

Ocean Currents and Water Density



Science
Film
Festival

Knowledge
Through
Entertainment

Ocean Currents

Water Density

Thermodynamics

Science Film Festival Films

▶ [Anna and the Wild Animals - Internship with the Penguins](#)

Learning Goals

- To understand what water density means.
- To understand how water density affects ocean currents.
- To understand ocean circulation.

Explanation of Scientific Principles

Ocean currents are masses of water that flow in a definite direction from one place to another around the world. Currents are caused by differences in temperature, differences in salinity, and by wind. The differences in the density of water can also cause currents to form and move. Density is affected by temperature and salinity. Cold water or water with dissolved salts (higher salinity) is denser than warm water or water without dissolved salts (low or no salinity).

Water gets denser with depth because cold, salty ocean water sinks to the bottom of the ocean basins below the less dense warmer water near the surface. The sinking and transport of cold water at depth combined with the wind-driven flow of warm water at the surface creates a complex pattern of ocean circulation called the "global conveyor belt".

Explanation of Connection to the Film

One of the aspects that the film looks at is a penguin species that lives and thrives off the coast of Africa known as the Cape Penguin. The climate is not as cold as the poles where most penguins are found however, they are well adapted to the climate at the Cape. This is due to the cold ocean temperatures (the cold Benguela current) that flows here.

The film explains the circulation of the cold Benguela current to help understand that cold water contains more oxygen therefore more nutrients and plankton are present in the water hence providing a better supply of food for the Cape Penguins. The connection of the experiment to the film is to help learners understand how ocean currents work.

Materials

- Glass bowl
- Jug of ice water
- Cup of hot fresh water
- Ground Pepper
- Food coloring

Preparation

1 Preparing the cold water: Add a glass of room temperature water into the fridge for 15 minutes to cool or alternatively add some ice cubes to water and let melt.

2 Preparing the boiling water: Boil your water to a 100°C and have it ready before you begin with the experiment. The water should be used hot in order to get better results.

Ocean Currents and Water Density

1

Fill the bowl $\frac{3}{4}$ full with cold water.

2

Sprinkle a bit of pepper on the surface of the water.

(The pepper represents the movement of the "currents").

3

Place several drops of food coloring into the cup of hot water.

4

Slowly pour $\frac{1}{4}$ cup of hot water into the bowl of ice water.

5

Observe how the hot water stays on the surface.

(Depending on the heat of the water, it may not be fully noticeable). Remind students that the top layer of water stays warmer; the cold water is denser and stays at the bottom.

6

Observe what happens as the hot water cools.

(It should begin to sink, mixing with the colder water).

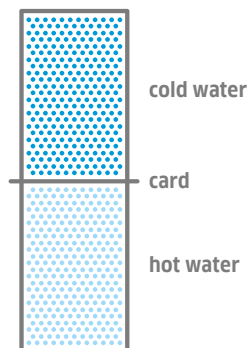
Also, note what happens to the pepper.

(It moves representing currents.)

7

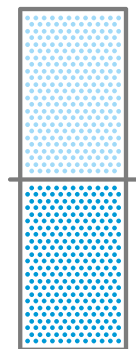
Repeat the experiment, but reverse the position of the two temperatures of water. This time, start with a bowl of hot water. Pour colored ice water into the bowl.

This experiment can also be carried out with warm and cold water.



The cold water and the warm water will mix.

The cold water and the warm water should not mix.



→ www.youtube.com/watch?v=A2nEh0Zlqo8&feature=youtu.be&t=1m15s

→ oar.marine.ie/bitstream/handle/10793/942/Lesson%20Plan_Science_Ocean%20Currents%20and%20Water%20Density_191213.pdf?sequence=1&isAllowed=y