

Measurement of the Depth of the Ocean

Overview

This lab will result in students designing, building and testing a simple mechanical depth gauge used to measure the depth of the ocean. This would be a “beyond” lesson after building the Sea Perch. This lesson is geared toward high school students and lends itself to physical and mathematical analysis.

Grades: 8th – 12th

Time: Five 45-minute periods

Objectives

The students will:

- Comprehend the physical properties of pressure and Boyle’s Law as demonstrated by the designing of a depth gauge
- Construct a capillary depth gauge
- Calculate the calibrated depth marks of the capillary tube
- Determine the margin of error of the depth gauge

Skills Attained

- Design, build and calibrate a measuring device
- Calculate the margin of error of a measuring device

National Science Education Standards

Content Standard A - Science as an Inquiry

- Abilities necessary to do scientific inquiry
- Crosses disciplines and grade levels

Content Standard B – Physical Science

- Structure and properties of matter
- Motions and forces
- Interactions of energy and matter

Content Standard D – Earth and Space Science

- Energy in the earth system

Content Standard E – Science and Technology

- Abilities of technological design
- Understandings about science and technology

Content Standard G – History and Nature of Science

- Nature of scientific knowledge

Lesson

Scenario

While running tests with a Sea Perch ROV, the depth sounder on the research ship breaks. You and your fellow research scientists must build this depth gauge and calibrate it so when you release your experiment you know where the ROV is in the water.

Because you are at sea, you have to construct something with objects found on the vessel. *Hint: an air bubble caught in a tube with water will contract as more pressure is put on the tube.*

However, you must know how much error exists in your measurements so you can evaluate your data. Is the bubble the size you expect it to be at a known depth? What are different ways you can test this while your ROV is in the water?

Materials:

Clear tubing – 3.5 inches (aquarium style tubing)

Hot melt glue

Colored blackboard

Permanent marker

Line with depth measurements

Meter stick

Calculator

Sea Perch with underwater camera attached

Monitor to view video images

Procedure

1. Attach the tubing on the blackboard in a vertical orientation with the hot melt glue
2. Plug the upper end of the tube with glue
3. Calculate the bubble size for a depth of 17 feet
4. Place the various calibration marks from 17 feet to 0 feet deep
5. Attach the capillary depth gauge to the Sea Perch so that the camera sees the calibrated depth marks and the gauge is in a vertical position.
6. Submerge the ROV underwater to a known depth. Observe and record the capillary gauge reading.

Option:

Construct a depth gauge using various diameter of tubing as a comparison.

Assessment:

- Compare the known depth to the observed reading on the capillary gauge
- Analyze how close the observed reading is to the predicted measurement.
- Determine the margin of error, if any, for the capillary gauge.