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Venturi Tube #2201

Warning:

- Not a toy; use only in a laboratory or educational setting.
- Contains latex.



Introduction

In 1738 Daniel Bernoulli revolutionized fluid dynamics by publishing *Hydrodynamica*. Within the pages of this book, he laid out what has become known as **Bernoulli's Principle**. This principle explains that when the velocity of fluid (a liquid or a gas) increases, the amount of pressure it exerts decreases. Bernoulli's Principle is today perhaps most

famously recognized as the concept behind the lift force that raises airplanes into the sky, but it is an essential force in other applications, such as carburetors and atomizers, and with many weather phenomena as well.

It is written out below:

$$P_1 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g h_2$$

- P = Pressure at a Given Point
- ρ = Mass Density
- ø = Gravitational Constant
- h = Altitude

In this display of Bernoulli's principle, one can compare the pressure and velocity of any two points in a flowing fluid. Using Bernoulli's work as his guide, Italian physicist Giovanni Battista Venturi came up with what would be coined the **Venturi Effect**. His work applied this what Bernoulli found towards understanding how fluid flows in a pipe that has a constriction. He found that when water (or any other non-compressible fluids, for the sake of this demonstration's simplicity) flowing through a pipe encounters a constriction, it will pick up speed while traveling through the constriction and exert less pressure on the

walls of the tube.

Your Venturi Tube demonstration will allow you to easily observe this effect in action. Some **additional supplies** are required:

- Food Coloring
- Air pump capable of producing a steady flow
- Rubber tubing



How to Use

Your Venturi Tube demonstration consists of one Venturi tube with a constriction in the middle attached to a three-leg manometer. Each leg of the manometer connects to the Venturi tube at a different point on it: the middle leg connects to the area beneath the thin constriction area, and the two outer legs connect to the chambers on either side of the constriction.

By blowing air through the Venturi tube when water is present in the manometer, you will see a clear demonstration of the Venturi Effect and Bernoulli's Principle in action. You can look at the image at the bottom of the page to see an illustration of what you can expect to encounter when you run this experiment.

- 1. Stand your demonstration up so that the manometer is on the bottom and the Venturi tube is on top and level with the table. You may simply hold it in this position with your hand or you may set up a support stand and use it to suspend your Venturi tube for a more stable demonstration.
- 2. Fill your manometer up evenly with about an inch-and-a-half of water in each leg. (Note: Add food coloring to your water so that your demonstration is easier to view. Filling your manometer may be done through an opening of the Venturi tube or by partially removing the manometer, whichever works easier for you.)
- 3. Attach a hose hooked up to an air pump to one end of the Venturi tube.
- 4. Turn on the air pump so that air flows through the Venturi tube. Notice the change in the water levels in the legs of your manometer. Legs attached to sections of the Venturi tube undergoing higher pressures will have lower water levels. As predicted by Bernoulli's Principle and the Venturi Effect, the water level in the middle leg of the manometer will be the highest of the three because the air in the tube flows quickest through the constriction.

