

STEM Kit!

Compliments of Fairport Robotics!

This month's kit:

Water Bottle Diver!



In this kit, you will make a diving sea urchin using the enclosed supplies!

Materials: 2 paper clips, 1 piece of straw, 1 pom-pom ("sea urchin")

Not included: Plastic bottle

Directions:

1. Find an empty plastic bottle you have around your house. You could use a regular water bottle and drink all the water. If you have a "stiff" plastic bottle with thick, smooth plastic, that works even better!



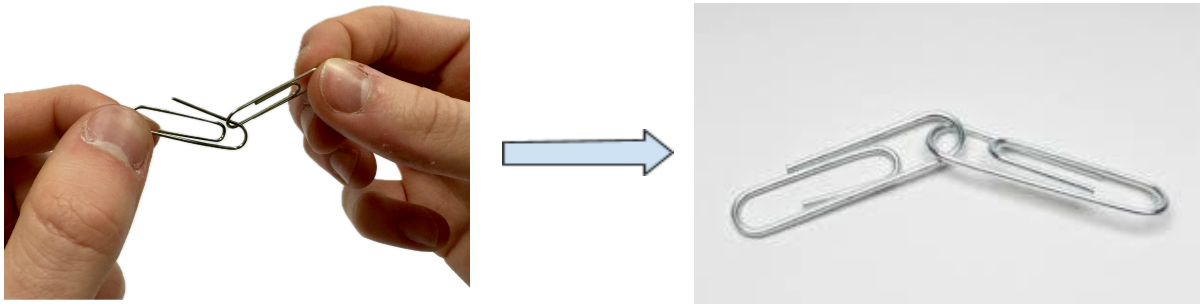
Regular plastic bottle
Good!



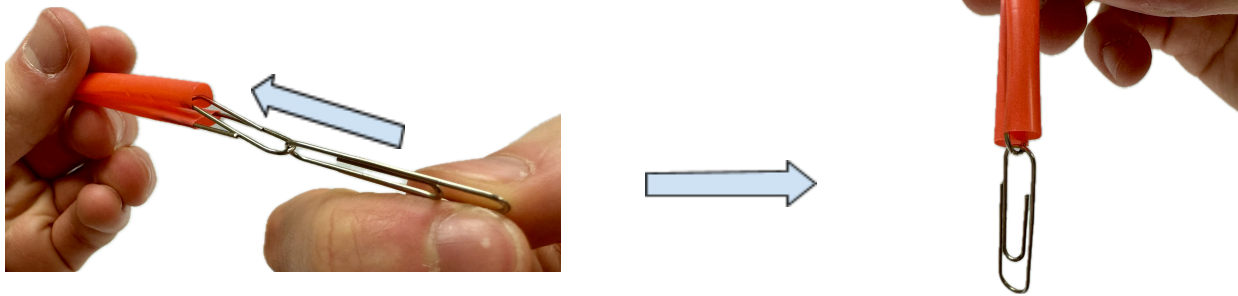
"Stiff" plastic bottle
(thicker plastic)-
Best!

2. Fill your empty bottle with warm water from your sink. Get it as full as you can- fill it all the way up to the brim! Then put the cap back on the bottle, trying not to spill!

3. Attach your 2 paper clips together like this. Slide the end of one through the opening of the other. Bend them back to their original shape.



4. Fold your straw in half and pinch it at the fold. Slide both parts of one of your paper clips into both openings of the straw. This will hold the ends of the straw together.



5. Next, attach your pom-pom ("sea urchin") to the paper clip that is hanging loose. Bend the point of the paper clip outward and poke it directly through the center of the pom-pom. Slide the pom-pom to the bottom of the paper clip and bend it back to normal. You have now completed your "diver!"



6. Now, we will put it all together! Take the cap off your bottle from before, being careful not to spill water. Hold your diver from the top of the straw so that the pom-pom and paper clips point down. Carefully place your diver in the top of the bottle. Don't push it too far down.

If you do it right, your diver should float on the surface like a fishing bobber!



7. Screw the cap back onto the bottle, while pushing gently on your diver with the cap. Screw the cap on tight so the bottle is completely closed.

8. Now for the moment of truth...
Squeeze your bottle as hard as you can and your diver should dive down to the bottom of your bottle!
Ta-daaaa!

***Ask a parent to squeeze the bottle if it's too hard. It takes some muscles!**



9. If your diver isn't working, fish it out of the bottle. Then, place it back in the bottle with the urchin pointing down. Make sure the diver floats before you screw the cap back on!

How does this work?

This kit has to do with density, pressure, and buoyancy. What do those mean?

Density (den-sit-ee) is a measure of how heavy something is compared to its size.

Objects with high density have a lot of mass (stuff) in a space.

Pressure (presh-shur) is a measure of how much force acts on an object. If you remember from other STEM kits, a force is a push or pull on something.

When objects are under a lot of pressure, there is a lot of force pushing on them.

Buoyancy (boy-in-see) is a measure of whether objects float or sink.

Buoyant objects float. Some buoyant fruits are apples, bananas, and lemons.

Non-buoyant objects sink. Some non-buoyant fruits are mangoes and avocados.

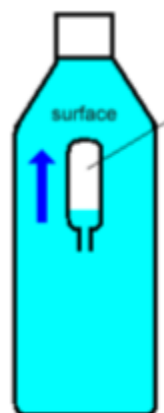
The secret to this kit is that there is an air bubble hiding where the straw is folded!

Because you put the straw in the water with the holes pointing down, air gets trapped in the straw and can't escape!

The same thing happens when you submerge an upside-down bucket in a swimming pool or the ocean. Some air gets trapped at the top of the bucket. This is because the air wants to float to the top but is stopped by the bucket. You can keep your hand in the bucket to feel the air bubble for yourself!

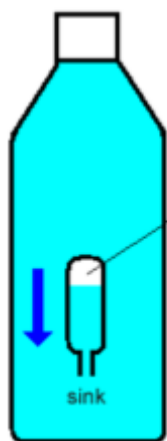


The air bubble is what makes your diver float when the bottle isn't being squeezed. Air has a very low density and floats to the surface of water. The air bubble pushes up on the diver, which makes the diver float.



Air pocket

Low pressure,
High buoyancy



Air pocket

High pressure,
low buoyancy

When you squeeze the bottle, the diver seems to sink to the bottom like magic. What's going on here?

When you squeeze the bottle, you increase the pressure of the water inside. This causes the water to push on the air bubble inside of the straw. The air is forced into a smaller space and some water takes its place. Because of this small amount of water, the diver is now just heavy enough to sink!

Other fun stuff!

Try tilting the bottle around slowly before squeezing it, or even turn it upside down! The diver should always float to the top no matter how the bottle is tilted.

If you have the supplies, make more divers with a small piece of straw and some paper clips! Put them all in one bottle to make an army of divers!

How does this relate to STEM?

Submarines make use of this science. Submarines sink by taking in ocean water into large tanks. This makes them heavier, which allows them to sink as deep as they want. When submarines want to come back up, they pump the water out of their tanks to become lighter.



If you enjoyed this STEM activity and love to be creative, consider joining a Fairport FIRST Lego League team or Fairport Robotics, Team 578! For more information, email us at info@fairportrobotics.org!

Stay tuned for a new STEM activity next month!