

## **Introduction to Bernoulli's Principle**

**Recommended grades level(s)** 10-12

**Time Duration:** - 30 minutes

**Objective(s):**

Students will observe and document behavior of materials that undergo a change in fluid velocity nearby.

**Materials and/or Resources:**

Two ping pong balls  
Straw for each member of the team  
Two books (supplied by the student)  
Funnel  
Paper Clip  
Extra Straw to use in the cup  
Water  
Lit candle  
Scissors  
Cups  
Large can

**Background Information:**

Bernoulli's principle tells us that air that is moving at high speed has lower pressure than still air. The air moves around the ball to create a pocket around the ball of low pressure air.

**Procedures:**

Station # 1: Take two books of about the same height and place them about 12 cm apart (2.54 cm = 1 inch). Place a sheet of paper over the gap between the books. Place your straw parallel to the plane of the paper but above the paper by 1 cm. Gently blow through the straw and observe. Now place the straw the same distance below the paper in the same orientation. Gently blow through the straw and observe.

Station # 2: Place the two ping-pong balls at a distance of 2.54 cm apart on the table. Take your straw and gently blow a stream of air between the two. Put your ping-pong balls away in the designated place for the future station or lab group.

Station # 3: Simulation of perfume "atomizer": Fill your cup of water. Use scissors to cut the straw at a point that is about 0.5 cm above the height of the cup as shown earlier. Use the marker at your station or table to mark of the height of the water **INSIDE** the straw before moving on with this experiment. Take the other straw and set it perpendicular to the straw in the cup according to the diagram on the board. Blow through the "other" straw and have an observer mark the new height of the water within

the straw and have an observer mark the new height of the water within the straw “sitting” in the water. \*(This will be tough to do and you need to follow the instructions given to you at the beginning of class)

Station # 4: Place the ping-pong ball in the funnel. Use the technique demonstrated at the beginning of class to “blow the ping-pong ball out” from the top as diagrammed on the board. Attempt to use the same procedure when the ping pong ball/funnel system is upside down. Can you defy gravity with Bernoulli?

Station # 5: Place a lighted candle behind a large can (Ex. Large Chunky Soup can) so that you cannot see the candle. Blow on the can and watch how the air will bend around the can (on both sides) to blow out the candle.

**Reproducible Materials:**

Handout 1

**Development Resources:**

<http://www.lessonplanspage.com/SciencePhysics-IntroToBernoullisPrinciple1012.htm>.

## Introduction to Bernoulli's Principle

Analysis and conclusion:

Station # 1:

- 1) What happened to the paper when you placed a velocity of air parallel and above it?
- 2) What happened to the paper when you placed a velocity of air parallel and below it?

Station # 2:

- 3) Write Bernoulli's equation below and circle the variables that you witnessed in this experiment.
- 4) From the above equation, how did the variables observed affect one another? (i.e.: the buoyant force on an object is larger when a larger volume of fluid is displaced by the object).

Station # 3:

- 5) Approximate your change in height of the fluid inside the "sitting" straw.
- 6) Name three examples of how Bernoulli's principle can be used in a device at home.

Station # 4:

- 7) Why could you not "blow the ping-pong ball out"?
- 8) Did your team succeed in defying gravity? Draw a diagram of this station below and show force vectors.

Station # 5:

- 9) What happened in this experiment? Why?

Conclusion:

- 1) Relate what happens when a large truck is passing your car on interstate 40.
- 2) Julie is riding in a car with her large family and, to her disgust, grandpa lights up a cigar. The car is filled with smoke and finally Julie asks him to crack open his window. How does the pressure outside the car now relate to the pressure inside the car? What happens to the disgusting smoke particles? (two questions = two answers)
- 3) Use the diagram below to explain one reason why airplanes can fly. Use the words pressure, velocity, and force as well as vector arrows.