DIY
LAKE SCIENCE

FREEZING LAKES

IN THE WINTER, WHY DON'T LAKES FREEZE INTO A SOLID BLOCK OF ICE?

ACTIVITY DESCRIPTION

In some parts of the world, lakes freeze during winter. Does all the water freeze, or just the surface? In this activity you'll explore water's unique properties of freezing and melting, and how these relate to density and temperature.

Age: 10 and up

Preparation: 15 minutes + freeze time
Activity: 25 minutes
Cleanup: 10 minutes

ACTIVITY MATERIALS

- Loaf pan-sized container, glass or clear plastic
- Blue and red food coloring
- Hot and cold water
- Two drinking cups of equal size (approximately 250 – 500 mL (1-2 c)) that can hold hot and cold water
- 12 blue ice cubes (made in advance using blue food coloring)
- Container for holding and pouring water (such as a pitcher)
- Spoon

MATERIALS NOTE

A rectangular glass baking dish or clear plastic food storage container, at least 7 cm deep or more, works well. Make your ice cubes ahead of time, by mixing about 500 mL of cold water with 10 drops of blue food coloring. Carefully pour the blue water into a standard, empty ice cube tray. Place in the freezer until frozen. Water used to fill the loaf pan-sized, clear container should sit for 30 minutes to reach room temperature.

SAFETY

Be careful not to spill the red and blue water you prepare. Be very careful with hot water to avoid burns. You may need an adult to help you.

STEP 1

Pour cold water into the rectangular container until the water is about 7 -10 cm deep. Wait about 30 minutes for the water to come to room temperature. This container represents a lake.

STEP 2

Fill one cup with blue ice you made earlier, then add cold water until the cup is nearly full. Place 10 drops of blue food coloring into the water and mix carefully.

STEP 3

Fill the other cup halfway with hot water. Place 10 drops of red food coloring into the cup and mix.

Tip: The hot water cup is only filled halfway so there is an equal volume of water in the two cups.

STEP 4

Predict what you think will happen when you pour hot red water into one side of the water-filled container and ice-cold blue water into the other side. Will the colors mix, stay separate or move in some other way?

Next, one person should slowly and carefully pour hot red water into one side of the large water-filled container, while the other slowly pours ice-cold blue water into the opposite side. Use the spoon to keep blue ice cubes from leaving the cup, or spoon out the blue ice before pouring the water.

STEP 5

Looking through the side of the container, watch the red and blue water to see how the colors move around in your lake. Do the red hot water and blue cold water move the same way? Was your prediction correct?

Tip: Watch the water move for about 2 minutes. Use your device's camera to take images of the water every 10 seconds, so you can go back later and see how the two colors of water moved over time.

STEP 6

Let the container of water sit for an hour. Come back and look at the red and blue water you poured into your lake. What do you see now?

STEP 7

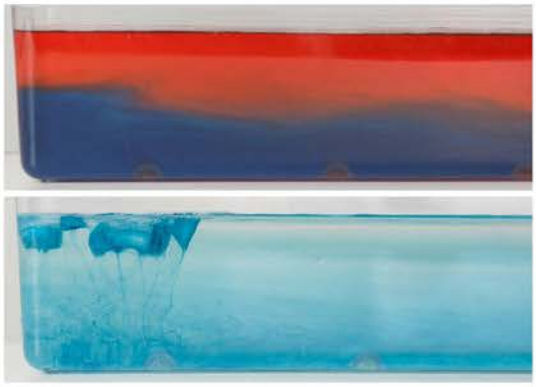
Pour the water from the large container down a sink. Rinse the container, then repeat Step 1. This time, predict what will happen when you put a handful of blue ice cubes into the large container of water. What do you think will happen to the cubes and any blue water that melts off the cube?

STEP 8

Carefully place a handful of blue ice cubes into the large, water-filled container. Watch what happens, again looking through side of container. Were your predictions correct?

WHAT'S GOING ON?

The density of water (or how much mass there is in a certain volume) changes with temperature. Cold water is denser than hot water. That's why you should have seen the hot red water rise to the top of your lake, while the cold blue water sank towards the bottom. Most liquids increase in density as temperature decreases, but water is unique. It's most dense at 4° C. When water freezes (at 0° C), it's less dense than liquid water—that's why the ice floated. When the ice melted, the blue water should have sunk to the bottom because the blue water's density is greater than the ice cube it came from!



Warm water usually floats on top of cold water, but ice is less dense than liquid water.

SURVIVING UNDER ICE

Water's amazing physical properties make it possible for organisms to survive the winter in frozen lakes. Because ice is less dense than liquid water, the ice stays at the top of the lake. The ice insulates the water below from the cold winter air. This keeps lake organisms from freezing! However, it's still not easy for the animals in a frozen lake—there's less light, oxygen, and food because of the surface ice layer. Lake organisms have several adaptations that allow them to survive in the cold, dark, oxygen-poor environment of a lake in the winter. For instance, many fish spend the winter in a dormant state, where their heart rate and movement slow down.

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CREDITS

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This activity from the DIY Lake Science app allows families to investigate and learn about lakes and bodies of water at home or on the go! The app features twelve hands-on investigations, as well as videos and a lake simulation.

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