



Curiosity Guide #305

Buoyancy

Accompanies Curious Crew, Season 3, Episode 5 (#305)

Submarine Bottles

Investigation #7

Description

Create a submarine that dives!

Materials per person or team

- 16 to 20 oz. empty plastic bottle
- 3 rubber bands
- 24 pennies
- Tape
- Plastic tubing or long, flexible straw
- Drill
- One-fourth-inch drill bit
- Clay

Procedure

- 1) Drill a small hole in the cap of each bottle so that the plastic tubing can fit inside.
- 2) Drill three additional holes up the side of the bottle, spaced evenly apart. This will be the bottom of the submarine.
- 3) Make three separate penny stacks, one with 4 pennies, one with 8, and one with 12.
- 4) Wrap each penny stack in a piece of aluminum foil.
- 5) With a rubber band, strap the smallest stack close to but not covering the hole near the top of the bottle.

- 6) Repeat with the stack of eight pennies near the middle hole, and the stack of 12 near the bottom hole.
- 7) Feed the plastic tubing through the hole in the cap. Secure in place with a piece of clay.
- 8) Place the bottle in the tank of water so the bottle sinks.
- 9) Gently blow into the flexible tube and observe.
- 10) What do you notice?

My Results

Explanation

Buoyancy is determined by both an object's mass and volume. The relationship between those two factors is referred to as density. Density equals Mass divided by Volume. For example, an object that floats in water, like a piece of Styrofoam, is said to be positively buoyant because its density is less than the fluid around it. An object that sinks, like a nail, is said to be negatively buoyant because its density is greater than the density of the fluid around it. If an object floats suspended within a medium, it is said to be neutrally buoyant because the densities of both the object and the fluid are the same.

When an object is immersed in a fluid, either liquid or gaseous, there is always an upward force that works against gravity. This buoyancy force is equal to the weight of the fluid the object displaces. A submarine has the ability to change its density by taking on or pumping out additional water in the submarine's ballast in order to rise or sink.

More to think about: Submarines are amazing ships! Submarines use the sea water to add weight to the ship's ballast to sink, and they blow in compressed air to make the submarine rise. It's incredible that water can push up such heavy things, but have you ever noticed how much easier you can lift something when an object is underwater rather than on land? Water's pushy buoyancy force upward makes lifting lots of things easier, even another person! Try it sometime!

Keep wondering: So the next time you are boating, swimming, watching a hot air balloon, or designing your own blimp, you can think about the amazing, pushy power of buoyancy forces going upwards. If it weren't for buoyancy, it would really be a downer! Stay curious, and keep experimenting!

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