PART TWO: STUDENTS ENGAGE IN THE EXPERIMENTS

EXPERIMENT #1 Paper Tent

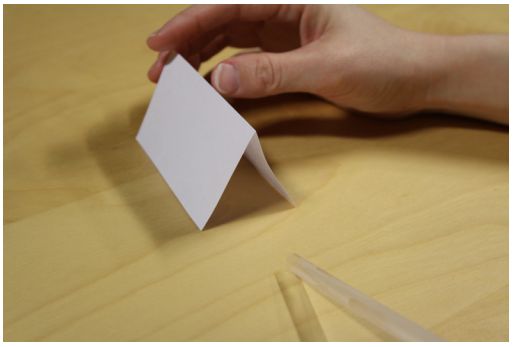
Materials:

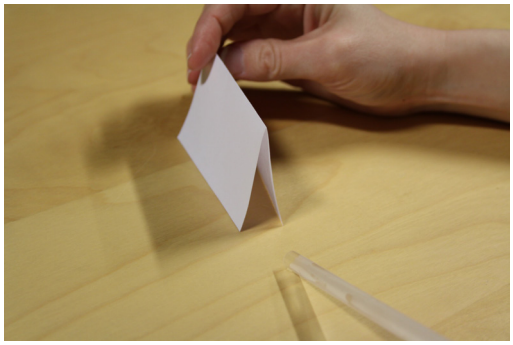
Per pair of students

- One 3 ½" x 4" piece of paper

Per student

- Bernoulli Experiment Log
- One straight straw





Instructions for the experiment:

1. **Fold the paper in half to make a paper tent.**
2. **Place the paper tent on a flat surface such as a table or a desk.**
3. **Position the straw about 2 inches away from the paper tent so that you will be able to blow a steady stream of air across the surface of the table or desk and through the tent.**
4. **Observe what happens.**
5. **Now, blow harder and observe what happens.**
6. **Record your observations on your Bernoulli Experiment Log.**

Expected outcome and reason why:

When the experiment is performed correctly, the sides of the card will pull towards one another. The reason for this outcome is that the faster moving air under the card creates relatively lower pressure compared to the air over the card, and as a result, the card will bend toward the table or desk because, according to the Bernoulli Principle, higher pressure air pushes toward lower pressure air.

Troubleshooting:

If the experiment does not work as expected, students may have the end of their straw too close to or too far away from the paper tent or they may not be blowing hard enough.

Materials:

Per pair of students

- Two empty soda cans (of the same size)
- Ruler

Per student

- Bernoulli Experiment Log
- One straight drinking straw

Instructions for the experiment:

1. **Place the two soda cans parallel to one another and ¾ of an inch apart on a flat surface such as a table or desk.**
2. **Use a straw to blow between the two cans about 1¼-inches above the surface of the table or desk.** Be sure that the open end of the straw is placed in front of the cans and not between them.
3. **Observe and record what happens.**

Expected outcome and reason why:

When the experiment is performed correctly, the two cans will move together. The reason for this is that the air blowing through the straw will be faster moving than the air on any other side of the cans. Thus, according to the Bernoulli Principle, the faster moving air exerts lower pressure and the two cans are drawn toward each other.

Troubleshooting:

If the experiment does not work as expected, students may have the cans too far apart, the straw may be too close or too far away from the cans or the students are not blowing forcefully enough through the straw.

EXPERIMENT #5 Balancing Cheese Balls

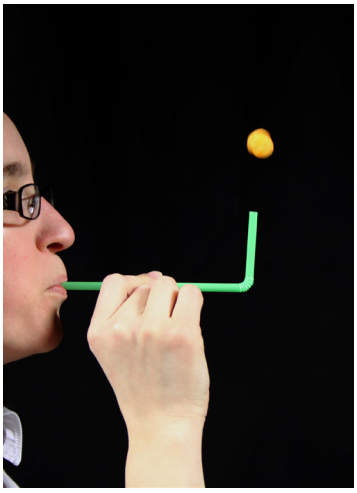
Materials:

Per student

- One flexible drinking straw
- One puffed cheese ball
- Bernoulli Experiment Log

Instructions for the experiment:

1. **Bend your straw into an "L".**
2. **Place the long end of the straw in your mouth, with the short end pointing upwards.**
3. **Take a deep breath and blow steadily through the straw.**
4. **Try to balance the cheese ball in the stream of air coming out of the end of the straw.**
5. **Try to tilt your straw.**
6. **Observe and record what happens.**



Expected outcome and reason why:

When the experiment is performed correctly, the cheese ball will balance itself in the steady stream of air coming from the short end of the straw. This happens because the air coming out of the straw is moving fast, so the faster moving air has less pressure than the slower moving or still air around the cheese ball. If the cheese ball starts to move away from the air stream, it experiences pressure from the still or slower moving air, which pushes the cheese ball back in place. If however, the straw is tilted, the force produced by the stream of air will no longer be sufficient to keep the cheese ball afloat because the force of gravity will then take over.

Troubleshooting:

If the experiment does not work as expected, students may not be blowing forcefully enough through the straw or they may be blowing with too much irregularity. A steady stream works best. Another possibility is that the short end of the straw may not be upright.

Materials:

Per pair of students

- Medium-sized funnel or the top of a 2-liter pop bottle cut to look like and act as a funnel
- One ping-pong ball or one small Styrofoam ball the size of a ping-pong ball

Per student

- Bernoulli Experiment Log
- Alcohol swab (to clean the funnel when shared between students)

Instructions for the experiment:

1. **Place the ball in the funnel.**
2. **Tilt your head back and point the wider end of the funnel upwards toward the ceiling or sky.**
   Note: For health reasons only one student should blow into the funnel.
3. **Blow air forcefully through the narrow end of the funnel in an attempt to lift the ball out of the funnel.**
4. **Observe and record what happens.**
5. **Now, with ball in the funnel as before, hold the funnel in front of you and blow forcefully across the top of the wider end of the funnel.**

Expected outcome and reason why:

When the experiment is performed correctly, the air coming directly underneath the ping-pong ball will be moving more quickly than the air over the top of the ball. As Bernoulli's Principle states, this faster moving air results in a decrease in air pressure under the ball. This causes the ball to be pushed into, rather than out of the funnel, by the higher air pressure coming through the top of the funnel. The end result is the ball stays in the funnel.

By blowing over the top of the funnel, the speed of the air traveling over the top of the funnel is increased, which causes the air pressure in that area to decrease. Therefore, the ball rises because it is being pushed out of the funnel by the higher air pressure coming from underneath.

Troubleshooting:

If the experiment does not work as expected, students may be blowing too close to or too far away from the funnel, or they may be directing the air they are blowing into the funnel rather than across the top of the funnel.

EXPERIMENT #3 Cup of Water

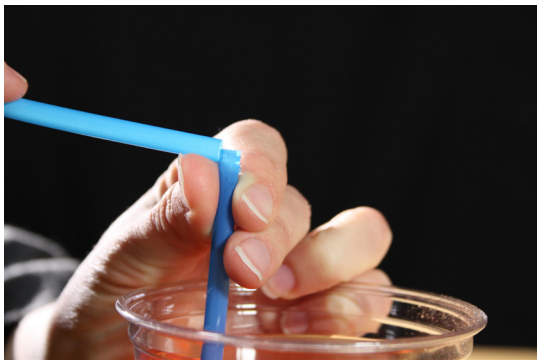
Materials:

Per pair of students

- Scissors
- One clear plastic cup (a 10-ounce cup works well)
- Water

Per student

- Bernoulli Experiment Log
- One straight drinking straw



Instructions for the experiment:

Note: the spray from the straws can get messy. You may wish to place a garbage bag or towel on the table to keep the area as clean as possible

1. **Fill a clear plastic cup, nearly to the rim, with water.**
2. **Cut the drinking straw in half.**
3. **Place one half of the straw in the water so that the bottom of the straw does not touch the bottom of the cup.**
4. **The top of the straw should be sticking out above the rim of the cup.**
5. **Position the second half of the straw so that it is perpendicular to, but not touching the straw in the cup of water.** You should be able to blow a stream of air over the hole of the straw sticking out of the water.
6. **Once the straw is in position, blow very hard through the straw.**
7. **Observe and record what happens.**

Expected outcome and reason why:

When the experiment is performed correctly, the water will rise through the straw in the cup, spraying away from the stream of air being blown across the straw.

The reason for this is that as the student blows through the straw, the faster moving air over the top of the straw creates an area of low pressure while the pressure on the surface of the water remains unchanged. Therefore, the water is drawn up the straw because of the area of low pressure.

Troubleshooting:

If the experiment does not work as expected, students may not be blowing through the straw with enough force or they may be blowing too close to or too far away from the top of the straw that is positioned in the water.