MAGIC BALLOONS AND AIRFOIL DESIGNS

Your group will perform two experiments in which air flows around different surfaces and observe the results. Determine which theory or theories of lift best explain your observations in each experiment. Be prepared to share your ideas with the class.

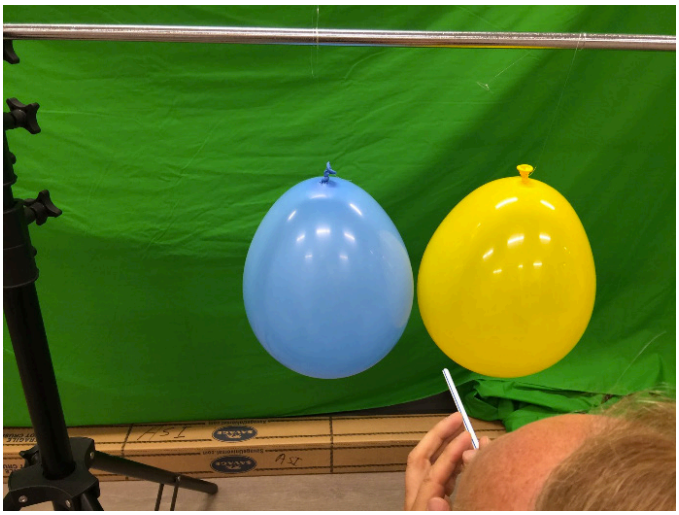
EXPERIMENT 1: MAGIC BALLOONS

MATERIALS (per team)

- 2 balloons
- Two (2) 12" pieces of string
- Tape
- Straw

PROCEDURE

1. Inflate each balloon and tie off the end.
2. Cut two pieces of string to the same length. About 12 inches long works well.
3. Tie one piece of string to the tied end of each balloon.
4. Using tape, attach the strings to a table or desk so that the balloons hang freely. Space them one to two inches apart and about the same distance from the desk or table.
5. Use the straw to blow air between the balloons and observe what happens.
6. Vary the speed and amount of air and note any differences.



Write your observations below.

1. What happened when you blew air between the balloons?

   Students should observe that the balloons came together when they blew air between them.

2. What changed when you varied the amount and speed of the air?

   Students should observe that when they blew harder, the balloons came together faster.

3. Which theory or theories of lift best explain what you observed?

   Bernoulli's Principle

4. Why did you choose this theory or theories?

   The faster air moving between the balloons creates an area of low pressure, which pulls the balloons in.

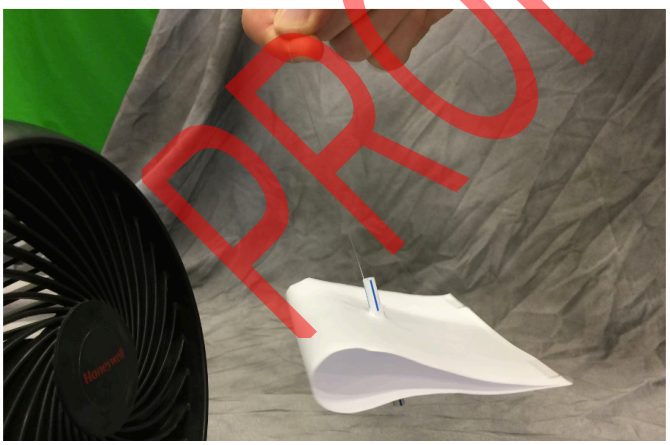
EXPERIMENT 2: AIRFOIL DESIGNS

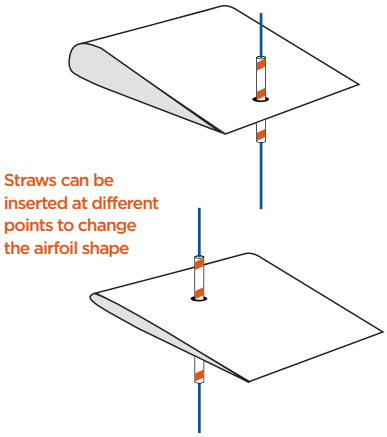
MATERIALS (per team)

- Several pieces of 8-1/2” x 11” paper
- Tape
- Plastic straw (cut in thirds)
- String
- Scissors
- Single-hole punch
- Electric box fan or other small variable speed fan (per class)

PROCEDURE

1. Cut your piece of paper to create two 5-1/2” x 8-1/2” sheets.
2. Bend the 5-1/2” x 8-1/2” paper in half as the illustration shows, being careful not to crease the fold.
3. Punch a hole through both sides of the paper. Where you place the hole will determine the shape of your airfoil. A hole closer to the fold will create a flatter shape, while a hole farther from the hole will create a more rounded shape.
4. Insert the straw through the hole, making sure it goes through both sides of the paper.
5. Insert the string through the straw, holding both ends so the airfoil can move freely up and down the string.
6. Tape the ends opposite the fold together so your airfoil holds its shape.
7. With the fan off, position the airfoil in front of the fan with the fold in the paper closest to the fan.
8. Turn the fan on and watch to see if the airfoil rises. If it does, lift is being produced.
9. Try different fan speeds and different shapes of airfoils made by other students. Observe which airfoil shapes create the most lift.





Write your observations below.

1. What happened when you turned on the fan?

   Students should observe that the wing moved up the string when the fan was turned on.

2. What changed at higher speeds?

   At higher speeds, the wing should move farther up the string.

3. Describe the airfoil shape that created the most lift?

   The thicker wing should produce more lift.

4. Which theory or theories of lift best explain what you observed?

   Bernoulli's Principle and Newton's Third Law

5. Why did you choose this theory or theories?

   Possible answers:
   Bernoulli's Principle—The higher speed air flowing over the curved surface on the top of the wing produces low pressure.
   Newton's Third Law—The wind striking the bottom of the wing produces the reaction of the wing rising.