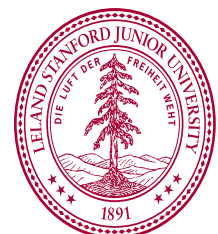# UNIT 2

Matter Matters

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

S C A L E
Stanford Center for Assessment,
Learning & Equity

LELAND STANFORD JUNIOR UNIVERSITY
DIE LUFT DER FREIHEIT WEHT
1891

7th Grade Science Unit 2: Matter Matters
Culminating Project

<u>Unit Essential Question</u>: *How can models of matter help us understand the resources we use?*

<u>Challenge</u>

Nature provides us with many resources that we need. We call these "natural resources". But are we using up too much of these natural resources? Is everyone getting his or her fair share? Water is an example of one natural resource that is very important to all living things. With the Aral Sea, you saw an example of a water reservoir that has changed dramatically over time. Phenomena, like these, are happening all over the world!

http://tamara-favazza.blogspot.com/2012/03/bio-hd-wallpapers.html

In response to these environmental issues, an online magazine is looking for ideas on how to distribute water more equally and more sustainably to people around the world. <u>As a group</u>, you will pick and research a location that does not have access to a lot of freshwater. Using what you learned about Earth processes and changing states of matter, your group's job is to figure out a way to make water more available in that region. Then create a short video for the online magazine that provides a background on the natural resource of water and explains your solution. <u>Individually</u>, you will then write a digital article that accompanies your video to explain your group's solution in more detail.

<u>Group Product Criteria for Success</u>

Your video should include:

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

- ❑ A description of the location your group has chosen
    - o Why is there a lack of freshwater available?

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

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

7th Grade Science Unit 2: Matter Matters
Culminating Project

Individual Project Criteria for Success

Your digital article should include:

- ❑ A background on the natural resource of water
  - o 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.
  - o Describe the importance of water for all organisms.
  - o 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
  - o Explain why water is unevenly distributed throughout the world.
  - o Describe how humans are making the problem worse.
  - o Reference your group's location as an example and cite evidence from Task 2 to support your explanation.

- ❑ A description of your solution
  - o Explain how your solution uses a change in state to help make water more available to the community.
  - o 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
  - o Describe the pros of the solution: how will it maximize water availability?
  - o Describe the cons of the solution: how will it negatively affect the environment?

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

➢ Positive Comment:

➢ Constructive Comment:

7th Grade Science Unit 2: Matter Matters
Culminating Project

❑ A description of your solution
   o Explain how your solution uses a change in state to help make water more available to the community.
   o 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.

   ➢ Positive Comment:

   ➢ Constructive Comment

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

   ➢ Positive Comment:

   ➢ Constructive Comment

7th Grade Science Unit 2: Matter Matters
3-Dimensional Individual Project Rubric

Overview: The following rubrics can be used to assess the individual project: the digital article. Each rubric is aligned to one section of the *Individual Project Criteria for Success*, located on your Culminating Project Student Instructions. Use these rubrics to see if you are doing your best work on your individual project.

Rubric 1: Student develops a scale model to describe the atomic composition of water that is too small to be seen.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student develops an **inaccurate** scale model to describe the atomic composition of water that is too small to be seen.	Student develops a **partially accurate** scale model to describe the atomic composition of water that is too small to be seen.	Student develops a **mostly accurate** scale model to describe the atomic composition of water that is too small to be seen.	Student develops a **completely accurate** scale model to describe the atomic composition of water that is too small to be seen.

Rubric 2: Student explains how the availability of water likely affects human population size in a region, using data and a cause-and-effect relationship from Task 2 as evidence to justify this prediction.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student **inaccurately** explains how the availability of water likely affects human population size in a region. OR Student **accurately** explains how the availability of water likely affects human population size in a region, using **no** data and **no** cause-and-effect relationship from Task 2 as evidence to justify this prediction.	Student **accurately** explains how the availability of water likely affects human population size in a region, using **no** data, just a cause-and-effect relationship from Task 2 as evidence to justify this prediction.	Student **accurately** explains how the availability of water likely affects human population size in a region, using **a** source of data and a cause-and-effect relationship from Task 2 as evidence to justify this prediction.	Student **accurately** explains how the availability of water likely affects human population size in a region, using **multiple** sources of data and a cause-and-effect relationship from Task 2 as evidence to justify this prediction.

7th Grade Science Unit 2: Matter Matters
3-Dimensional Individual Project Rubric

Rubric 3: Student constructs an explanation for the causes of uneven distribution of water throughout the world, using evidence to support their explanation.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student constructs an **inaccurate** explanation for the causes of uneven distribution of water throughout the world.	Student constructs a **partial but accurate** explanation for the causes of uneven distribution of water throughout the world, using **no** evidence to support their explanation.	Student constructs a **partial but accurate** explanation for the causes of uneven distribution of water throughout the world, using **relevant** evidence to support their explanation.	Student constructs a **complete and accurate** explanation for the causes of uneven distribution of water throughout the world, using **relevant** evidence to support their explanation.

Rubric 4: Student develops a model to describe how their solution changes water into a state that is most useful to humans and accurately explains relevant science content.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student develops an **irrelevant** model to describe how their solution changes water into a state that is most useful to humans and **does not** accurately explain relevant science content.	Student develops a **relevant** model to describe how their solution changes water into a state that is most useful to humans and accurately explains **limited** relevant science content.	Student develops a **relevant** model to describe how their solution changes water into a state that is most useful to humans and accurately explains **almost all** relevant science content.	Student develops a **relevant** model to describe how their solution changes water into a state that is most useful to humans and accurately explains **all** relevant science content.

7th Grade Science Unit 2: Matter Matters
Project Organizer

Unit Essential Question: *How can models of matter help us understand the resources we use?*

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. After each task, you will return to the table below to organize what you learn as you go through the unit. By the end of the four tasks, you will have all this information to use for your culminating project. For each activity, be sure to include answers to **ALL** the questions provided.

Lift-Off Task: A Shrinking Sea	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.
Task 1: Explosions in Human Population	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 humans. ☐ 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.

1

7th Grade Science Unit 2: Matter Matters
Project Organizer

|	
Task 2: Unequal Access to Resources	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?
Task 3: What is Water?	You've explored molecular structure with a simple molecule—water. ❑ Draw a model of the molecular structure of water. o Label and explain its parts. ❑ Research and explain how the molecular structure of water gives it properties that make it useful to humans.

Task 4: Changing States	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 of the pros and cons of your solutions.

S C A L E

7th Grade Science Unit 2: Matter Matters
Lift-Off Task: A Shrinking Sea

Unit Essential Question: *How can models of matter help us understand the resources we use?*

The pictures below show satellite images of the Aral Sea over a period of 35 years. Despite its name, the Aral Sea is not a sea at all, but actually a lake of freshwater in Central Asia.

https://www.tes.com/lessons/OfGohCI9CIm8oA/the-aral-sea
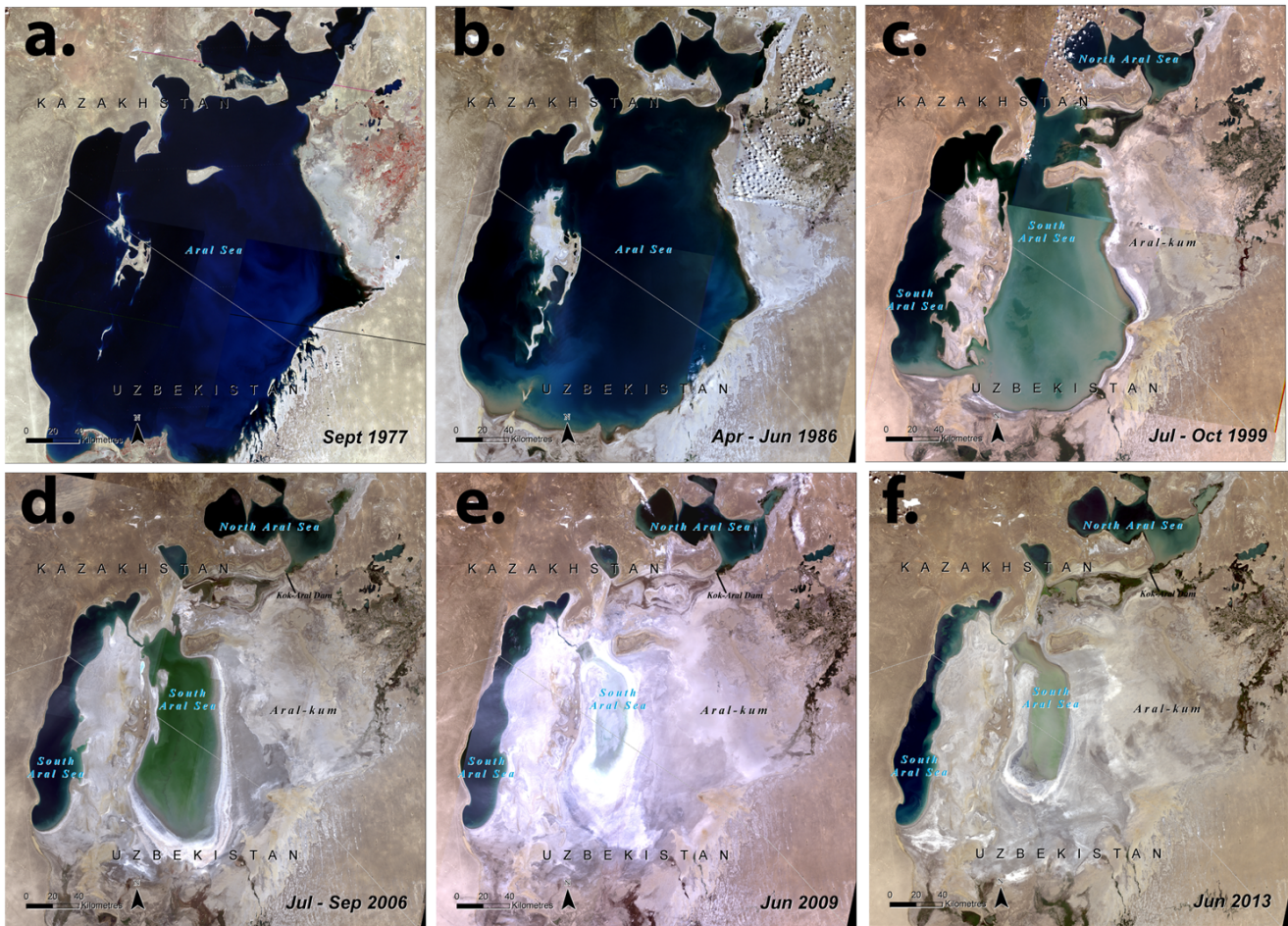
Part A: If you wanted to know what is happening to the Aral Sea, what questions would you ask? Individually record any questions you would need to ask to get a better understanding of the changing Aral Sea.

Part B: As a group,

- ➢ Discuss what questions each member wrote on his or her list.
- ➢ On a large piece of poster paper:
    - o Write the phrase "The Changing Aral Sea" in the middle of your poster and draw a circle around it.
    - o Around the circle, record the questions that were similar across your group members.
    - o Draw lines to link together questions that relate to each other.
    - o Draft possible answers to the questions, using your prior knowledge. Connect these to the questions on your poster.
- ➢ Post your group poster on the wall.
- ➢ Walk around and look at each groups' ideas.

Part C: As a whole class,

- ➢ Construct a class concept map with the phenomenon in the middle: "The Changing Aral Sea".
    - o Decide which key questions you want to have on the concept map.
    - o Draw lines with arrows between two key questions to show that there is a relationship.
    - o Make as many connections as you can between the questions on the concept map.
- ➢ It's important for everyone to share their ideas and it's okay if you don't agree.
- ➢ You will revise and add new questions and information to this concept map as you learn more about natural resources and matter on Earth.

Unit Essential Question: *How can models of matter help us understand the resources we use?*

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.

This should be completed individually in your Project Organizer.

7th Grade Science Unit 2: Matter Matters
Lift-Off Task: A Shrinking Sea

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Reflection
Individually reflect on the Lift-Off Task, using the questions provided:

1. At the beginning of this task, you made a list of all the questions you have about the changing Aral Sea. Look back at your list: think about the questions your peers asked that you did not initially write down. How are their questions different from the ones you originally asked?

2. In this unit, we will be focusing on two crosscutting concepts:
    - **Cause and Effect**: cause and effect relationships may be used to predict events.
    - **Scale, Proportion, and Quantity**: scaled models can be used to study systems that are too large or too small.

    Looking at your class concept map, give one example of how a crosscutting concept came up in today's task.

3. Now that you understand what project you'll be working on over the course of this unit, what else do you need to know? What additional questions do you have?

7th Grade Science Unit 2: Matter Matters
Task 1: Explosions in Human Population

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Engage
In the Lift-Off task, you looked at satellite images and asked questions to begin to make sense of the phenomenon of the shrinking Aral Sea. Many of you asked why this is happening and began to make predictions that humans might be somehow at fault. In this task, you will explore how and why humans are having more of a presence on planet Earth and predict how this might be affecting environments like the Aral Sea.

Cause and Effect: In pairs, use the video to make predictions about population growth.

http://overpopulationrisks. blogspot.com/2012/03/soylent-green.html

1. Based on the past data, what do you think we can expect for future human population size? Explain.

2. What do you think population growth means for our future?
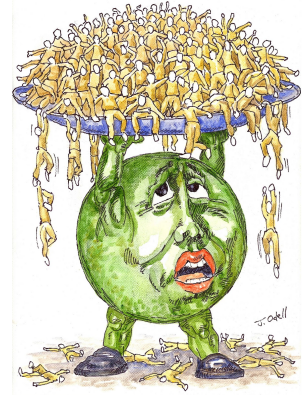
**Unit Essential Question:** *How can models of matter help us understand the resources we use?*

Explore
Analyzing and Interpreting Data: In order to make informed predictions about the future, we have to identify **cause and effect** relationships in the past that can help us understand why human population increases. To do this, explore graphs with your group that show the history of human population growth and look for **patterns**: At what times in history have we seen explosions in human population?

7th Grade Science Unit 2: Matter Matters
Task 1: Explosions in Human Population

Graph 1: Major Population Changes
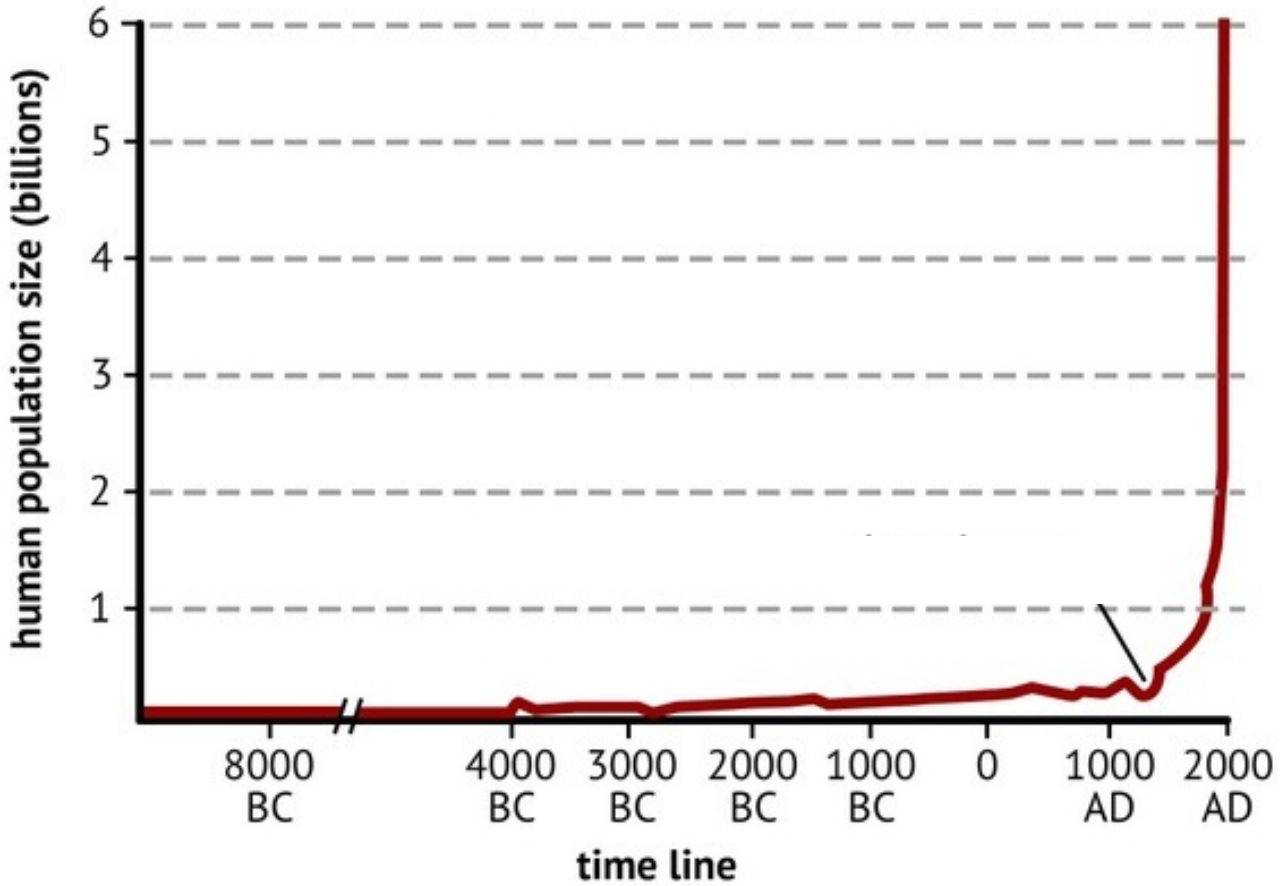
1. Analyze the graph:
   a. What does the X-axis show?

   b. What does the Y-axis show?

   c. What does the graph show?

2. Around what year do you see the population first begin to increase?

   a. Hypothesize: What do you think might have been happening at this time in history that would cause this increase in human population?

3. Around what year do we see the second major population explosion?

   a. Hypothesize: What do you think might have been happening at this time in history that would cause this increase in human population?

7th Grade Science Unit 2: Matter Matters
Task 1: Explosions in Human Population

Graph 2: Big Technological Revolutions

http://unurthed.com/2011/10/24/salk-on-world-population-and-human-values/
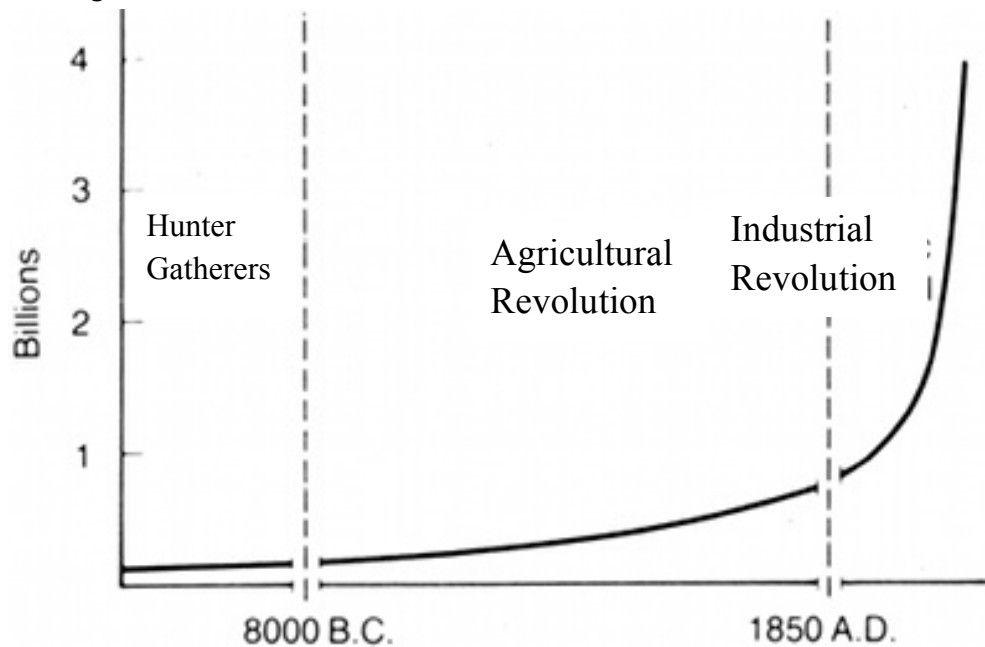
In Graph 1, you made predictions about why there were such large increases in population around 10,000 BC and around 1850. This graph identifies the reasons why: the agricultural revolution in 10,000 BC and the industrial revolution in 1850 AD. Based on the names of these revolutions and your own prior knowledge, refine the predictions you made with the last graph:

1. Why do you think the agricultural revolution led to more population growth?

2. Why do you think the industrial revolution led to more population growth?

7th Grade Science Unit 2: Matter Matters
Task 1: Explosions in Human Population

Graph 3: More Technology Revolutions
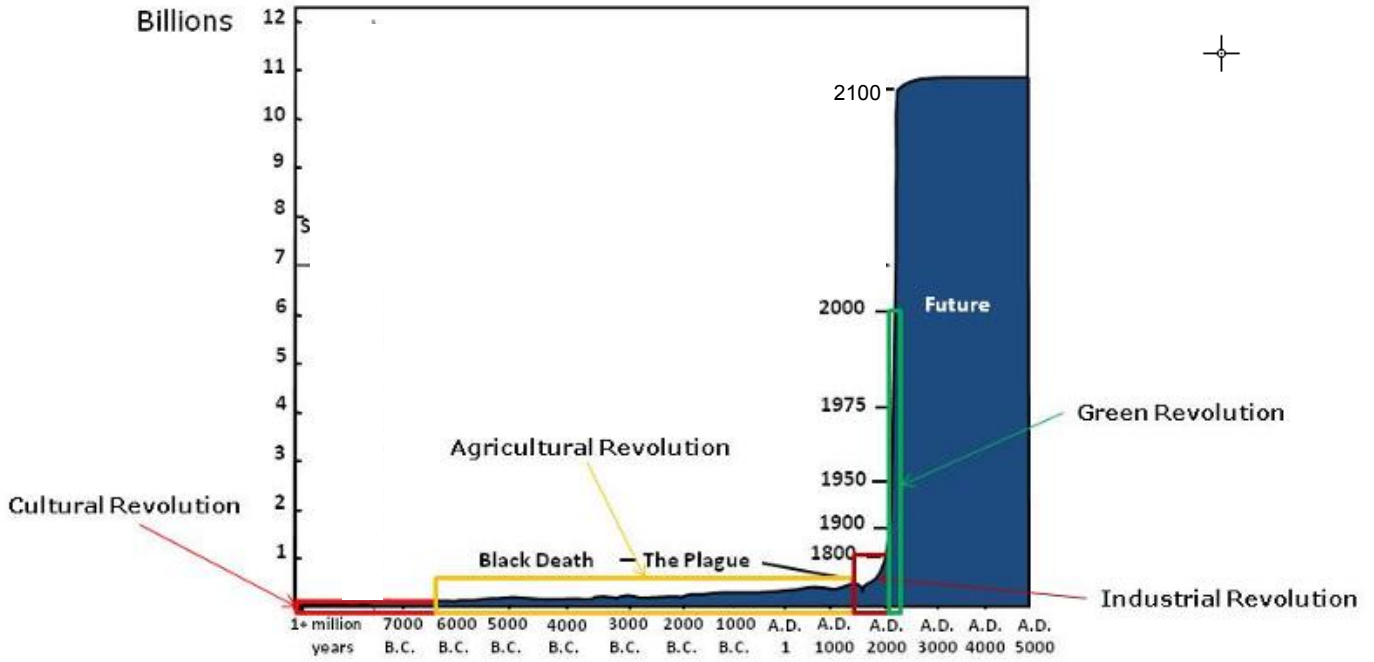
http://cgge.aag.org/PopulationandNaturalResources1e/CF_PopNatRes_Jan10/CF_PopNatRes_Jan10_print.html

In this graph, population size is shown in blue. This graph identifies the population growth associated with the agricultural revolution with a yellow box and the industrial revolution with a red box. It also identifies a more recent period known as the Green Revolution with a green box.

1. Take a look at the green box that represents the Green Revolution: what happened to population growth?

2. Based on the name "Green Revolution" and your own prior knowledge, why do you think the Green Revolution led to more population growth?

3. According to this graph, what do they predict will happen to human population in the future? Do you agree or disagree?

7th Grade Science Unit 2: Matter Matters
Task 1: Explosions in Human Population

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Explain

In Unit 1, you learned that the availability of resources affects populations. Is this the case for humans too?

- <u>In pairs</u>, read the resource card provided by your teacher to learn more about the three population explosions in human history.
- **Constructing Explanations**: Then <u>individually</u> write a paragraph explaining how the evidence (graphs and resource card) supports the idea that the availability of natural resources affects human population growth.

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Elaborate

Cause and Effect: Now that we know what is causing population growth, we can use this understanding to help us think about our future. <u>Individually</u>, make a projection for future generations:

1. Based on the evidence you gathered throughout this task, do you think our population will continue to grow dramatically? Why or why not?

2. Think back to the phenomenon of the Aral Sea from the Lift-Off task. If human population continues to grow in this way, what might we run out of? Why?

7th Grade Science Unit 2: Matter Matters
Task 1: Explosions in Human Population

a. If we begin to run out of some natural resources, how might this then affect human population growth?

Unit Essential Question: *How can models of matter help us understand the resources we use?*

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.
    o Use data from the task to justify why you think this is the case.

This should be completed underlineindividually in your Project Organizer.

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Reflection

Individually reflect on Task 1, using the questions provided:

1. At the beginning of this task, you were asked to predict what population growth might mean for our future. Look back at your prediction: after collecting all the evidence today, how would you change or add to your prediction? Use evidence from the task to justify your changes or additions and record below.

7th Grade Science Unit 2: Matter Matters
Task 1: Explosions in Human Population

2. In this task, we focused on the crosscutting concept of:
   - **Cause and Effect**: cause and effect relationships may be used to predict events.

   Where did you see examples of **Cause and Effect** in this task?

3. Now that you have learned more about how availability of resources affects human population, what questions do you still have?

7th Grade Science Unit 2: Matter Matters
Task 2: Unequal Access to Resources

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Engage
In the last task, you discovered that humans, like all organisms, need natural resources to support life. As our population grows, so does our need for more and more of these natural resources. Where do these resources come from? And what lengths will we go to in order to extract these natural resources from the Earth?

As a class, watch a video about fracking and answer the questions below in pairs.
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?

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Explore
The questions now become: Why isn't there an unlimited amount of resources for us to use? Why are some resources, like natural gas, available in some places but not others? To answer these questions, we have to understand how geoscience processes create the resources around us.
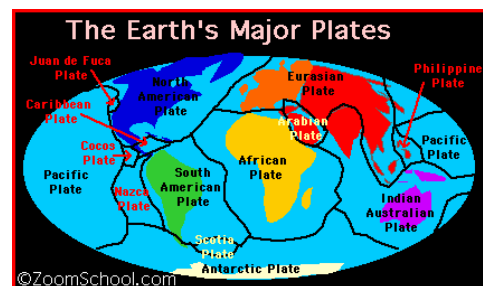
In Unit 1, you learned that the continents have moved over time. The continents actually sit on top of what we call tectonic plates, and these are what are moving. **Cause and Effect:** At their boundaries, plates can bang into, dive under, split further apart, or slide along each other. This is what creates different geologic features, like mountains, volcanoes, earthquakes, and mid-ocean ridges.

It is plate tectonics that create the beautiful environments we see today! Now it's time to see how this leads to the distribution of resources we have today.

Stanford NGSS Integrated Curriculum 2018

7th Grade Science Unit 2: Matter Matters
Task 2: Unequal Access to Resources

1. Your task is to <u>leave your home group</u> and become an expert in one resource. When you move to your expert group, fill in the chart below so you will be prepared to report back to your home group.

Assigned Resource: _____		
What caused it to form?	Where can you find it?	How have humans affected it?

2. <u>Return to your home group</u> and report out on the resource you became an expert in. Take notes on others' resources below:

Other Resource	What caused it to form?	Where can you find it?	How have humans affected it?

7th Grade Science Unit 2: Matter Matters
Task 2: Unequal Access to Resources

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Explain

1. <u>As a class</u>, watch the following video that summarizes many of the things you have learned about natural resources: https://www.youtube.com/watch?v=LxHdUd_Q12Y (Stop at 2:45).

2. <u>Individually</u>**, construct an explanation:** 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.

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Elaborate

In your project, remember that we not only want to provide more equitable access to a resource, we also want to do it in a way that doesn't hurt the environment. <u>In pairs</u>, discuss the following question: What do you think humans can do to help preserve the resources you learned about today so that we don't run out?

7th Grade Science Unit 2: Matter Matters
Task 2: Unequal Access to Resources

Unit Essential Question: *How can models of matter help us understand the resources we use?*

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?

This should be completed <u>individually</u> in your Project Organizer.

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Reflection
<u>Individually</u> reflect on Task 2, using the questions provided:

1. At the beginning of this task, you watched a video on fracking and thought about the availability of natural gas throughout the world. Look back at your response: does this example seem to match what you have learned about distribution of other resources? Why or why not?

2. In this task, we focused on the crosscutting concept of:
   • **Cause and Effect**: cause and effect relationships may be used to predict phenomena.
   Where did you see examples of **Cause and Effect** in this task?

3. Now that you have learned more about how natural resources are distributed, what questions do you still have?

S C A L E

7th Grade Science Unit 2: Matter Matters
Task 3: What is Water?

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Engage
In the last task, you learned about the processes that distribute natural resources around the world. One of those was water—a very important resource for humans and all other organisms. <u>As a group</u>, take a look at the picture of an environment that your teacher provides. Discuss the questions below and be prepared to share your observations with the class.

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

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

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Explore
Over the last few tasks, you've explored lots of different examples of matter, like water. You've thought about where water comes from and how it is used, but what is water and how does it behave in different conditions?

1. **Developing and Using Models:** <u>With a partner</u>, make a model of a water molecule using the materials and instructions provided by your teacher. You will reference this model throughout the task.

2. **Scale, Proportion, and Quantity**: This is just what one water molecule looks like. When you see water in real-life, you are seeing millions of water molecules together. But as you saw in the picture at the beginning of this task, water can come in many different forms—rain, snow, ice, even invisible in the air! How do the water molecules behave differently in these different forms?
    a. <u>As a group</u>, conduct the following investigations to observe water in different states and record your observations.
    b. Use the **cause and effect** relationship you identify in the experiment to predict how the molecules might be behaving. Use the discussion questions to help you!

7th Grade Science Unit 2: Matter Matters
Task 3: What is Water?

Station 1: Liquid Water—Hot and Cold		
Diagram of Experiment		Observations
Warm Water	Cold Water	

Station 2: Gaseous Water (Water Vapor)		
Diagram of Experiment		Observations
Flask Pushed Into Hot Water	Flask Pushed Into Cold Water	

Station 3: Solid Water (Ice)		
Diagram of Experiment		Observations
Frozen	Liquid	

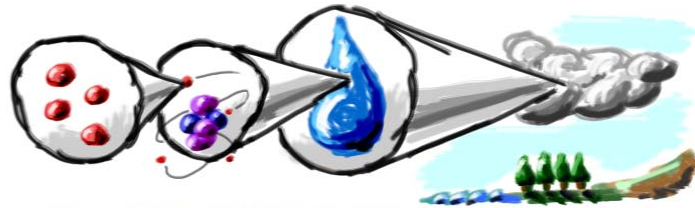**7th Grade Science Unit 2: Matter Matters**
Task 3: What is Water?

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Explain

You have investigated how water behaves in different conditions and made models of your hypotheses. Now let's delve into the science *within* the matter.

1. Individually, read the following article that tells you about matter. Use the annotation protocol provided by your teacher to make sense of the ideas.

> **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.

Using the article and the *Explore* activities, discuss the questions below with your partner:

1. Refer back to your model: Pointing to different parts of your model, explain to your partner why the name "H^2O" makes sense for a water molecule?

7th Grade Science Unit 2: Matter Matters
Task 3: What is Water?

2. **Developing and Using Models**: Draw models of how you think the water molecules were behaving in the experiments:

Warm Water	Cold Water	Frozen Water

3. **Cause and Effect** – Think back to your investigations:

    a. What do you think causes water to change into a different state?

    b. Do you think the actual molecules change when water is in a different state? If not, what else might be happening?

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Elaborate

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.

7th Grade Science Unit 2: Matter Matters
Task 3: What is Water?

Unit Essential Question: *How can models of matter help us understand the resources we use?*

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

This should be completed <u>individually</u> in your Project Organizer.

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Reflection
<u>Individually</u> reflect on Task 3, using the questions provided:

1. At the beginning of this task, you identified different examples of water in an environment. Look back at your initial response: after learning everything you have about properties of water, how would you categorize each of the examples you identified: as solid, liquid, or gas?

2. In this task, we focused on the crosscutting concepts of:
   - **Cause and Effect**: cause and effect relationships may be used to predict phenomena.
   - **Scale, Proportion, and Quantity**: scaled models can be used to study systems that are too large or too small.
   Where did you see examples of **Cause and Effect** and **Scale, Proportion, and Quantity** in this task?

7th Grade Science Unit 2: Matter Matters
Task 3: What is Water?

3. Now that you have learned more about the molecular structure of water and how it behaves in certain conditions, what questions do you still have?
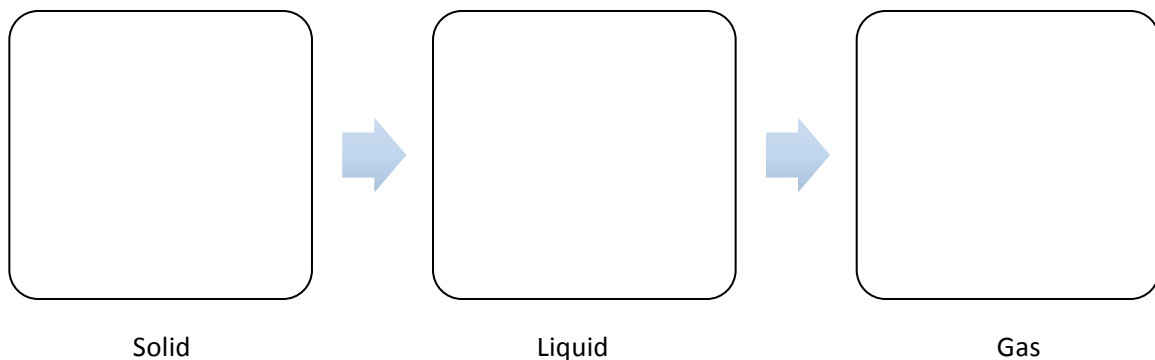
7th Grade Science Unit 2: Matter Matters
Task 4: Changing States

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Engage
In the last task, we observed water in different states—solid, liquid, and gas. But how do we change water from a solid to a liquid to a gas? And what is happening to water at the molecular level to change its state? Using your own prior knowledge and experience, individually draw what you think is happening to the molecules when water is in different states and write down an idea of what causes water to change from one state to another.

| Solid | Liquid | Gas |

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Explore
In the last task, you did experiments with water in real life and made hypotheses about how the water molecules were behaving. Now you will be able to see the movement of molecules using a computer simulation model developed by scientists! As a group, follow the instructions below:

1. Open the simulation on your computer by going to the following website:
    https://phet.colorado.edu/sims/html/states-of-matter-basics/latest/states-of-matter-basics_en.html.

2. Select "States" on the left-hand side.

3. From the *Atoms and Molecules* on the right, select "Water" and change the thermometer to Celsius.

4. Use the buttons on the right to change the water from solid to liquid to gas. In each state, observe for at least one minute and then record your observations in the data table on the next page.

7th Grade Science Unit 2: Matter Matters
Task 4: Changing States

State	Temperature (Celsius)	Diagram (Model)	Observations of Particle Motion	Kinetic (Motion) Energy of Particles *Circle one*
Solid				High Medium Low
Liquid				High Medium Low
Gas				High Medium Low

7th Grade Science Unit 2: Matter Matters
Task 4: Changing States

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Explain

Developing and Using Models: Now that you know how water molecules behave in different states, let's make a model. <u>With your group</u>, plan a skit that shows the science behind water in different states and what **causes** the changes. When you narrate your skit, you must include the following science words:

- o   Particles
- o   Molecules
- o   Kinetic Energy

- o   Motion (or move)
- o   Thermal Energy
- o   Temperature

- o   Solid
- o   Liquid
- o   Gas

If you are unsure what some of these science words mean, use the definition cards provided by your teacher or research them with your group. Use the space below to <u>individually</u> record any planning of your skit since you will be describing your skit on your own in the next activity.

7th Grade Science Unit 2: Matter Matters
Task 4: Changing States

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Elaborate

Before you have an opportunity to present your skit to the rest of the class, use the Stronger Clearer protocol to get feedback and make revisions.

1. **Individual Think Time:** Turn your student guide over so you can't see it. Take a minute to think about how you will explain your skit to a first partner.

2. **Partner Discussion 1:** You will work in pairs with another student in a different group. One of you will be Student A and the other Student B. Student A will start first:
   - **Student A:** Without looking or reading what you wrote down, describe your skit using as many of the science words as you can remember.
   - **Student B:** Listen and ask clarifying questions. Ask questions to help Student A explain states of matter and use the science terms. For example, you might ask, "Does your skit have all the states of matter?" or "In your skit, do you describe thermal energy, particle motion, and temperature?"
   - **Both Student A and Student B:** Write down any notes, thoughts, or questions that came up in this discussion.

   Now switch roles and repeat the steps above.

3. **Partner Discussion 2:** Repeat the partnering process with another student. Remember to try to strengthen and clarify your explanation. Write down new notes, insights, and questions.

4. **Partner Discussion 3:** Repeat the partnering process with another student. Remember to try to strengthen and clarify your explanation. Write down new notes, insights, and questions.

5. **Revision:** After you have worked with partners to clarify your skit, review your notes. Return to your group to revise and practice your skit, so that it is ready to present.

7th Grade Science Unit 2: Matter Matters
Task 4: Changing States

Unit Essential Question: *How can models of matter help us understand the resources we use?*

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!
  - o Create a few possible design sketches with captions explaining how they work.
  - o Explain some of the pros and cons of your solutions.

This should be <u>individually</u> completed in your Project Organizer.

Unit Essential Question: *How can models of matter help us understand the resources we use?*

Reflection
<u>Individually</u> reflect on Task 4, using the questions provided:

1. At the beginning of this task, you drew an initial model of water molecules in different states and came up with an idea of what causes water to change from one state to another. Look back at your initial drawings and ideas. Now think about what you have learned about particle motion using the computer simulation. How would you change or add to your initial drawings and ideas?

2. In this task, we focused on the crosscutting concept of:
   - **Cause and Effect**: cause and effect relationships may be used to predict phenomena.
   Where did you see examples of **Cause and Effect** in this task?

3. Now that you have learned more about what happens to water when thermal energy is added or removed, what questions do you still have?