# Science Sustainability Sleuths Day 2

DiscoveryCube

This guide accompanies *Science Sustainability Sleuths Day 2*

## PRIOR TO TEACHING

### Subject
Salt Water

### Program Length
45 minutes – 1 hour

### Program Objective
Ocean water is super salty, so you don't want to drink it. But, through this fascinating investigation into salt water and this fun experiment, you will learn how to harness the power of the water cycle to separate salt from water.

### Next Generation Science Standards
*3-PS2-2:* Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

*5-ESS2-1*: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

*5-ESS2-2*: Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

*5-PS1-1*: Develop a model to describe that matter is made of particles too small to be seen.

*5-PS1-3*: Make observations and measurements to identify materials based on their properties.

*5-PS1-4*: Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

*5-PS2-1*: Support an argument that the gravitational force exerted by Earth on objects is directed down.

## What I Need Today

- [ ] warm tap water
- [ ] measuring cup
- [ ] measuring spoon
- [ ] salt
- [ ] mixing spoon
- [ ] paper
- [ ] pencil
- [ ] small weights, such small rocks, marbles, or coins
- [ ] clear plastic or glass bowl*
- [ ] small clear cup that can easily fit inside the bowl*
- [ ] plastic wrap*
- [ ] tape*
- [ ] sunlight or heat lamp*
- [ ] crayons, markers, or colored pencils (optional)

* For a faster experiment, you can also do this on the stove as a demonstration (or have students get help from an adult), but instead of using plastic or glass, make sure you use stovetop approved materials, such as a pot, boil-safe mug, and foil. Also, make sure you use proper safety gear, such as hot mitts.


## Vocabulary

*Desalination* – The process of removing salt and other minerals from a liquid (such as water).

*Water Cycle* – The movement of water around the Earth from liquid to vapor (gas) to ice (solid) and back again. The Water Cycle has several stages: evaporation, condensation, and precipitation.

*H2O* – The chemical formula for a water molecule: 2 hydrogen atoms and 1 oxygen atom.

*Accumulation* – When something is gathered together (such as liquid water molecules coming together to form a puddle or the ocean).

*Evaporation* – When liquids (such as water) change into a gas (vapor).

*Water Vapor* – Water in its gas form (above its boiling point of 100 degrees Celsius/212 degrees Fahrenheit). Steam is a form of water vapor.

*Condensation* – When gases (such as water vapor) change into a liquid.

*Precipitation* – When water falls from the sky as rain (liquid), snow (solid), sleet (solid), or hail (solid).

## Instructor Prep

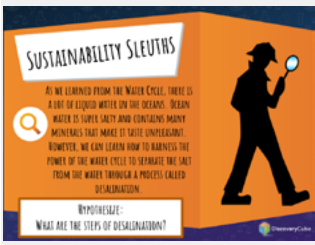
☐ In advance, send students a list of the materials needed for today's lesson.

*Using the power of the sun to separate salt from water can take a long time. If you want to speed up this experiment, it can be done on the stove, either as a demonstration, or with each student receiving help from an adult. Alternatively, you can have your students set-up their experiments and report back on their results next week.

# PROCEDURE

## What We'll Learn

Desalination is the process of removing salt and other dissolved minerals from water. Even though California is next to the world's largest ocean, it is expensive and difficult to turn ocean water into drinking water.





## What Will Happen?

Scientists ask questions and make predictions before they start investigating. Have your students hypothesize: after cleaning salt water, what will their newly cleaned water taste like?

- ○ Salty
- ○ Sweet
- ○ Fresh, clean water
- ○ Slightly salty

## What to Do

### REVIEW - DAY 1: LOS ANGELES' ENVIRONMENT

Have your students show off their water cycles in a bag. What did they learn from watching their experiment over the course of the week?

## VIDEO - HIDDEN WORLDS: MYSTERIOUS SALTS

To continue learning about the importance of water conservation, watch *Hidden Worlds: Mysterious Salts*: https://vimeo.com/502316390/7804495175

Reflect on the video: we have a limited amount of fresh, usable water on Earth. In fact, 97% of the Earth's water is found in oceans and is too salty to drink or use to grow most of our food. We also can't use water frozen in glaciers or polar ice caps, which make up about 2.5% of the water on Earth. That means only .5% of the water found on Earth is fresh, liquid, and ready for us to use. But why can't we just remove the salt from ocean water and turn it into fresh water? Let's do this experiment to find out!

## EXPERIMENT - DESALINATION-SALT SEAS SEPARATION


**1)** Most of us don't have easy access to a large body of salty water, so for this experiment, create your own salt water. In your clear bowl, mix about ½ cup of warm water with about 1 tablespoon of salt. Keep stirring the mixture until all the salt dissolves.

*Tips & Tricks*: If you are doing this on the stove, make sure you use a stovetop approved pot instead of a clear bowl, along with proper safety gear and an adult's help.


**2)** Place the bowl on a flat surface under direct sunlight or a heat lamp.

*Tips & Tricks*: If you are doing this on the stove, place the pot on a cooled stovetop burner.


**3)** Place the small clear cup right-side-up in the middle of the salt-water solution. If the cup is too light weight and is floating on the water, try putting clean weights inside, such as a couple marbles or coins.

*Tips & Tricks*: If you are doing this on the stove, use a boil-safe mug instead.

**4)** Cover the bowl with the plastic wrap, taping it around the edge. Make sure you do not stretch the plastic wrap too tightly.


*Tips & Tricks*: If you are doing this on the stove, press foil around the top of the pot instead of using plastic wrap and tape.

*Fun Fact*: The covering helps trap the heat from the sun or stove, warming the salt water solution. As the mixture heats, the water evaporates and begins to form drops of clean water that cling to the plastic wrap or foil lid.

**5)** Place a small weight in the middle of the plastic so the lid points the water downward toward the cup.


*Tips & Tricks*: If you are doing this on the stove, put the weight in the middle of the foil so it points toward the mug; then turn the stove onto low.

*Fun Fact*: The weight in the middle of the lid causes the droplets to run down towards the center and drip into the cup or mug, mimicking precipitation

**6)** Check on the experiment every half hour or hour. What's happening? If it's not a sunny day, try leaving the experiment outside for several days.


*Tips & Tricks*: If you are doing this on the stove, the experiment will happen much faster, so it's important to use a hot mitt to help you lift the foil lid every 5 to 10 minutes to check on the progress of the evaporation, condensation, and precipitation.

**7)** When you can see a pool of water in the small clear cup (or mug), remove the plastic (or foil) and taste the water. Does it taste salty? How does it compare to any water left in the larger bowl (or pot)? Can you see any salt crystals left behind in the bowl? For an added challenge, can you get the water to entirely evaporate, leaving behind only your dried salt?



*Fun Fact*: The process of removing salt and other dissolved minerals from water is called "desalination". Although California is next to the world's largest ocean, it is time consuming and expensive to clean water this way, so the process is not used very often. There are also concerns about how the desalination process impacts animals who live in the ocean.

## EXPERIMENT - WATER CYCLE COMIC STRIP

**1)** While you wait for your desalination experiment to separate the salt from the water, have your students create a comic strip that creatively explores the water cycle. Start by having them find a piece of paper, a pencil, and crayons, markers, or colored pencils (if they have them).

**2)** Fold the paper in half vertically, and then unfold so you see a crease running down the middle of the paper.

**3)** Then fold the paper horizontally; unfold and lay flat so you see 4 boxes.

**4)** Use a pencil to trace the folds, making it easier to see the 4 boxes.

**5)** Remind your students that after a rainfall, water gathers (accumulates) into puddles, pools, ponds, streams, rivers, lakes, and even the ocean. In your first box, draw a picture of a puddle, pond, or other body of water and add 3 cartoon water drops to the body of water, each representing a molecule of H2O. Label this box "accumulation".

**6)** Review from the previous lesson that evaporation (water changing from the liquid to the gas form) occurs when temperatures rise, heating the water and changing it from a liquid into a gas. The gas (water vapor) rises into the sky because it weighs less than the liquid water. In your second box, redraw the pond, draw the sun in the sky, and add the 3 cartoon water drops in the air, depicting water vapor. These are the same H2O molecules that were in the pond, but they have now evaporated. To show this, draw three arrows from the pond pointing upward toward the drops of water. Label this box "evaporation".






**7)** Explain that condensation (water changing from the gas to the liquid form) occurs when temperatures drop, cooling the water and changing it from a gas into a liquid and forming the beginnings of a cloud. In the third box, draw a cloud and add the 3 cartoon water drops to represent the same 3 H2O molecules. Label this box "condensation".

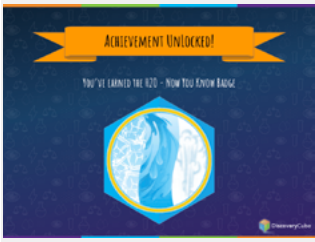
**8)** Remember clouds need bits of dust or ash to form. When the dust is no longer able to hold the liquid (or solid) water, the water will fall from the sky (precipitation). In the fourth box, draw the cloud and add the 3 cartoon water drops as rain falling out of the cloud. Label this box "precipitation".

**9)** As your students add color to their cartoon comic strip, review the stages of the water cycle to remind them that a single molecule of H2O (the "same" 3 cartoon water drops) goes through a cycle – the water never disappears, it just changes form.

# CONCLUSION

## What We Discovered

To complete the H2O Now You Know badge, have your students reflect on what they discovered. We would love to see pictures of their desalination experiments and water cycle comic strips. Please email pictures to *educationemail@discoverycube.org*.


## For Next Week

Have your students gather these supplies:

- [ ] ¼ cup salt
- [ ] ½ cup flour
- [ ] 3 tablespoons warm water
- [ ] measuring cups
- [ ] measuring spoons
- [ ] medium or large mixing bowl
- [ ] mixing spoon
- [ ] microwave
- [ ] markers or paint
- [ ] paper or template*
- [ ] pen or pencil (optional)
- [ ] parchment paper, wax paper, or cling film
- [ ] masking tape (optional)
- [ ] hot mitts (optional)
- [ ] *empty toilet paper tubes, paper towel tubes, and/or wrapping paper tubes (as many as possible). Note: these will not be needed until week 4.