Fish Buoyancy

Raccoon Creek Explorers Activity #29

Supplies:

- A clear, empty bottle with lid (lable removed)
- water
- a pen cap OR sauce packet like ketchup, mustard, soy sauce or duck sauce
- if using a pen cap, you will also need some modeling clay

Vocabulary:

buoyancy- the tendency of an object to float in a liquid or gas. Buoyancy depends on two factors: the density of the object, and how much liquid or gas it displaces.
density- the amount of space (volume) an object takes up compared to the amount of matter in the object (its mass).
mass- the measure of how much matter is in an object.
swim bladder- a special organ some fish have that helps regulate their buoyancy
volume- the amount of space an object takes up

Background:

Has this ever happened to you? You go swimming and try to dive to the bottom of the pool, but it takes a lot of effort to get down there! Or maybe you've tried to float on your back but kept sinking! It can be difficult to stay exactly where you want to be in the water, so how do fish manage it all the time? As it turns out, many fish have a special adaptation for this! They have an organ called a swim bladder which is filled with gas. The fish can inflate or deflate the gas in this organ to help them rise, sink, or stay at the same level in the water! When the fish wants to rise, it increases the gas in the swim bladder to make itself less dense. When it wants to sink, it releases some of the gas to become more dense. Not all fish have this adaptation, and you'll typically see the ones that don't hanging out along the bottom.

For this activity, we'll be making a kind of science toy called a Cartesian Diver. This little diver in a bottle helps illustrate how a pocket of gas behaves under water depending on the water pressure.

Let's Get Started:

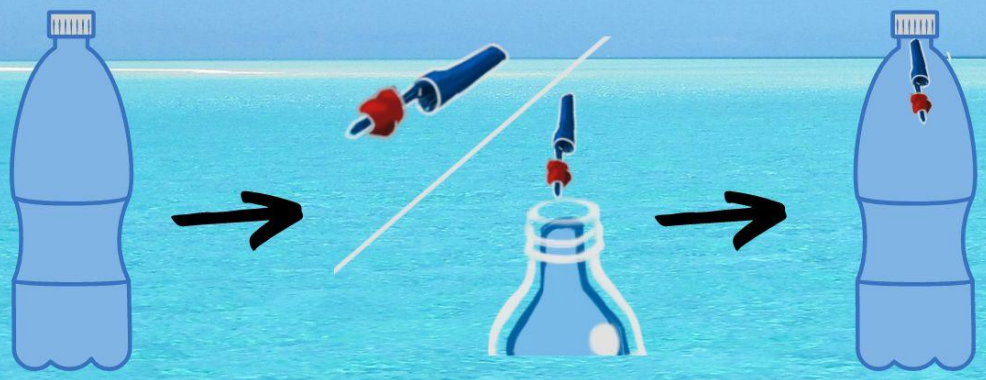
1.) Fill your bottle all the way to the top with water. Try not to leave any room for air.

2.) Get your diver ready! If you're using a sauce packet, congratulations, your ready! If you are using a pen cap, ad a small piece of clay to the end point of the cap. You may need to adjust this to make sure the cap is the right weight.

3.) Slowly place your diver in the bottle. Some water will spill out,, so watch for that! Your diver should just float on top. If not, try a different sauce packet or take some of the clay off the pen cap. If the pen cap floats too much, you can add more clay.

4.) Put the lid on and make sure its screwed tight with no air in the bottle.

5) Squeeze the bottle hard and watch the diver sink! When you release the bottle, it should float back up to the surface.



Reflect:

How does this demonstration work? There's a small pocket of air inside the pen cap and the sauce packets. What happens to this air when you squeeze the bottle? Gasses compress easier than liquid, so when you increase the pressure in the bottle, the air bubble compresses, making the diver more dense, so it sinks. When you release the pressure, the air expands again and the diver floats!

Apply:

Why do you think some fish have this adaptation and others don't?

If water pressure increases as you dive down, how would this affect fish with swim bladders?

How do human divers regulate their density when they dive? What other ways are there to increase or decrease buoyancy?

Does the temperature of the water affect the density of the diver?

Does it matter if the bottle is not filled all the way with water? Why?

Wrap-Up:

This demonstration is all about density! Density is a way of describing a substance based on how much mass it has in a certain amount of space, or volume. Mass is a little different from weight because mass measures how much of something there is, while weight is the pull of gravity on that object. For example, a person would weigh less on the moon then they do on earth because the moon has less gravity. However, they would still have the same mass! Objects have high density when they have a lot of mass but small volume. They have lower density when they have less mass, or the same amount of mass but more volume. For an object to float, it needs to be less dense than water. For it to sink, it needs to be more dense. In order to stay in the middle, it needs to have about the same density as water!

When you squeeze the bottle, the air bubble in the cap or packet is forced into a smaller space. It still has the same mass, but a smaller volume, making it more dense than the water around it., so it sinks!