

Lesson Plan

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| Assessment | AFL, experiment, worksheet |
| Cross-curricular | |

Big Ideas

- Fluids are an important component of many systems.
- Fluids have different properties that determine how they can be used.

Learning Goals

- To have a basic understanding of what a fluid is.
- To build a hydrometer and understand how it works.

Specific Expectations:

- 2.1** follow established safety practices for using apparatus, tools, and materials
- 2.3** investigate and compare the density of a variety of liquids
- 2.7** use appropriate science and technology vocabulary
- 3.3** explain the difference between solids, liquids, and gases in terms of density, using the particle theory of matter
- 3.5** determine the buoyancy of an object, given its density, in a variety of fluids

Description:

This is **lesson one** in a five-lesson unit on fluids. The unit uses submarines as a framework on which to build knowledge and conduct experiments. This lesson focuses on fluid basics and building a hydrometer.

Materials/Resources:

Build a Submarine Part 1 Visuals, Experiment Worksheet, Assessment for Learning Rubric
 Objects of different densities (e.g. pieces of wood, rock (heavy and light rocks), different types of foam, etc.)
 Graduated cylinders or beakers (1 per group)
 Something to stir (e.g. skewer)

Salt, Straws, Play dough
 0.5 teaspoons measuring spoons
 Waterproof markers
 Wet sand (or similar heavier substance)

Safety Notes:

Introduction

Opening Discussion

- This unit is about FLUIDS.
- What do we know about fluids?
 - Both gas and liquids are fluids.
 - Fluids can flow, expand, contract, are affected by heat, etc.
- Fluids have some basic properties: mass, volume, density.
- We will start today by learning more about density – use slideshow.
 - Slide 2: What is density? (The number of particles in a given volume. High density means many particles and hence heavier. Etc.)
 - Slide 3 and 4: Discuss a few examples of high and low-density objects (e.g. a metal vs. air, a heavy piece of wood vs. a light one).
 - Pass around a few objects that illustrate different densities.
- Let's talk about the density of fluids now:
 - Slide 5: Do all fluids have the same density? (no – think e.g. oil and water, or air and water for that matter).
 - Slide 6: What happens when fluids of different densities are allowed to settle? (heavier ones go to the bottom)
 - Can density of fluids change? (Yes, due to temperature, salt content (e.g.)
- Let's build a device to MEASURE the density of different fluids. This is called a hydrometer

Action

Build a Hydrometer

The hydrometer is easy to make but students have to carefully mark lines on it as the height above the water that it floats at only changes by very small amounts as you add salt. You can have fun by making students first calibrate the hydrometer with their increasingly salty water and then use it to figure out the density of a “mystery” salt solution you prepared. Use the attached worksheet to record the data.

- Push some play dough into one end of a straw (fill a couple of cm of the straw)
- Fill a graduated cylinder with water almost to the top (so you can reach in with two pinched fingers and touch the surface of the water)
 - If the cylinder has a ml scale, note the volume. Otherwise make sure to add water using a measuring cup so you know how much water is in the beaker.
- Drop the straw into the water, plugged side down.
 - Straw should be at least half submerged. If not, drop in some wet sand (or add more play dough) to make it heavier and test again.
- Carefully pinch the straw at the water line. Pull out and mark this location carefully with a fine point water proof marker (if possible).
- Now carefully **draw additional marks on the straw** on each side of the one you already have at 1 mm or 2 mm intervals. About 10 total marks should do for now.
 - If you have different colours make each mark with a different colour. Otherwise you will just have to count your lines carefully when you do the experiment.

- Drop the straw in the water again. Note which line is closest to the surface of the water. Record on worksheet
- **Repeat several times** adding (e.g.) half a teaspoon of salt each time (2.7 grams). Record each time, at which line the hydrometer is balanced.
 - NOTE: Make sure to stir the salt with a skewer until all the salt is dissolved each time!
- This calibrates the hydrometer. Now you can determine what the density of the mystery salt solution is:
 - Float hydrometer in mystery solution. Record which line it balances at and extrapolate from earlier measurements what density of salt you think this is equal to (in g/ml)

Consolidation/Extension

Discussion

- So how does the hydrometer work? (The more buoyant it is, the higher it floats. Buoyancy increases as the density between the water and air inside the hydrometer increases – so the more dense the water is the more it can support and lift the hydrometer. Just like how people float on the Dead Sea!)
- How can we explain this in terms of particle theory?
 - Higher density = more particles per given volume.
 - More particles = more support for immersed object. **An object always sinks into the fluid until the volume of displaced fluid is equal in weight to that of the immersed object.**
- How are mass density and volume related then? (mass = density x volume, etc.)

Homework

- Create a title page for your unit project (which is simply all the worksheets put together). Be creative and remember that it's about submarines!
- Tomorrow we will start looking at a really cool application of these principles. A submarine!
- For **DAY 3** bring in:
 - An empty 2 litre pop bottle