

Layered Ocean: Davy Jones' Locker

Overview

The world's ocean currents are driven by variations in density and caused by variations in salinity and temperature. These currents exist in layers within the water column. In this lesson, students observe and replicate a model of ocean layering using knowledge about the physical properties of water that cause layering. Students are challenged to create a model to determine if the mythical Davy Jones' Locker is possible: float a vial at the surface, float a vial at mid-water and sink a vial to the bottom.

Alignment with NGSS

Performance Expectations (Middle School)

MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. *Students will create models of ocean layering. They will discuss how ocean layering occurs and how it relates to local and global ecosystems.*

Science and Engineering Practices

Asking Questions/Defining problems: *Students will observe an unexpected phenomenon and work collaboratively to identify possible strategies to replicate it.*

Developing and using models: *Students will build a model of ocean layering based on knowledge of water properties.*

Analyzing and interpreting data: *Students will generate data on bottom water, mid-water and surface water temperatures and salinities in the layered model.*

Developing and using models: *Students will create their model, and utilize their experimental data to explain how ocean layering occurs.*

Crosscutting Concepts

Patterns

Students will identify patterns in rates of change and other numerical relationships in their salinity and density investigations.

Cause and effect: mechanism and explanation

Students will investigate how temperature and salinity impact density, and, in turn, how density impacts layering and buoyancy.

Scale, proportion, and quantity

This lesson leads students to recognize the steep gradients that form thermoclines and haloclines in the water column, as well as the mixing that occurs near the boundaries. They must use scale model to demonstrate layering.

Stability and change

Students will explore how changes in temperatures and specific gravity occur as part of ocean layer mixing.

Disciplinary Core Ideas

MS-ESS2.C The roles of water in Earth's surface processes. Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents.

This lesson focuses on how temperature and salinity impact water density, and how oceans move in currents.

MS-ESS2.D Weather and climate. The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents.

Students will make predictions to understand how their model relates to global and local weather and ecosystems.

Optional Pre-Lab Assignment

MIDDLE SCHOOL

Sink and Float for Solids: <http://www.middleschoolchemistry.com/lessonplans/chapter3/lesson4>

Optional Post-Lab Assignment

MIDDLE SCHOOL

Temperature and Density:

<http://www.middleschoolchemistry.com/lessonplans/chapter3/lesson6>