



PROJECT OCEANOLOGY



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 (High School)

HS-ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. *Students investigate how temperature and salinity impact density, and ocean layering.*

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



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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

HS-ESS2-C The Roles of Water in Earth's Surface Processes The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.

Students will use what they know about water properties to create an ocean layering model using temperature and salinity as variables.

Optional Post-Lab Assignments

Ocean Layers: Ocean Density: <https://earthref.org/ERDA/1010/>

A lesson by Scripps Institution of Oceanography in which students study a cross section of the Atlantic Ocean to understand ocean layering and deep ocean currents.

OR

Ocean Currents and Sea Surface Temperature:

<https://mynasadata.larc.nasa.gov/lesson-plans/my-nasa-data-lesson/?passid=9>

A lesson by NASA to help students identify a link between ocean temperatures and currents as related to our concern for current climate change.