



Principles of Flight



Lesson Plan: Have a Ball with Bernoulli II

Grade Level: 3

Subject Area: Science

Time Required: *Preparation:* 10-15 minutes
Activity: 1 class period, 30-45 minutes

National Standards Correlation:

Science (grades K-4)

- Science as Inquiry Standard: Understandings necessary to do scientific inquiry.
- Science as Inquiry Standard: Abilities necessary to do scientific inquiry.
- Physical Science Standard: Properties and changes in properties in matter.
- Unifying Concepts and Processes Standard: Evidence, models and explanation.

Summary: Students will predict, demonstrate, and observe the effects of air pressure.

Objectives: Students will:

- Predict the effect of moving water or air on air pressure
- Use a ping-pong ball and a stream of water to demonstrate an effect of lowered air pressure
- Use two cans to demonstrate an effect of air pressure
- Explore the power of wind
- Analyze the results of two activities and infer that moving air causes an area of lower pressure
- Identify common characteristics in the cause and effect of lowered air pressure, as stated in Bernoulli's Principle
- Write a paragraph comparing what happened in the two activities and the cause of those results

Background: Daniel Bernoulli was a mathematician who lived about 200 years ago. He was born in 1700 and died in 1782. He came from a family of mathematicians in Switzerland and was probably the most famous mathematician in the family. He published *Hydrodynamics* in 1738, in which he stated what is now called Bernoulli's Principle: As the speed of a fluid (liquid or gas) increases, its pressure decreases. He studied how wind affects objects. Through his experiments, he learned some very interesting facts about why things fly. We will do similar experiments to find out more about wind and flying.

Materials: You will need:

- Ping-pong ball
- Piece of string (8 cm)
- Transparent tape
- Sink with a faucet
- 2 empty soft-drink cans for each student
- Ruler for each student
- Drinking straw for each student
- Data recording sheet or individual student journals



Safety Instructions: Be sure that students do not share straws. Have extra straws on hand so all students can have his/her own.

Procedure:

A. Warm-up

1. Share with the class the previous information included in Background.
2. Before doing the “Have a Ball” activity, tell students step-by-step (Activity # 1 in part B below) how the activity will proceed.
3. Have students write predictions of what will happen in individual student journals or on data recording sheets.
4. Allow students to share predictions with the class.

B. Activity I

1. Have students conduct this experiment as a whole class activity.
2. Tape the string to the ball.
3. Turn on a faucet, and let the water run fast.
4. Have students hold the string and ball as close as possible to the stream of running water without letting the ball touch the water. You may want to repeat this step several times allowing students to take turns.
5. Have students record observations in student journals or on data recording sheets.
6. Discuss observations. Lead students to realize the ball moved toward the stream of water because an area of lower pressure was formed near the rapidly moving water, causing the ball to be “drawn or pulled” in.

C. Activity II

1. Have students work individually on this activity.
2. Place the cans on their sides about 3 cm apart.
3. Blow air between the cans through the straw. (*Note: the cans will come together more dramatically if students hold the straw parallel to the table.*)
4. Place the cans 2 cm apart. Blow between them through the straw again.
5. Place the cans 1 cm apart. Blow between them one more time.
6. Record observations in student journals or on data recording sheets.
7. Ask these questions:
 - What happened when you blew between the cans?
 - How did the effect change as you moved the cans together?
 - Why do you think the cans acted as they did?



- What does the low air pressure between two objects cause them to do?
- What would happen to two objects if the air pressure between them were high instead of low?

D. Wrap-up

1. Have students write a paragraph comparing what happened in the two activities and the cause of those results. Students may include illustrations in the form of drawings or diagrams.
2. Students may place the paragraphs in their science portfolios.

**Assessment/
Evaluation:**

Listen to student remarks during discussions to see if their predictions and observations demonstrate an understanding of the effects of air pressure. Ask questions to check for understanding. Check summary paragraphs and illustrations.

Extensions:

1. Use your observation from this activity to explain how the wind might affect things that fly.
2. Explain how the speed of wind affects air pressure.
3. Design a demonstration to show how the speed of wind affects air pressure.

**Resources/
References:**

Wings and Rockets, Harcourt Brace, pp. 23-25, 1995.

