

DISCUSSION

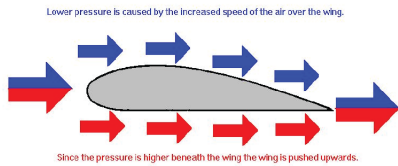
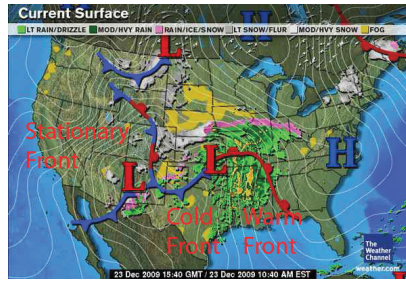
Real World Applications and Discussion Questions

1 Firefighters: Firefighters use the Bernoulli principle in trying to rid a house of smoke. After the fire has been put out, they will use a fan to air the house of all the smoke. Think about what you learned with the Bernoulli Bag (about how you strategically had more effective air flow when you adjusted the Bernoulli Bag about a foot from your face), where do you think the firefighters place the fan? (If students need help, prompt them.) Right at the doorway of the house or a few feet away from the doorway outside of the house? (Answer: The firefighters place a small amount of space between the fan and the doorway in order to maximize the air flow.) They call this “Positive Air Flow.”

2 Flight: The airplane was designed so that the air flow would travel quickly over the wings of an airplane in order to create lift!

The quickly moving air creates low pressure and the high pressure air rushes in underneath it and presses up on the wings to create lift.

3 Weather: The earth’s weather systems are based on low pressure systems rising and high pressure systems rushing in to fill the vacuum of space. As the air molecules “bump into” the warm earth, the air warms. Warm air rises and acts as a low pressure system. As the warm air low pressure system rises, cool air (a high pressure system) rushes in to fill the void. This process creates wind and helps even out the earth’s temperatures.



T E A C H E R S G U I D E



BERNOULLI BAG
ITEM # 7040-00

ENERGY - MOTION

How many breathes does it take to fill an 8 foot long plastic tube?
- Just ONE!
Learn how Bernoulli’s Principle is used by firefighters, meteorologists, hot-air balloon pilots, the aviation industry and more.

Explore Bernoulli’s principle of air pressure with this long plastic bag. By placing it firmly to your mouth (like a balloon), it will take many breaths to blow it up. But if you hold it out in front of your mouth and blow, air pressure in the stream you produce is reduced, entrapping surrounding air to join in filling up the bag. So you can blow it up with a single breath! This is especially effective after your students have counted many of their own breaths in attempting to fill up the bag!



Materials

- Bernoulli Bag
- One piece of notebook paper per student
- Two balloons
- String
- Yard stick or wooden dowel
- Optional hair dryer and ping pong ball

Goals & Objectives

Students will:

- understand Bernoulli's principle, air pressure decreases as the speed of air increases.
- understand that air pressure acts in all direction. Sideways, up and down. A high pressure system will press on a low pressure system.
- **Advanced:** understand that Bernoulli's principle is used in flight, firefighting and weather systems.

ENRICHMENT

1 Kissing Balloons:

Show students two balloons hanging from a yard stick or wooden dowel by two pieces of string. They should be hanging so that the balloons are about six inches apart. Ask students "What do you think would happen if we blew into the center of the two balloons?" Solicit answers from students. Blow into the middle of the balloons and watch the balloons move together. As you are blowing fast moving air in between the balloons you are creating a low pressure system and the high pressure system around it is pressing the balloons together.

2 Optional

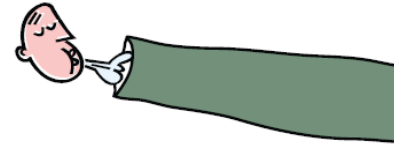
Hairdryer and Ping Pong Ball:

Demonstrate the Bernoulli principle by placing a ping pong ball on top of a hair dryer pointed upwards. Turn the hair dryer on. The ping pong ball should magically stay a few inches from the hair dryer. Turn the hair dryer to the side. The ping pong ball should still stay a few inches from the hair dryer in the low air pressure system created by the hair dryer. Ask students what they think will happen if you turned the hair dryer upside down. Demonstrate what happens (*). Ask students to explain what is happening and why the ping pong ball is staying in one place?

ACTIVITIES

- 1 Show students the bag. Ask: "How many breaths do you estimate would fill up this bag?" Take different answers from students. Have a volunteer student to come up and fill the bag by blowing air into the bag. (If you have enough one Bernoulli bag per student or group allow each student to try and fill the bag. Take hygienic precautions as to not share germs.) Compare the predictions of how many breaths it actually took.

- 2 Tell students that you can fill up the bag with ONE breath. Ask students if they can figure out how. Give students an opportunity to experiment.

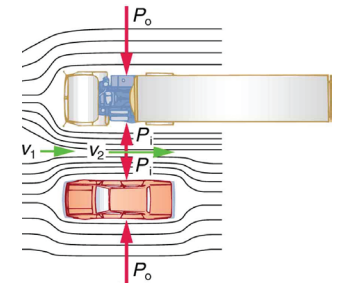


- 3 Demonstrate the Bernoulli principle by holding the Bernoulli bag about a foot from your face. With just one breath the bag will magically fill with air. Once the bag is full, close it tightly by holding the mouth of the bag in one hand and sliding your other hand toward the captured air to compress it. Release for repeated demonstrations or tie the end of the bag in a slip knot for further discussion or activities.

**The science behind this is that as you blow quickly you are creating a low*

pressure system in front of the bag so that it creates a vacuum and air quickly fills in around the space to fill up the bag.

- 4 Explain other examples of the Bernoulli principle the students may have encountered. Ask: "Have you ever been on the side of the road and a car whizzed by you and you felt the rush of wind? That is because the car going at a fast speed is creating a low pressure system and sucking in air and dust and dirt with it."



- 5 Have each student pull out a piece of notebook paper and put it on their bottom lip. Have them blow over top of the paper. The paper should lift (*). Ask students to explain what is happening and why using the Bernoulli principle.

*Note

It is always best to DO an experiment ahead of time to be able to best present it to the class.

