

SUBMARINE SCIENCE

AGES

Teens/tweens

PROGRAM DESCRIPTION

Submarines are large, powerful vessels that travel underwater. First invented in the early 17th century, they have been used for military missions, tourism, scientific explorations, and more. The secret to submarines is buoyancy, their ability to float in water or air. The ballast tanks of a submarine fill with water to sink the submarine deep into the ocean, or they fill with air so the vessel rises to the surface and floats on water. In this program, participants create a simple submarine out of a plastic bottle to test the water and air ratios needed to achieve buoyancy. Participants can also develop hypotheses on what happens if you fill the water bottle with different liquids, or travel in salt water vs. fresh water. Suggested runtime: 30–60 min.

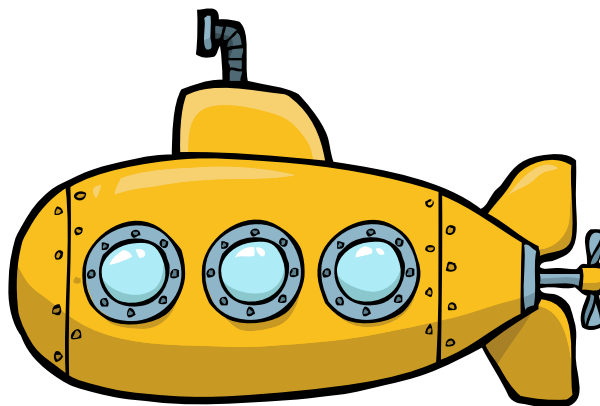


Image source: Shutterstock

MATERIALS AND PREPARATION

Materials:

- Plastic bottles (one per participant)
- Reusable bendy straws (one per participant)
- Pennies (24 per participant)
- Aluminum foil
- Rubber bands (3 per participant)
- Large bowls, or a kiddie pool, filled with water
- Small amount of clay

Preparation:

Before the program, hold each water bottle horizontal and drill or punch three evenly spaced holes across the bottom. See Resources for the original tutorial from the National Museum of the U.S. Navy.

TIP:

To study mechanical engineering, aerodynamics, or hydrodynamics in a more complex submarine experiment, see the Science Buddies experiment under Resources.

ADAPTATION:

For children, premake a few submarines so participants can start experimenting with buoyancy right away.

ADAPTATION:

For a family engineering night, provide snacks and have families design their own submarines. Hold submarine races, and don't forget prizes!

ADAPTATION:

Submarines are sometimes used to assist submersibles or remotely operated vehicles (ROV) for ocean exploration. Instead of building a submarine, consider partnering with a local school's robotics club to explore underwater robotics by building and testing simple ROVs.

GAME/ACTIVITY

To assemble the submarines:

- Wrap foil around three stacks of pennies (one stack of 4, one stack of 8, one stack of 12).
- In between the pre-drilled holes, wrap three rubber bands around the water bottle.
- Place the small stack of pennies under the rubber band closest to the cap.
- Place the medium stack of pennies under the middle rubber band.
- Place the large stack of pennies under the rubber band furthest from the cap.
- Slip the short end of a straw into the open end and secure it with clay.
- Place in water and allow it to sink (keep the straw above water).
- Blow in the straw to raise the submarine.

UNIQUE SPACE AND/OR PERSONNEL NEEDS

Due to the kiddie pool filled with water, this is a good program to take outside.

RESOURCES

Web

Penny submarine experiment from *National Museum of the U.S. Navy*:
<https://bit.ly/2ROFt6o>

Build a submarine video tutorial from *Science Buddies*:
<https://bit.ly/3wD1J1R>

“Bottled-up Buoyancy” from *Science Buddies*: <https://bit.ly/3wHh6qj>

“How Submarines Work” from *National Geographic Kids*:
<https://bit.ly/3vuoaWO>

“How Submarines Work” from *HowStuffWorks*: <https://bit.ly/3vr45AY>

Books

Non-fiction

In the Waves: My Quest to Solve the Mystery of a Civil War Submarine (2020) by Rachel Lance (YA/adult)

Secrets of a Civil War Submarine (2005) by Sally M. Walker (YA)

GAME/ACTIVITY

The Amazing History of Transportation (Machines in Motion) (2020) by Tom Jackson (children's)

Submarines at Sea (2017) by Louise A. Spilsbury and Richard Spilsbury (children's)

Flying Deep (2018) by Michelle Cusolito and Nicole Wong (children's)

Otis and Will Discover the Deep (2018) by Barb Rosenstock and Katherine Roy (children's)

Fiction

One if by Land, Two if by Submarine (2019) by Eileen Schnabel (YA)

20,000 Leagues under the Sea (1870) by Jules Verne (YA)

Mary Underwater (2020) by Shannon Doleski (children's)