

## Engineering – Bottle Raft!

**Ages: 5 - 13**

Hello everyone. This is Bill from the Okanagan Regional Library System. Welcome to the fun and inventive world of making STEAM projects in your own home. Each week, I will share a fun and interesting project that you can make using materials commonly found in your own home.

Even though we can't be together right now, we can still learn how to make exciting projects each week!

This week's project: How to make your own Bottle Raft.

### Bottle Raft



This activity could save your life! If you were stranded on a desert island and you had some large empty barrels, you could make a raft to escape. It is a simple matter of balancing forces. The weight on the raft's platform pushes the raft downward into the water, but this force is balanced out by the buoyance, or "up thrust," of the water pressing against the air-filled plastic bottles. Because these forces are equal, the raft floats.

Empty plastic bottles float well in water, but to make an effective raft, you need to build a platform on which to support a weighted load. It is a fairly simple project – the raft's platform is made of craft sticks glued together, and it is attached to the bottles with stretched rubber bands.

### Materials Needed:

- Bowl of marbles or small stones
- 8 Rubber bands
- Glue
- 22 Craft Sticks
- Scale
- 2 Plastic Bottles
- Sink full of water for testing



**Time:** 60 minutes.

### Steps:

1. Lay 10 craft sticks side by side. Secure them together by adding glue to two more craft sticks and positioning them on either side of the platform.



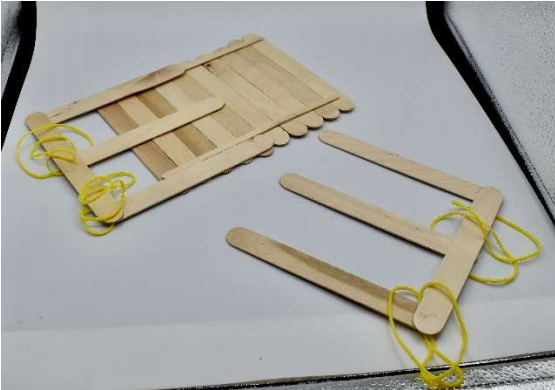
2. Take three craft sticks. Space them evenly so that they stretch the length of one craft stick. Put glue at the far end of each stick. Press one craft sticks on top of the dabs of glue to make an E shape. Repeat steps 2 and 3 to make a second E shape.



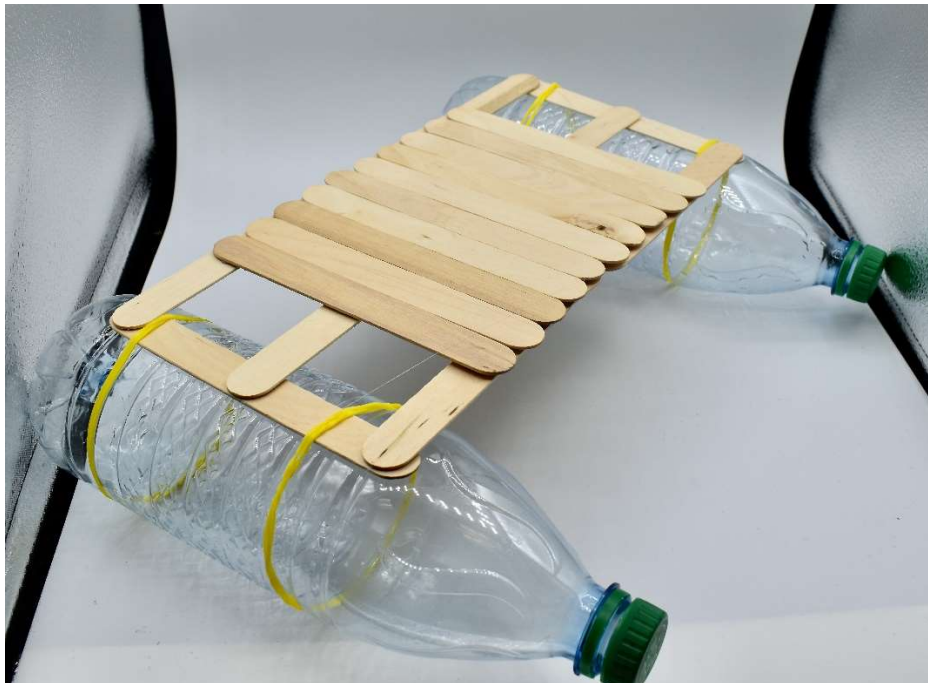
3. Once the glue on your E shapes has dried, slip 4 rubber bands over the ends of each one.



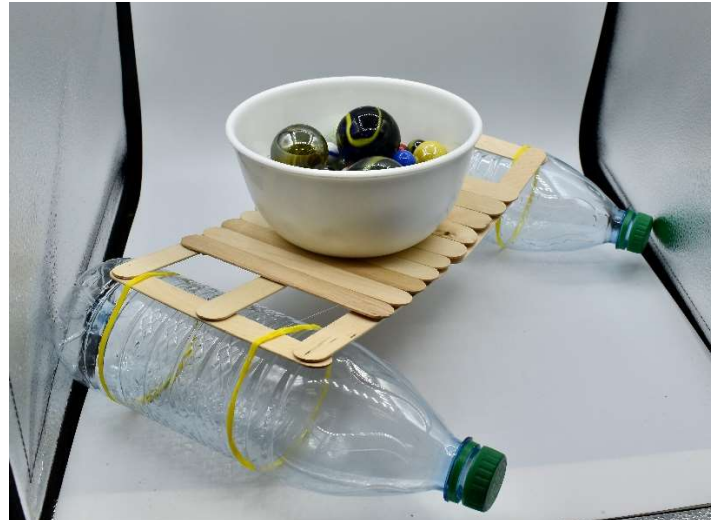
4. After you have placed the rubber bands onto both of your E shapes, turn the raft's platform over and glue the E shapes on to it at both ends. Use lots of glue. Leave it to dry completely.



5. Stretch the rubber bands one by one enough to push the bottles through. Try to ensure that the rubber bands are evenly spaced.



6. Use the scale to weigh the bowl of marbles, so you can see how heavy a load your raft is able to carry. In this example, the marbles and bowl weigh 1162 grams.



7. Float your raft in the sink. Gently place the bowl of stones on top of your raft's platform. Can it take the load???



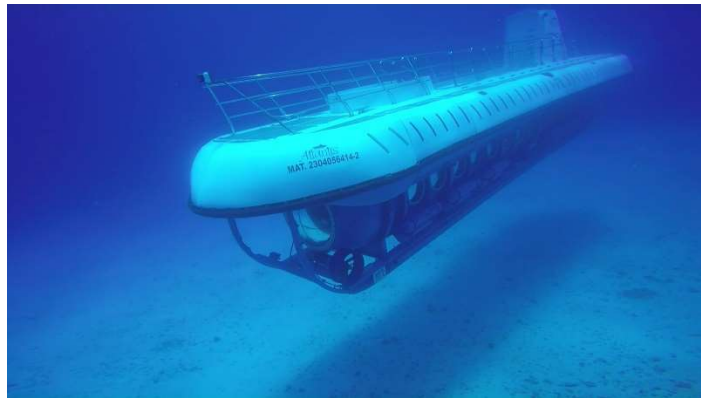
## Test and Tweak

See how much weight your raft can support by experimenting with heavier loads. You could also adapt your raft to make a bridge or even a boat. To make a boat, add a sail to give it propulsion and a rudder underneath to help it steer a straight path.

## The Science behind your Icy Orbs

Whether or not an object floats depends on something called density. Density is how much mass (stuff) an object contains relative to its volume (the amount of space it takes up). When you place an object in water, the water pushes it upward with a force called buoyancy. If an object is denser than water, the buoyancy is too weak to support its weight, and the object sinks. That is why small, heavy things like coins and stones sink. Objects with low density, like the air-filled plastic bottles, are less dense than water, so the buoyancy supports their weight and makes them float. Any object denser than water will sink, and any object less dense will float.

## Real World Science – Submarines



Submarines can change their buoyancy – that is how they rise to the surface and dive deep. They have tanks that can be filled with water or air. At the surface, they take water into these tanks, increasing their density – so they sink. To rise up, air is pumped into the tanks, reducing their density and allowing them to float to the surface.

## STEAM

This activity includes everything you need for a comprehensive STEAM project.

**Science:** Understanding how buoyancy affects objects placed in water.

**Technology:** Understanding how changing the density of an object can cause it to float or sink.

**Engineering and Art:** Constructing and decorating the bottle raft.

**Math:** Measuring the mass of objects and then seeing how they affect the buoyancy of the raft.