

Cartesian Diver

Divers mysteriously move up and down inside a bottle of water.

WHAT TO DO

Observe a small pipette bulb floating at the top of a closed bottle full of water. Squeeze the bottle very hard and it will sink to the bottom. Release and it floats back to the top. Squeeze just right and make the diver stay suspended at any depth.

WHAT'S HAPPENING?

Liquid water is nearly incompressible, i.e. its molecules are as close together as they can possibly be, no matter how hard you try to squeeze them closer. Since the bottle is completely filled with water and the lid screwed on tightly, squeezing it cannot make the volume any smaller. The little pipette "diver" in the bottle has a small amount of air trapped inside, however, making it slightly less dense than water, so that it floats to the top of the bottle. Now as you squeeze the bottle, the water inside squeezes on the trapped air in the diver (which can be compressed), making its volume smaller so that water flows in through the hole in the bottom to take its place. With this extra water the overall density of the pipette becomes slightly greater than that of the water in the bottle, causing it to sink. The pipette is transparent, so you can actually see the water forced into the pipette. When you release your pressure the opposite occurs and the diver rises to the top, but if you squeeze just hard enough you can match the density of the diver to that of water so that it doesn't float or sink, it "flinks". This pipette basically dives and surfaces just like a real submarine. It's called a Cartesian Diver after the famous scientist René Descartes who created a simple toy based on the original scientific device.