twig SCIENCE

GRADE 5
MODULE 3

H2O Response Team

Monday, April 18th

Teachers: Please make sure to review this slide before teaching!

Each student will need a copy of the worksheet for reading more about desalination (after the video and discussion) and filling out the pros and cons. They'll also be using their Chromebooks today!

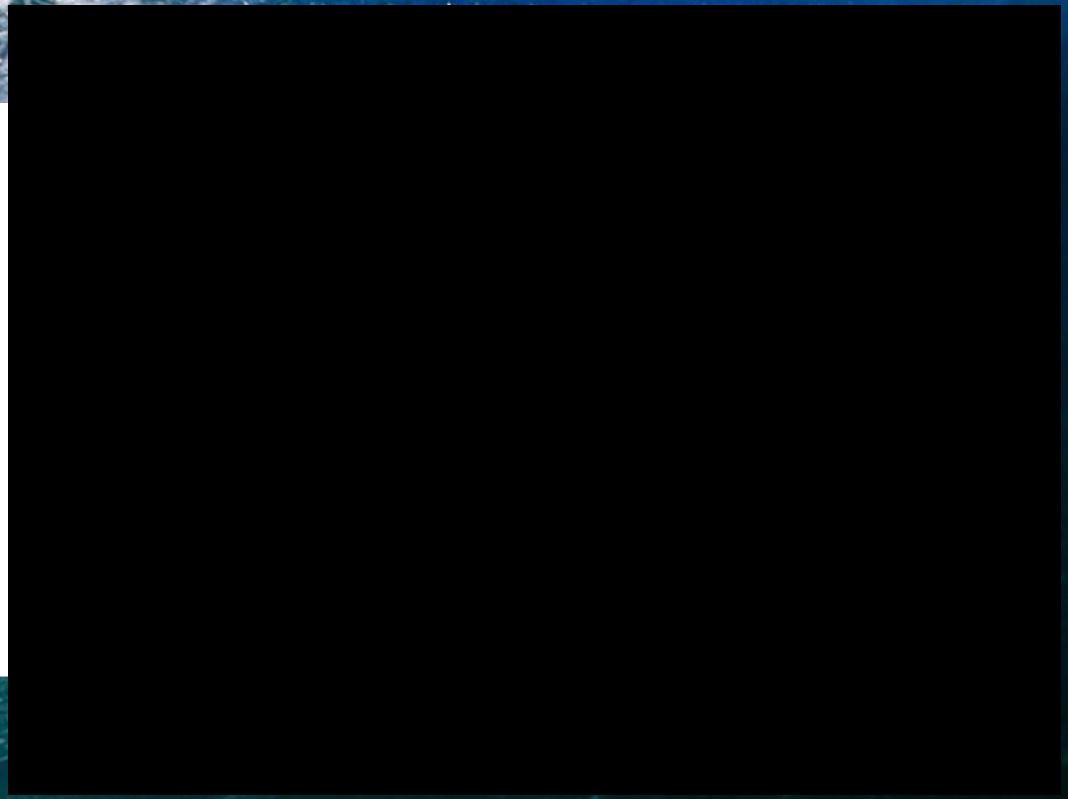
Overview:

- As a class, view videos and discussion points on Slides 3-7 (some info can be found in the Speaker notes)
- Students will work individually or in partners to complete the worksheet (see student facing slide info on slide 8)
    - They will need their chromebooks (GC has all resources already linked for all 3 classes)
    - Students are given work time to complete the sheet
- Bring the class back together to share out what they found as pros and cons of desalination

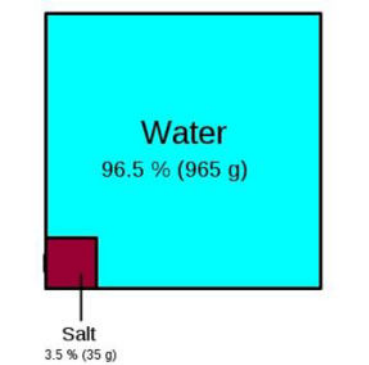
Driving Question 4

Why are oceans salty?

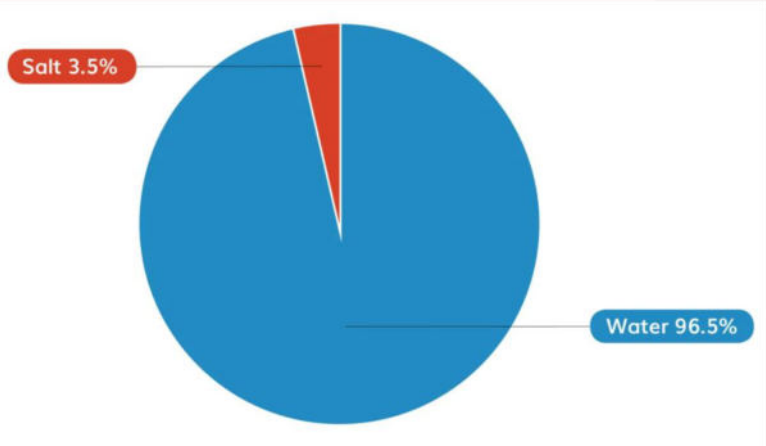
Click here for the link to the video!

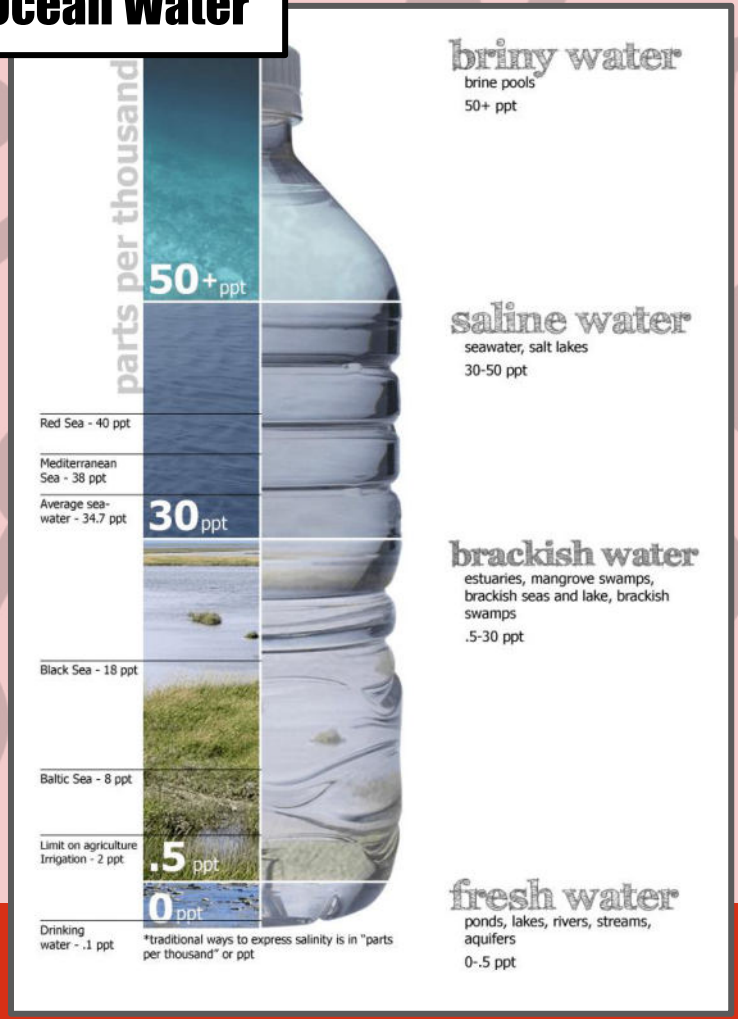


Visual Representations of Salinity of Sea/Ocean Water



What do you notice?
What do you wonder?





Discuss as a class using knowledge from our unit and the videos:

- ***Where is the majority of the Earth's water?***
- ***What do we know about this water?***
- ***Why are oceans salty?***
- ***How much salt is in seawater?***

- I think ocean water is salty because _____ .
- Based on my knowledge of , I think ocean water is salty because _____ .
- Your idea is interesting, however, .
- I agree with your idea that _____ , and I would add that _____ .

Lesson 1

A Drop in the Ocean

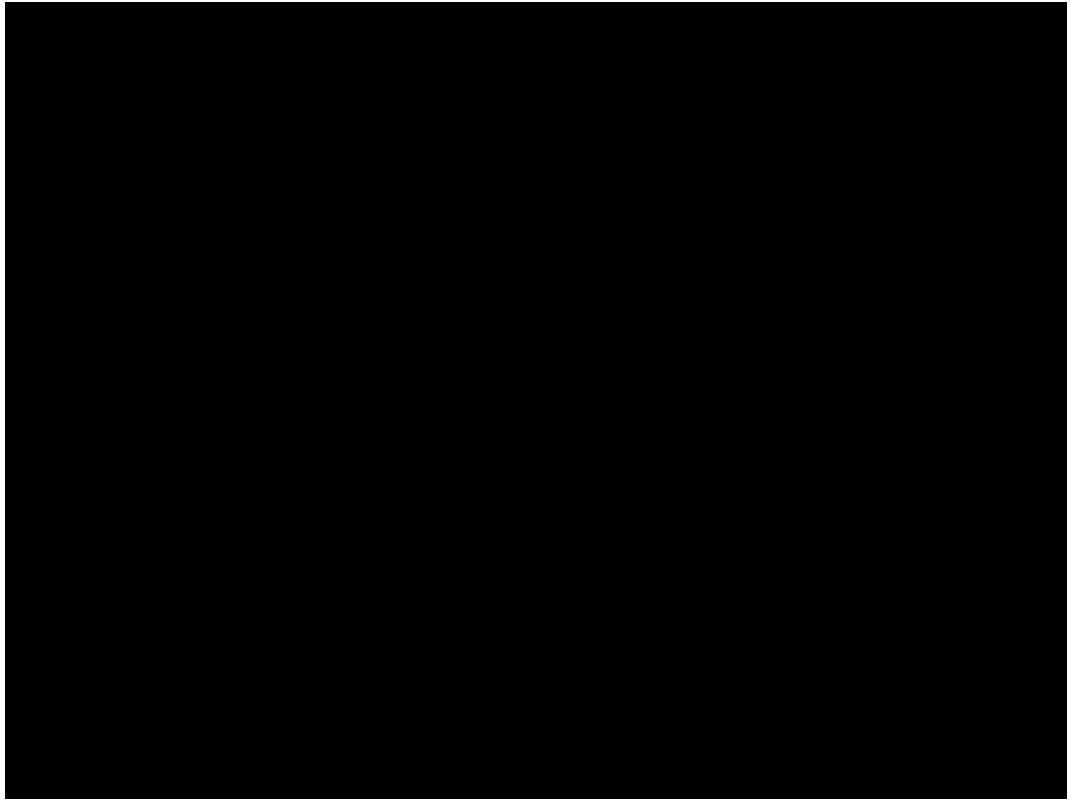
Click here for the link to the video.

Lesson 1

Possible Solutions?

Desalination

Students: Make sure you have your worksheet in front of you so you can take notes on the things you learn!

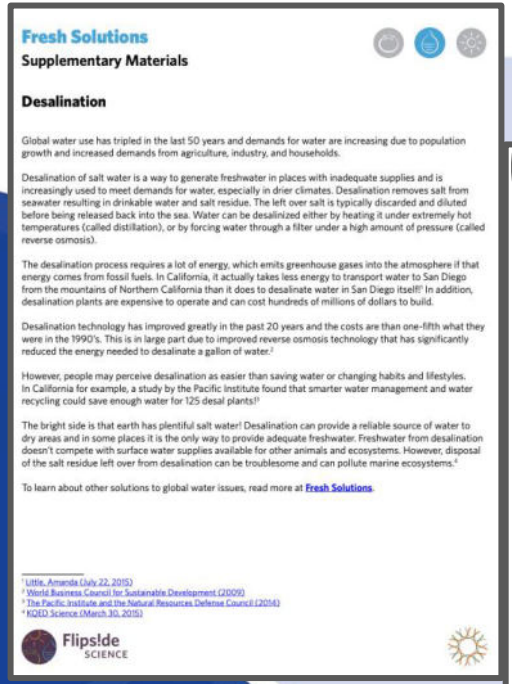


Click here for the link to the video.

Students: Please be ready to get your **Chromebooks** to complete the next steps!

Your turn!

Using your Google Classroom resources (under Desalination in the April 18-22 Topic), work as a team to complete the worksheet. You must utilize the resources provided to complete the lesson.



Fresh Solutions

Supplementary Materials

Desalination

Global water use has tripled in the last 50 years and demands for water are increasing due to population growth and increased demands from agriculture, industry, and households.

Desalination of salt water is a way to generate freshwater in places with inadequate supplies and is increasingly used to meet demands for water, especially in drier climates. Desalination removes salt from seawater resulting in drinkable water and salt residue. The left over salt is typically discarded and diluted before being released back into the sea. Water can be desalinized either by heating it under extremely hot temperatures (called distillation), or by forcing water through a filter under a high amount of pressure (called reverse osmosis).

The desalination process requires a lot of energy, which emits greenhouse gases into the atmosphere if that energy comes from fossil fuels. In California, it actually takes less energy to transport water to San Diego from the mountains of Northern California than it does to desalinate water in San Diego itself![1] In addition, desalination plants are expensive to operate and can cost hundreds of millions of dollars to build.

Desalination technology has improved greatly in the past 20 years and the costs are than one-fifth what they were in the 1990's. This is in large part due to improved reverse osmosis technology that has significantly reduced the energy needed to desalinate a gallon of water.[2]

However, people may perceive desalination as easier than saving water or changing habits and lifestyles. In California for example, a study by the Pacific Institute found that smarter water management and water recycling could save enough water for 125 desal plants![3]

The bright side is that earth has plentiful salt water! Desalination can provide a reliable source of water to dry areas and in some places it is the only way to provide adequate freshwater. Freshwater from desalination doesn't compete with surface water supplies available for other animals and ecosystems. However, disposal of the salt residue left over from desalination can be troublesome and can pollute marine ecosystems.[4]

To learn about other solutions to global water issues, read more at Fresh Solutions.

[1] Little, Amanda (July 22, 2015)
[2] World Business Council for Sustainable Development (2009)
[3] The Pacific Institute and the Natural Resources Defense Council (2014)
[4] KQED Science (March 30, 2015)

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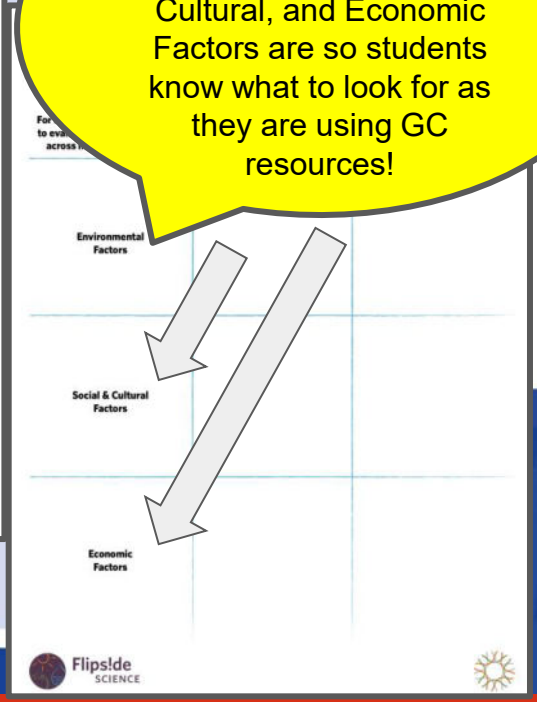

Environmental Factors

Social & Cultural Factors

Economic Factors

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Teachers: You may need to **review** what Environmental, Societal & Cultural, and Economic Factors are so students know what to look for as they are using GC resources!

Teachers: Do not proceed to the next slide until your class has had work time and are ready to reflect on what they've learned about desalination! Early finishers may check out the **Aquation: Freshwater Access Game** that has been posted on GC!

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After you have finished “Weighing the Benefits and Drawbacks of Desalination”, let’s discuss and reflect!

When using desalination…

- ***What are the environmental factor drawbacks?***
  - ***What are the benefits?***
- ***What are the social and cultural factor benefits?***
  - ***What are the drawbacks?***
- ***What are the economic factor drawbacks?***
  - ***What are the benefits?***

Do you think we should increase the number of desalination plants?

- ***Why or why not?***

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GRADE 5
MODULE 3

H2O Response Team

Tuesday, April 19th

Desalination Model

Teachers: Please make sure to review this slide before teaching!

Each student will need a copy of the worksheet for designing a desalination station (after the video and discussion) and explaining why they created the plant they did.

*Jones & Johnston have time to work on finishing yesterday's activity also!

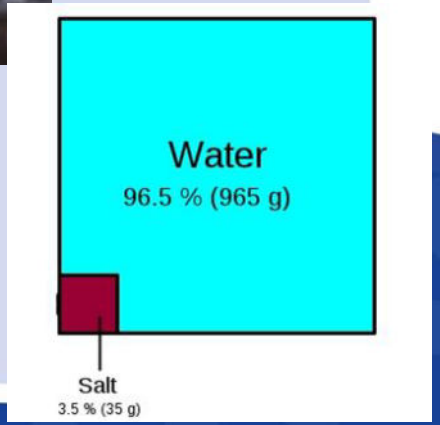
Overview:

- As a class, view videos and discussion points on Slides 3-7 (some info can be found in the Speaker notes)
- Students will work individually or in partners to complete the worksheet (see student facing slide info on slide 8)
    - They will need their chromebooks (GC has all resources already linked for all 3 classes)
    - Students are given work time to complete the sheet
- Bring the class back together to share out what they found as pros and cons of desalination

Teachers: Please hand out the desalination worksheet; students will need this after they watch the video!

Discuss:

Why is desalination important?
Think back to our discussions yesterday!



Can we drink salt water?

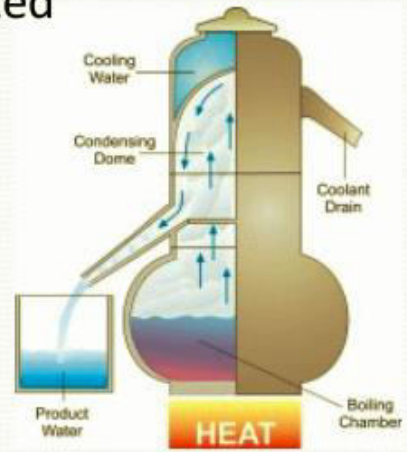
The Rime of the Ancient Mariner

Water, water, everywhere
And all the boards did shrink
Water, water, everywhere
Nor any drop to drink
-Samuel Taylor Coleridge

- Small quantities are not harmful, but it is counterproductive (it just makes you more thirsty!)
- Eventually, it can be dangerous, ultimately producing fatal seizures, heart arrhythmias and kidney failure

Desalination Technologies

1. Thermal Desalination Processes
   - Similar to the Earth's natural water cycle
   - Water is heated, evaporated and collected
   - Produces clean water and brine



Example: Multi-Stage Flash Desalination

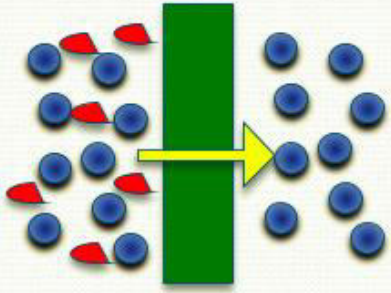
- Process uses multiple boiling chambers kept at different atmospheric pressures
- Saltwater enters the system and is boiled and evaporated in each chamber
- Process produces clean water and brine

Desalination Technologies

2. Membrane Desalination Processes
   - Saltwater is forced through membrane sheets at high pressures
   - Membrane sheets are designed to catch salt ions
   - Process produces clean water and brine

Example: Reverse Osmosis

- Saltwater is forced through a membrane at 600 to 1000 psi
- Multiple layers of membranes remove as many of the salt ions as possible



Desalination Plant!

Pay close attention to the order of the processes! You'll need this info to create your own desalination station!

Video link if it does not work above!

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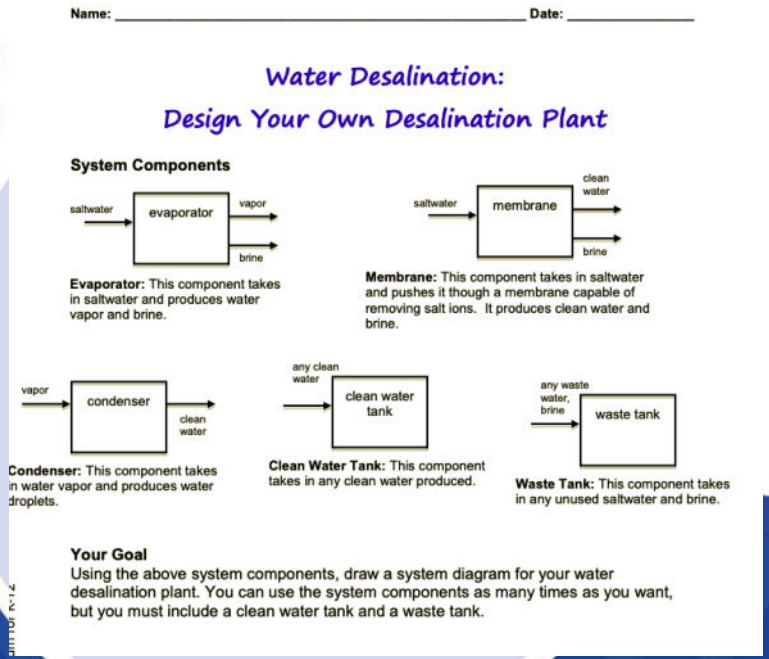
Students: Please be ready to get your **worksheets** to complete the next steps!

Your turn!

Using your background knowledge, work as a team or individually to complete the worksheet. You must design your own desalination station and explain **why you would create it in this way!**



Name: _____ Date: _____

Water Desalination:
Design Your Own Desalination Plant

System Components

Evaporator: This component takes in saltwater and produces water vapor and brine.

Membrane: This component takes in saltwater and pushes it though a membrane capable of removing salt ions. It produces clean water and brine.

Condenser: This component takes in water vapor and produces water droplets.

Clean Water Tank: This component takes in any clean water produced.

Waste Tank: This component takes in any unused saltwater and brine.

Your Goal

Using the above system components, draw a system diagram for your water desalination plant. You can use the system components as many times as you want, but you must include a clean water tank and a waste tank.

Teachers: Do not proceed to the next slide until your class has had work time and are ready to reflect on desalination! Early finishers may check out the **Aquation: Freshwater Access Game** that has been posted on GC!

Reflect!

Share out as teams/individuals how you created your Desalination Station and **Why**!

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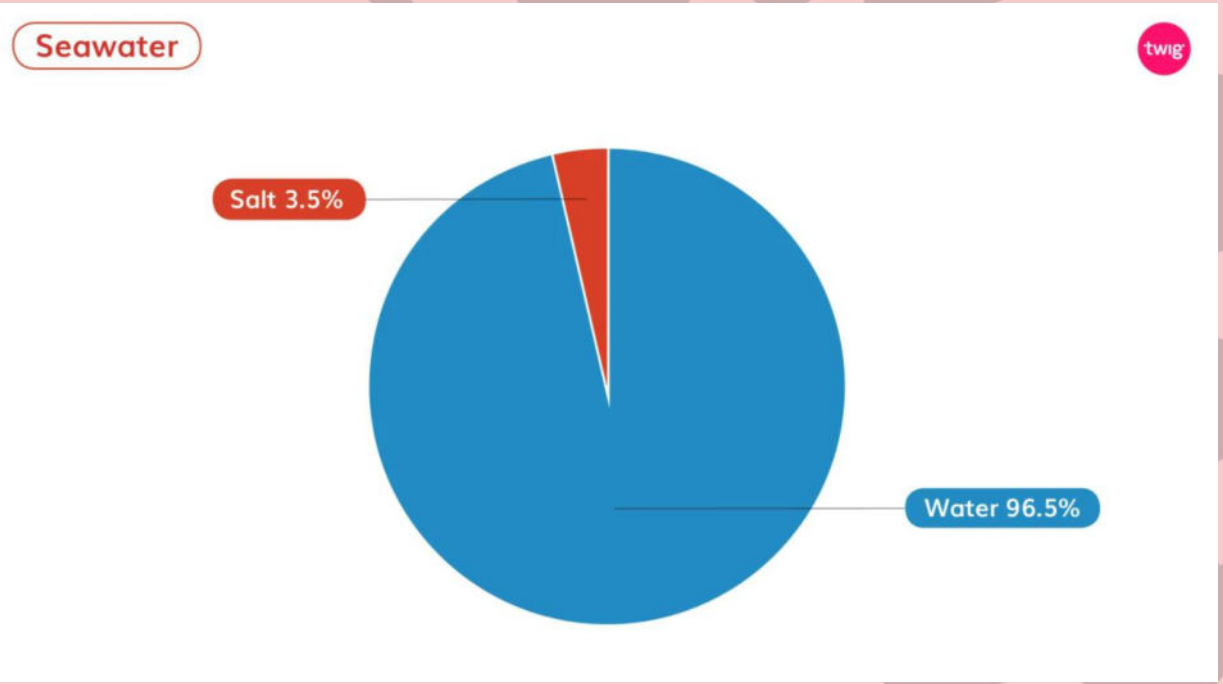
GRADE 5
MODULE 3

H2O Response Team

Wednesday, April 19th

Measure with Hydrometer or Make Desalination Model?

What do we notice about this graph?



Teachers: Students will need workbooks & tray materials **Don't forget to wrap string around the thermometer so it doesn't get dropped into the cylinder!

Remember, we only have enough for 4 groups at a time (others can do Aquation)

Prepare trays of materials for each group:

- 3 oz. paper cup filled with 3–4 tsp of salt
- 250 mL graduated cylinder filled with 200 mL of water
- Hydrometer
- Thermometer
- Measuring spoon set ⇦ Students will use TSP only

Introduce the Activity
In teams, students will work to make seawater that has the same salt content as real seawater.

Display the tray of materials. Read through the Salt Water Investigation Steps on page 81. Make sure students understand the instructions and answer any questions they have.

Ensure students understand that they will add salt to the water one spoonful at a time, using a 1 mL, or 2 mL measuring spoon. They will record each addition on a new row in the table, observe the water, measure the salt content, and record their findings in a graphic organizer.

Introduce Hydrometers & how to use them

What does the name hydrometer tell you about what this tool does?
Hydro- means it has to do with water.
-Meter means it has to do with measuring.

Explain that students will use the hydrometer to measure the saltiness of water. Hydrometers have their own system of measurement that must be converted.

Display the Hydrometer Reading Conversion Table visual. This visual allows you to convert the reading on the hydrometer to the percentage of salt in the water. Refer to the highlighted numbers.

What is a hydrometer?

First, let's break down the parts of the word **HYDROMETER**

HYDRO = means it has to do with water

METER = means it has to do with measuring

Hydrometer

How does it work? Check out the video below (start at 16 seconds)!

Open to Pg. 81 in your TWIG Notebooks!
Materials you will need for your group:
*Please pass these out AFTER reviewing slides 23-27 together.

Hands-On Investigation
Use the hydrometer to measure salination.

Hydrometer

- 3 oz. paper cup filled with 3–4 tsp of salt
- 250 mL graduated cylinder filled with 200 mL of water
- Hydrometer
- Thermometer
- Measuring spoon set

Students and Teachers: Since we have limited supplies, the groups that are not doing the experiment first will work on the Aquation game on Google Classroom!

Hands-On Investigation
Use the hydrometer to measure salination.

Hydrometer

Carry Out Investigations • Investigate how many spoonfuls of salt you must add to make the water in your cup as salty as ocean water.

1. Measure the temperature of your water. Write it here: _____
2. Use the Hydrometer Reading Conversion Table. Find the hydrometer reading that means 3.5% of the water is salt.
3. Write your target hydrometer reading here: _____
4. Add one spoonful of salt at a time to your cup of water. For each spoonful you add, measure and record the hydrometer reading, and write your visual observations.

*each spoonful is 1 teaspoon (TSP)

5. Keep adding spoonfuls of salt until you reach your target hydrometer reading.

Challenge

Students: Respond to the prompt on page 83 in your Twig Books after they complete the activity..

Hydrometer Reading	Percentage of Salt in Water (%)														
	10°C	11°C	12°C	13°C	14°C	15°C	16°C	17°C	18°C	19°C	20°C	21°C	22°C	23°C	24°C
1.02	2.5	2.5	2.5	2.6	2.6	2.6	2.6	2.6	2.7	2.7	2.7	2.7	2.8	2.8	2.9
1.021	2.6	2.6	2.7	2.7	2.7	2.7	2.7	2.8	2.8	2.8	2.9	2.9	2.9	3	3
1.022	2.7	2.8	2.8	2.8	2.8	2.9	2.9	2.9	2.9	3	3	3	3	3.1	3.1
1.023	2.9	2.9	2.9	2.9	3	3	3	3	3.1	3.1	3.1	3.2	3.2	3.2	3.3
1.024	3	3	3	3.1	3.1	3.1	3.1	3.2	3.2	3.2	3.3	3.3	3.3	3.3	3.4
1.025	3.1	3.2	3.2	3.2	3.2	3.2	3.3	3.3	3.3	3.3	3.4	3.4	3.5	3.5	3.5
1.026	3.3	3.3	3.3	3.3	3.3	3.4	3.4	3.4	3.5	3.5	3.5	3.5	3.6	3.6	3.6
1.027	3.4	3.4	3.4	3.5	3.5	3.5	3.5	3.5	3.6	3.6	3.6	3.7	3.7	3.8	3.8
1.028	3.5	3.5	3.5	3.6	3.6	3.6	3.7	3.7	3.7	3.8	3.8	3.8	3.8	3.9	3.9
1.029	3.6	3.7	3.7	3.7	3.7	3.8	3.8	3.8	3.8	3.9	3.9	3.9	4	4	4.1
1.03	3.8	3.8	3.8	3.8	3.9	3.9	3.9	3.9	4	4	4	4.1	4.1	4.1	4.2

Teachers: Leave this on the screen during the experiment!

Hands-On Investigation

Observe how to measure salination!

Note: Since the teacher won't add salt to our water initally, the hydrometer reading will be between 1.0 and 1.015. **Why?** The water you get from the faucet has been t**reated to make it safe to drink, but that it still contains traces of other substances, including salt, which affect its densit**y. This is why the hydrometer reading is above 0.

Challenge

Students: Respond to the prompt on page 83 in your Twig Books after they complete the activity..

Hydrometer Reading	Percentage of Salt in Water (%)														
	10°C	11°C	12°C	13°C	14°C	15°C	16°C	17°C	18°C	19°C	20°C	21°C	22°C	23°C	24°C
1.02	2.5	2.5	2.5	2.6	2.6	2.6	2.6	2.6	2.7	2.7	2.7	2.7	2.8	2.8	2.9
1.021	2.6	2.6	2.7	2.7	2.7	2.7	2.7	2.8	2.8	2.8	2.9	2.9	2.9	3	3
1.022	2.7	2.8	2.8	2.8	2.8	2.9	2.9	2.9	2.9	3	3	3	3	3.1	3.1
1.023	2.9	2.9	2.9	2.9	3	3	3	3	3.1	3.1	3.1	3.2	3.2	3.2	3.3
1.024	3	3	3	3.1	3.1	3.1	3.1	3.2	3.2	3.2	3.3	3.3	3.3	3.3	3.4
1.025	3.1	3.2	3.2	3.2	3.2	3.2	3.3	3.3	3.3	3.3	3.4	3.4	3.5	3.5	3.5
1.026	3.3	3.3	3.3	3.3	3.3	3.4	3.4	3.4	3.5	3.5	3.5	3.5	3.6	3.6	3.6
1.027	3.4	3.4	3.4	3.5	3.5	3.5	3.5	3.5	3.6	3.6	3.6	3.7	3.7	3.8	3.8
1.028	3.5	3.5	3.5	3.6	3.6	3.6	3.7	3.7	3.7	3.8	3.8	3.8	3.8	3.9	3.9
1.029	3.6	3.7	3.7	3.7	3.7	3.8	3.8	3.8	3.8	3.9	3.9	3.9	4	4	4.1
1.03	3.8	3.8	3.8	3.8	3.9	3.9	3.9	3.9	4	4	4	4.1	4.1	4.1	4.2

Teachers: Leave this on the screen during the experiment!

Hands-On Investigation

Use the hydrometer to measure salination.

Review

Review the results of your investigation.

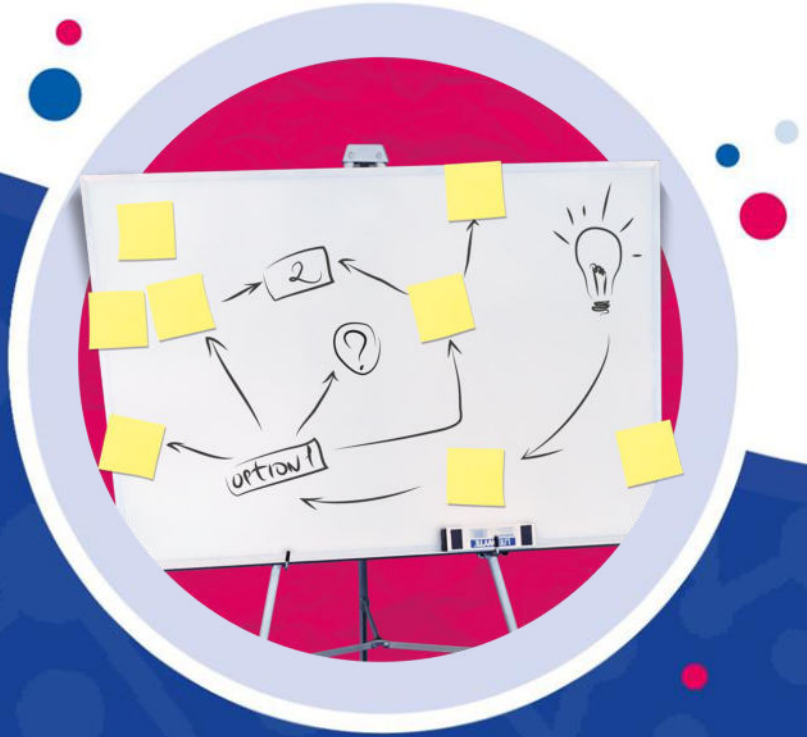
Connect to Science and Engineering Practices

Think about how scientists use models to communicate ideas.

SEP-2—Developing and Using Models

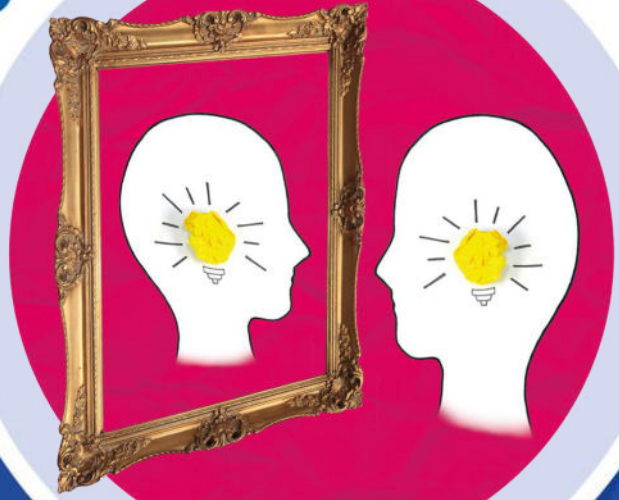
Develop and Use Models

Draw a model to show the amount of salt water in the ocean.



Reflect

Complete the Reflect activity.



Lesson 2

The Salty Sea

H2O Response Team

Review what you learned about the salinity of the ocean.

Reading for Evidence

Read and annotate an article about salt in the ocean.

LESSON 2

Why Is the Ocean Salty?

Read and annotate "Why Is the Ocean Salty?" As you read, use these close reading strategies:

- Circle key words.
- Underline confusing words or sentences.
- Add drawings or notes to remember important facts and ideas.

More than 95% of all the water on Earth is salt water. About 3.5% of its weight comes from the salt dissolved in the water. If we could remove all this salt and spread it evenly over the Earth's land surface, it would be more than 150 meters thick and the height of a 40-story building.

If you've ever swum in the ocean, you know how salty the water is. Chances are, you've even swallowed a bit of the water. Yuck! The large amount of salt in the ocean makes it taste pretty awful.

You know how much salt is in seawater. But how did it get there?

It might surprise you, but the salt in seawater mostly comes from the soil and rocks here on land. When it rains, the salt and minerals in soil and rocks are dissolved and washed into rivers connected to the ocean. Over a very long period of time, the salt built up, and the sea got more and more salty.

Some of the salt from the rocks is like the kind we eat. A lot of it gets used by organisms in the ocean.

The Manhattan Municipal Building, a 40-story building

Kids swimming in the ocean

NOTES

LESSON 2

Discuss

Discuss the article and answer the questions.

Discuss

Discuss systems and draw a diagram to show how the ocean gets salty.

Science Tools

Think about the science tools you used today.

Reflect

Complete the Reflect activity.

Lesson 3

How the Sea Gets Salty

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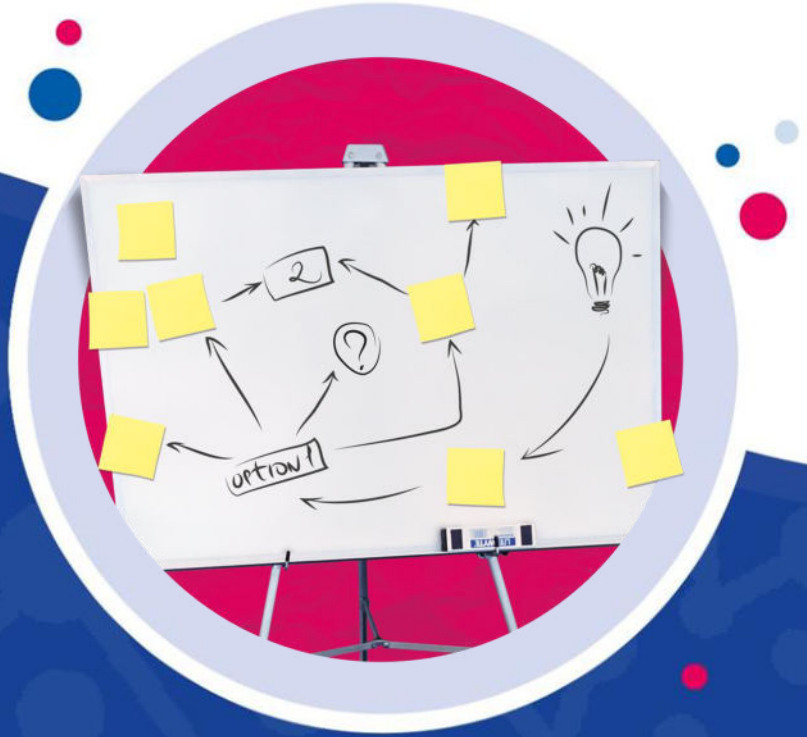
Review

Review how the ocean becomes salty.

Develop and Use Models

Model how the ocean becomes salty.

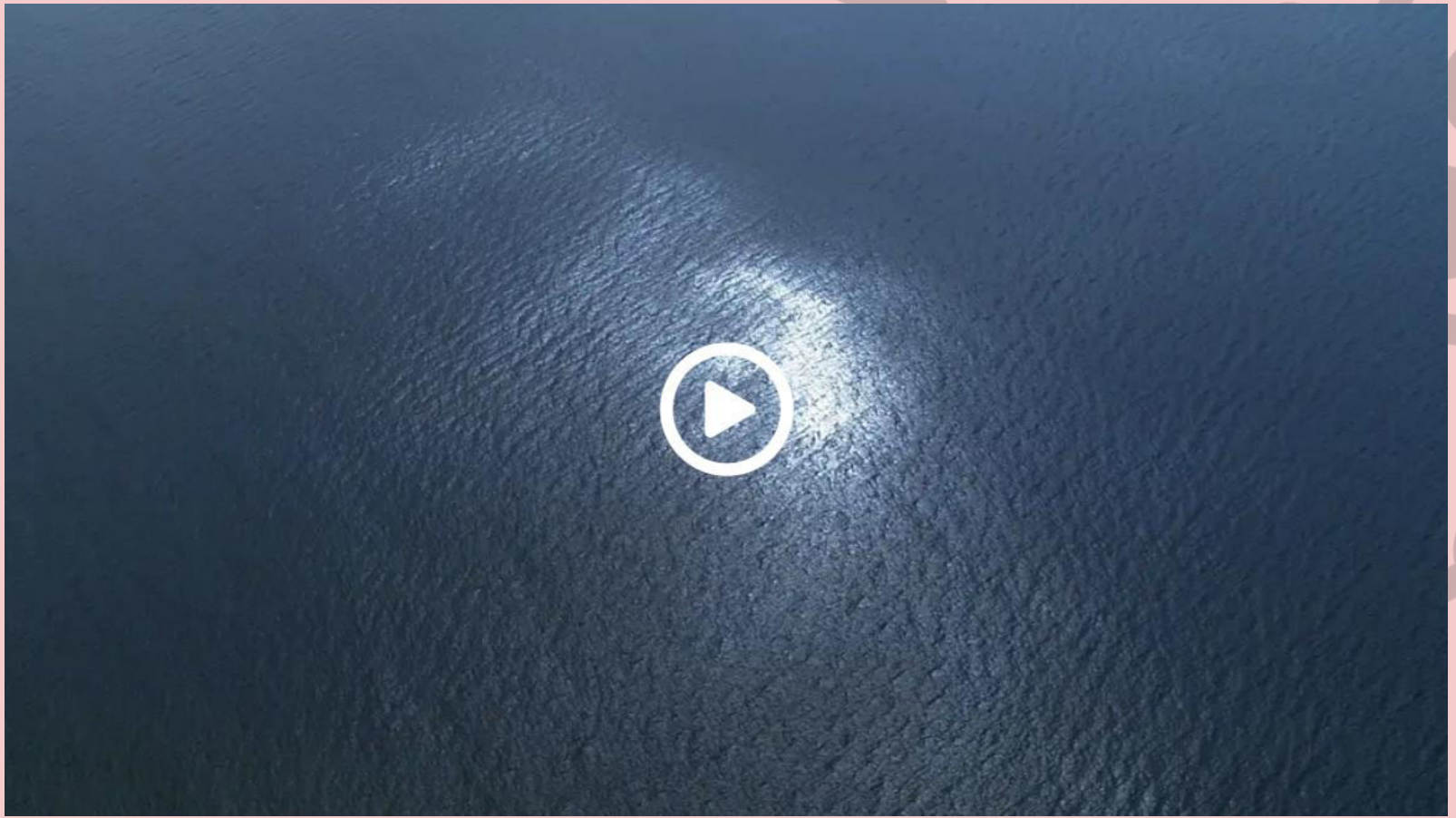


Discuss

Discuss how your model helps you understand the process of salination.

Observe the Video

Observe the video about why the ocean is salty.



Connect to Crosscutting Concepts

Think about the systems you observed today.

CCC-4—Systems and System Models

Reflect

Complete the Reflect activity.

Lesson 4

Salination Models

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Review

Review the process of ocean salination.

LESSON 2

Why Is the Ocean Salty?

Read and annotate "Why Is the Ocean Salty?" As you read, use these close reading strategies:

- Circle key words.
- Underline confusing words or sentences.
- Add drawings or notes to remember important facts and ideas.

More than 95% of all the water on Earth is salt water. About 3.5% of its weight comes from the salt dissolved in the water. If we could remove all this salt and spread it evenly over the Earth's land surface, it would be more than 150 meters thick and the height of a 40-story building.

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Some of the salt from the rocks is like the kind we eat. A lot of it gets used by organisms in the ocean.

The Manhattan Municipal Building, a 40-story building

Kids swimming in the ocean

NOTES

LESSON 2

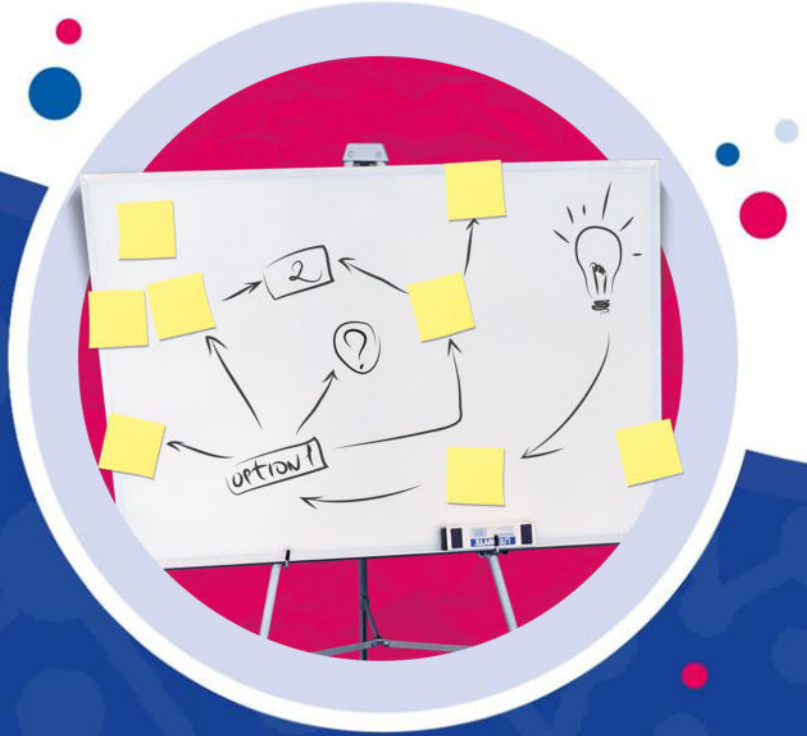
Ocean Salination Model Rubric

Students' models and presentations will be evaluated using the following rubric:

Feature	Standards	Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Design and Create a Water-Saving Campaign					
Participation in the design	5-ESS2-1, ESS2.A, SEP-2, SEP-8, CCC-4	Several team members did not contribute ideas during the design process.	Most team members contributed ideas during the design process.	All team members contributed ideas during the design process.	All team members contributed ideas equally during the design process.
Modeling Ocean Salination	5-ESS2-1, ESS2.A, SEP-2, SEP-8, CCC-4	The model reflects only one of the four elements.	The model reflects only two or three of the four elements.	The model accurately reflects the following elements: • Shows and describes what happens when rain hits rocks. • Shows how salt water gets to the ocean. • Shows what happens to salt in the ocean. • Shows the role that thermal vents have.	The model clearly and accurately reflects all four elements.
Sphere Interactions	CCC-4	The sphere interactions involved in each step of making the ocean salty are not labeled.	The sphere interactions involved in some steps of making the ocean salty are labeled.	The sphere interactions involved in each step of making the ocean salty are labeled.	The sphere interactions involved in each step of making the ocean salty are clearly labeled.

Develop and Use Models

Make a poster to model sphere interactions.



Do the Gallery Walk

Have a gallery walk to share and explain your poster.

Lesson 5

Exploring Desalination

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H2O Response Team

Share your ideas about water supply around the world.

Hands-On Investigation

Observe how to build a desalination model.

Hands-On Investigation

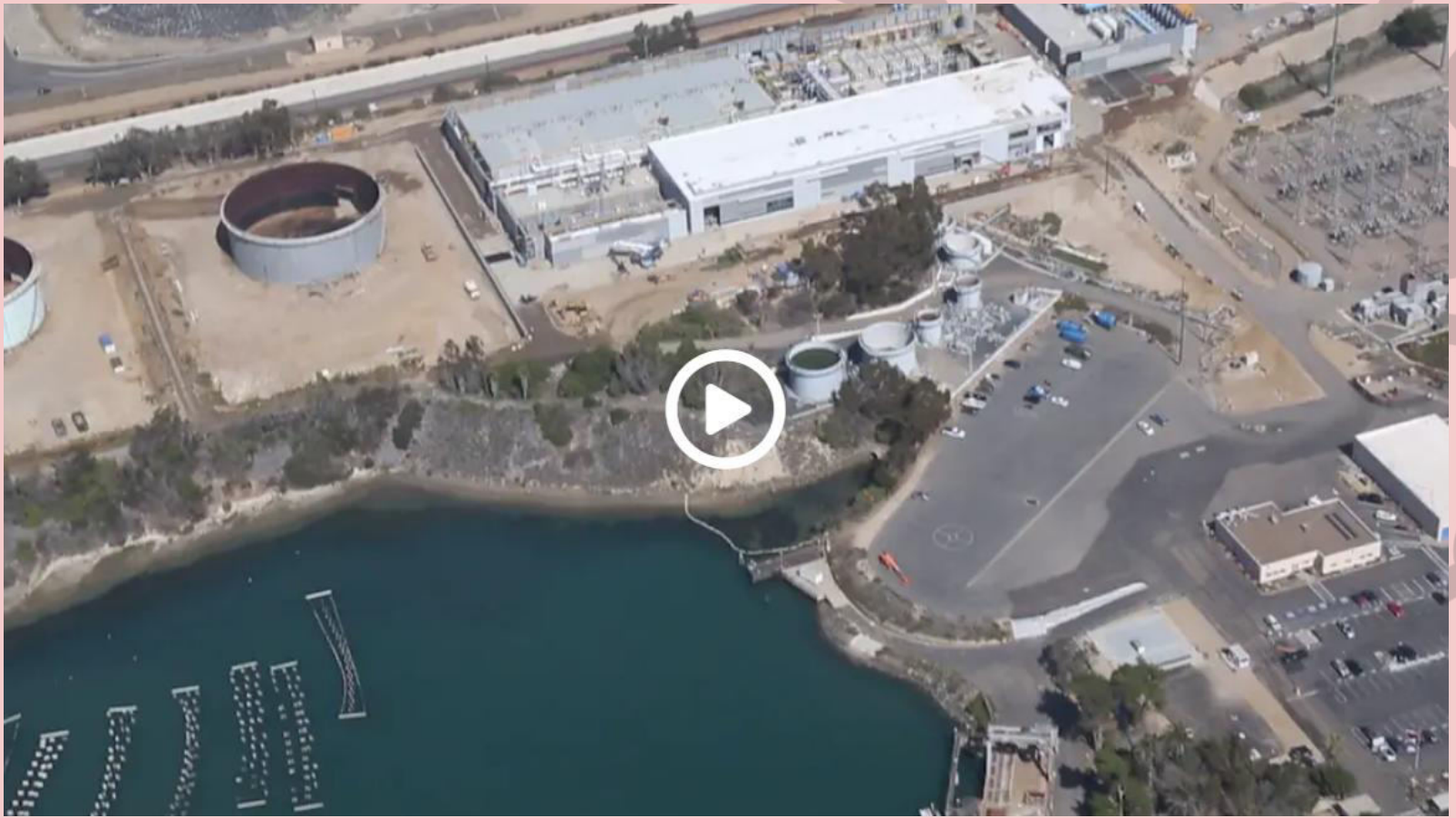
Build and draw your desalination model. Then make a prediction about what will happen.

Hands-On Investigation

Leave your model in a sunny place.

Summarize

Observe and summarize the video about desalination.



Connect to Crosscutting Concepts

Discuss systems, organisms, and ecosystems.

CCC-4—Environmental Principles and Concepts

Reflect

Complete the Reflect activity.

Lesson 6

To Salinate, or Desalinate?

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Discuss

Discuss the desalination investigation you set up last lesson.

Hands-On Investigation

Observe and record how your model has changed.

Discuss

Discuss the results of your desalination investigation.

Connect to the Driving Question

Discuss how ocean water gets salty.

Reflect

Complete the Reflect activity.

Research

Research large-scale desalination and make a poster of the process.

Lesson 7

Ocean Systems

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H2O Response Team

Review your work as a hydrologist in the H2O Response Team.

Read Aloud

Listen to a text about oceans and record sphere interactions.

Share

Share your notes on sphere interactions with your classmates.

Discuss

Discuss the sphere interactions as a class.

Connect to Disciplinary Core Ideas

Share your ideas about how to protect oceans.

DCI-ESS3.C—Environmental Principles and Concepts

Pre-Exploration

Complete the Pre-Exploration about natural systems.

ELA Reading Extension

Turn and talk about how one diagram helped you understand the concept of the text.