Sink or Float- Get the Submarine Sitting Just Right!

Submarines rely on an expansive network of tanks and connecting lines to move fuel oil, freshwater and seawater in and out of the various locations on the tank. Everything within the submarine, including the submarine itself plays a part in whether the submarine sits on the surface, underwater and its position underwater.

In this activity students will experiment with different materials and volumes of materials to adjust their “submarine” in the water.

Objectives:

The student will be able to:

* Define density and volume relative to objects and their buoyancy in the water
* Measure the volume of a liquid

Vocabulary:

* Density is how much matter is taking up a defined space (volume); D = M/V
* Volume is the amount of space matter occupies
* Ballast is material used to balance position of vessels (ships, submarines); historically stones were used, present day ballast in ships is water

Materials and Procedures:

Using 50mL centrifuge tubes as “submarines”, students will use different materials and volumes of materials to experiment with where their submarine will sit in a pitcher/container of water.

* 50mL graduated centrifuge tubes with lids, one per student
* Clear tea pitcher or tub filled with water so location of centrifuge tube in container can be observed from the side
* Vegetable oil, extra water
* Pennies, nuts (hardware)
* Hot glue gun
* Balance (mass)\* optional

1. Observe the position of an empty centrifuge tube (filled only with air) when it is placed in the container of water
2. Remove centrifuge tube, dry and with help of adult hot glue a nut to the tip of the tube
3. Observe position of tube in water
4. Remove and now fill with fuel oil “ballast”; pick an arbitrary volume using the graduations on the tube
5. Remove tube, remove oil and now use the same volume of water- compare and contrast the position of the tube in water
6. Now encourage students to design placement of more nuts or pennies on the tune to have it sit in the container more like a submarine. Can they add ballast in various combinations to haveit sit in various locations in the container?