

Ketchup Cartesian Diver

(Ireland)

Background:

Lots of good physics can be taught and learnt through the use of science toys, many can be packaged as 'magic tricks'

There are many versions of the Cartesian Diver, ranging from bought fishing games, to divers made from droppers, test tubes and pen tops.

The ketchup sachet diver has to be one of the simplest.

All Cartesian Divers can be used to introduce and explore the principles of: Archimedes, buoyancy, flotation, density, compression of gases and liquids.

You will need:

- ✓ Flexible transparent plastic bottle with cap
- ✓ Tomato ketchup sachet
- ✓ Water
- ✓ Bowl or jug

Follow these steps:

1. Place a few ketchup sachets into a bowl or jug of tap water
2. Choose one that floats in the water
3. Remove any labels from the bottle and fill it all the way to the top with water.
4. Add the ketchup sachet to the bottle and screw the cap on tightly.

5. Slowly squeeze the bottle and the sachet magically on your word of command should sink to the bottom of the bottle.
6. When you stop squeezing, the packet will float back up to the top.

So what happened?

Squeezing the bottle increases pressure on the condiment packet, compressing any air inside. When the higher pressure compresses the air in the packet, the packet displaces less water, thus decreasing its buoyancy and causing it to sink. When you release the pressure the air inside the packet expands once again. The packet's buoyancy increases and the diver rises.

The Greek philosopher Archimedes was the first person to notice that the upward force that water exerts on an object, whether floating or submerged, is equal to the weight of the volume of water that the object displaces. That is, the buoyant force is equal to the weight of the displaced water.

What next?

- Try the experiments with food condiments such as mustard, brown sauce vinegar etc.
- Try with different sized bottles and shapes such as shampoo or mouthwash bottles
- Change the temperature of the water does it change the floatation?
- Try with liquids of different densities such as salty water, vinegar, oil etc.

