earth and the Sun:

- Sun: Flashlight or Other Light Source
- Earth: Styrofoam Ball
- Poles: Toothpicks
- Equator: Rubber Band



Physical Model

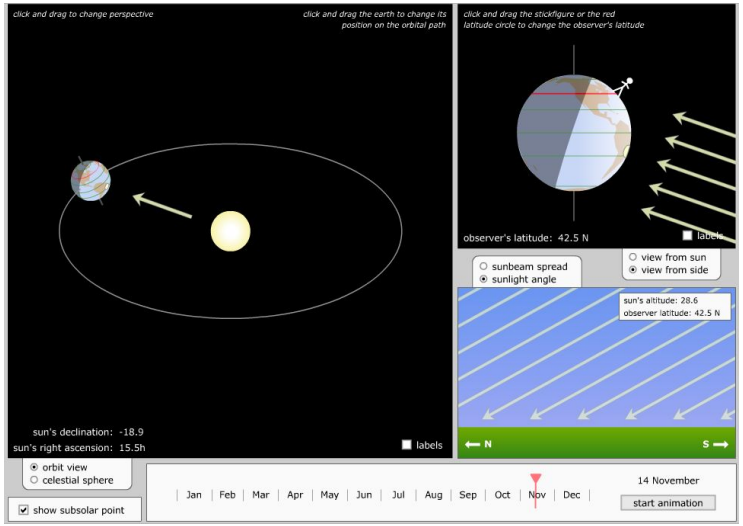
1. Follow the instructions in your Student Guide to model the process of Earth doing one full rotation on its axis over the course of one day.
2. Discuss and answer the discussion questions.



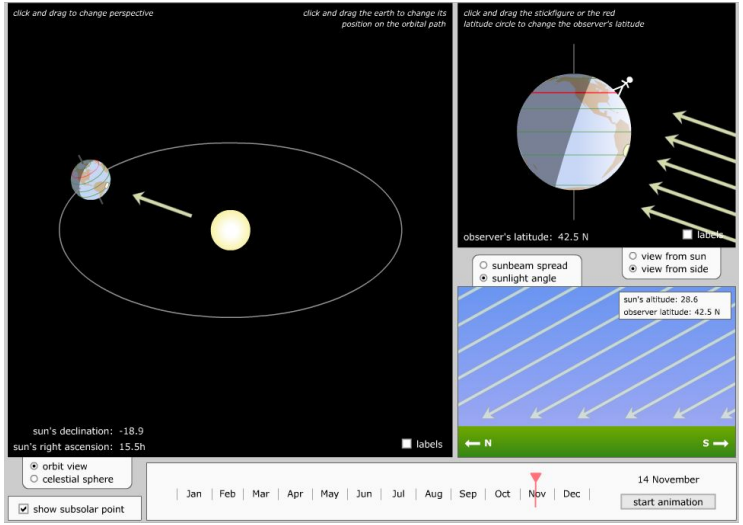
Computer Model

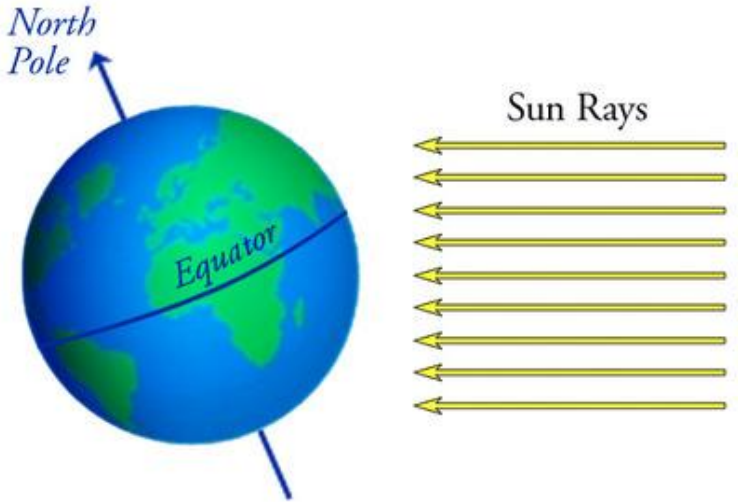
Follow the directions in your Student Guide:

1. Open the simulation on your computer.
2. Play around with the simulation to get comfortable with the functions.
3. Try out the settings in the table and discuss the questions to help you analyze the computer model.
4. Pick a location and run the simulation. Make any final observations.



What Patterns did you observe in both models?





Explain

Developing and Using Models

Your friend in the United States wants to plan a ski trip to New Zealand during their winter break in December. Individually, explain to your friend whether this is a good idea and draw a model to illustrate your explanation.

Elaborate

Stronger Clearer

1. **Individual Think Time:** What will you say to your partner without looking at your written explanation?

2. **Partner Discussions:**
   a. **Student A:** Describe your model.
   b. **Student B:** Listen and ask clarifying questions.
   c. **Student A and Student B:** Write down any notes to make your model and explanation stronger and clearer.

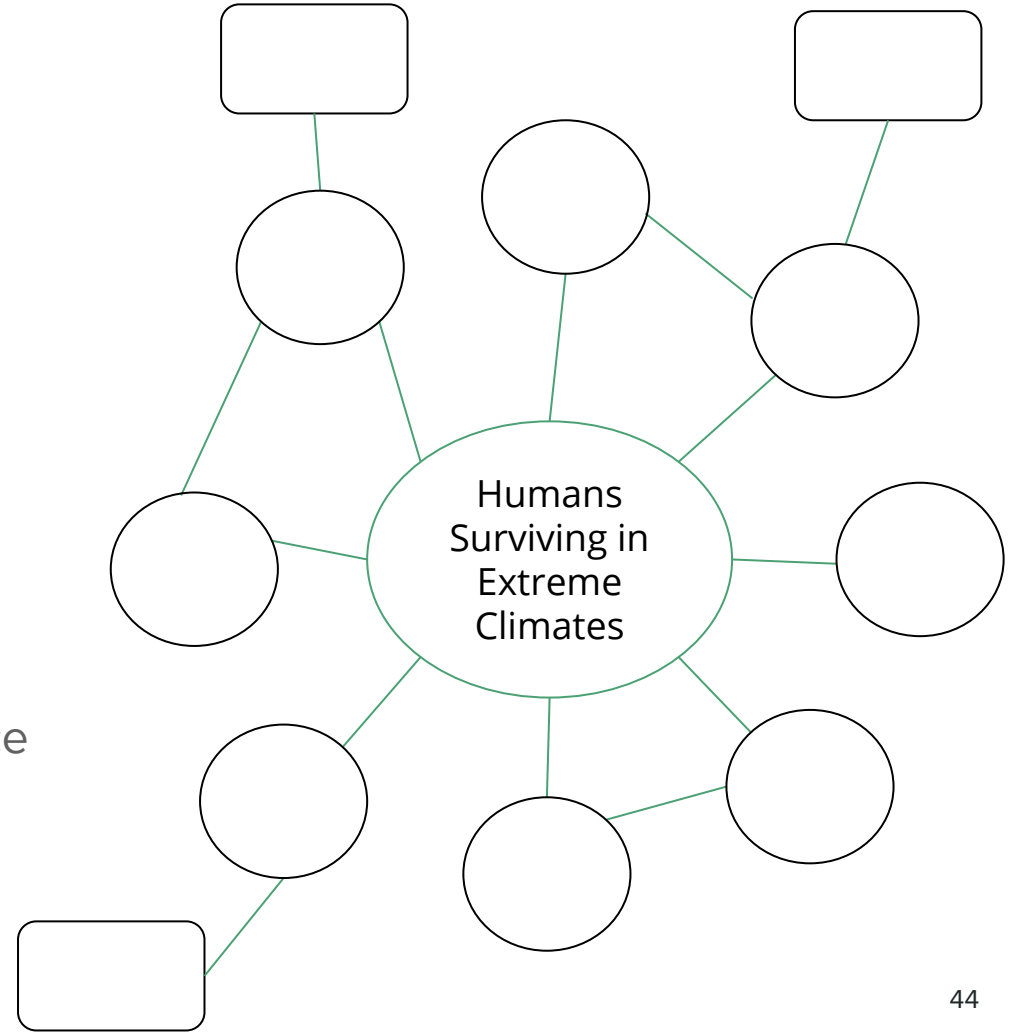
3. **Repeat with 2 more partners!**

4. **Revise your model and explanation.**

Class Concept Map

Add to your class concept map:

- New questions (circles)
- New ideas learned (squares)
- New connections (lines and connector words)
- Crosscutting concepts used (trace in color)
    - Systems and System Models



Evaluate

Connecting to the Culminating Project

You have been asked to design a product that makes it more comfortable for people to live in a region with an extreme climate. Research the region you selected.

- Where is it located on Earth?
- How can its location on Earth explain the typical temperature in the region?
- Draw a Sun-Earth model to show and explain a major cause of your region's climate.

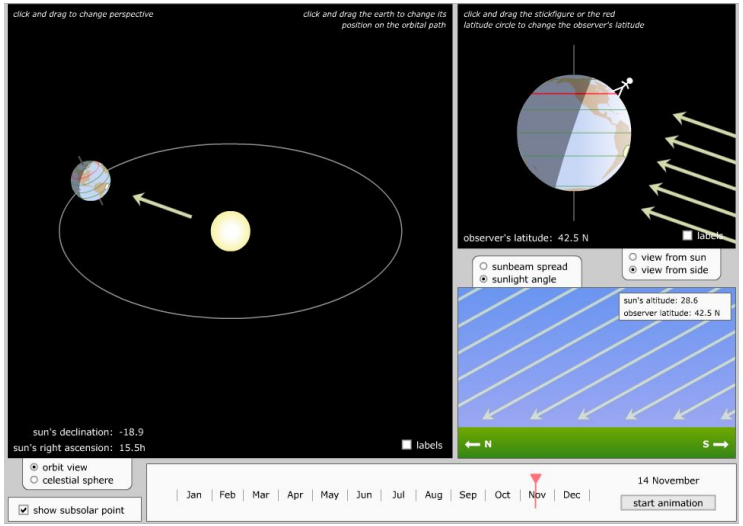
Reflection

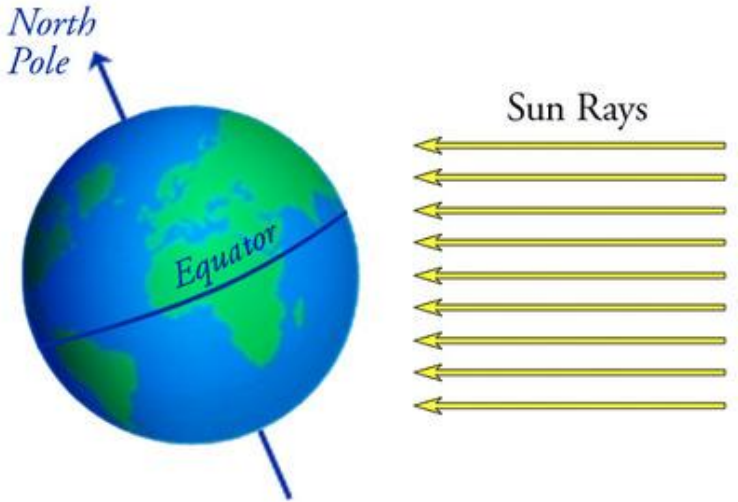
Complete the questions at the end of your student guide to reflect on what you have learned in Task 1.

Climate, Part 2 - Oceans & Atmosphere

Task 2

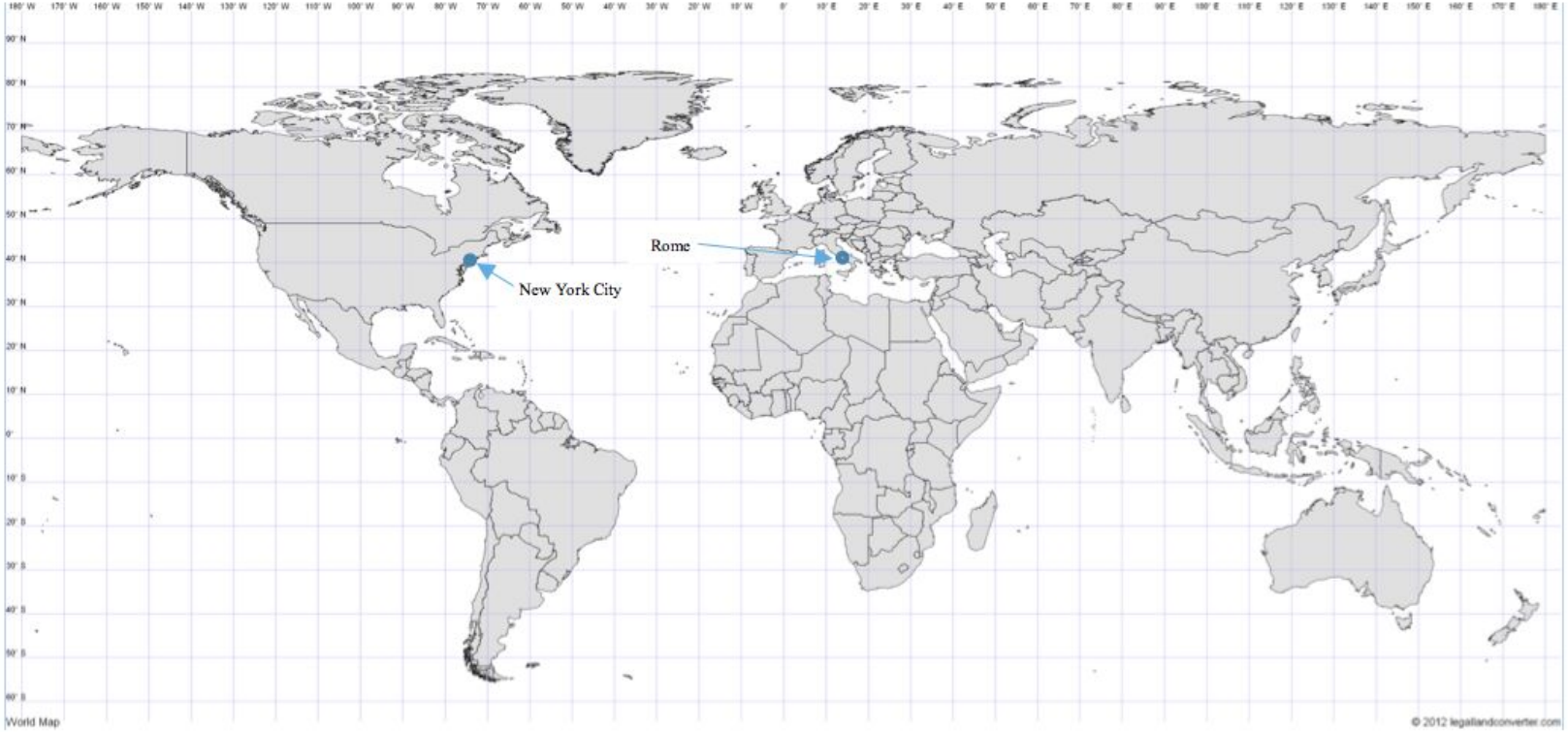
What questions do you still have?





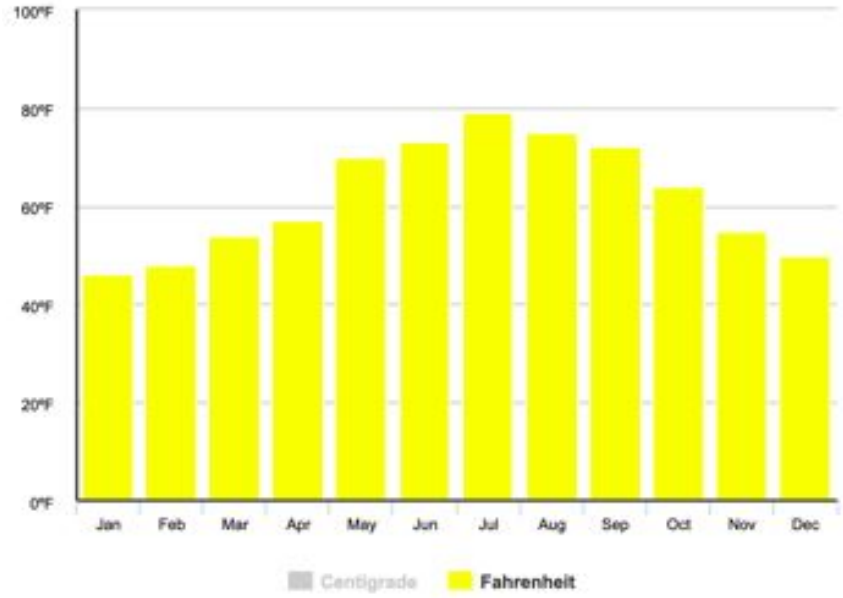
Engage

Do all regions that are the same distance from the equator have the same climate?



New York City and Rome are at a similar latitude. Do they have the same climate?

New York City, USA

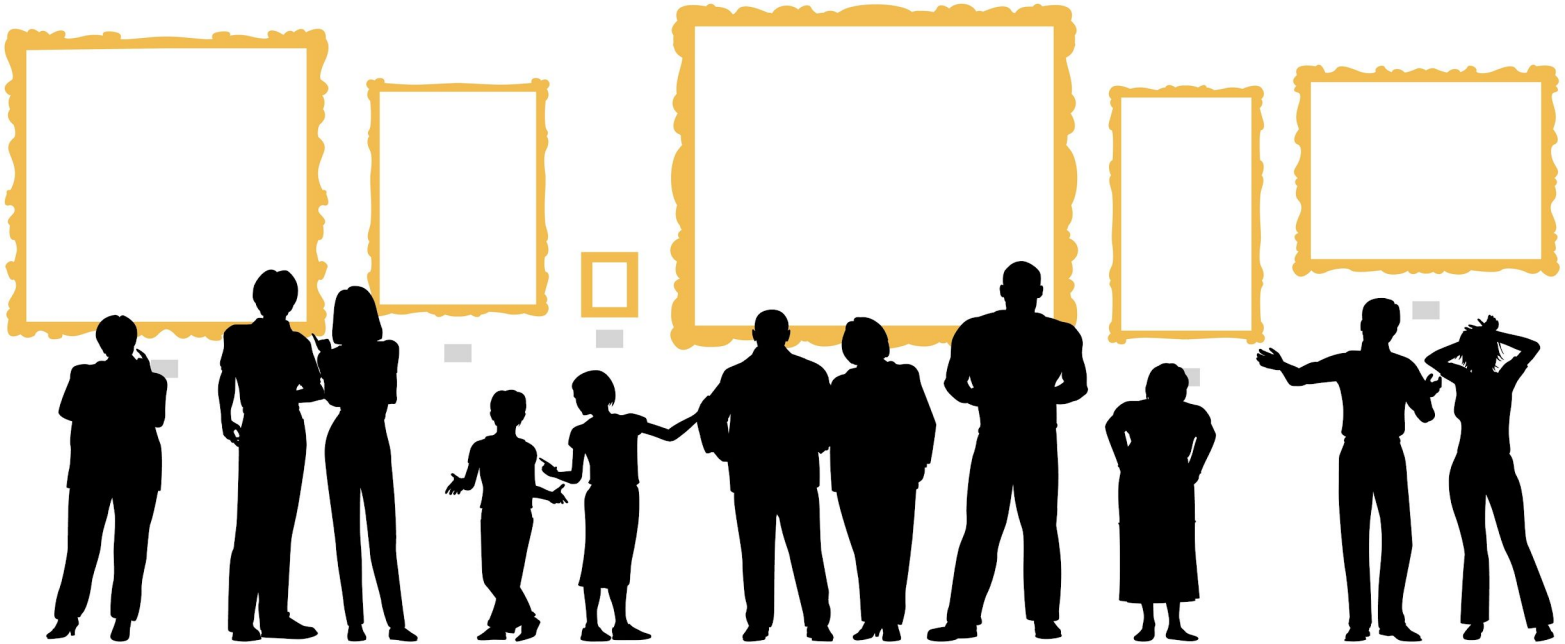


Rome, Italy

How can temperatures in January be so different for two cities at nearly identical latitudes?

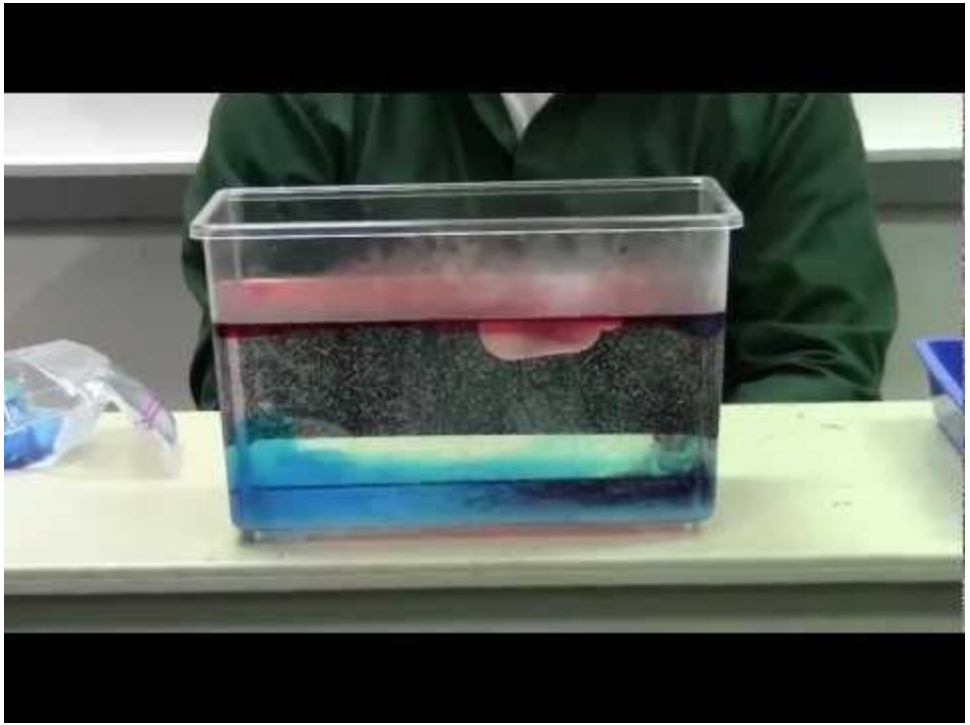
1. Individually, write your explanation on an index card.
2. In groups,
    - Share: Read your index card and place it on the table for all to see.
    - Discuss: Talk about which ideas seem to fit best with what you know and what the data shows.
    - Consensus: Write a group explanation on poster paper.
    - Display: Be prepared to share your explanation with the class in a gallery walk.

Gallery Walk



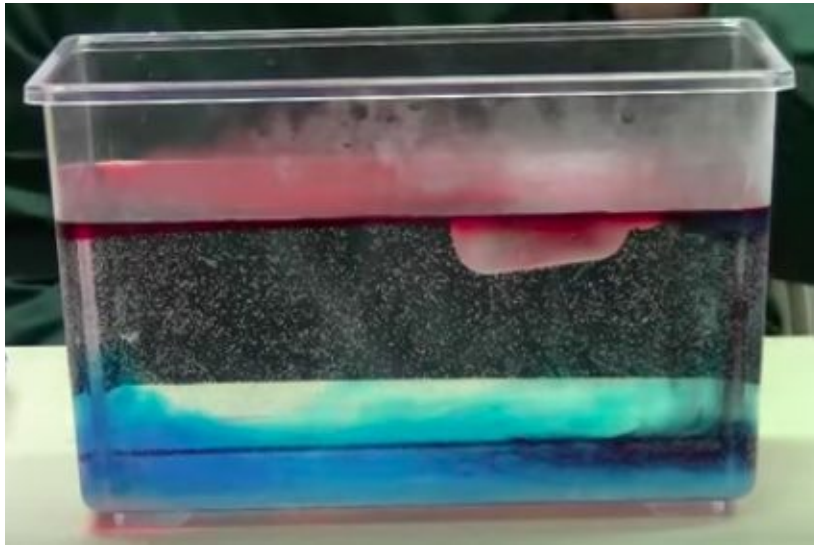
Explore

Ocean Circulation Model



https://www.youtube.com/watch?v=bN7E6FCuMbY

Ocean Circulation Model



1. Individually record your observations.
2. With your group, discuss what you noticed. Predict what you think may happen after one hour has passed.
3. Individually, write and/or draw your prediction and explanation.
4. Record any questions you still have.

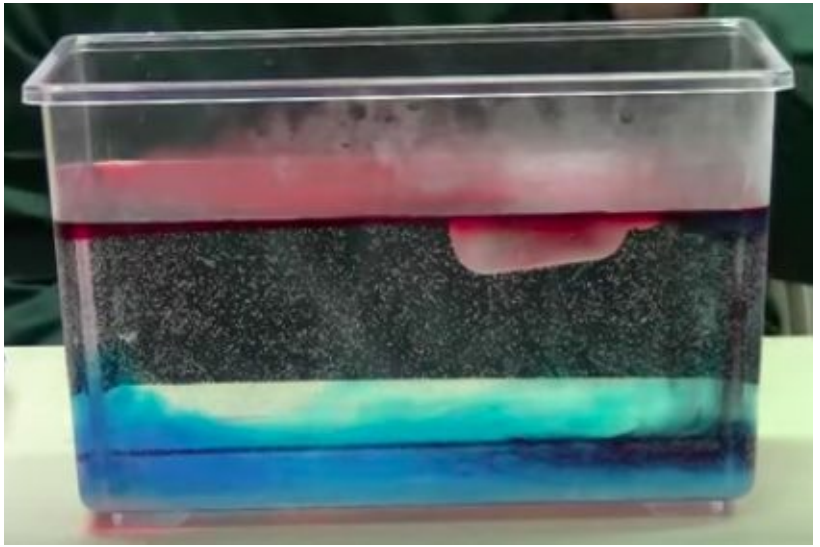
Atmospheric Circulation Model

Atmospheric Circulation Model

Individually,

1. Record your observations.
2. Explain what you think is happening.
3. Record any questions you still have.

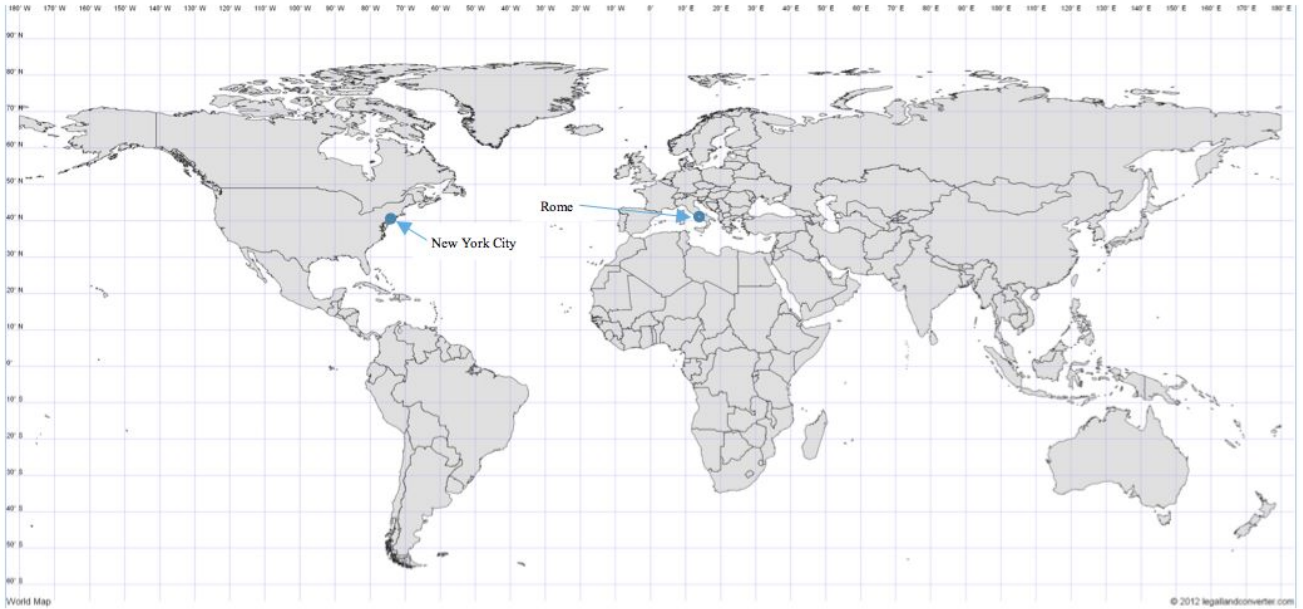
Compare the Models!



Compare and discuss your explanations from the Oceanic Circulation Model and the Atmospheric Circulation Model. How are they similar? How are they different?

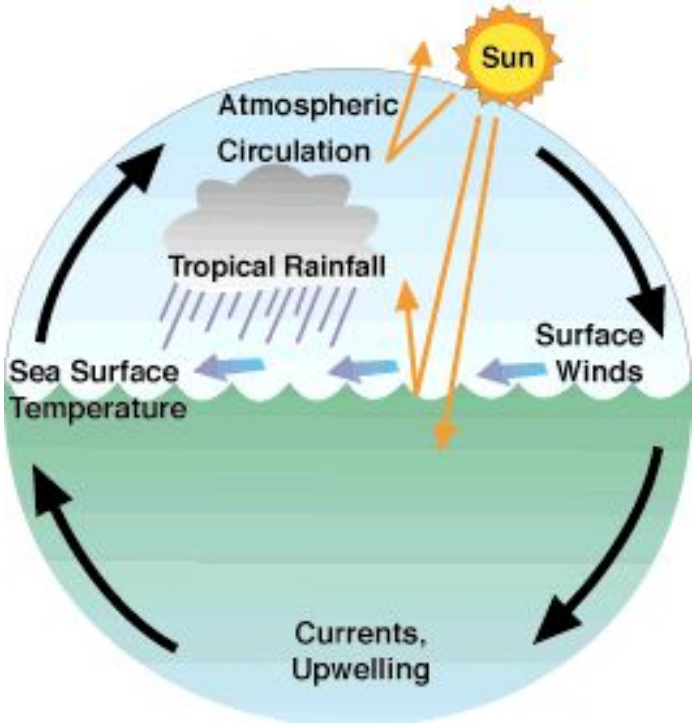
Explain

Explain Your Initial Ideas



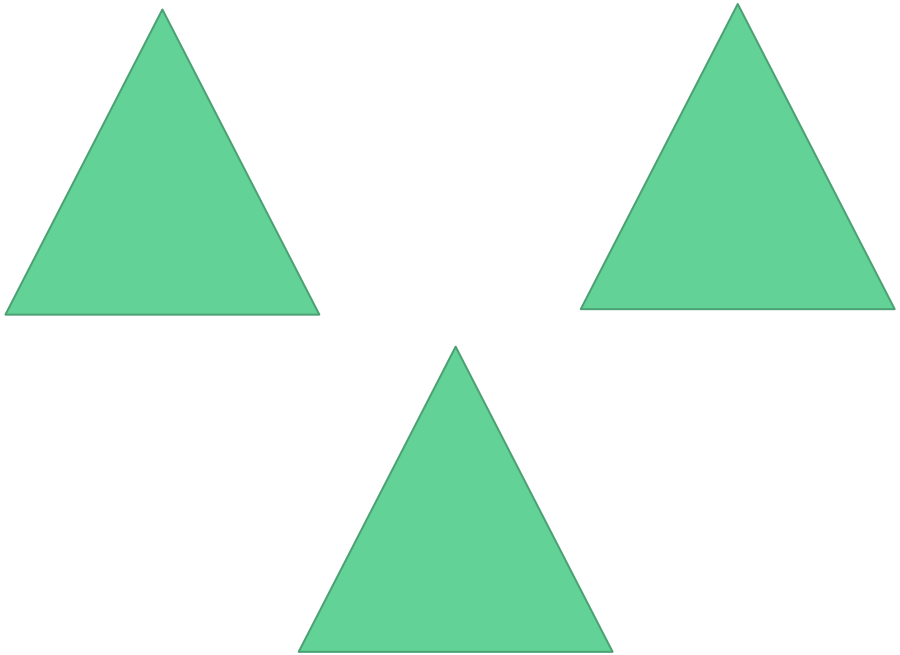
How do you think the movement of water in the ocean and air in the atmosphere contributes to the temperature differences between Rome and New York City in January?

How Does Air and Water Move Around Our Planet?



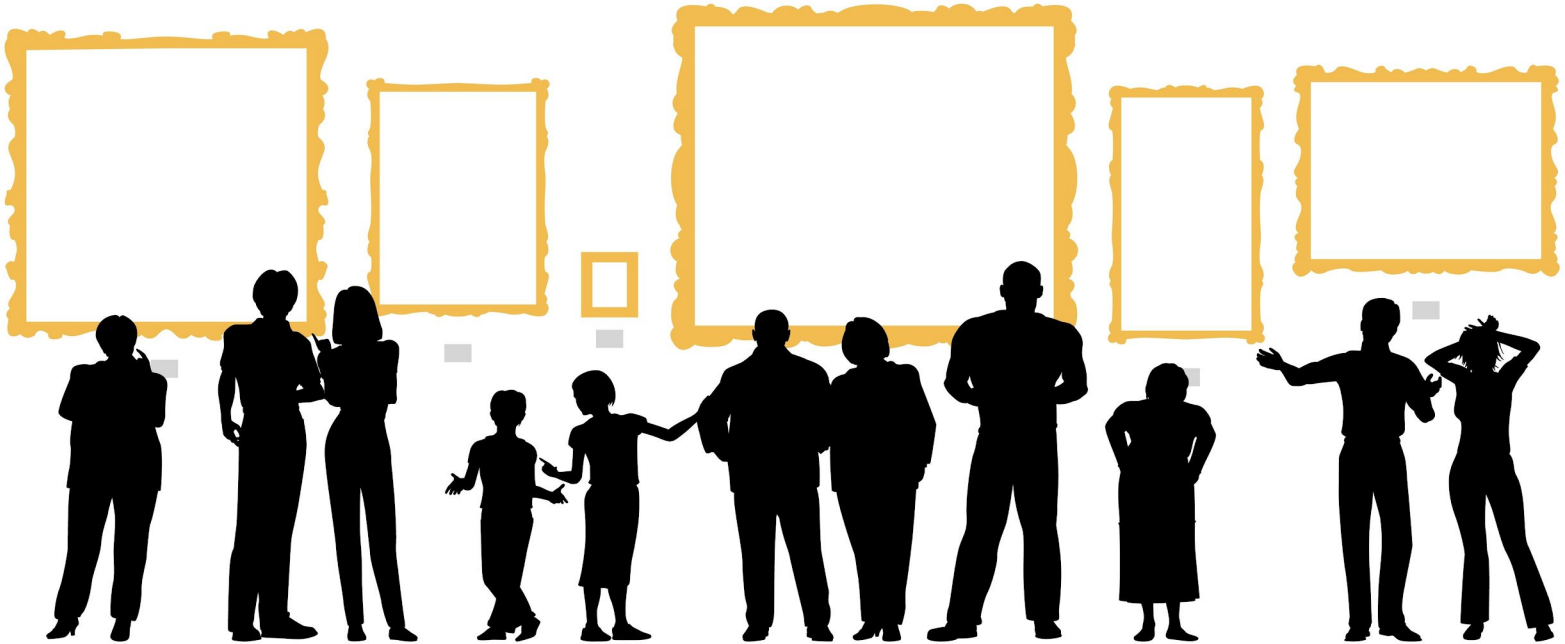
Individually, read and annotate the article to learn about how air and water moves around our planet.

Developing Models - Components

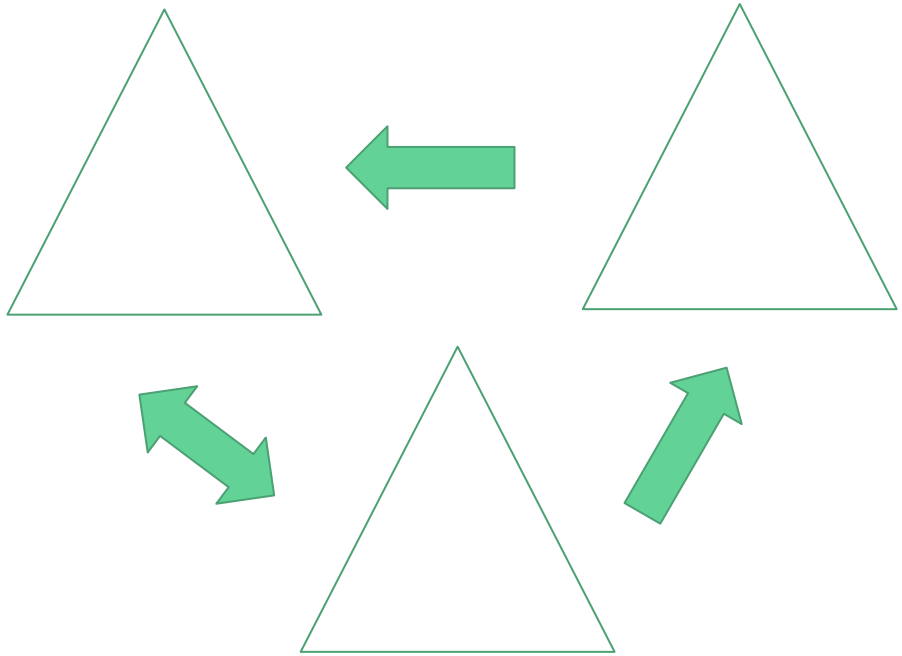


As a group, list all the parts of the oceanic and atmospheric systems. Then make a drawing to represent each part.

Gallery Walk - Learn From Others!



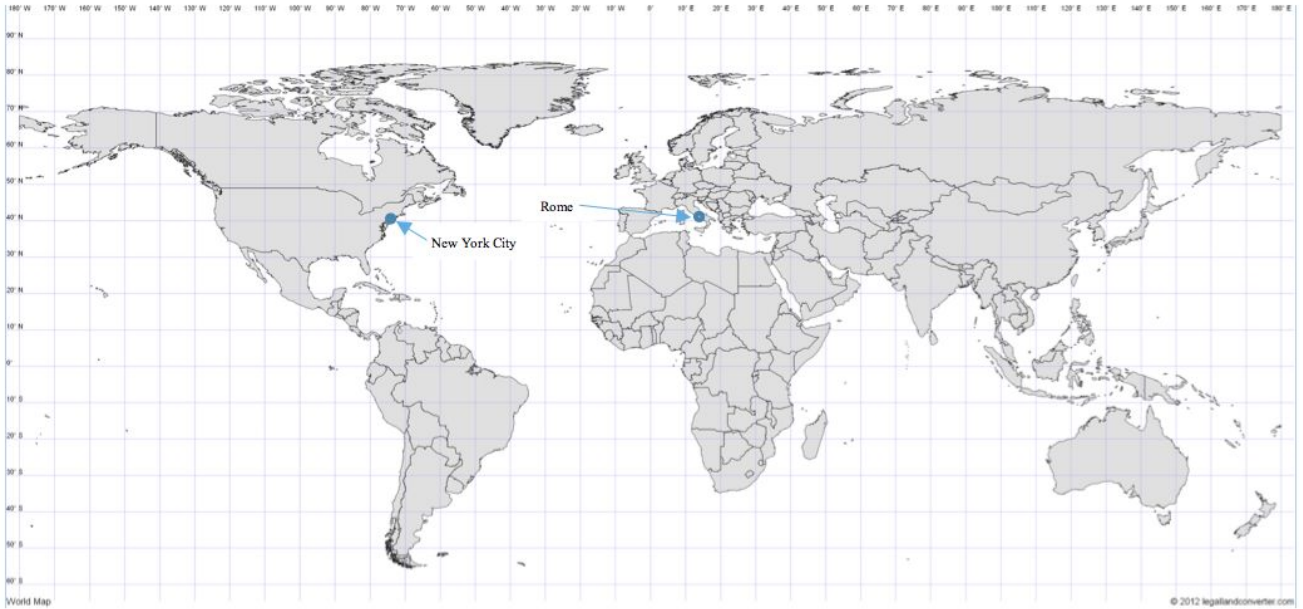
Developing Models - Interactions



In partners, describe with words and drawings how each component affects the other components in both systems.

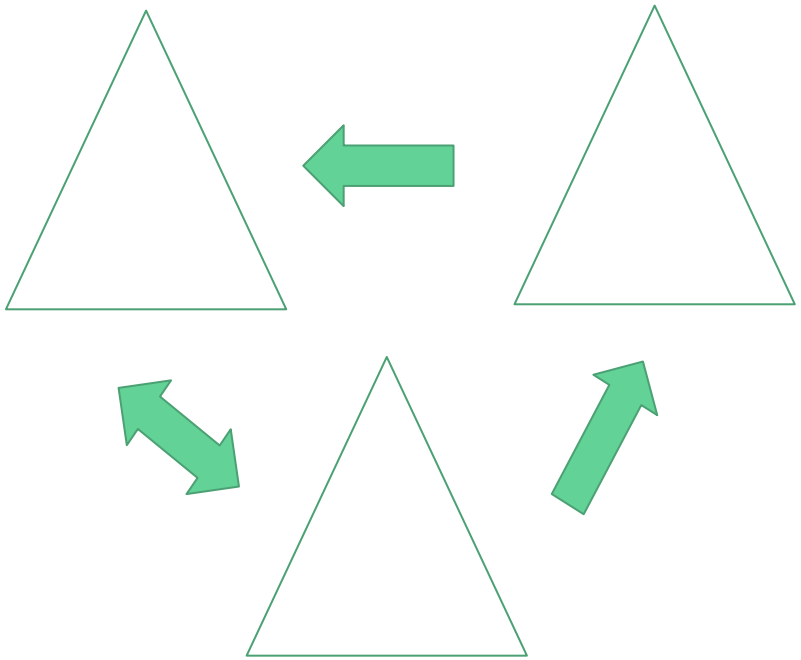
Elaborate

Using Models to Explain Phenomena



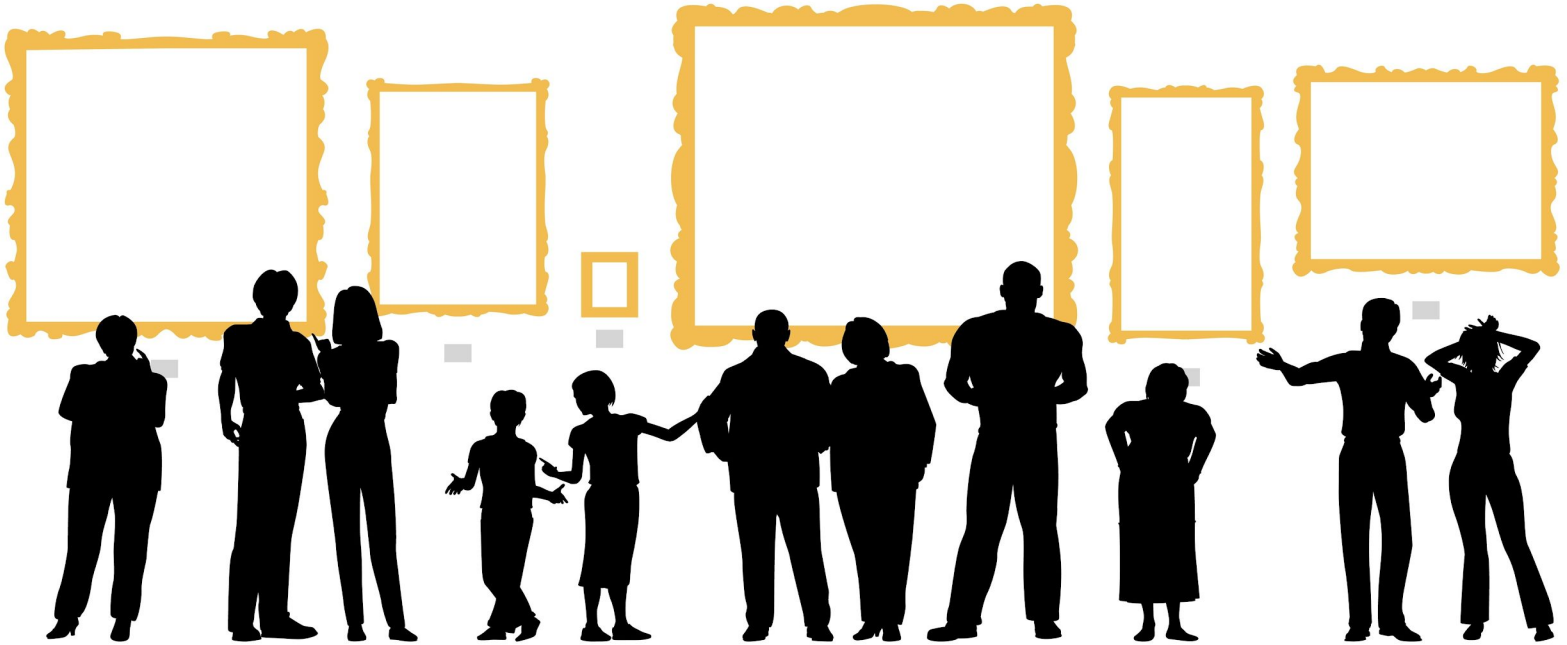
How do you think the movement of water in the ocean and air in the atmosphere contributes to the temperature differences between Rome and New York City in January?

Criteria for Model



1. Should use words, arrows, and drawings.
2. Must include <u>at least</u> the following components (terms):
    - latitude
    - temperature
    - atmosphere
    - wind
    - ocean current
    - Density
    - Heat

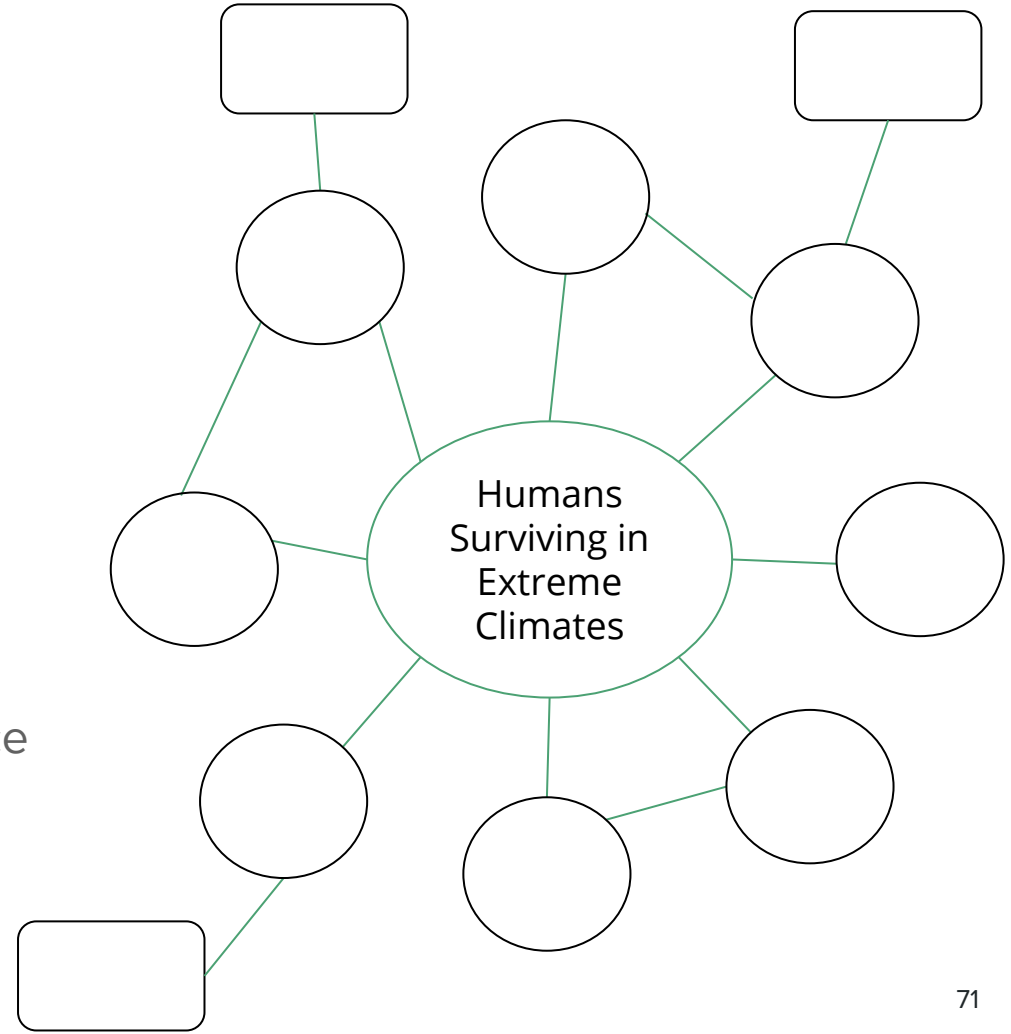
Gallery Walk



Class Concept Map

Add to your class concept map:

- New questions (circles)
- New ideas learned (squares)
- New connections (lines and connector words)
- Crosscutting concepts used (trace in color)
    - Cause and Effect



Evaluate

Connecting to the Culminating Project

You have been asked to design a product that makes it more comfortable for people to live in a region with an extreme climate. For the region you selected:

- Construct a model to explain how atmospheric and oceanic circulation affect the climate in your region.

Complete this **individually** in your Project Organizer.

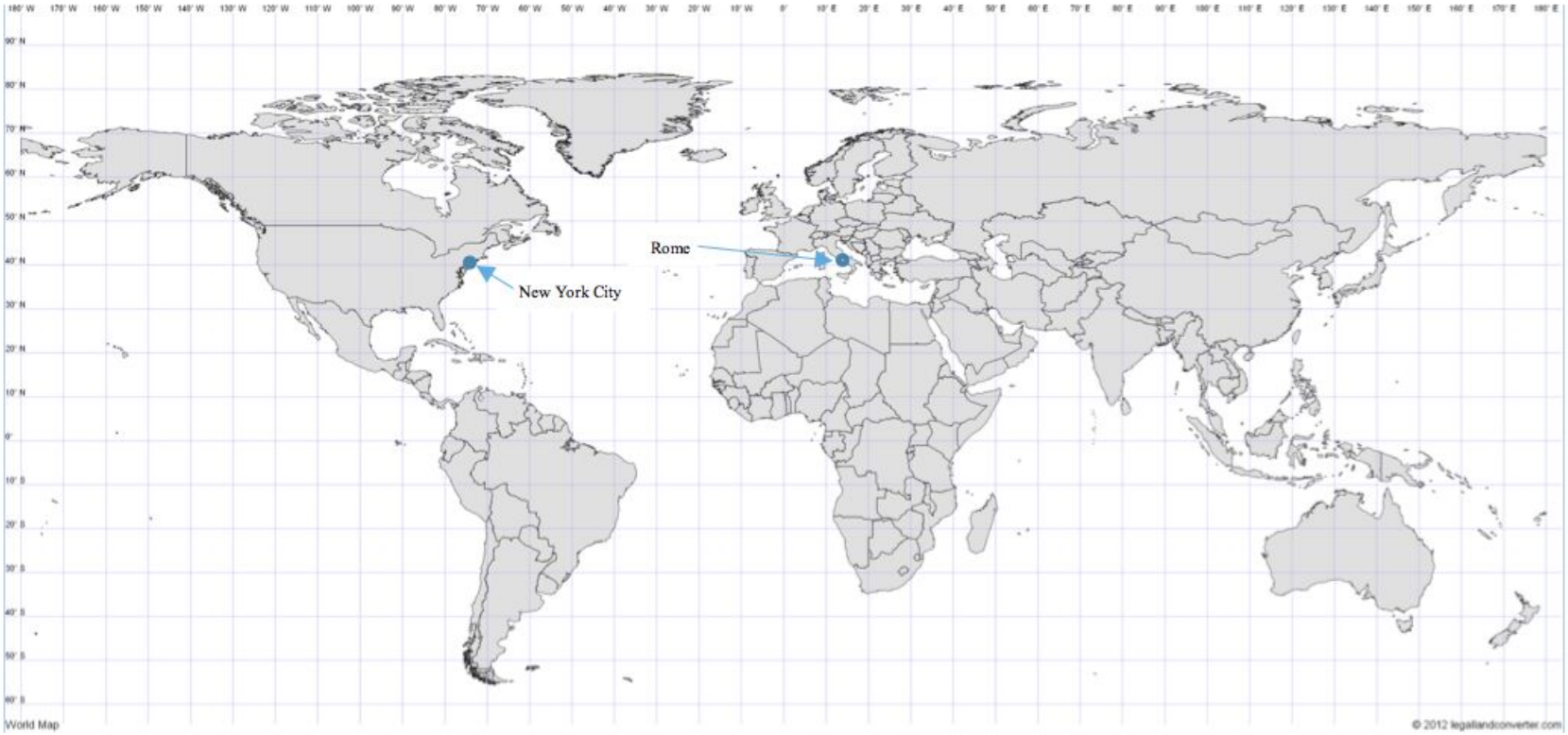
Reflection

Complete the questions at the end of your student guide to reflect on what you have learned in Task 2.

A Water Molecule’s Journey

Task 3

What questions do you still have?



Engage

What are some ways that water is a part of different climates?

In pairs, make a list: Where do we see water in different environments?

Explore

Take the Journey of a Water Molecule!

1. I will tell you where to start your journey. Fill this station in as #1 in your data chart.

2. At each station, read about your location and roll the dice to see where you will go next. Fill in your chart each time to keep track of your journey as a water molecule.

3. Continue until you have recorded 10 locations. Keep in mind that sometimes you repeat a station you have visited before!

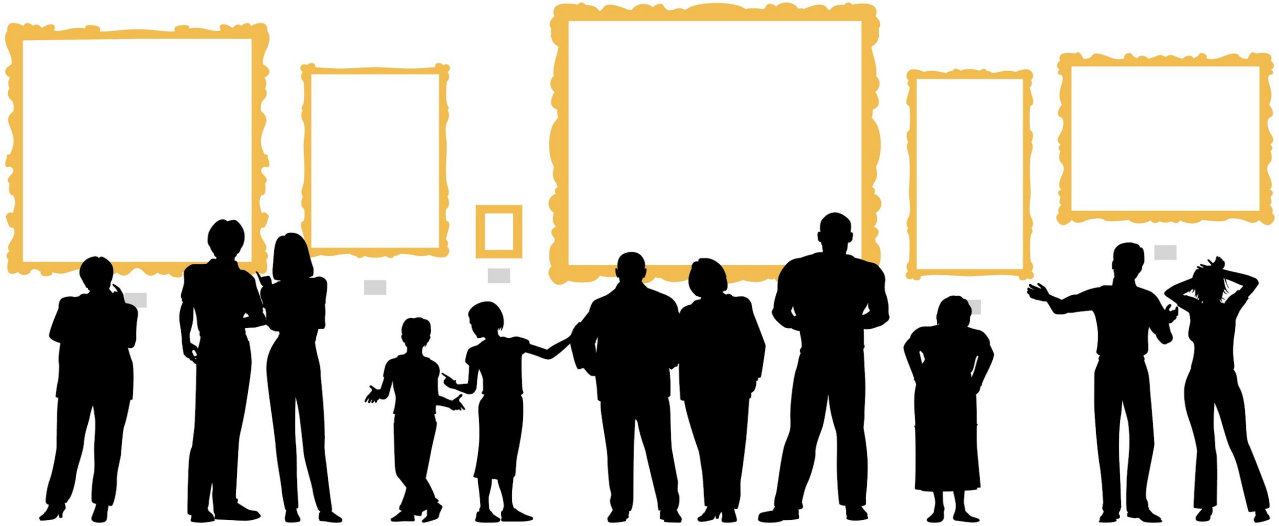
Explain

Developing and Using Models

As a group, compare and combine all your journeys to make a poster map that shows the cycling of water through Earth's systems.

- Use pictures, words, and arrows and make sure to include all the components outlined in your Student Guide.
- Return to the stations if you need to!

Gallery Walk – Give feedback!



Use post-its to leave feedback on other groups' posters.

Feedback to Consider

- Are there any connections (arrows) missing?
- Are there any locations missing where water can be found?
- Are any of the major processes that move water missing?
- Are there examples of energy and forces that drive the water cycle that are missing?
- Could there be more detail added?

Revise Your Models

Elaborate

Critique, Correct, and Clarify

Prompt: What happens to the water when a puddle dries on the sidewalk?

1. Critique: Identify any errors, unclear ideas, or missing details in the explanation below. Share with a partner.

> *When a puddle dries on the sidewalk, the water disappears completely. This is because the air after a storm create an energy that makes the water disappear. Water will only be created again by the sky during the next storm.*

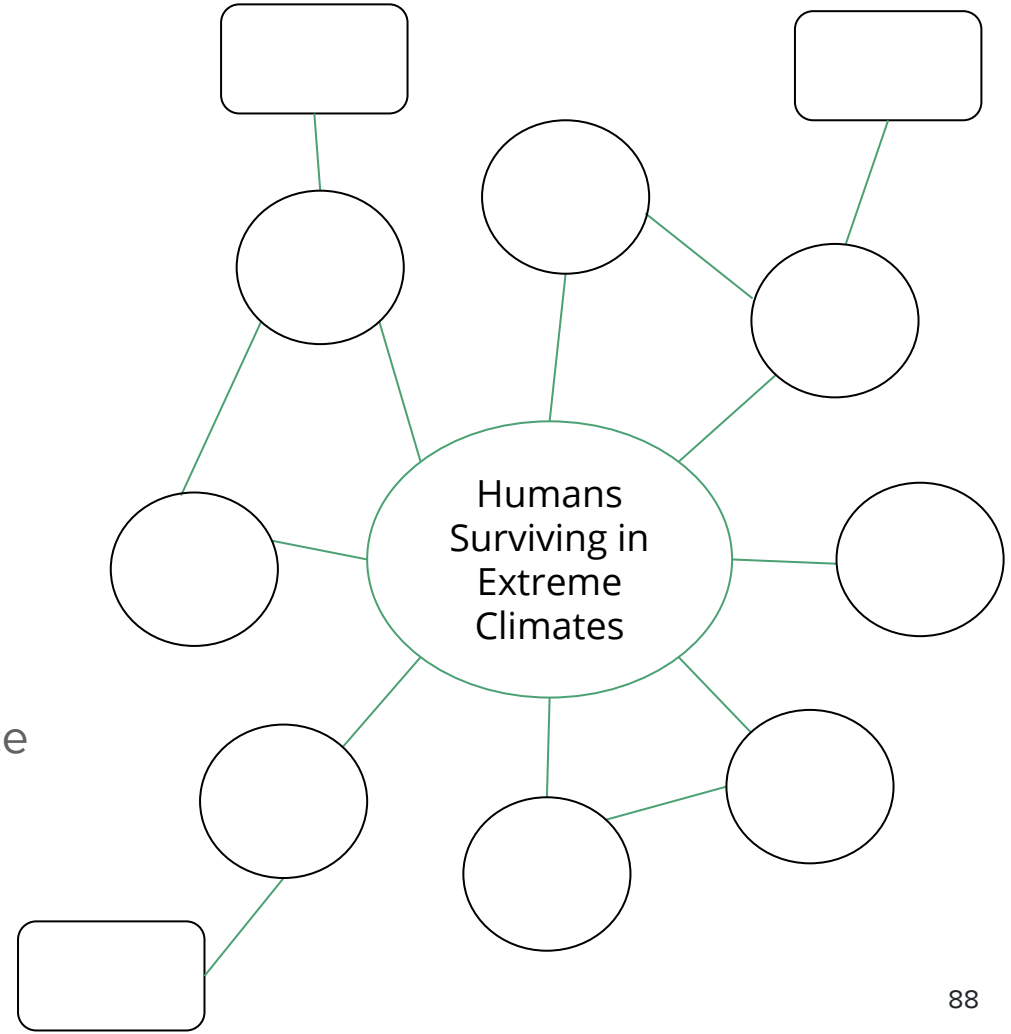
2. Correct: Individually, write an improved explanation.

3. Clarify: With a partner, discuss and describe how and why you corrected the explanation.

Class Concept Map

Add to your class concept map:

- New questions (circles)
- New ideas learned (squares)
- New connections (lines and connector words)
- Crosscutting concepts used (trace in color)
    - Energy and Matter



Evaluate

Connecting to the Culminating Project

You have been asked to design a product that makes it more comfortable for people to live in a region with an extreme climate. Think about the region you selected.

- What are some ways that water is a part of your region's climate?
- Using words or a model, describe the processes that create the water conditions in your region.

Complete this **individually** in your Project Organizer.

Reflection

Complete the questions at the end of your student guide to reflect on what you have learned in Task 3.

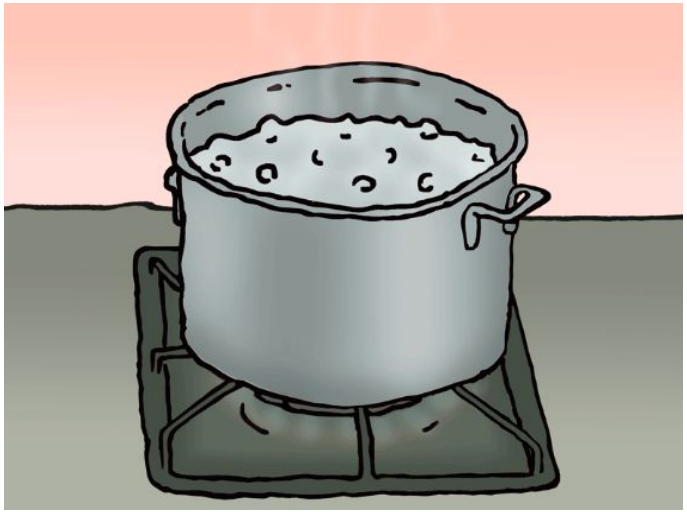
Thermal Energy Transfer

Task 4

What questions do you still have?

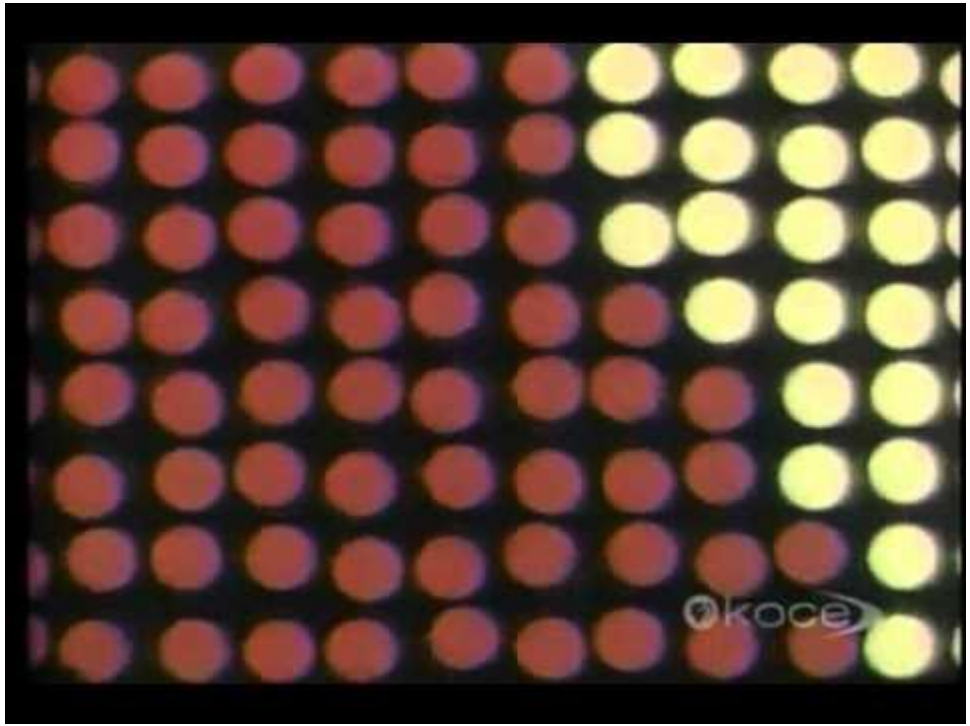
Engage

How Does Temperature Actually Work?



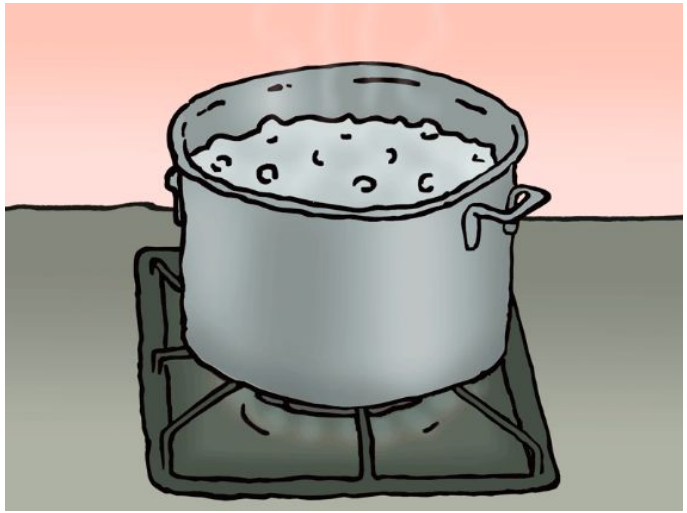
Imagine you are boiling a pot of water while cooking pasta. You place a cool metal spoon into the pot to stir the mixture. You have to leave the stove for a minute and when you come back, you grab the metal spoon...ouch! It's now super hot!

How Does Temperature Actually Work?



https://www.youtube.com/watch?v=wV7gzcKegdU (0:00 - 0:20)

How Does Temperature Actually Work?



Make a hypothesis: Why is the handle of the spoon hot even though it is not submerged in the boiling water?

Explore

We know the temperature of objects can change. But how is temperature able to change? And what factors affect changes in an object's temperature?

Planning and Carrying Out Investigations

With your group, plan an experiment to try to answer these questions.

- Choose from the materials provided by your teacher to see how the following are related to each other: the type of matter, the mass of a substance, and the change in temperature of a substance.
- Use the planning questions in your Student Guide to help you.
- Check your plan with your teacher before starting your experiment!

Explain

Read About Temperature vs. Thermal Energy vs. Heat

Temperature vs. Thermal Energy vs. Heat

Temperature, thermal energy, and heat are so closely related, it can get a bit confusing. Even though we accidentally use them interchangeably, these terms actually have some important differences.

Remember in the last unit when we learned about kinetic energy—the energy of motion? Kinetic energy not only applies to the motion you can see with the naked eye but also to any motion you can't see. We know from past science classes that all things are made up of very small particles or molecules we can't see. Even in solids, these particles are moving ever so slightly. The more quickly the particles move, the more energy they have. Both thermal energy and temperature measure the kinetic energy of an object's particles.

- Thermal energy is the *total* kinetic energy of particles within a material or system.
- Temperature is the *average* kinetic energy of particles within a material or system.

The words *total* and *average* are very important in these definitions. For example, a swimming pool at 40 degrees (lower temperature) actually has more thermal energy than a cup of tea at 90 degrees (higher temperature)…this is because the pool contains a lot more water.

Unlike thermal energy and temperature, heat is not a property describing a material system. Heat is a measure of change because it describes the transfer of thermal energy between objects.

Partner Check for Understanding

Turn over your paper and try to describe the difference between temperature, thermal energy, and heat in your own words.

Scale, Proportion, and Quantity

As a group, draw conclusions about your investigations:

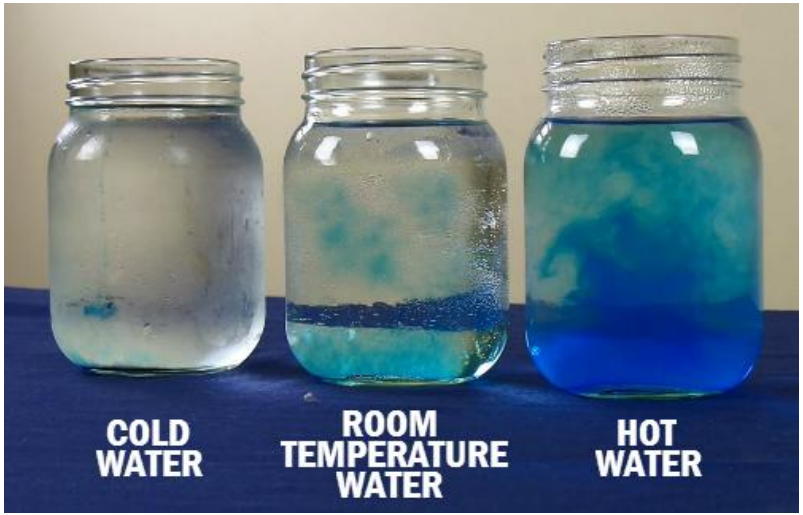
- What factors affect changes in an object's temperature?
- How and why does temperature change?

Don't forget to use evidence from your experiment, others' experiments, and the article!

Elaborate

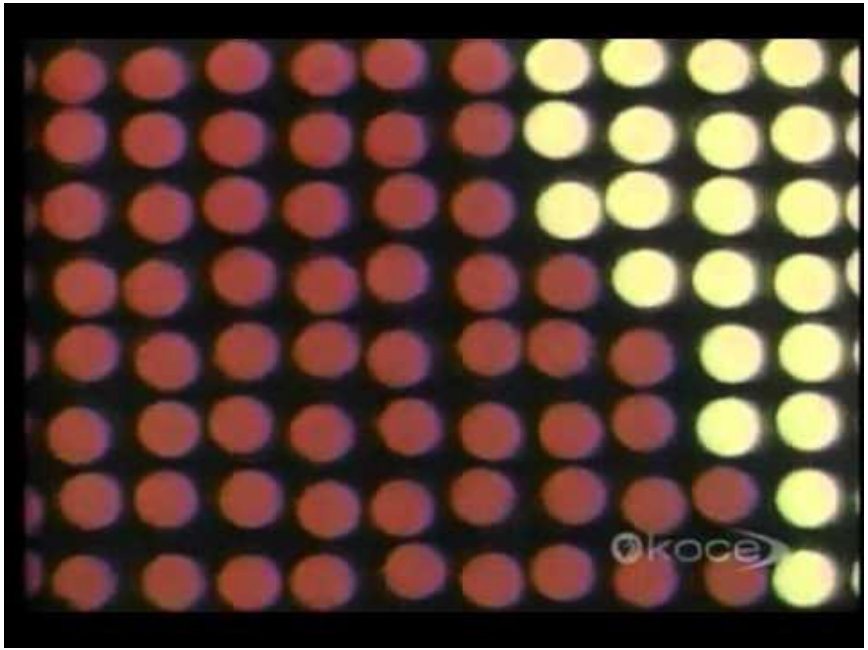
Class Demo

Watch food coloring mixing in water at different temperatures.



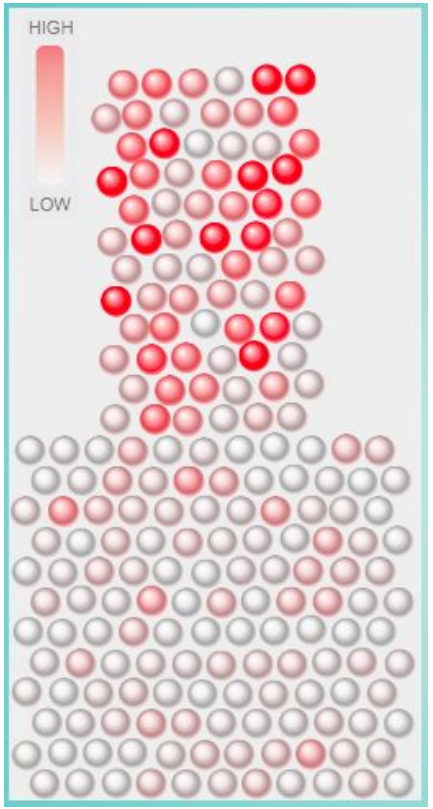
Individually, hypothesize: Why do you think this is happening?

Why does thermal energy transfer between objects and why does the temperature change?



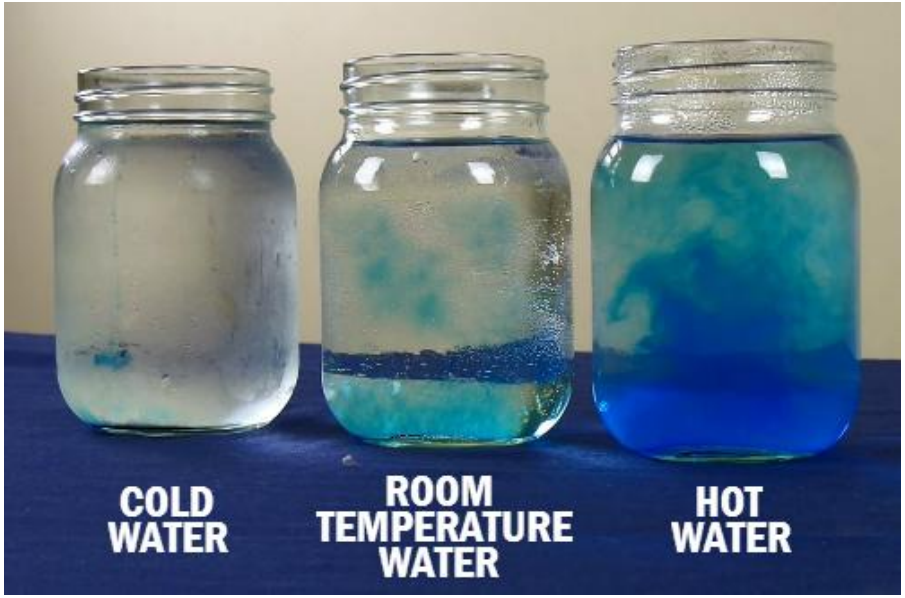
https://www.youtube.com/watch?v=wV7gzcKegdU

How does thermal energy transfer work?



http://lab.concord.org/embeddable.html#interactives/external-projects/CREATE/solid-heat-transfer.json

Return to your hypothesis

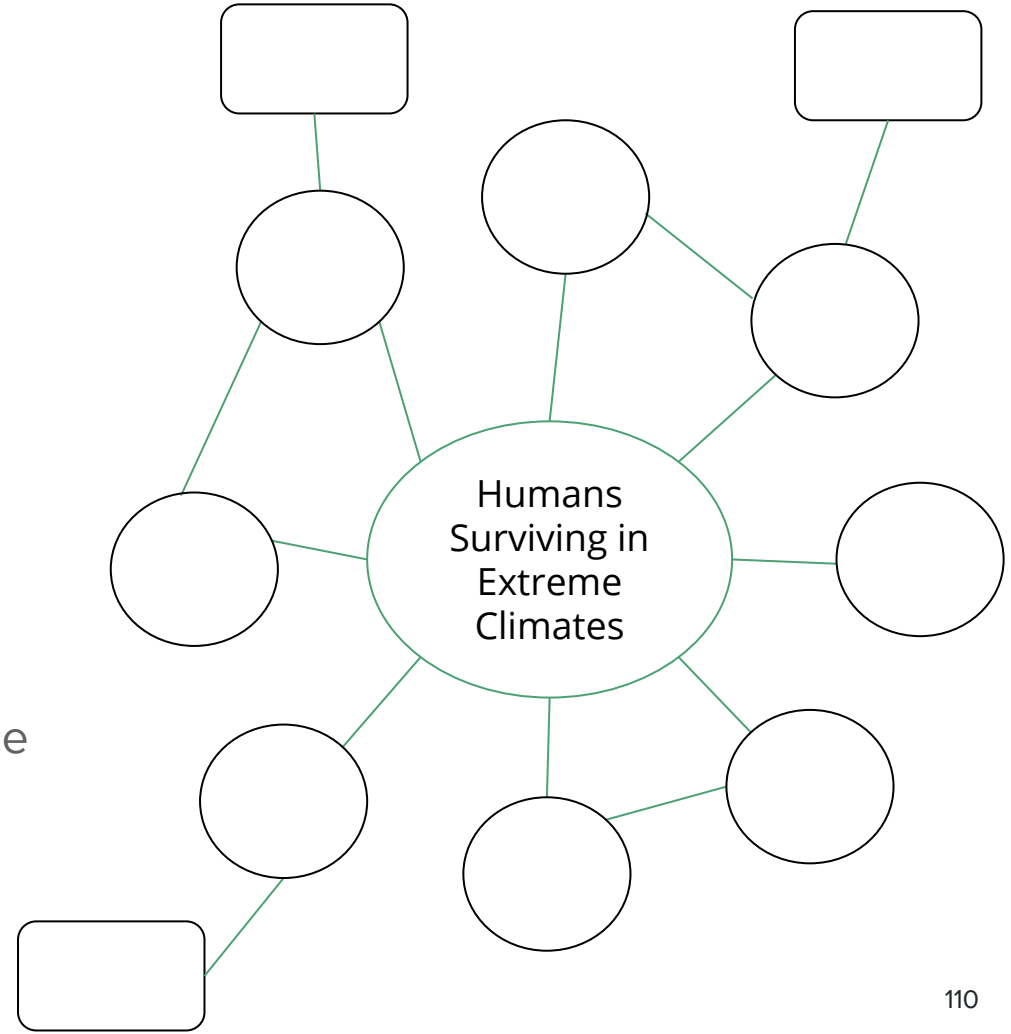


Why did the food coloring mix differently at different temperatures? How does this help explain what you saw in your other investigations?

Class Concept Map

Add to your class concept map:

- New questions (circles)
- New ideas learned (squares)
- New connections (lines and connector words)
- Crosscutting concepts used (trace in color)
    - Scale, Proportion, and Quantity



Evaluate

Connecting to the Culminating Project

You have been asked to design a product that makes it more comfortable for people to live in a region with an extreme climate. Think about the climate in the region you selected.

- Will your product need to help people stay warm or cool down?
- Would this require increasing the kinetic energy of the particles or decreasing the kinetic energy of the particles? Explain.
- Based on your explorations, how might you be able to make this possible? What factors should your product consider?

Complete this **individually** in your Project Organizer.

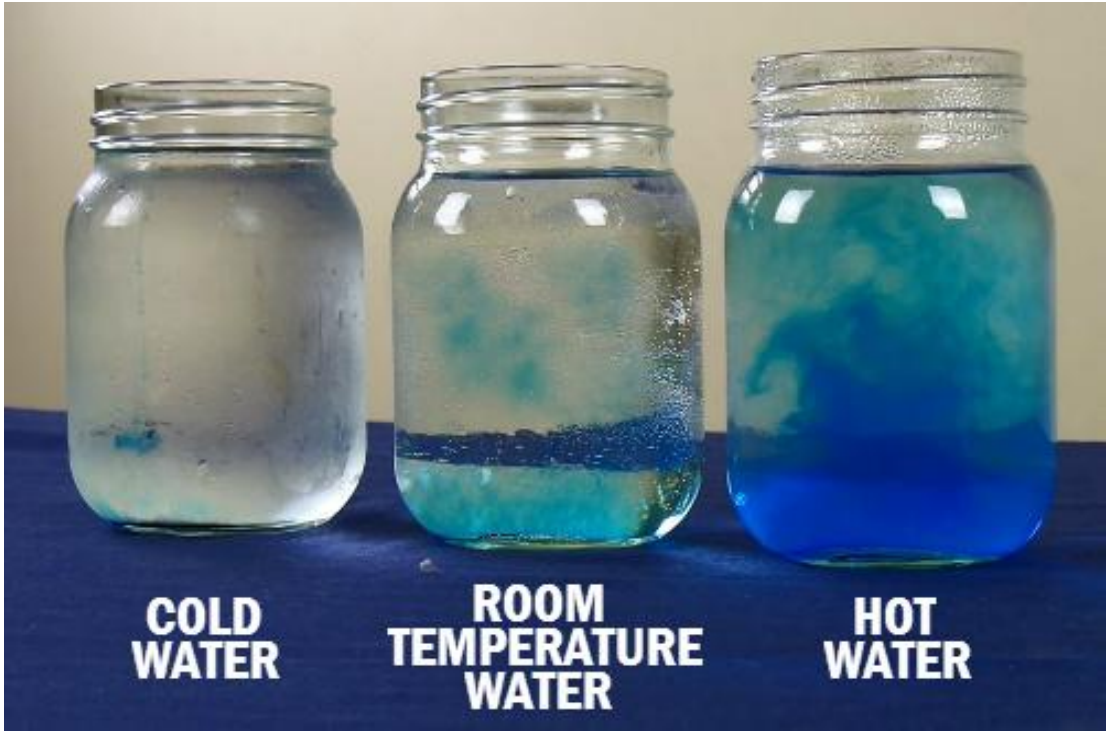
Reflection

Complete the questions at the end of your student guide to reflect on what you have learned in Task 4.

Extreme Living Solutions

Task 5

What questions do you still have?



Engage

It’s Time to Design, Build, and Test Your Product!

First, individually think:

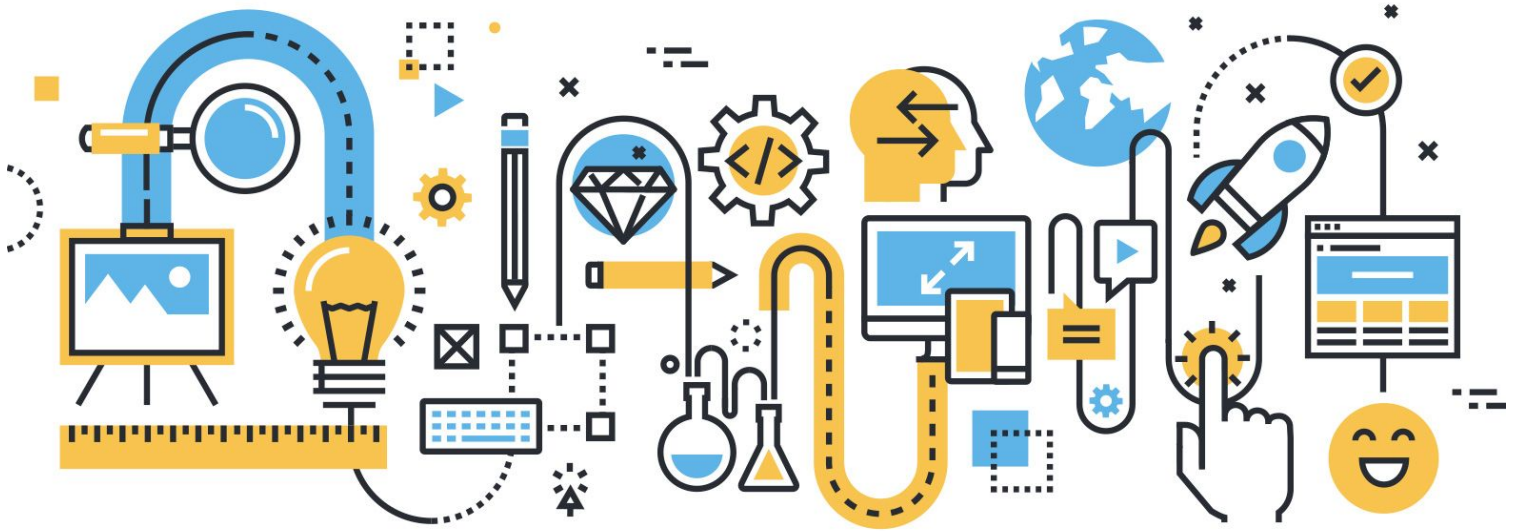
- What kinds of products might make the temperature conditions more comfortable for the people living there?
- Which of these products uses the science concepts you investigated in Task 4?

Create a Group Design Board

Follow the directions on your Student Guide to create a Design Board that will help you brainstorm ideas and decide on a design.

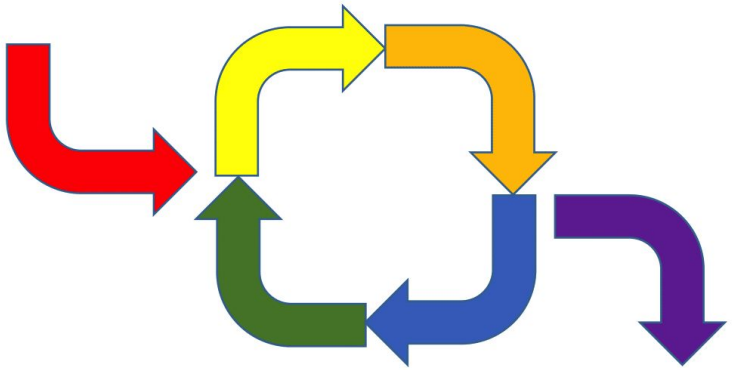
Explore

Designing Solutions



In groups, use the questions in your Student Guide to guide you through a process to design, build, and test a product that minimizes or maximizes thermal energy transfer.

Designing Solutions



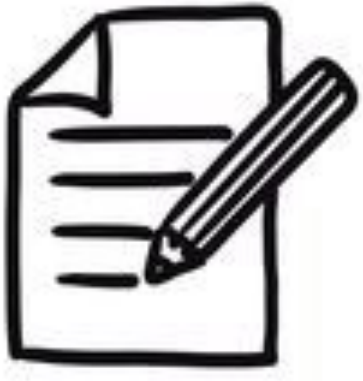
1. Define the Problem
2. Gather Inspiration
3. Design Your Product Prototype
    a. Clear your design with your teacher before continuing!
4. Build and Test Your Prototype

Explain

Make a Product Poster

- How your product works
- The data from your test of the prototype
- An explanation of why you got these results, using knowledge of thermal energy transfer and the kinetic energy of particles

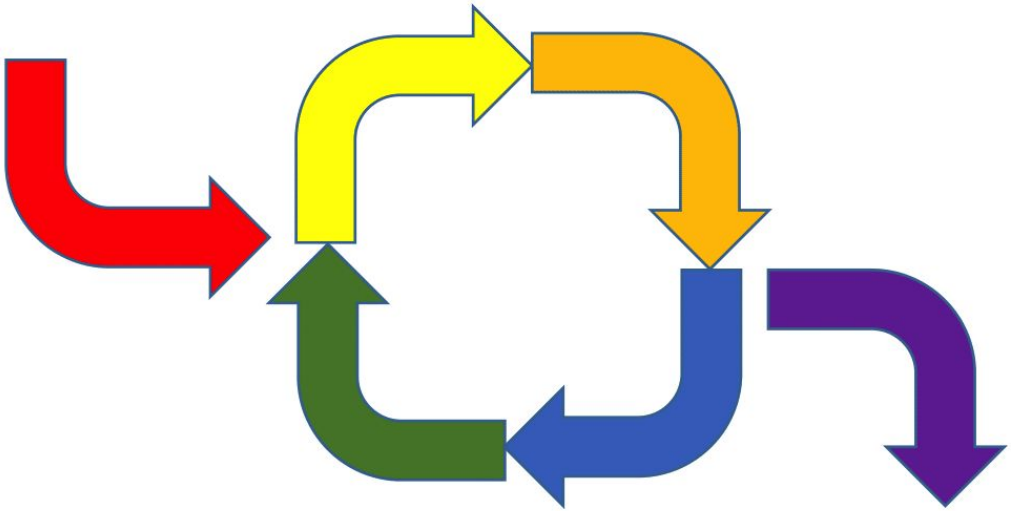
Learn From Others’ Designs



- Record features about designs that might also work for your product
- Include the data that supports these features...you will use this data for your Culminating Project!

Elaborate

Revising Solutions

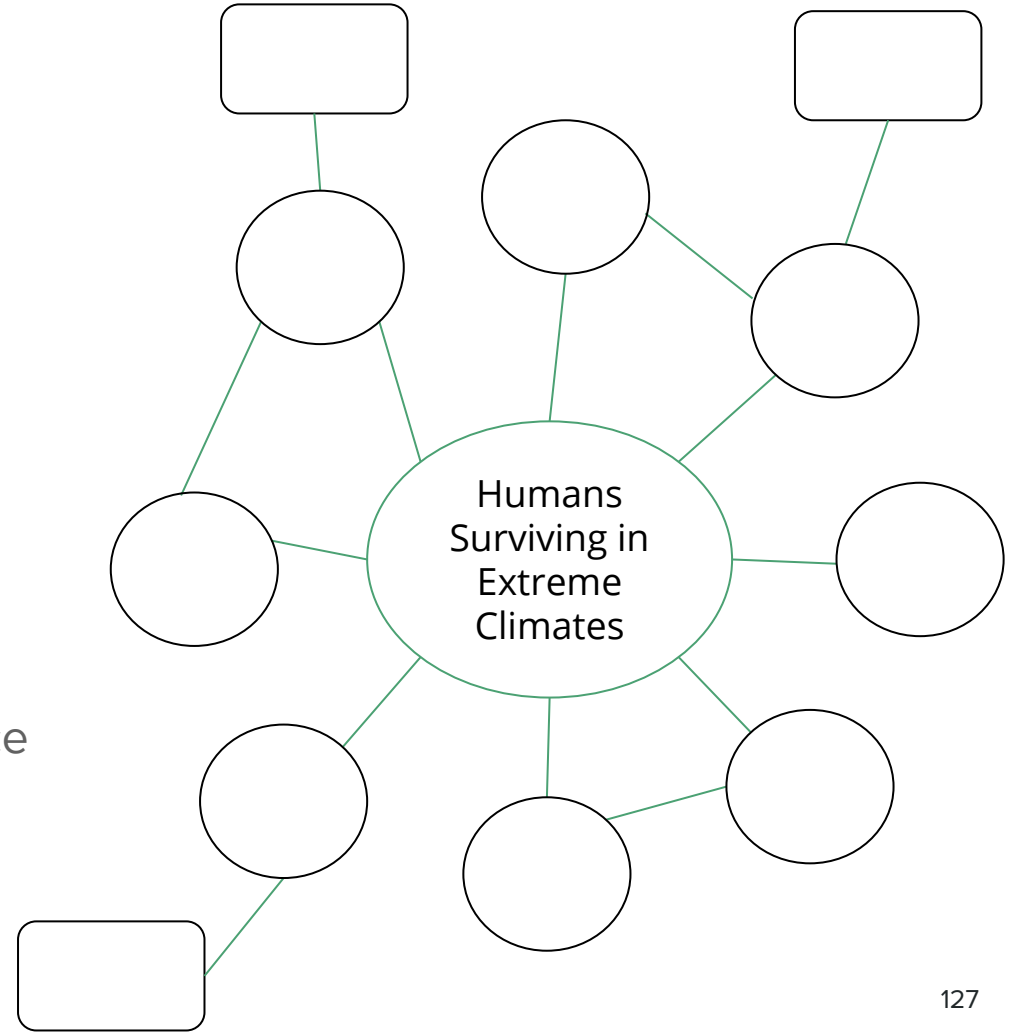


Analyze data from other groups' prototypes and use this data to make adjustments to your own design!

Class Concept Map

Add to your class concept map:

- New questions (circles)
- New ideas learned (squares)
- New connections (lines and connector words)
- Crosscutting concepts used (trace in color)
    - Energy and Matter



Evaluate

Connecting to the Culminating Project

You have been asked to design a product that makes it more comfortable for people to live in a region with an extreme climate. You now have a revised prototype of that product!

- Draw a labeled diagram of your final product.
  - Show how thermal energy transfer is either minimized or maximized.
- Explain how it works.
- Describe how you combined best characteristics from different designs to create a product that best meets your criteria and constraints.
  - Cite the data that supports your decisions.

Complete this **individually** in your Project Organizer.

Reflection

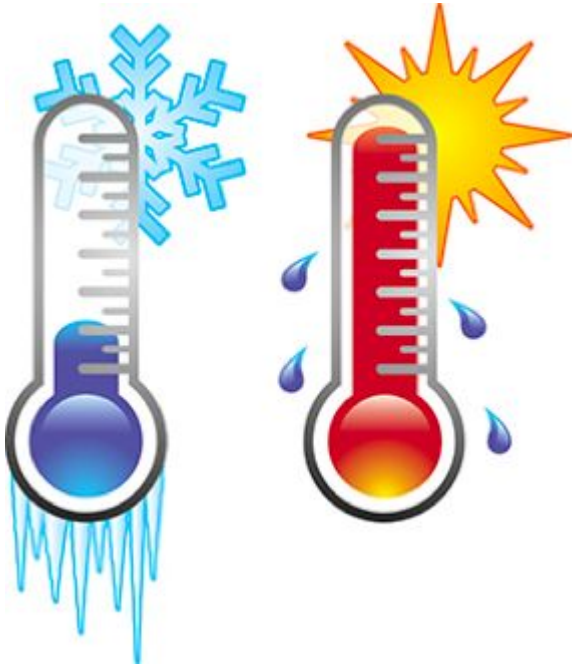
Complete the questions at the end of your student guide to reflect on what you have learned in Task 5.

Culminating Project

Help make it possible for people to live in regions with an extremely hot or extremely cold climate!

Group Project - Present a thermal product for enhanced comfort in extreme weather regions

Individual Project - Write a consumer report that reviews the thermal product and the science behind it



Don’t forget to use your checklist of criteria!

Group Project Criteria for Success

Your product presentation should include:

- ☐ A description of the selected region
  - What is the climate like in that region?
  - What are the causes of this climate?
  - Why does the climate make it difficult to live in this region?
- ☐ A labeled diagram or physical prototype of the product
- ☐ An explanation of how the device works, including descriptions of:
  - Temperature
  - Thermal Energy Transfer
  - Kinetic energy of particles
- ☐ Quality Presentation Structure
  - Includes visuals related to the content
  - Is organized logically
  - Is interesting to the audience

Help make it possible for people to live in regions with an extremely hot or extremely cold climate!

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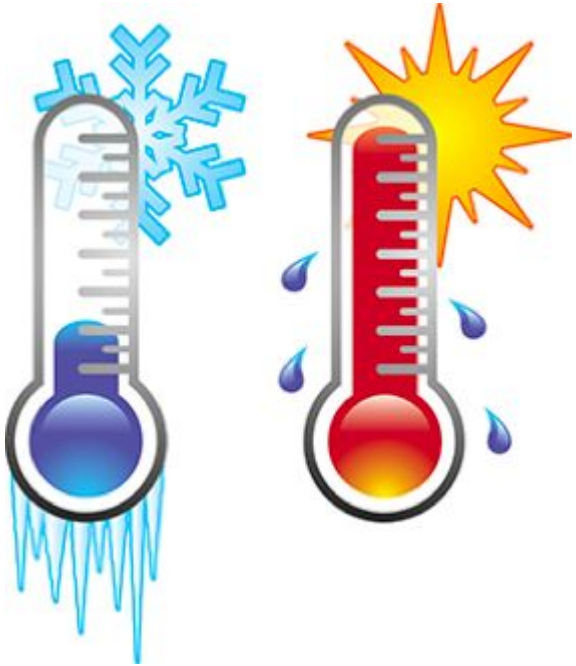

Don’t forget to use your checklist of criteria!

Individual Project Criteria for Success

The Consumer Report should include:

- ☐ A definition of the problem the product addresses:
  - Where is the region and why is it difficult to live there?
  - What criteria would make a successful solution to this problem?
  - What makes it difficult to solve this problem?

- ☐ A detailed description of the climate in that region, including model(s) that show:
  - Why the location of the region on Earth results in its extreme temperature
  - How atmospheric and oceanic circulation affect the climate in your region
  - The processes that create the water conditions in your region
  - *For at least one of the above bullets, cite patterns in data that allowed you to figure out these cause-and-effect relationships

- ☐ A description of the design process:
  - Describe your original design: What proportional relationships from the Task 4 investigations inspired the original design of your product?
  - What data from various tests did you use to make improvements on your final design?

- ☐ A labeled diagram of your product that explains how it works, including:
  - A description of how your product helps individuals stay warm or stay cool
  - A model that shows how your product affects energy transfer and the kinetic energy of particles

- ☐ Pros and cons of the final product

Peer Review

Consumer Report Peer Review Feedback

Complete after you have a full first draft of your Consumer Report.

Consumer Report Owner's Name	
Consumer Report Reviewer's Name	

Review the following sections of the Consumer Report:

- ☐ A definition of the problem the product addresses:
  - Where is the region and why is it difficult to live there?
  - What criteria would make a successful solution to this problem?
  - What makes it difficult to solve this problem?

  ➢ Positive Comment:

  ➢ Constructive Comment:

- ☐ A detailed description of the climate in that region, including model(s) that show:
  - Why the location of the region on Earth results in its extreme temperature
  - How atmospheric and oceanic circulation affect the climate in your region
  - The processes that create the water conditions in your region
  - *For at least one of the above bullets, cite patterns in data that allowed you to figure out these cause-and-effect relationships

  ➢ Positive Comment:

  ➢ Constructive Comment:

- ☐ A description of the design process:
  - Describe your original design: What proportional relationships from the Task 4 investigations inspired the original design of your product?
  - What data from various tests led you to make improvements for your final design?

  ➢ Positive Comment:

  ➢ Constructive Comment:

- ☐ A labeled diagram of your product that explains how it works, including:
  - A description of how your product helps individuals stay warm or stay cool
  - A model that shows how your product affects energy transfer and the kinetic energy of particles

  ➢ Positive Comment:

  ➢ Constructive Comment:

- ☐ Pros and Cons of the final product

  ➢ Positive Comment:

  ➢ Constructive Comment: