
Matter Matters

Unit 2

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.

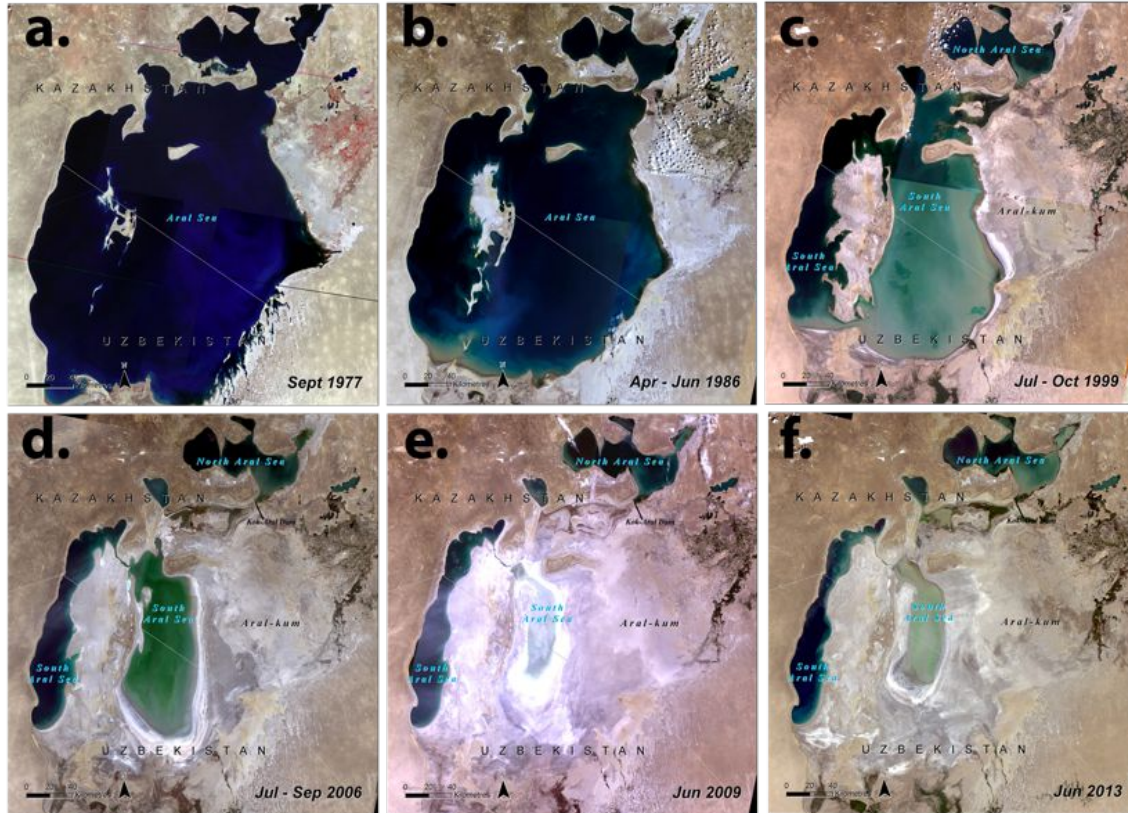
Unit Essential Question

How can models of matter help us understand the resources we use?

A Shrinking Sea

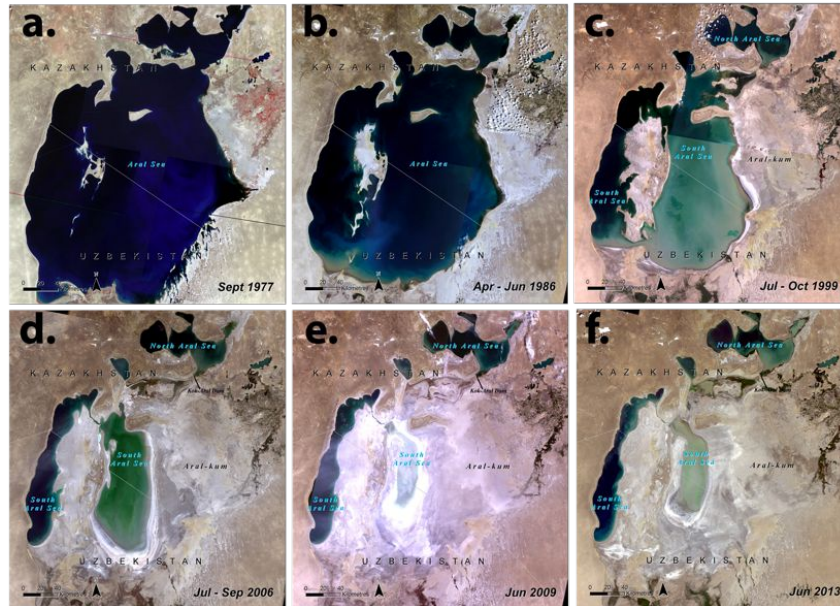
Lift-Off Task

The Aral Sea (1977 - 2013)



Generate Questions!

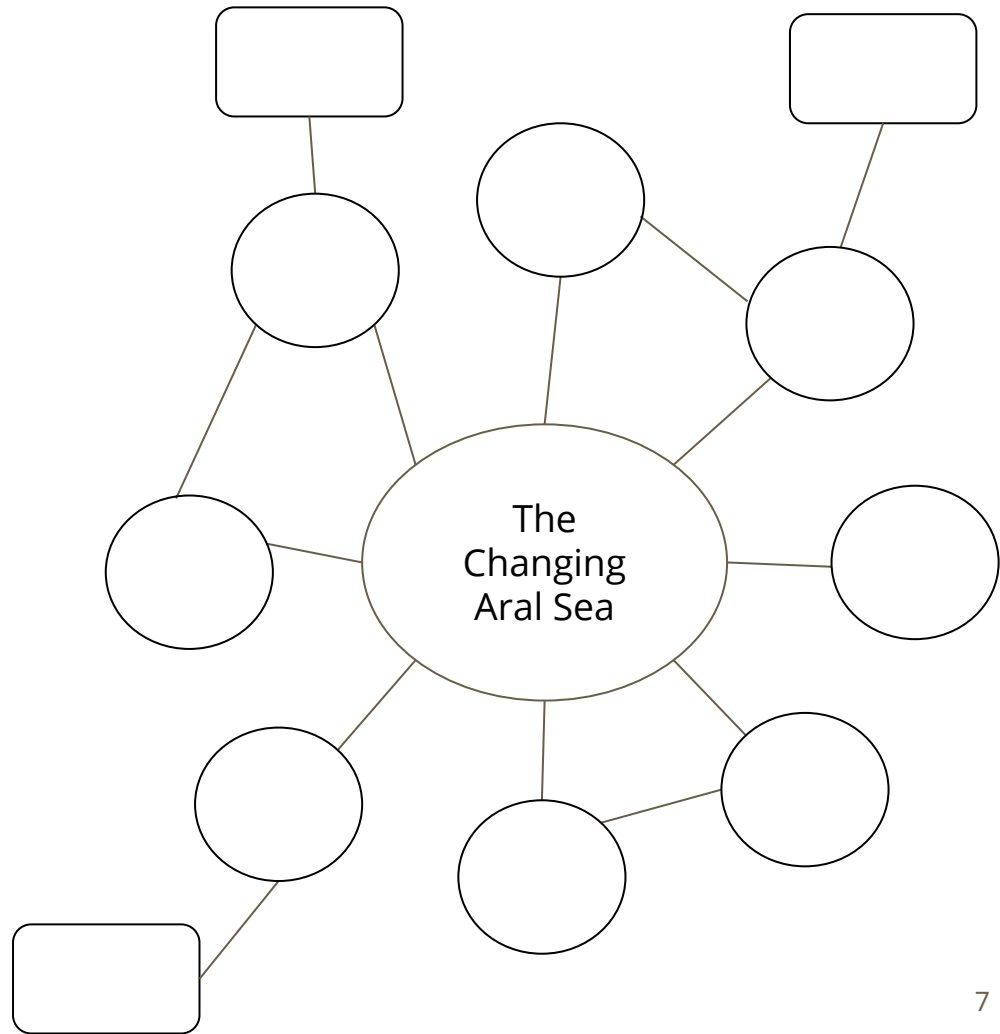
If you wanted to know more about what is happening to the Aral Sea, what questions would you ask?



Group Concept Map

As a group, create a concept map that shows:

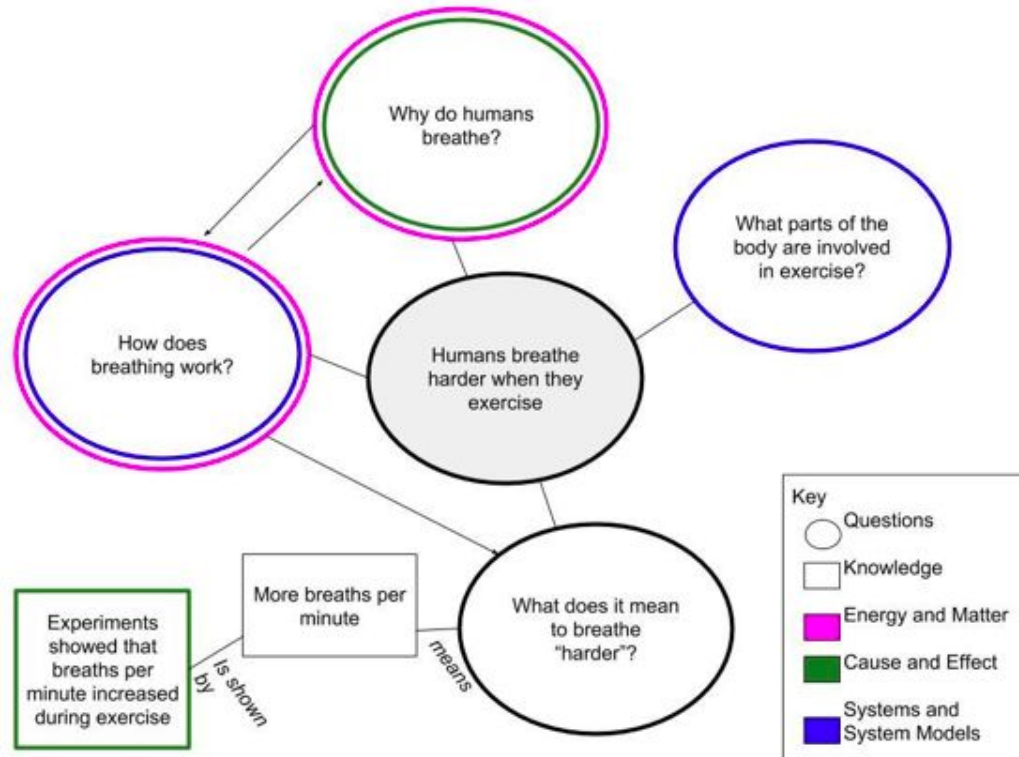
- Questions your group members had in common (circles)
- Possible answers to some questions (squares)
- Connections between related questions (lines)



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

Develop a solution to make water more available



Group Project - A short video for an online magazine that explains a way to make water more available to a community with little freshwater

Individual Project - A digital article with more science background and detail on your group's solution

Connecting to the Culminating Project

You will be developing a solution to make water more available to people in a certain area, while also considering strain on the environment. Now that you have seen an example of a water reservoir changing drastically over time, think about why this might matter. Use your own prior knowledge to identify some ways humans use the natural resource of water.

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

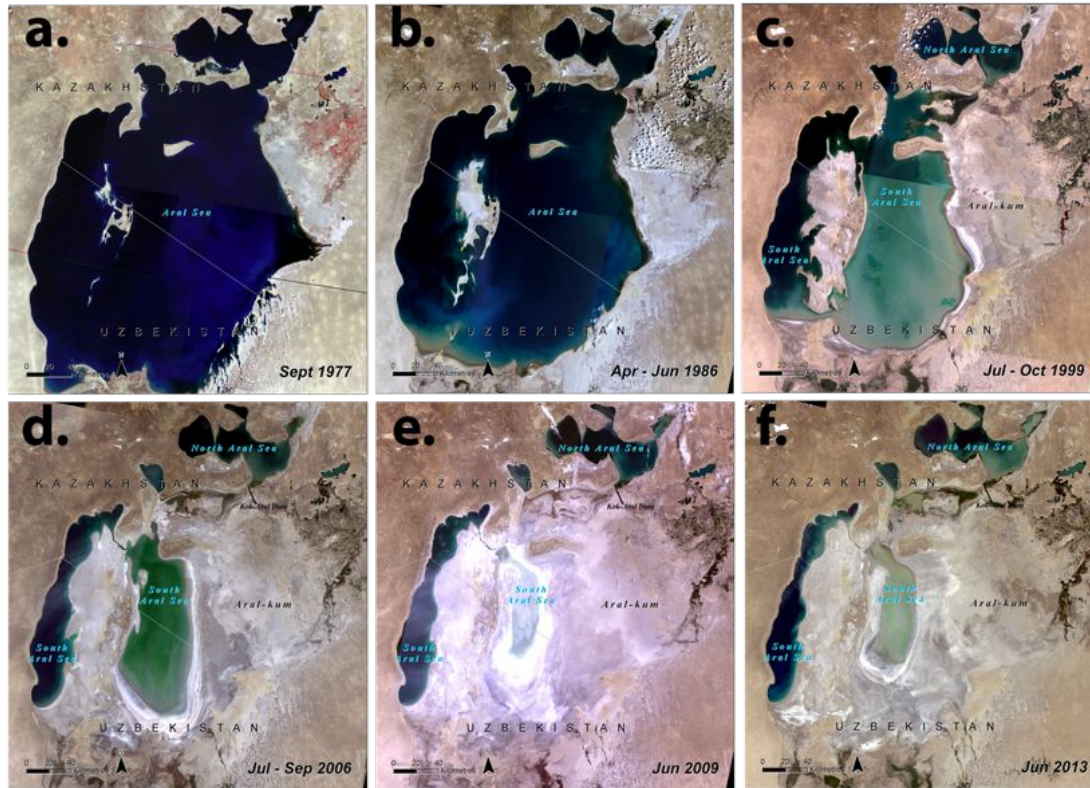
Reflection

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

Explosions in Human Population

Task 1

What questions do you still have?



Engage

Human Population Growth



<https://www.youtube.com/watch?v=QsBT5EQt348> (stop video at 0:30)

Think-Pair-Share

In pairs, discuss:

1. Based on the past data, what do you think we can expect for future population size? Explain.
2. What do you think population growth means for our future?

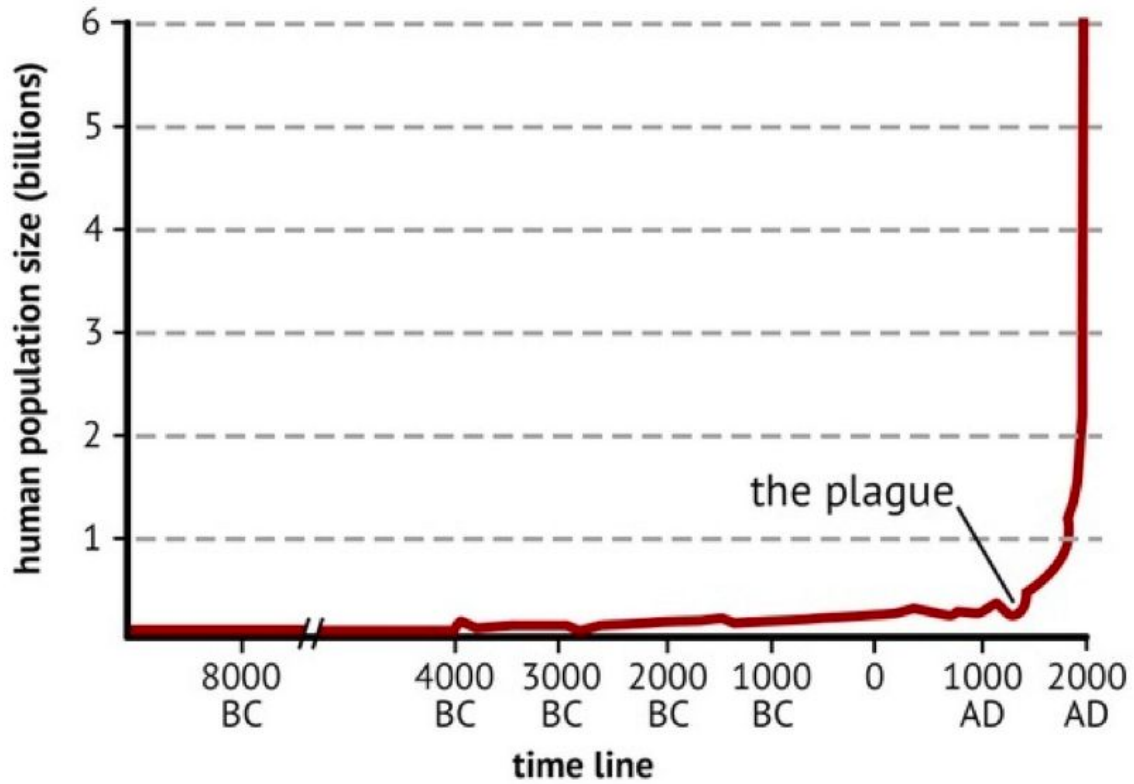
Explore

Analyzing and Interpreting Data

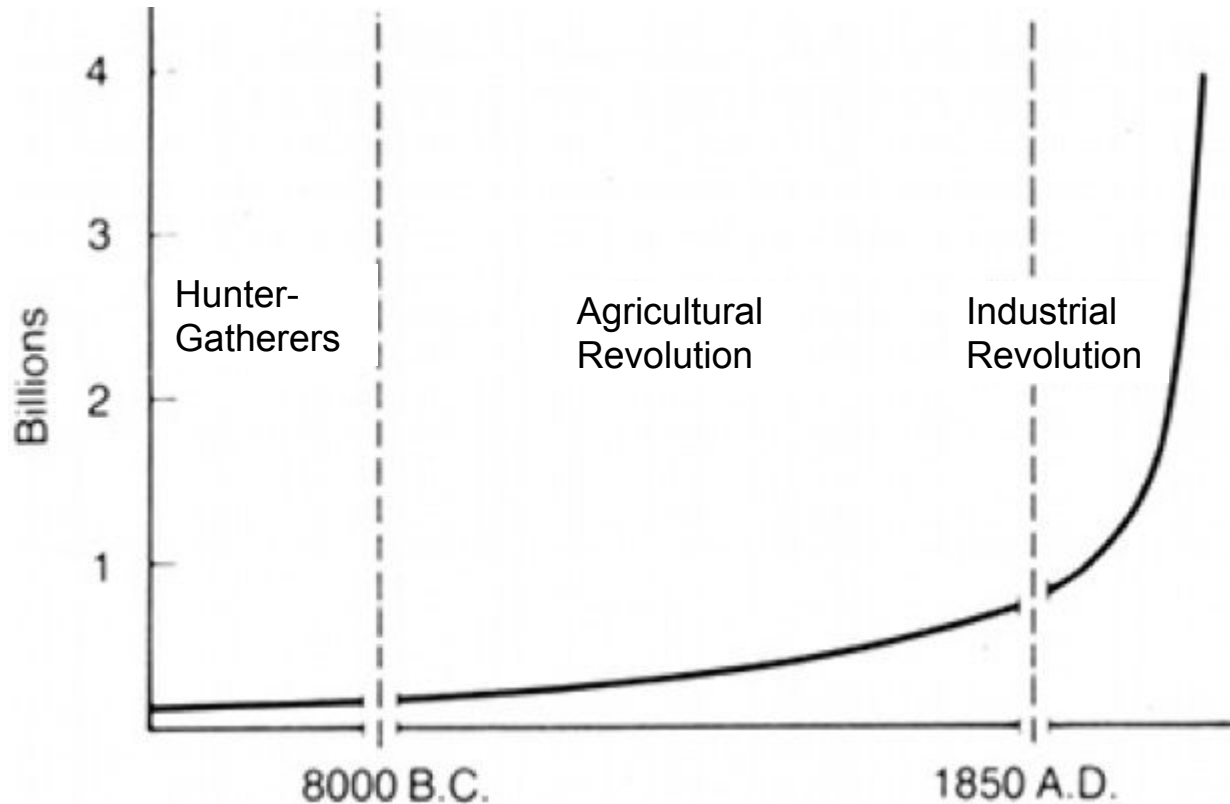
As a group,

1. Analyze three graphs that show the history of human population growth.
2. Answer the questions in your student guide to help you look for patterns:
At what times in history have we seen explosions in human population?
3. Use your analysis to identify cause-and-effect relationships.

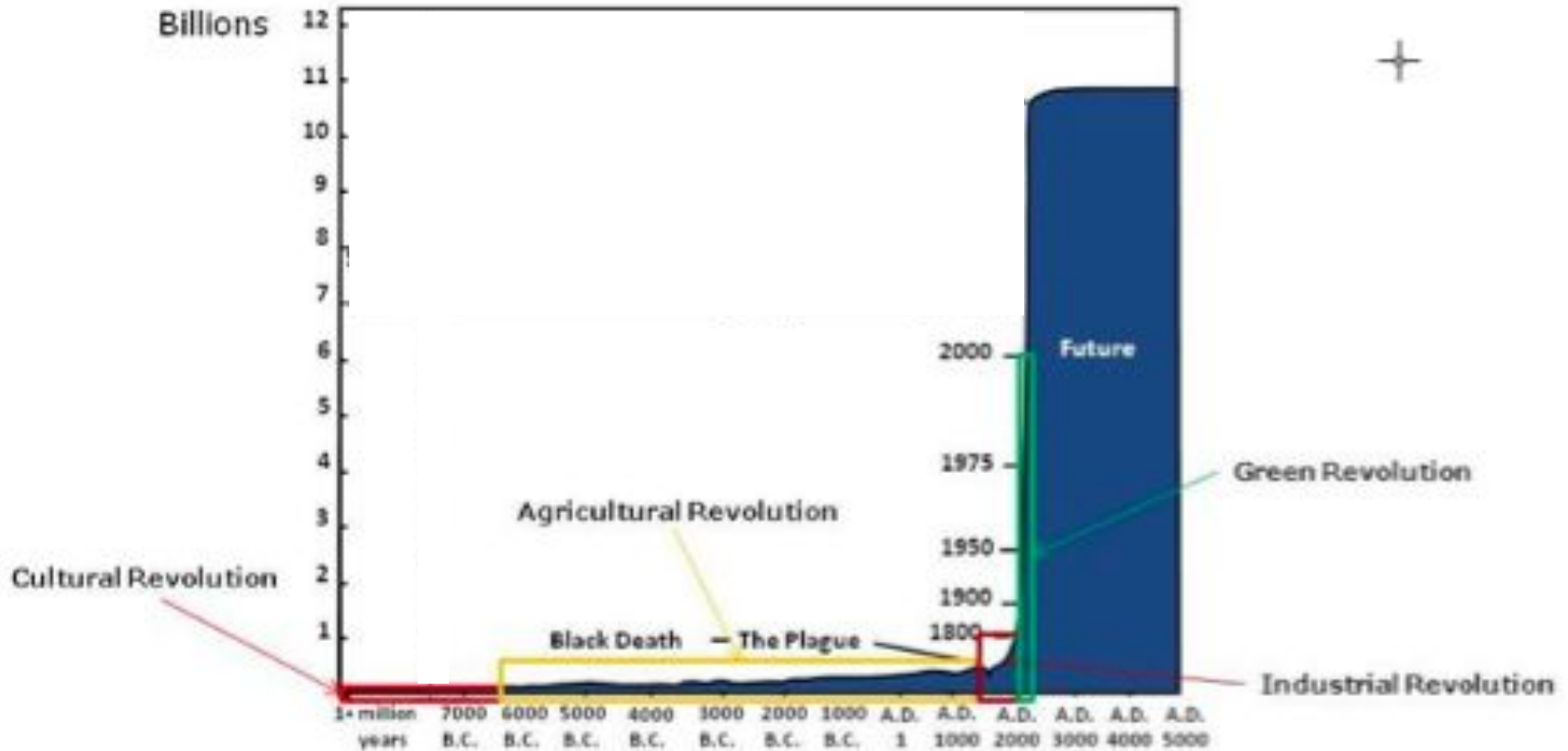
Graph 1: Major Population Changes



Graph 2: Big Technological Revolutions



Graph 3: More Technological Revolutions



Explain

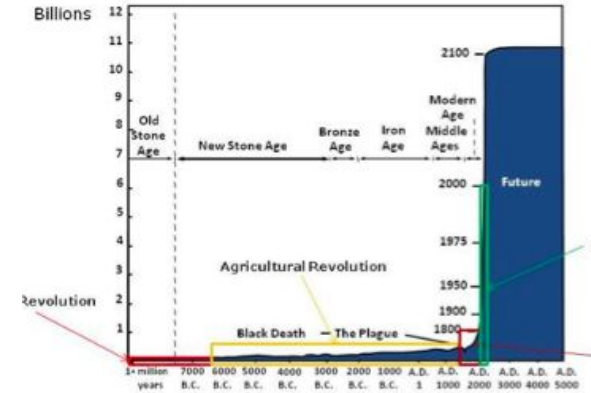
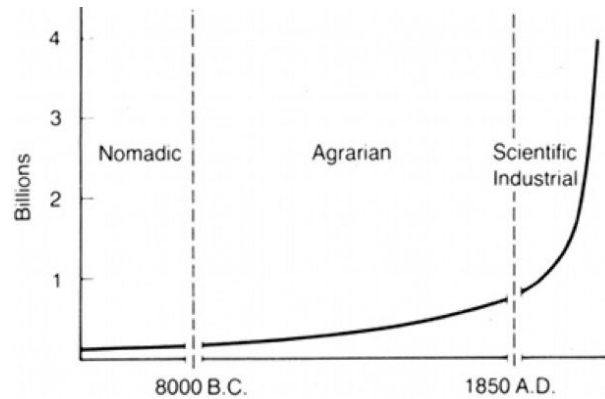
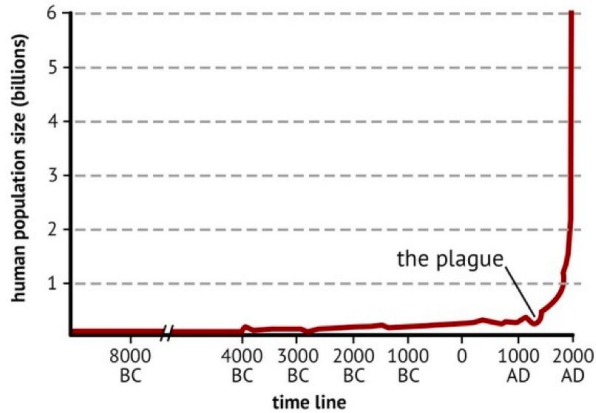
Critique, Correct, and Clarify

1. Critique: Analyze the response below:

The data supports that the availability of natural resources affects human population growth. For example, in Graphs 1 and 2, I observed that there was an increase in population around 10,000 BC and again more dramatically around 1700-1850. In graph 3, I saw that this happened again in the last 50 years because of the Green Revolution. Thus, the evidence clearly shows through these three cases that availability of natural resources affects human population.

2. Correct: Write an improved paragraph in your student guide.
3. Clarify: Describe how and why you corrected the response.

Constructing Explanations



Explain how the evidence (graphs and resource card) supports the idea that the availability of natural resources affects human population growth.

Elaborate

Cause and Effect

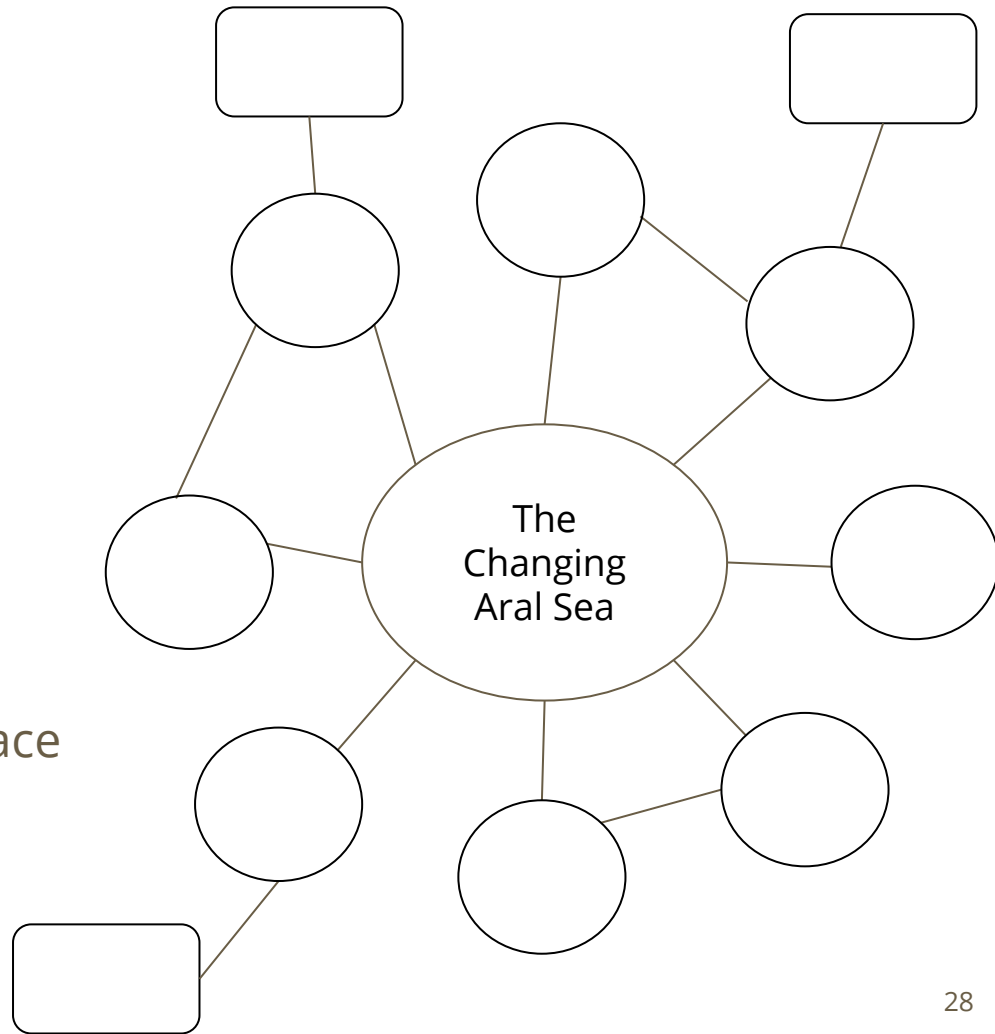


Now that you know what is causing population growth, use this knowledge to make a projection for future generations.

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 will be developing a solution to make a specific natural resource—water—more available to people around the world, while also considering strain on the environment. Now that you have seen how the availability of different resources has affected human population growth, apply this to the resource of water.

- Research and explain why water is important to human populations.
- Explain how the availability of water might affect human population growth.
 - Use data from the task to justify why you think this is the case.

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 1.

Unequal Access to Resources

Task 2

What questions do you still have?



Engage

Is natural gas and oil available everywhere?



<https://www.youtube.com/watch?v=7wXZE1uuJ8o>.

Think-Pair-Share

In pairs, discuss:

1. Is oil and natural gas available everywhere? If not, where can it be found?
2. What new techniques is the U.S. using to extract natural gas and oil from the Earth?
3. What are the consequences of getting natural gas and oil in this way?

Explore

Remember tectonic plates from Unit 1?

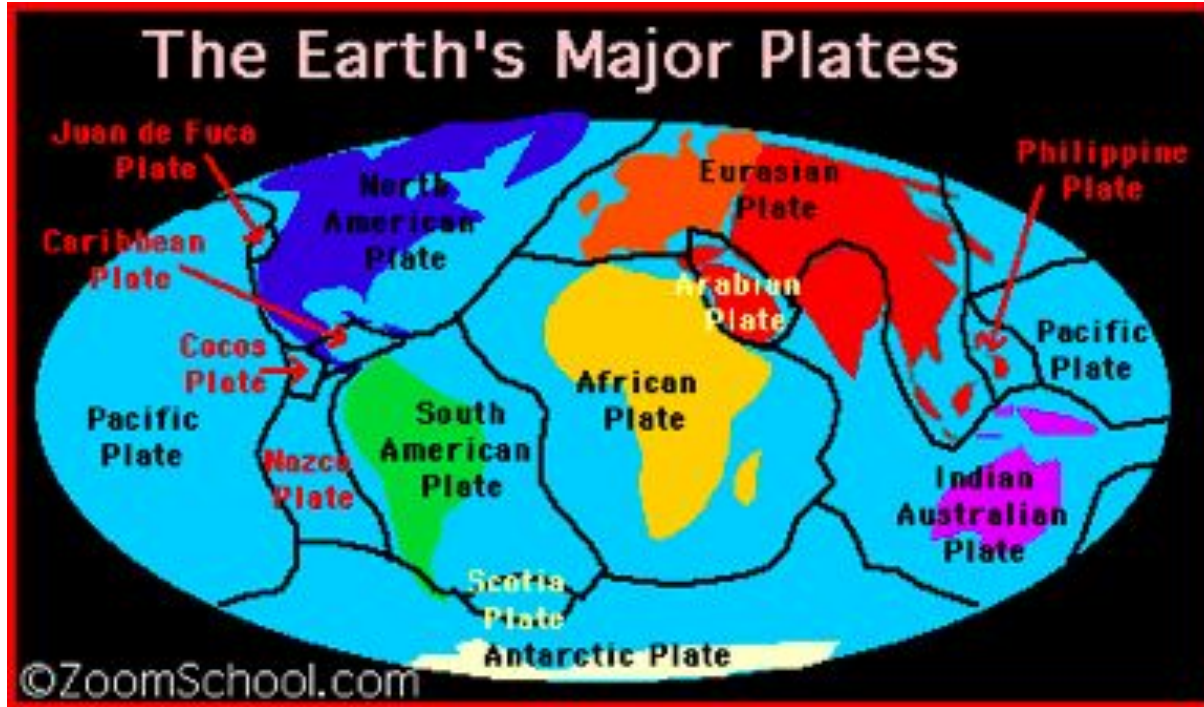
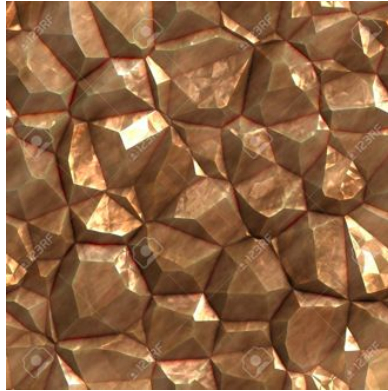


Plate movements lead to geologic features!

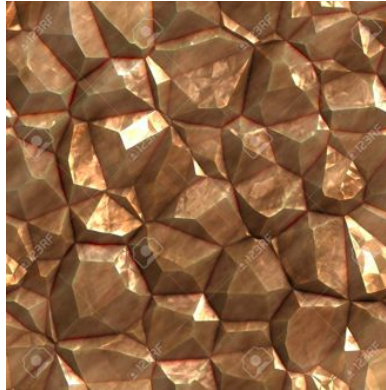


Become an expert in one natural resource



1. Leave your home group to become an expert group in one natural resource.
2. In your expert group, read the station card aloud with your group.
3. Take notes and prepare a statement to report back to your home group.

Share information about natural resources



1. Return to your home group.
2. Turn over your student guide as you present your resource to the rest of your group,
3. Other group members take notes and ask clarifying questions.
4. Repeat until each team member has presented on their resource.

Explain

Where do natural resources come from and how does this affect people?

Disciplinary Core
Idea ESS3A:



Natural Resources



Next Generation
Science
Standards



https://www.youtube.com/watch?v=LxHdUd_Q12Y (stop video at 2:45)

Constructing Explanations

Is every type of natural resource accessible to people in different regions of the world? Why or why not? How does this affect different people?

Use evidence from the *Engage*, the *Explore*, and the video you just watched, as well as cause-and-effect reasoning to justify your response.

Elaborate

Think-Pair-Share: Sustainability



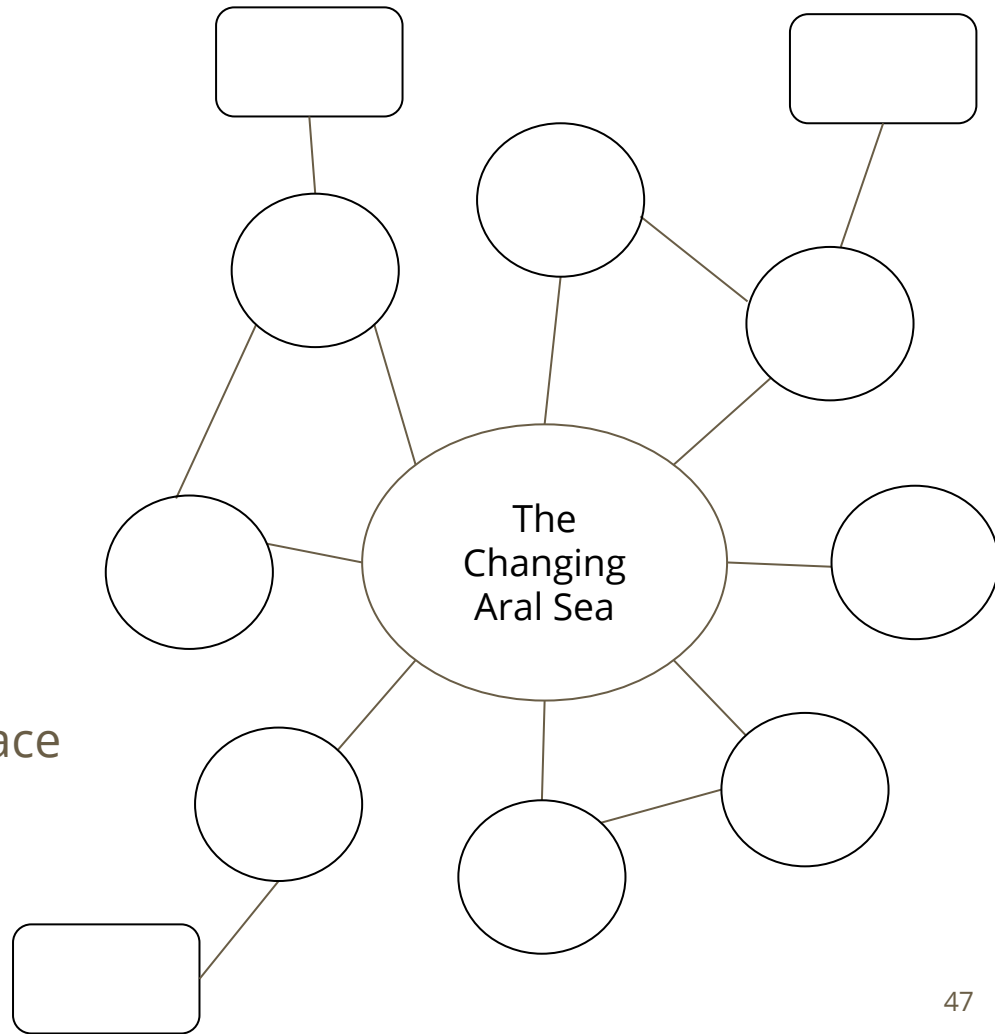
Sustainability - the avoidance of depleting natural resources in order to maintain a balance in ecosystems.

What do you think humans can do to help preserve the resources you learned about today so that we don't run out?

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 will be creating a proposal to make a natural resource more available to people around the world, while also considering strain on the environment. Every natural resource comes from some geologic process, which only happens in certain areas of the world.

- Explain why water is not available equally throughout the world, focusing on the process that makes it.
- How are some humans using more than their share?
- What is the effect on environmental systems?

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

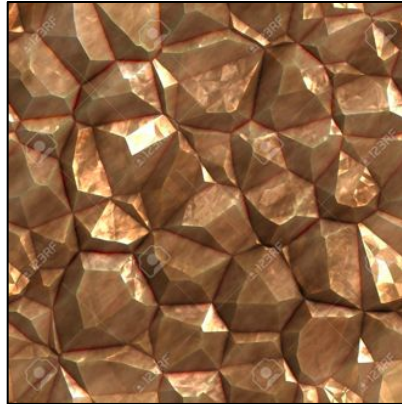
Reflection

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

What is Water?

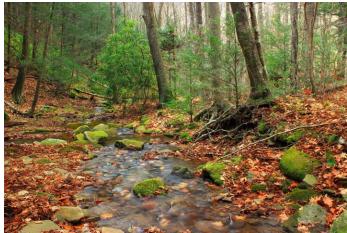
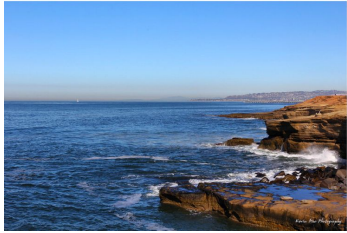
Task 3

What questions do you still have?



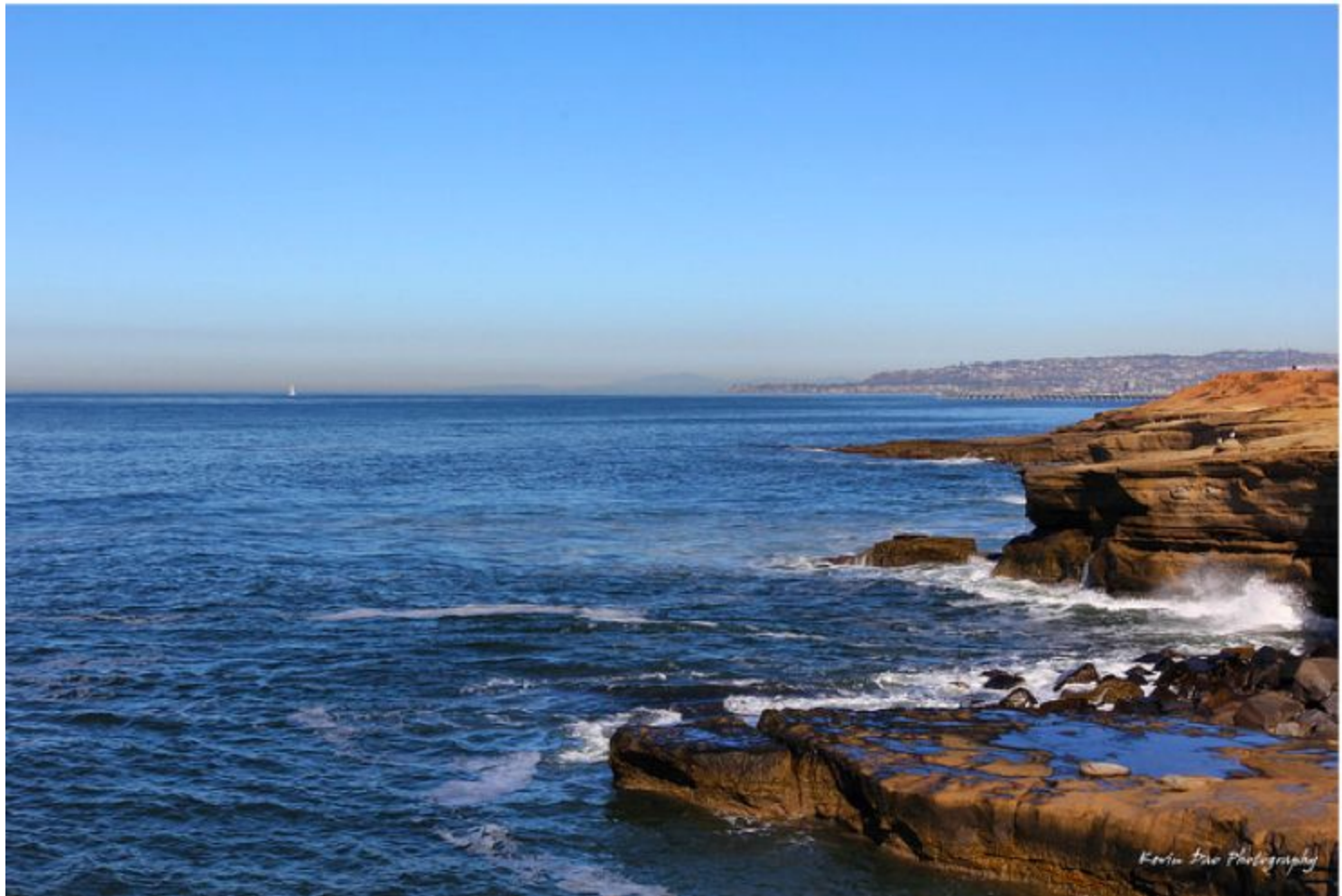
Engage

Where can we find water in different environments?



As a group, discuss:

1. What examples of matter do you see in this environment?
2. Where do you see examples of water in this environment?













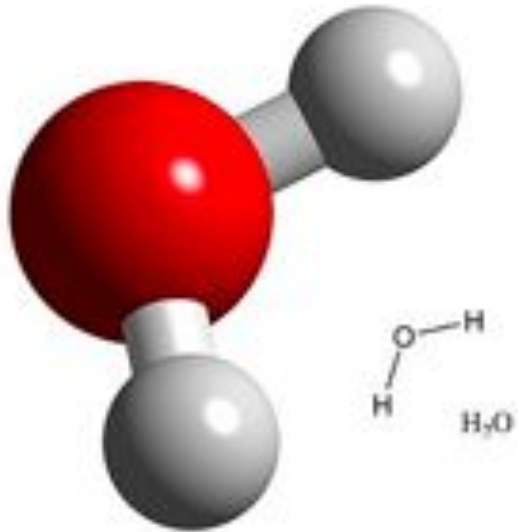




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Explore

Developing Models - Water Molecules



Individually make a model of a water molecule, using the following materials:

- Jelly Beans - hydrogen atoms
- Gumdrops - oxygen atom
- Toothpicks - bonds

Conduct investigations of water in different states



As a group,

1. Visit the lab stations to conduct investigations and observe water in different states.
2. Record observations.
3. Use the discussion questions to help you predict how the molecules are behaving and draw diagrams.

Explain

Draw conclusions and make hypotheses!

Matter is everything around you that has mass and takes up space. All matter is made up of very tiny building blocks called **atoms**. Atoms come in different types, kind of like different letters in an alphabet. Just like when you put different letters together to make words, when you put different types of atoms together, you can make different **molecules**.



Atoms > Molecules > Matter

http://leap5b.blogspot.com/2012/12/the-water-cycle_10.html

Water is a molecule that is made up of two different types of atoms—**hydrogen** (represented by the jelly beans in your model) and **oxygen** (represented by a gumdrop in your model). Its chemical name is H_2O because it has 2 hydrogen atoms and 1 oxygen atom.

The different forms of water you investigated today—ice, liquid water, water vapor—are called **states** of matter. These states are known as solid, liquid, and gas, which you have probably learned in previous grades.

Individually,

1. Read and annotate the article about matter.

With a partner,

2. Discuss the questions to draw conclusions about the labs and make hypotheses.

Elaborate

Apply what you've learned to a real-life scenario

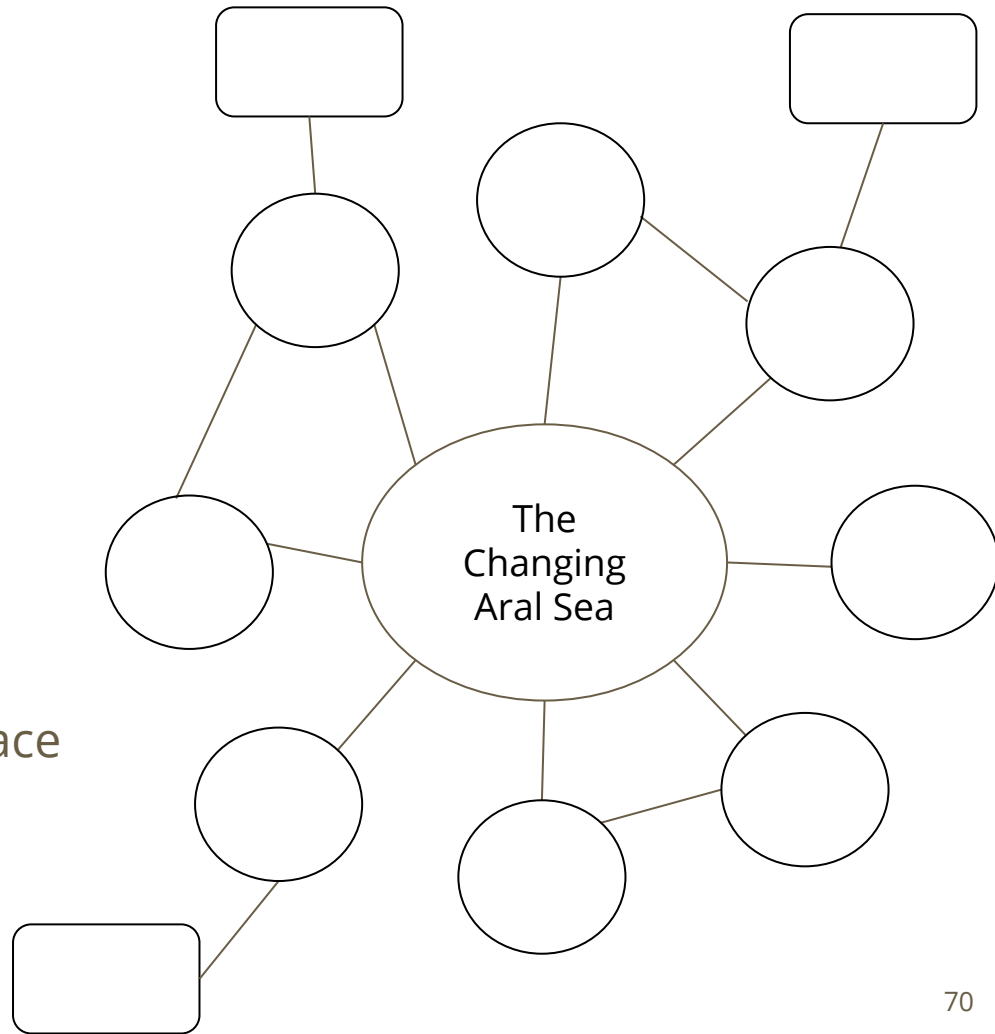
A friend in another class freezes water in her water bottle so it will slowly melt throughout the day and she will always have cold water. However, when she takes the bottle out of the freezer, she realizes it has exploded. How do you explain this? What did she do wrong? Individually, use what you have learned through the investigations to give your friend some advice.



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
 - Scale, Proportion, and Quantity



Evaluate

Connecting to the Culminating Project

You will be creating a proposal to make water more available to people around the world, while also considering strain on the environment. You've explored molecular structure with a simple molecule—water.

- Draw a model of the molecular structure of water.
 - Label and explain its parts.
- Research and explain how the molecular structure of water gives it properties that make it useful to humans.

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

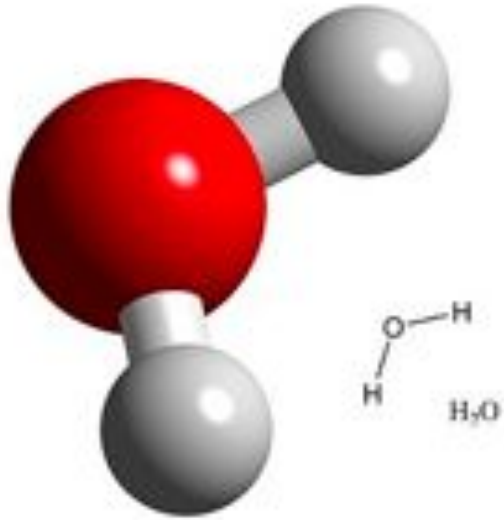
Reflection

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

Changing States

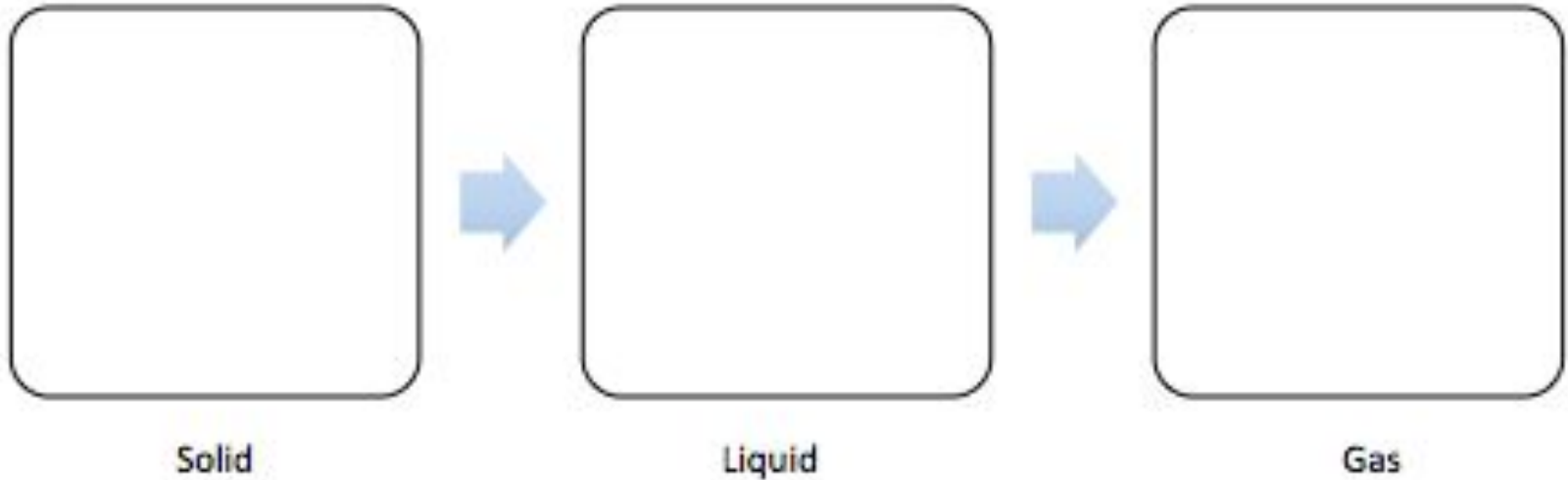
Task 4

What questions do you still have?



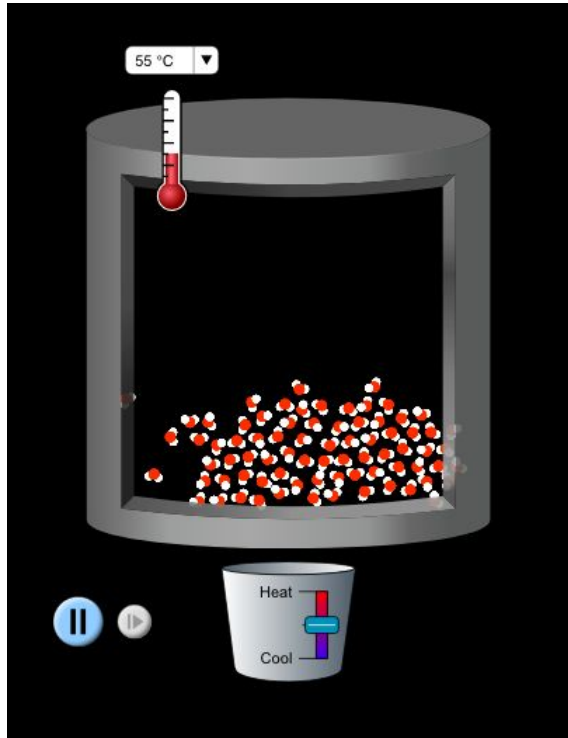
Engage

What is happening to the molecules when water is in different states?



Explore

Using Models - States of Water



As a group,

1. Open the *States of Matter* simulation on your computer.
2. Select “States” on the left-hand side and then “Water” on the right.
3. Use the buttons on the right to change water from solid to liquid to gas.
4. Observe and record observations.

Explain

Developing Models - States of Matter

Thermal Energy The energy an object has because of the movement of its particles. Also known as <i>heat energy</i> .	Temperature The average kinetic energy of the moving particles in a substance.
Kinetic Energy The energy an object or particles have due to motion.	State of Matter A form in which matter can exist, which depends on the arrangement and motion of molecules. Ex: solid, liquid, and gas.

With your group, create a skit that shows the science behind water in different states and what causes the changes.

Make sure to use all the science words on your student guide!

Elaborate

Stronger Clearer

1. **Individual Think Time:** What will you say to your partner without looking back at your skit plans in your student guide.
2. **Partner Discussions:**
 - a. **Student A:** Describe your skit using as many science words as possible.
 - b. **Student B:** Listen and ask clarifying questions.
 - c. **Student A and Student B:** Write down any notes to make your skit stronger and clearer.
3. **Repeat with 2 more partners!**
4. **Revise your skit.**

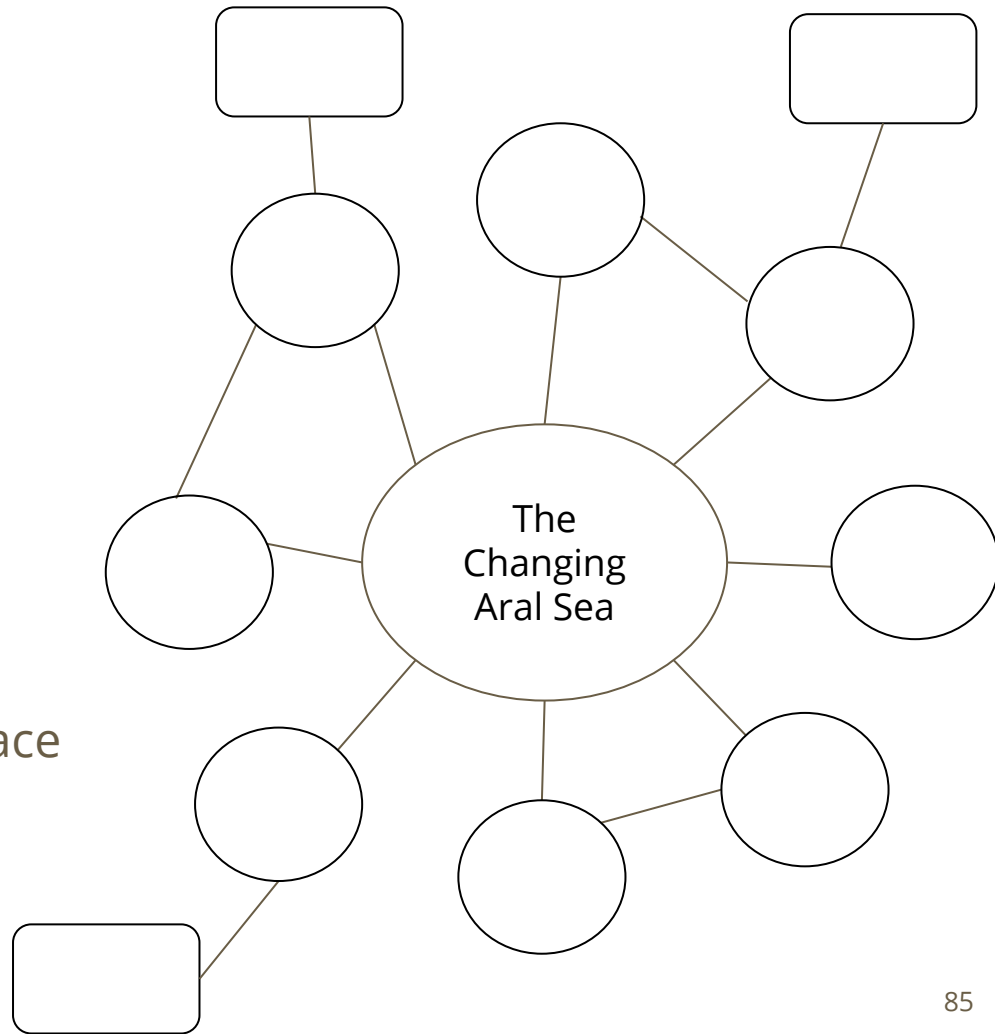
Present your skit!



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 will be creating a proposal to make water more available to people around the world, while also considering strain on the environment. Sometimes humans use natural resources as they exist in nature; other times humans use them by changing their state.

- Do some research: how might using water sometimes require changing its original state?
- Many communities don't have enough water (to drink, grow crops, etc.) Use what you have learned about changing states of water to brainstorm possible ways to provide them water. Keep in mind that you do not want to put too much strain on the environment!
 - Create a few possible design sketches with captions explaining how they work.
 - Explain some pros and cons of your solutions.

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.

Culminating Project

Develop a solution to make water more available



Group Project - A short video for an online magazine that explains a way to make water more available to a community with little freshwater

Individual Project - A digital article with more science background and detail on your group's solution

Don't forget to use your checklist of criteria!

Group Product Criteria for Success

Your video should include:

- A background on water:
 - What are different ways humans use water?
 - Why is water important to humans?

- A description of the location your group has chosen
 - Why is there not as much freshwater available?

- A solution that uses change of state to make water more available to this community:
 - How does your solution work?
 - What are the pros and cons of your solution?

- The video should:
 - Include visuals and dialogue
 - Be logically organized
 - Show equal participation of all group members

Develop a solution to make water more available



Group Project - A short video for an online magazine that explains a way to make water more available to a community with little freshwater

Individual Project - A digital article with more science background and detail on your group's solution

Don't forget to use your checklist of criteria!

Individual Project Criteria for Success

Your digital article should include:

- ❑ A background on the natural resource of water
 - Draw and explain a model that shows the atomic composition of water.
 - Explain how the molecular structure gives water properties that make it useful to humans.
 - Describe the importance of water for all organisms.
 - Explain how you think the availability of water affects human population size in a region.
 - Describe data from Task 1 that allows you to conclude this cause-and-effect relationship between water availability and population.

- ❑ An explanation of the global problem of freshwater access
 - Explain why water is unevenly distributed throughout the world.
 - Describe how humans are making the problem worse.
 - Reference your group's location as an example and cite evidence from Task 2 to support your explanation.

- ❑ A description of your solution
 - Explain how your solution uses a change in state to help make water more available to the community.
 - Draw a model of your solution to describe how it changes water into the state that is most useful to humans. In your model, include pictures, labels, and descriptions of:
 - The motion of water molecules and kinetic energy of particles in each state shown
 - Water as a solid, liquid, and/or gas
 - Explain how thermal energy and temperature affects the states of water in your solution.

- ❑ An analysis of your solution
 - Describe the pros of the solution: how will it maximize water availability?
 - Describe the cons of the solution: how will it negatively affect the environment?

Peer Review

Digital Article Peer Review Feedback

Complete after you have a full first draft of your digital article.

Digital Article Owner's Name	
Digital Article Reviewer's Name	

Review the following sections of the Digital Article:

- A background on the natural resource of water
 - Draw and explain a model that shows the atomic composition of water.
 - Explain how the molecular structure gives water properties that make it useful to humans.
 - Describe the importance of water for all organisms.
 - Explain how you think the availability of water affects human population size in a region.
 - Describe data from Task 1 that allows you to conclude this cause-and-effect relationship between water availability and population.

➤ Positive Comment:

➤ Constructive Comment:

- An explanation of the global problem of freshwater access
 - Explain why water is unevenly distributed throughout the world.
 - Describe how humans are making the problem worse.
 - Reference your group's location as an example and cite evidence from Task 2 to support your explanation.

➤ Positive Comment:

➤ Constructive Comment:

- A description of your solution
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 - Draw a model of your solution to describe how it changes water into the state that is most useful to humans. In your model, include pictures, labels, and descriptions of:
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 - Water as a solid, liquid, and/or gas
 - Explain how thermal energy and temperature affects the states of water in your solution.

➤ Positive Comment:

➤ Constructive Comment:

- An analysis of your solution
 - Describe the pros of the solution: how will it maximize water availability?
 - Describe the cons of the solution: how will it negatively affect the environment?

➤ Positive Comment:

➤ Constructive Comment: