CoSEE
CENTERS FOR OCEAN SCIENCES EDUCATION EXCELLENCE
BEST OF COSEE HANDS-ON ACTIVITIES

Activity Title: Melting Ice

Learning Objectives

This activity explores density, convection, stratification, and by inference the melting of ice bergs. Students are allowed an opportunity to make a hypothesis, test their hypothesis, and explain their observations.

Ocean Literacy Principles

#1 -- The Earth has one big ocean with many features

c. Throughout the ocean there is one interconnected circulation system powered by wind, tides, the force of the Earth's rotation (Coriolis effect), the Sun, and water density differences. The shape of ocean basins and adjacent land masses influence the path of circulation

d. Sea level is the average height of the ocean relative to the land, taking into account the differences caused by tides. Sea level changes as plate tectonics cause the volume of ocean basins and the height of the land to change. It changes as ice caps on land melt or grow. It also changes as sea water expands and contracts when ocean water warms and cools.

e. Most of Earth's water (97%) is in the ocean. Seawater has unique properties: it is saline, its freezing point is slightly lower than fresh water, its density is slightly higher, its electrical conductivity is much higher, and it is slightly basic. The salt in seawater comes from eroding land, volcanic emissions, reactions at the seafloor, and atmospheric deposition.

#6 -- The ocean and humans are inextricably interconnected

a. The ocean affects every human life. It supplies freshwater (most rain comes from the ocean) and nearly all Earth's oxygen. It moderates the Earth's climate, influences our weather, and affects human health

Supplies and Materials

- Graduated cylinder or beakers
- Clear plastic cups
- Bottle of fresh water
- Bottle of salt water (35 grams of salt in 1 liter) (Both fresh and salt water must be at room temperature and free of bubbles)
- Ice cubes (perfectly cubic ice cubes are greatly preferred)

Background

Students have observed melting but have not normally explored the impacts of convection or stratification on melting. A majority of students will probably predict that the ice cube in saltwater

will melt faster because of the common experience of adding salt to "melt" snow and ice on the roads or sidewalks (the ice only lowers the freezing temperature of liquid water to prevent refreezing).

However, since freshwater and saltwater are at identical temperatures, this is not a valid consideration.

The shape of the ice cube as it melts, the surfaces, and the overturning of the ice cube are fascinating to observe and explains the behavior of ice bergs melting in the ocean.

This exploration into ice melting, stratification, and convection can easily be transferred to understanding ocean circulation, thermohaline circulation, and impacts that global warming may have on ocean circulation.

Duration

30-45 minutes

Audience

Grades 6-12

Procedure

Have students hypothesize—Will an ice cube melt faster in freshwater or saltwater?

1. Using a graduated cylinder, measure and fill one cup with 250 ml of freshwater.
2. Using a graduated cylinder, measure and fill one cup with 250 ml of saltwater.
3. Place cups side-by-side on a flat surface.
4. Place an ice cube into the freshwater cup at the same time your partner places an ice cube into the saltwater cup. Record the starting time.
5. Observe both ice cubes in the cups. Record all observations by describing in words and drawing what you see happening in each cup.
6. Note the times at which each ice cube has completely melted.
7. Clean up your lab station.
8. Discuss your observations with your colleagues try to explain what happened in your cups.

Additional Extensions:

When an ice cube melts in cold water, the cold water sinks and is convection brings warmer water to the top which melts the ice cube faster.

When an ice cube melts in salt water, the freshwater floats on the more dense salt water and the solutions are stratified. Therefore the ice cube sits in cold water and melts more slowly.

How does life in the ocean depend on convection?

What factors directly affect salinity in the ocean?

How might global warming affect temperatures and salinities in the ocean?

How might a change in salinity affect Thermohaline Circulation in the ocean?

How would the Earth's climate change if the Thermohaline Circulation were to slow down or stop?

How might marine organisms be affected?

Assessment

Learning from this activity can be assessed by asking the following follow-up questions:

- What happens when freshwater is added slowly to saltwater?
- What happens when COLD freshwater is added slowly to WARM freshwater?
- Explain why you think the ice cube melted faster in the freshwater.
- Explain why you might have predicted that the ice cube may have melted faster in saltwater.
- Can you change the experiment and predict what would happen if….?

Acknowledgements

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