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Exploring the Estuary in your Kitchen

Water is a fascinating and special substance that can be found in many different forms. Even in your home right now, you should be able to find water in its **liquid** form from your sink, **solid** form in your freezer as ice, and all around you in its **gas** form as **humidity**.

In this science experiment, we are going to explore different water states to answer the question: Which freezes faster, **freshwater** or **saltwater**? The Hudson River is a freshwater river that meets up with the saltwater of the Atlantic Ocean. The place where these 2 different waters meet is called the **estuary** which has a special mix of fresh and saltwater together, **brackish water**.

In the winter, the 3 water types react to cold temperatures differently. In this experiment, we are going to create our river freshwater, estuarine brackish water, and ocean saltwater to see what happens when they are exposed to cold temperatures.

Questions to Ponder:

Have you ever seen parts of the Hudson River freeze over? Look on a [map](#) - what part of the Hudson River is closest to you? Does this part of the river have water that is fresh, brackish, or salt water?

Materials Needed:

3 Containers

A Freezer

9 Teaspoons of Salt

A Marker

Water

3 popsicle sticks (optional)

One-cup measuring cup

Food coloring (optional)

Experimental Procedure

Step 1: Let others in your home know that you are doing this experiment in your freezer. We want to make sure you have help to create space in your freezer for this science experiment. Plus, they can also help out and join in on the fun!

Step 2: Label each of the containers with numbers 1, 2 and 3. Try to label a piece of tape to stick to the outside so you can protect your container. Otherwise, if you cannot label the containers, label your popsicle sticks if you have them with the numbers 1, 2 and 3 (each stick should have a different number). This labeling can help you identify the different mixtures that will be added.

Step 3: Fill each of the 3 containers each with 1 cup of cold tap water.

Step 4: We will be adding different amounts of salt to each of the 3 containers according to the chart below.

| Container | 1 | 2 | 3 |
|----------------|----------------|-------------|-------------|
| Amount of Salt | 3 Teaspoons | 6 Teaspoons | 0 Teaspoons |
| Represents | Brackish Water | Salt Water | Fresh Water |

Step 5: If you have popsicle sticks, place 1 stick into each of the 3 containers. If you do not have popsicle sticks, don't worry - the sticks are just a tool you can use to determine which has frozen faster. Place all 3 containers in the freezer.

If you have some food coloring in your pantry, you can add 1 drop of any color into each of the containers before putting it into the freezer. When dropping in your color, do not mix it afterwards - just put in one drop and do the next step.

Steps 6: We will be checking the containers of water in 15-minute intervals for an hour and a half and we will record our observations in the boxes below.

Make a hypothesis: *What do you think will happen to the liquids in our 3 different containers?*

Which container do you think will freeze the fastest? Why?

Time containers were put into the freezer: _____

| Container | 1 | 2 | 3 |
|--------------------------------------|---|---|---|
| 0 minutes Time: | <i>Liquid</i> | <i>Liquid</i> | <i>Liquid</i> |
| 15 minutes Time: | <i>[Write or draw observation here]</i> | <i>[Write or draw observation here]</i> | <i>[Write or draw observation here]</i> |
| 30 minutes Time: | | | |
| 45 minutes Time: | | | |
| 60 minutes Time: | | | |
| 75 minutes Time: | | | |
| 90 minutes Time: | | | |
| Which froze first? Second? Third? | | | |

What happened throughout your experiment? What did you observe? Was your hypothesis correct? Why do you think some water froze and some did not?

Here is a cool video explaining how fresh and salt water have different freezing points from Britannica. <https://www.britannica.com/video/179991/seawater-water-points>

Vocabulary

Liquid: A substance that takes the shape of its container.

Solid: Firm and stable in shape.

Gas: A substance that will expand freely to fill the whole of a container, having no fixed shape and no fixed volume.

Humidity: A quantity representing the amount of water vapor in the atmosphere in a gas.

Freshwater: Water without salt.

Saltwater: Water with salt.

Estuary: Where a river meets an ocean.

Brackish Water: Water found in an estuary as a mix of fresh and salt water.

Standards Alignment

P- PS1-1. Ask questions and use observations to test the claim that different kinds of matter exist as either solid or liquid.

K-PS1-1. Plan and conduct an investigation to test the claim that different kinds of matter exist as either solid or liquid, depending on temperature

2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties

K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

3-ESS2-3. Plan and conduct an investigation to determine the connections between weather and water processes in Earth system

MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and phase (state) of a substance when thermal energy is added or removed

MS-PS3-4. Plan and conduct an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the temperature of the sample of matter