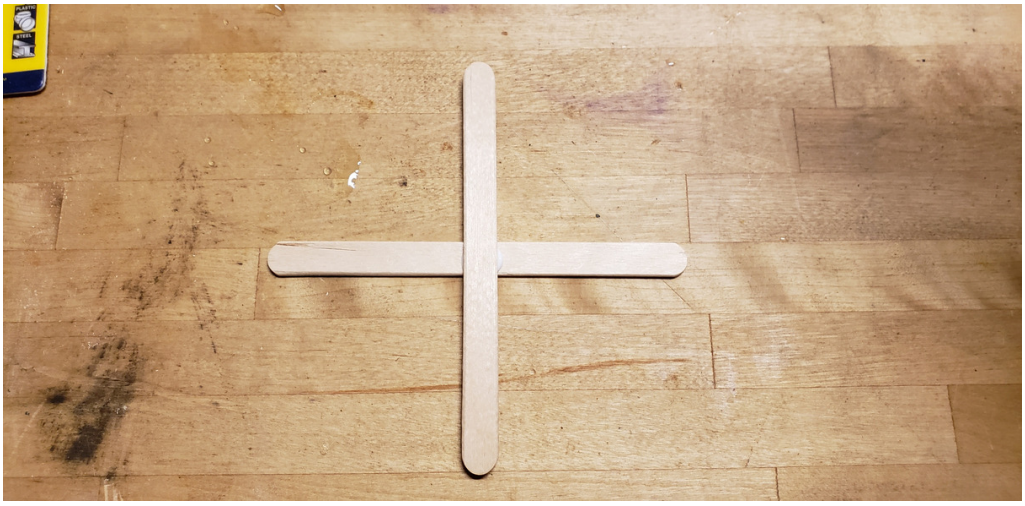
Teacher Prep

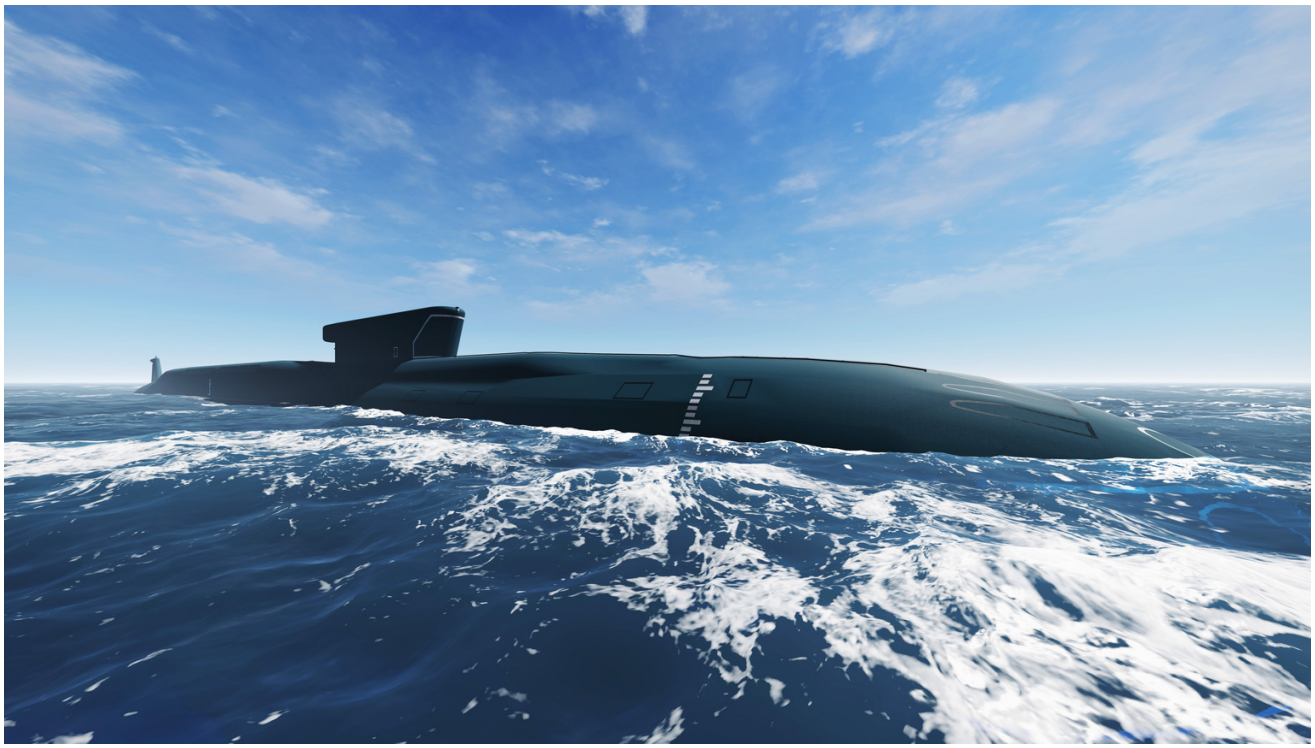
- Glue 2 popsicle sticks in an X to create a submarine propeller.



- Use a 1/16“ drill bit to drill holes in the following locations:
  - Center of propeller
  - Bottom of empty drink bottle Bottle cap

Submarines

- Submarines rely on special tanks that fill with either water or air.
- When the submarine is on the water's surface, the tanks are filled with air.
- When the submarine dives, the tanks fill with water. The water makes the submarine heavier, causing it to sink lower in the water.
- When the submarine is at the desired depth, there is enough air and water in the tanks to make the submarine the same density of the water. This means it will stay level at that water depth.
- When the submarine comes back to the surface, the water is pushed out of the tanks, which makes the submarine lighter than the water around it. This causes the buoyant force to counteract gravity, which causes the submarine to float upward.



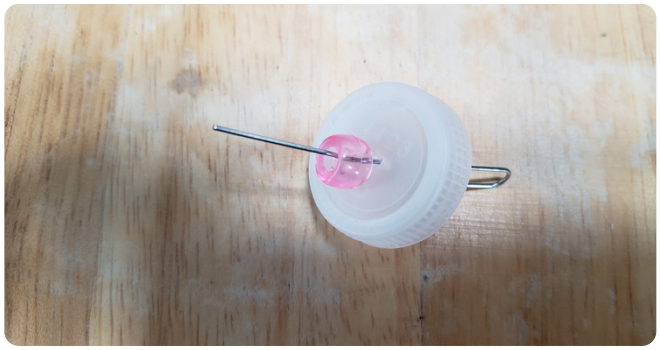
Building a Submarine

Step One: Build a Submarine

Follow the steps below to build a submarine for testing.

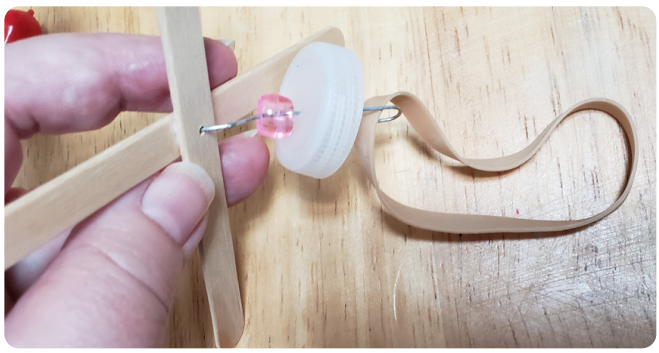
- Straighten one side of a paper clip.
- Poke the paper clip through the bottle cap.

- Place bead on straightened leg of paper clip.



- Place propeller on straightened leg of paper clip, in front of the bead.
- Bend straightened leg of paper clip so that holds propeller in place.

- Hook rubber band on to the part of the paper clip that is sticking through the underside of the bottle cap.



- Poke wire through the hole on the bottom of the empty water bottle. Push the wire through until it comes out the top of the bottle.
- Twist the wire around the rubber band on the end of the rubber band opposite the paper clip.

- Pull wire back through the bottom of the bottle, pulling the rubber band along with it.
- Continue pulling on the rubber band until the rubber band reaches the bottom of the bottle. As you are pulling, the paper clip will be pulled into the bottle and the bottle cap will be pulled onto the top of the bottle.

- Wrap the wire around the 3rd popsicle stick and let the popsicle stick rest against the bottom of the bottle.

Step Two: Testing Buoyancy

Follow the steps below to test the buoyancy of your submarine.

- Test your submarine propeller by winding the propeller and letting go. If the propeller doesn't spin, adjust the propeller and the paper clip that is holding it in place until it spins freely.
- Wind your propeller and place it in a large container of water. Pay attention to where the submarine travels.
- Test to see how adding different amounts of water to the water bottle to make your submarine travel on top of the water or below the water. To do this, add water to the water bottle, screw the top on the water bottle, wind up the propeller, place the water bottle in the container of water and let go.
- Most submarines carry equipment or people. Tape heavy objects, like pennies, to the submarine. Test again to see how adding different amounts of water to the water bottle make your submarine travel.