These demonstrations illustrate Bernoulli's principle that a fluid moving at higher speed exerts less pressure on a surface. This lab is best done before instruction on fluids and Bernoulli's principle.

Materials

Clean strip of paper, approximately 1" wide and 6 – 11 inches long
A quarter
A 1000 mL beaker (or suitable container)
A roll of toilet paper
A rod small enough to fit inside the t.p. roll
A source of air (powerful hair dryer or vacuum exhaust)
A ping-pong ball
A funnel

Set-up #1

Holding the narrow end of the piece of paper between your thumb and forefinger, blow across the length of the paper. It should start to flutter, as if it were a flag in the wind.

Ask the students to write down an explanation of why this happens. After giving the students a few minutes to contemplate and describe their solution, ask for volunteers to read their answer. Seek alternate views from other students, striving for a general consensus from the class.

Most students believe that air is blown under the paper, lifting it up.

Now, moisten your lower lip, and attach the narrow end of the paper. You may need to hold it in place. Show that there is no way that air can now get under the paper. Tell the students you are about to blow across the paper, and ask them what they think will happen now. They should write their responses below the previous estimation.

Once students have been given sufficient processing time, go ahead and blow across the paper. Many students will be astonished that the paper begins to straighten out and flap in the breeze, just as it had previously. This is because the act of blowing over the top of the paper will reduce the air pressure, thereby creating an excess pressure (Force divided by Area) on the bottom.

Set-up #2

Place the quarter near the edge of a table, and place the beaker on its side behind the quarter (opening facing the quarter). Tell your students that you are going to put the quarter into the glass without touching either the beaker or the quarter.

Ask the students how they would accomplish such a feat. Encourage classroom discussion. Some of the more interesting student ideas: kick the table from below; or tipping the table until the quarter slid into the beaker.

You are going to bend down to table level, and blow forcefully across the top of the quarter. When done well, the quarter usually make one-half of a rotation in the air and lands in the beaker. This will require some practice.

Set-up #3

Place the roll of toilet paper onto the rod. Hold it at arms length. Point the hair dryer or vacuum hose at the roll. Ask the students to describe what will happen.

Now, turn on the dryer/vacuum. The paper should start flying off the roll.

Set-up #4

Point the hair dryer or vacuum straight up and turn on. Tell the students you are about to place the ping-pong ball into the airstream. Ask them to describe what will happen over time (a few seconds).

Now, place the ball in the airstream. Does the ball behave as the student s predicted? The ball should rise and then stabilize. Try tilting the dryer or hose a little left and right of vertical. There will be a limit to how far you can tilt before the ball falls.

Set-up #5

Put the funnel on the end of the dryer/vacuum (vacuum probably works best for this demonstration). Hold the funnel vertical with the opening up. Tell the students you are about to place a ping-pong ball in funnel. Ask them to describe what will happen.

Now, turn on the dryer/vacuum and place the ping-pong ball into the funnel. Does the ball behave as predicted? Now tell the students you are going to invert the entire assembly while still on. Ask them to predict what will happen next.

Did the class predict this? The ball should still be in the funnel (if not, look for leaks between the funnel and vacuum).

All of these demonstrations show Bernoulli's Principle at work. Fluids apply less pressure as they move faster. Air is a fluid, too! These are a handful of demonstrations you can use to show your class that air is really there – although they can't see it, and only occasionally can they feel air, it has weight and can apply pressure.