TSAAPT

Texas Section of the American Association of Physics Teachers

Connecting physics teachers in the state of Texas

Cartesian (Condiment) Diver

What to do?

Squeeze the sides of the of the two liter soda bottle. The ketchup packets will sink. Release the bottle and the ketchup packets will float to the top again.

What's going on?

Initially, the average density of the ketchup packets is just slightly less that of water so they float. Since the fluid is a closed system, when you squeeze on the sides of the bottle you increase the pressure of the fluid. The pressure increase is felt everywhere inside the bottle (Pascal's Principle). The ketchup packets are compressible and their volume decreases due to the increased pressure. This increases the average density of the packets to just slightly greater than the density of water. Consequently the packets sink. When the pressure increase is released, the ketchup packets expand and they float back to the top.

How do I build it?

Materials: Two liter soda bottle, ketchup packets, aquarium sealant (optional)

Assembly: Fill the soda bottle with water to the top. You do not want any air at the top. By trial and error find several ketchup packets that work well - not all ketchup packets will work. Optional - When you have a good setup you can use aquarium sealant to seal the cap and make it permanent.

Enrichment

Try other packets of condiments – some will only sink and some will float no matter how hard you squeeze that bottle. Challenge your students to figure out why.