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Tantalus Cup
#2001

Warning:

- **Not a toy; use only in a laboratory or educational setting.**
- **Contains latex.**
- **Contains small parts.**
- **California Proposition 65 Warning: This product can expose you to chemicals including benzene and lead, which are known to the State of California to cause cancer, birth defects, or other reproductive harm. For more information go to www.P65Warnings.ca.gov.**

Introduction

The Tantalus Cup, also known as the Pythagorean Cup or the Greedy Cup, is a good demonstration of the workings of a siphon.

According to legend, Pythagoras – the man who also came up with the famous Pythagorean Theorem ($a^2+b^2= c^2$) – invented this device in his native island of Samos, Greece as a practical joke. He would use this joke cup to moderate beverage consumption at work sites he was supervising. His cups would function like a normal cup up until a point. People could drink from it as if it were a normal cup if they chose to fill it a "fair" amount. The second a "greedy" person decided to over fill their cup past the height of the central column, however, a siphon effect would occur and spill the entire contents of the cup into the lap of the drinker. His joke has been a popular gag gift and scientific demonstration ever since.

How to Use

1. Place your cup over an empty reservoir to collect the water that will fall from it once a siphon begins in later steps.

2. Fill the cup with water about halfway. Tilt the cup from side to side like you would when using a normal cup. Observe that nothing unusual occurs. **(Note:** A few drops of food coloring in your water will make this demonstration much easier to see.**)**

3. Add more water to the cup, slowly. The cup will fill like normal until the water level passes the curve of the central tube. Try to observe this moment closely, watching how the water level in the cup and the tube are the same until the siphon begins to work. Once the water level in the tube has passed this curve, the water will begin to travel through it until the water level in the cup is even with the entrance of the central tube.

How It Works

The mechanisms that cause siphons to function as they do are varied. It has long been believed that atmospheric pressure from the air column above the tantalus cup is the primary force causing siphons like the Tantalus Cup to begin working. After years of testing and operating siphons in vaccums, gravity and molecular cohesion are the primary forces causing siphons to work, though pressure can and does play a role.

Water, like all fluids, wants to naturally move from high pressure to low pressure. This basic principle is what creates the siphon effect. Gravity (and atmospheric pressure) give the water going up the central tube greater and greater potential energy until it reaches the top bend of the tube. Once water reaches this point, it is free to spend its gravitational potential energy in the process of travelling down the open end of the tube. Any atmospheric pressure in the system also pushes down on the water in the cup. This atmospheric pressure aides in the flow of the siphon, but it is not the cause of the movement. It is also important to note that cohesion between the water molecules helps keep the water flowing as a unit.

Once water is flowing down the tube, the movement of the fluid leads to a decrease in pressure within the tube. Since the water flowing through the tube has a lower pressure than the water in the cup, the tube acts like a straw through which all the water in the cup will flow through until its level is even with the intake-end of the siphon tube.