

Staying with the Flow

Use moving air to center a ball in midair!

Materials Needed

- Ping pong ball, or other small, light spherical object.
- Hairdryer (set on cold air)
- Watch, timer, clock, etc.
- Ruler, yard stick, or measuring tape
- Paper and pen
- Optional: Balloon (may need added weight inserted inside, or tape penny to it, after the balloon is inflated)

Grade Range

K-2
3-5

Topics/Skills

Science: Aerodynamics; Fluidics
Engineering

Learning Standards

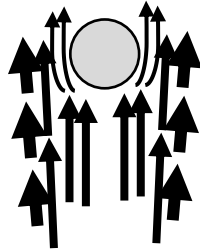
NGSS: [Matter and Interactions](#)

Duration

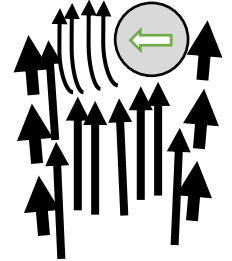
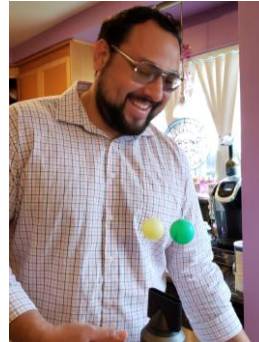
15 minutes

Prep Time

10 minutes



Thicker arrows = slower moving air and higher pressure



Ball is pushed back toward the center by the higher pressure of slower moving air

The wind can blow things away, but a stream of moving air can make a lightweight ball stay put! Amazing, but why does the ball not blow away or fall?

Activity Challenge

Keep one or more objects floating in place using a moving column of air.

Preparation

1. Select a workspace to conduct the experiments.
2. Collect materials.
3. Plug in a hair dryer and make sure it's set to "cool" (no heat)

To Do

1. Create a data table with the following headings: object, float time, float height, hair dryer angle (tilt), and notes (to record any modifications made during the experiment). See the sample table on the next page.
2. Turn on the hair dryer (high speed, cool setting). With the airflow pointing straight up, hold the ping pong ball or other object over the mouth of the hair dryer
3. Release the ball. If the ball flies away then try positioning the ball farther away from the mouth of the hair dryer before releasing the ball, but still directly above the mouth of the hair dryer.
4. Repeat for different objects and hair dryer positions.
5. Record the observations in the table. Note: some objects may not float.

Observations

- Note how long each object stays suspended within the column of moving air and its distance from the hair dryer.
- Make a drawing of the air flowing past a spherical (round) object that is floating above the blower and indicate the air pressures exerted on different portions of the object as it moves away from the center of the column of moving air.

Extensions

- Keep a ping pong ball floating for 20 seconds. Keep more than one object floating for 20 seconds.
- With the hair dryer pointing straight up, slowly tilt the dryer. How far can the dryer be tilted before the object flies off?
- Fasten the end of a cardboard, or paper tube, to the blower using tape. The tube should be of smaller diameter than the blower opening. Try suspending an object over the tube. **Ensure the hair dryer is set to cool!** Note what changes are observed compared to using the hair dryer without the tube in place. **Be sure to remove the tube when done!**

The Science behind the Activity

The wind, air moving along, can keep a kite from falling to the ground. Gravity is attracting the kite back to earth while the wind is pushing up on the underside of the kite. The ball is similarly being pushed upward by the air column moving up from the hair dryer. The kite is held in place by a string, but what keeps the ball from being blown up and away? Careful observation will show that the ball does move from side to side but seems to always return to the center of the column of moving air.

A scientist name Bernoulli discovered that air, and fluids, when moving faster will exert a lower pressure on their surroundings. Try this: hold a thin piece of note or newspaper by the long edge so the paper droops downward away from your mouth. Blow over the top curve of the paper and watch the far side lift upward. The moving air created a lower air pressure on the topside of the paper. The higher-pressure underneath the paper lifted the paper upward.

The moving air lifts the ball upward and then moves smoothly and even more quickly around the ball. The longer path around the sides of the ball forces the air to speed up. The process is like how air speeds up as it goes over the curved upper surface of a plane’s wing. Both faster moving streams of air create areas of lower air pressure.

When the ball moves toward the outside of the column of moving air one side of the ball faces air being dragged along by the air coming out of the hair dryer. That air is moving more slowly and so applies a higher pressure on the ball than the faster moving air coming from the hair dryer. The ball is pushed back into the column of faster moving air repeatedly as the ball moves from side to side. See the two illustrations at the top of the first page.

Data Table

Object	Float Time	Float Height	Blower Angle (Tilt)	Notes
Ex: Crumpled ball of foil	10 seconds		Straight up	
	15 seconds		20 degrees from vertical	Removed material to make it lighter