**Bernoulli’s Principle is AWESOME!**

**Learning Objectives**

Students should be able to:

* Understand that air pressure decreases as the speed of air increases.
* Understand that air pressure acts in all directions (not just down).

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**Materials List**

Each student should have:

* 1 sheet of paper (new or recycled)
* 2 round balloons
* 2 pieces of string (18 inches long)
* 2 small plastic cups
* 2 straws
* 1 ping pong ball
* Water

**Introduction/Motivation**

When talking baseball, why does a curveball curve? Why does an airplane fly? The reasons can be found in Bernoulli's Principle, which states that the faster a fluid moves the less pressure it exerts. There are different air velocities on different parts of a curveball as well as on the different parts of an airplane. Bernoulli's Principle tells us that these differences in velocity mean there are differences in pressure as well. On a curveball, the difference in pressure causes the ball to move sideways. Engineers use their understanding of pressure differences to make airplanes fly.

**Procedure**

***Part A: The Paper Tent***

1. On worksheet provided, answer the Part A, 1-3
2. Fold a piece of paper (lengthwise) in half and make a paper tent.
3. Predict what will happen when they blow into the tent. Will it appear to get larger, will it remain unchanged, or will it bend down toward the table? (Alternately, have students turn their paper tents upside down and blow through the V shaped paper.)

***Part B: Moving Balloons***

1. On worksheet provided, answer the Part B section.
2. Blow up two balloons. Tie them off, and then attach a string to each one.
3. Hold the two balloons together.
4. What will happen when they blow between the two balloons.
5. Have students hold the balloons 4-6 inches apart and blow between them. If the students hold the balloons too close together, the balloons will simply move away from the student. The balloons must be sufficiently far apart so that students can blow *between* the balloons, not *at* the balloons.

***Part C: Magic Moving Ball***

1. Place two plastic cups about 6 inches apart.
2. Place a ping pong ball in one of the cups.
3. Predict how to get the ball from one cup to the other without touching either the ball or cup.
4. Try a few of ideas. Then………
5. Gently blow across the top of the cup with the ball in it.
6. The ball should jump from one cup to the next. This is because the air pressure moving across the top of the cup is less than the pressure inside the cup. The higher pressure inside the cup forces the ping pong ball to jump out of the cup.
7. Experiment with how far apart they can place the cups and still get the ping pong ball to jump from one to the other.

***Part D: Bernoulli's Water Gun***

1. Get one cup filled with water and two straws.
2. Place one of the straws in the water.
3. Then students should cut the second straw in half to use as a "blower."
4. Ask the students to predict what will happen if they blow across the top of one straw in the water with the other straw.
5. Have students blow across the top of the straw with the other straw.
6. The water should rise up in the first straw and blow across their table. This happens because the air blowing across the straw in the cup reduces the air pressure at that point. The normal pressure underneath pulls the water up the straw and the moving air blows the water out and across the room.
7. Have students experiment with different straw lengths as the "blower."