



# Safety Science Tools

## Rising Smoke

Open your students' eyes to the importance of scientific literacy. As a Science Educator, you can help them draw connections between science, engineering, math, and language. These lessons can help build their confidence, strengthen their interest, and apply their knowledge to solve new problems.

### THE SAFETY LESSON

Why are smoke alarms installed up high? Build your own hot air balloon and “see” how hot air rises.

If there was a fire in your house, the heated air would rise. Smoke generated by the fire would rise up with the hot air and stay near the ceiling of the room, so that's a good place for the smoke alarm – high up on the wall or on the ceiling. If the smoke alarm senses the smoke in the warm air, it sounds a warning signal that alerts you and your family so you can get out safely.

Because hot air and smoke rise, when you see or smell smoke the safest place is near the floor. So get down and get out! The important thing is to get out as soon as possible and call 9-1-1.

### MATERIALS

- Lightweight 30-gallon trash bags\*
- Hair dryer
- Cellophane tape
- Thread
- Scissors

*\* The best bags for this experiment are 30-gallon size, 0.5 mil thickness, which is very thin for a large trash bag. Look for the cheapest large trash bags; they will be the thinnest.*



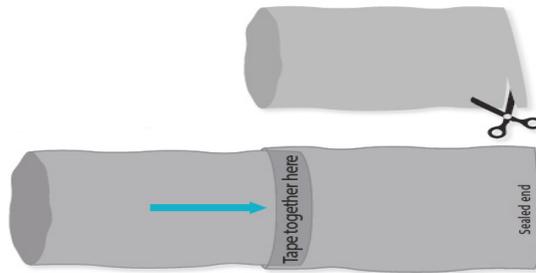
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Prior to presenting this experiment to your students, cut the sealed end off of one trash bag, to make a big tube.

Ask for 3 – 4 volunteers. Have one volunteer wave the bag around to fill it with air. Quickly gather up the open end to close off the bag. Hold the filled bag upright. Note that the bag flops over.

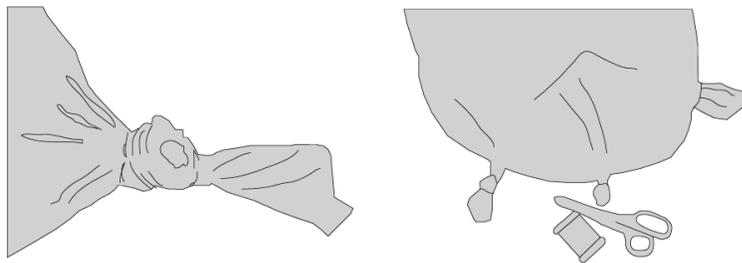
Ask your students why they think the bag flops over. Explain that the air in the bag is the same temperature as the air in the room. The weight of the plastic is not supported by this air.



Have the volunteers work together to prepare the materials.

### PREPARE THE MATERIALS

- Slide the cut trash bag (the tube) just inside the open end of another bag.
- Tape the edges together, tube to bag, to make one giant bag.
- Tie 4 small knots along the edge of the open end of the bag to make the opening smaller, about 6 inches (15 cm) in diameter.



- Using a piece of thread about 5 feet (1.5 m) long, tie it to one of the knots.
- Tie a small object (key, large binder clip, etc.) to the other end of the thread. This is the weight to keep your hot air balloon from floating away!

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### RUN THE TEST

It's time to test the hot air balloon! Ask for a new volunteer, have the volunteer perform the test.

- Point the hair dryer into the opening of the bag, being careful to not let the plastic touch the hair dryer.
- Turn the hair dryer on its hottest setting.

Ask the remaining children to count to 30, once they get to 30 turn off the hair dryer. Ask the volunteer to touch the outside of the bag – is it warm? Did the bag rise up?

Ask the students:

- Do you think we could have gotten the bag filled to capacity with room temperature air?
- Why do you think the bag is holding itself upright?
- Now that the air in the bag is cooling, what is happening? Why?

The heat from the hair dryer causes the air molecules to move around and spread apart, so there are fewer molecules inside the bag. That makes the air inside the bag (the hot air) lighter than the cooler air outside the bag, so the bag rises. When the warm air cools off or escapes from the bag, the bag drops to the ground. A real hot air balloon stays afloat because it has a gas burner under the opening of the balloon that continuously heats the air inside.

### SAFETY SCIENCE

Our experiment proved that hot air rises and in a fire, smoke, with the heated air rises too. The smoke fills a room from the top down. Smoke from a fire produces a poisonous gas called carbon monoxide. Carbon monoxide (CO) has no color and no odor, so you can't see it, smell it or taste it, and that makes it especially important to also have carbon monoxide alarms in every home.

Ask your students what they think carbon monoxide alarms do when they sense the presence of CO. Just like smoke alarms make a loud sound when smoke is in a room, carbon monoxide alarms make a loud sound when CO is in a room.

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