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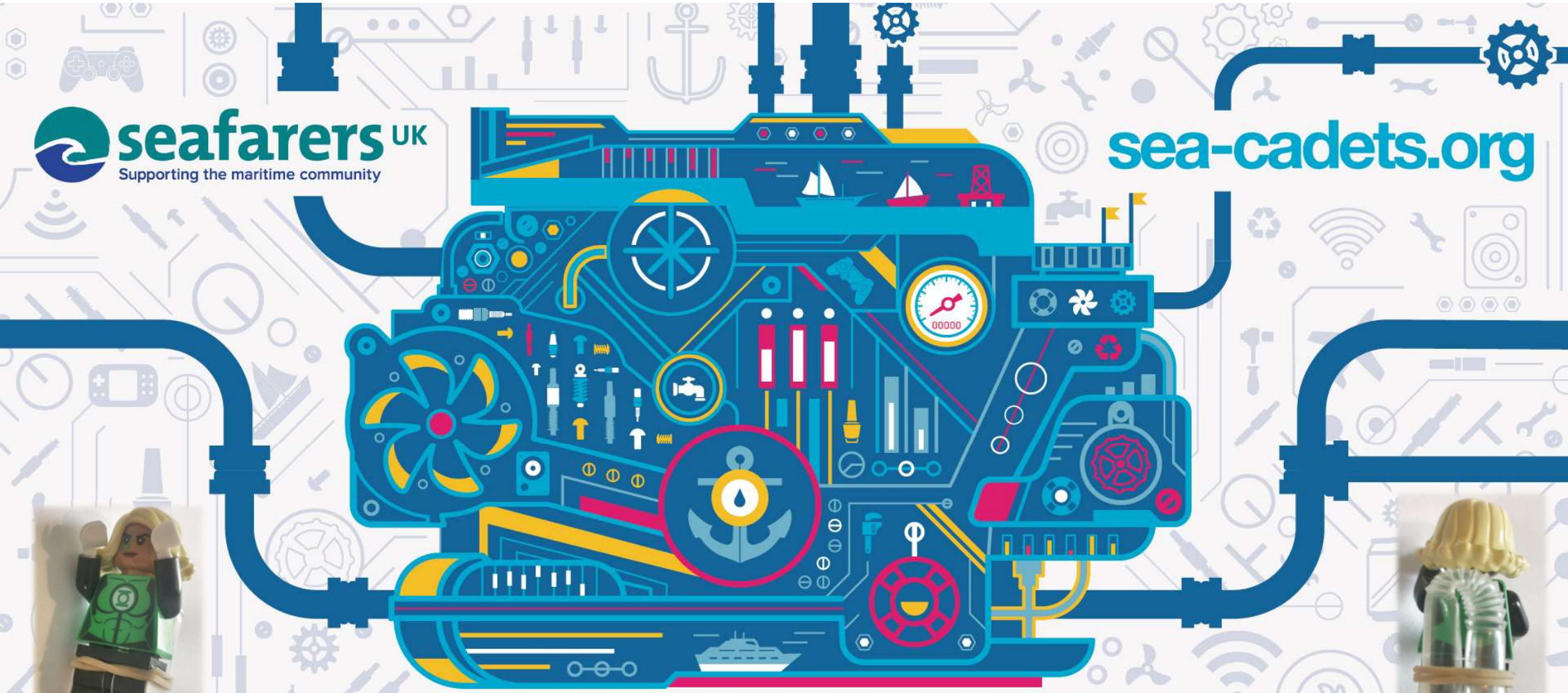


Cartesian Diver Experiment

Cartesian Diver Experiment

Have you ever wondered what makes something buoyant? Why some things float and others do not?

Using a fun Cartesian diver experiment will help us to understand this.

Equipment: A 2 litre clear plastic bottle with cap filled with water; A jug of water; Clear straws; A lego mini figure or similar; small elastic bands, weights (nuts, washers)

- **So how do we make one? Let's watch a cool video to show us how!**

- Below are some ***handy hints***:

1) A Cartesian diver needs to be able to float in a sealed bottle of water. To make sure your diver will float first test it in the jug, and make any adjustments you need to ensure it floats.
2) Once you have your diver adjustments made place it in the bottle and pop on the lid. The diver will sink when the bottle is squeezed, and float back up again when you release the bottle.
2) You might need to adjust the amount of water in your bottle to help your diver move up and down.
2) When you squeeze the bottle use both hands and squeeze as hard as you can!

So what exactly is going on with our diver??? Let's break it down.

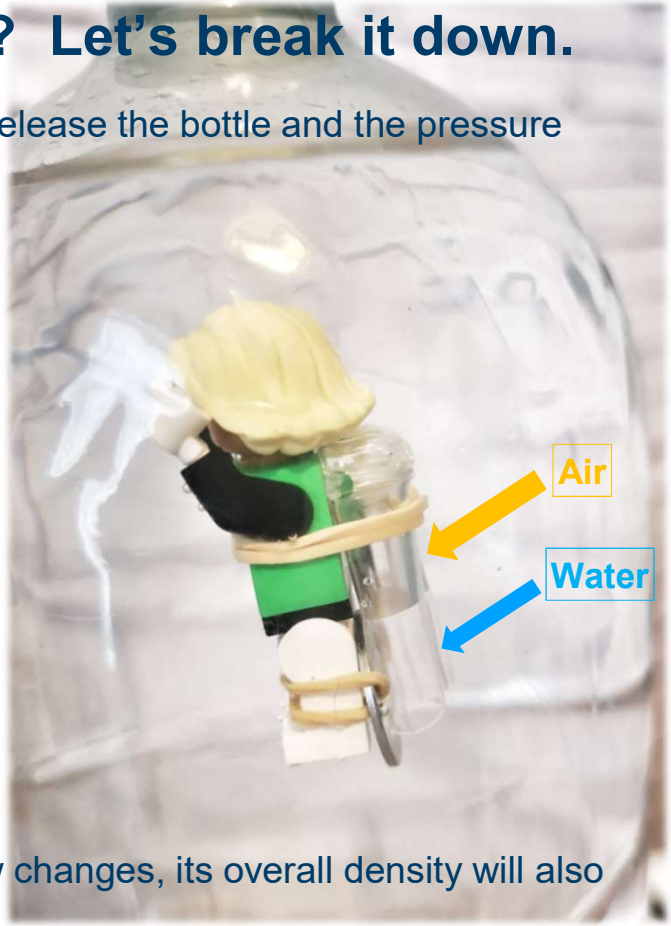
Our diver has a bubble of air inside the straw on its back. Squeeze and release the bottle and the pressure on the bottle, the fluid inside it and on that air bubble changes.

Look closely at the straw as you squeeze the bottle, you see the air bubble shrinks, it's forced into a smaller space, and is compressed. At the same time water is taken up into the straw. So the density of our driver has increased and it sinks.

Do the reverse, release the pressure on the bottle, the air bubble expands into a larger space and pushes out the water, the density of the diver decreases and so it floats.

Density is the reason that the diver floats or sinks! Density is mass divided by volume. Reduce the volume and density increases.

So we can see that the when the volume of the air inside our divers straw changes, its overall density will also change, and this will make it float or sink.



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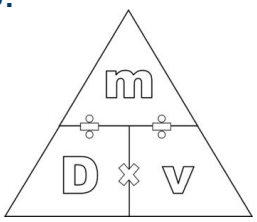
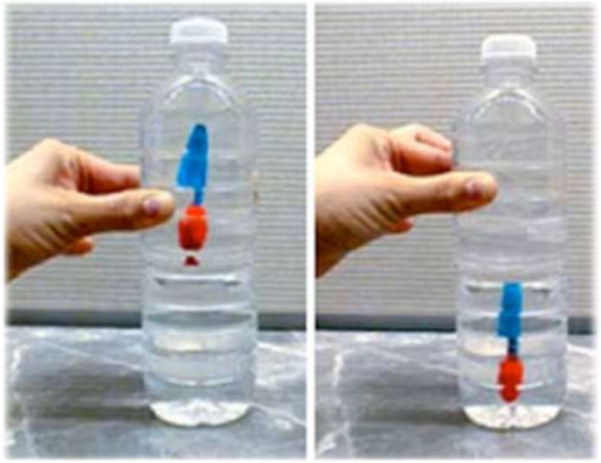
$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$



Less dense, the diver floats



More dense, the diver sinks

You might want to know some more…….

To change the density of our diver by changing the volume of air inside its straw we applied a pressure by squeezing the bottle.

Press play to see this is action.

It is **Pascal's Law** that tells us that a change in pressure is felt within the entire bottle, including on the air bubble in the straw, and it is that increased pressure which compresses or forces the air bubble into a smaller volume inside the straw…..which makes our diver more **Dense.**

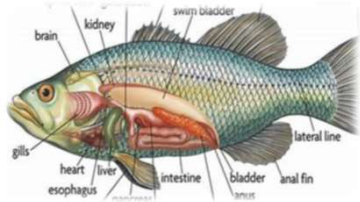
Then we run into **Archimedes principal**, which states that **"the buoyant force is equal to the weight of the water that an object displaces"**. When the air bubble is compressed, the divers buoyant force becomes less than the divers weight, and so it……**SINKS!**

When we release the pressure the reverse happens and the diver floats!

CHALLENGE YOURSELF!! Add more than one diver, change the size of their straws.

Engineering Connections in the real world

Fish physiology - Most boney fish have a swim bladder that models a lung and enables fish to control their buoyancy, or height in the water column, without swimming.



Scuba diving - Scuba divers use special equipment such as weighting systems, diving suits and buoyancy compensators to control their buoyancy. They can adjust this by adjusting the volume of gas in the bladder, which is taken from the diver's air tank or mouth

Submersibles -Submersibles enable the exploration of depths much greater than can be reached via satellite and shipboard technologies; these creative submersible and remotely operated vehicle (ROV) inventions enable people to explore very deep ocean communities and discover new species.