611-2265 (30-045) Cartesian Diver

Introduction: The Cartesian diver is a classic science experiment that demonstrates buoyancy, also known as Archimedes's principle. It also has some use demonstrating the ideal gas law. It is named after French philosopher and scientist Rene Descartes.

The diver is a device that sinks and floats according to pressure changes. This is made possible due to two physical rules regarding buoyancy.

Pascal's principle states that any pressure placed on a fluid is the same throughout the fluid. The Cartesian diver has a small hole in it, to allow for the passing of air and water. This means that if the diver is placed in an airtight chamber, any change in pressure inside the chamber will cause an equal change in pressure inside the diver.

In addition, Archimedes' principle states that if an object displaces a greater weight of water than its own weight, it floats. If it displaces a lesser weight of water than it's own weight, it sinks.

Operation: You will need an airtight, semi-flexible container for this demonstration. An empty 2-liter pop bottle works perfectly. Fill it completely with water, put the diver inside, and cap it tightly. **It is imperative that the container is airtight; otherwise the experiment will not work.**

The diver should have almost neutral buoyancy; that is, it only slightly floats. Ideally it should be as submerged as possible without sinking. You will note that the diver is shaped like a small man with no arms. This is to maintain the proper relationship between the mass of the diver and its volume.

To use the diver, squeeze the sides of the bottle. As you increase the pressure of the system, Pascal's principle tells us that the pressure is uniform throughout the entire fluid. This means that any part of the system that can be compressed is. Water has an extraordinarily low compressibility, but air is highly compressible. This means that the air inside the diver takes up less space. To fill the void, water enters the diver. This increases its mass, so much so that the diver weighs more than the water it displaces. According to Archimedes' principle, it should sink, and it does.

When the excess pressure is removed from the system, the air inside the diver is allowed to expand to its normal volume. This lowers the mass of the diver, which increases its buoyancy. The diver floats once more.

Warranty and Parts:
We replace all defective or missing parts free of charge. Additional replacement parts may be ordered toll-free. We accept MasterCard, Visa, checks and School P.O.s. All products warranted to be free from defect for 90 days. Does not apply to accident, misuse or normal wear and tear. Intended for children 13 years of age and up. This item is not a toy. It may contain small parts that can be choking hazards. Adult supervision is required.

May we suggest:

611-2255 "Squidy" Cartesian Diver: What fun! Our colorful plastic squid swims up and down in a water-filled plastic soda bottle. Includes plastic soda bottle and cap, instructions and materials to make "squidy", and illustrated activity guide describing scientific principles.

611-2240 Pascal's Ball: Our hollow sphere connected to a hand pump shows that water pressure transmits in all directions through ten equidistant nozzles. Sphere has 3" diameter and 250 mL capacity. With instructions.