DIY Mini Sub

Collect

- Water
- Condiment packet (ketchup, taco sauce, soy sauce, etc.)
- 1L clear plastic bottle
- Paperclips
- Kosher salt
- Tablespoon
- Permanent markers (optional)

Make an ocean

1. Clean the bottle and remove the label and cap.
2. Decorate your bottle with permanent markers to create an underwater environment for your submarine. **Heads up!** This step is totally optional, but we think it adds to the fun.
3. Fill the bottle with water until it is about two inches from the top.

Dive, dive, dive

1. Place the condiment packet submarine into the bottle.
2. Did the packet sink or float?
    - If the packet floats, add a paperclip to the bottom of the packet.
    - If the packet sinks to the bottom, add about three tablespoons of salt to the water, cap the bottle, and shake until it dissolves. This will increase the density of the water. Keep adding salt until the packet is floating near the top of the bottle.
3. Fill the remainder of the bottle with water until it is all the way to the brim. Screw the cap on tightly.
4. Gently squeeze the bottle. Watch as the submarine goes up and down at your command.

What's happening?

To be neutrally buoyant, the density of the condiment packet must be equal to the density of the water. If you added a paperclip, you increased the packet's density. If you added salt, you increased the density of the water.

Just like the condiment packet, neutral buoyancy for a submarine occurs when the density of

the submarine is equal to the density of the water around it. Submarines dive and resurface by filling an area called the ballast with air or water to increase or decrease the vessel's buoyancy. Filling the ballast with water causes the submarine to sink, and filling it with air causes it to rise up again.

When you squeeze the sides of the bottle, you are increasing the pressure on the water inside. That increase in pressure is applied to everything inside the bottle, including the condiment packet. The packed has a smaller air pocket inside, which is compressed when pressure is increased. When squeezed, the overall density of the packet becomes greater than the density of the water, causing the submarine to sink. Once the pressure is released, the air inside of the packet expands and the packet rises to the top again.

Take it further

What else could act as a submarine? Find another object that has trapped air inside of it or find an object that you could add an air pocket to, like an eyedropper, pen cap, or straw. Repeat the experiment with your new submarine.