

Sneezy Simulations

Achoo! For You



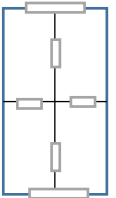
Demonstrate how droplets are spread by sneezing. Show that covering a sneeze and practicing social distancing can lower the chances of spreading disease.

Activity Challenge

Simulate sneezing and make normally clear droplets visible to the eye. Show how far and wide the droplets from a sneeze can travel.

Preparation

1. Choose indoor and outdoor test sites with about 6 feet of clear space to the nearest wall or other vertical surface.
2. Review the Materials Needed and gather all the required items.
3. Research and discuss how sneezing can spread disease.
4. Tape 4 pieces of white paper together, then tape to a washable wall or other vertical surface.



To Do

1. Squeeze the juice out of a large lemon into a cup, preferably one with a lip for pouring.
2. Carefully pour all the lemon juice into the spray bottle or balloon. Use a funnel, if you have one, to make this easier.
Note: *If using a spray bottle skip to step 7a.*
3. Cut off about 2 inches of a straw and insert it halfway into the balloon.
4. Make an airtight seal between the straw and the balloon opening using tape or a rubber band.
5. Fully inflate the balloon by blowing into the straw then pinch the straw closed so the air and liquid stay in the balloon.
6. Shake the balloon while still pinching the straw.
7. Hold the balloon about 12 inches from the wall, pointing the straw at the paper. Stop pinching the straw to release the air and liquid from the balloon.
 - 7a. If using a spray bottle, spray a fine mist at the paper from about 12 inches away.
8. Let the paper dry until any droplets of lemon juice have evaporated and disappeared.
9. Heat the paper with a dry clothes iron, or hot air from a blow dryer, or other safe source of heat, until the droplets become clearly visible. **(Adult supervision is needed for this step).**

Materials Needed

- Spray bottle (small) with mist setting
- Balloon
- Straw (large diameter, if possible)
- Water
- Lemon (for juice)
- Small rubber band
- Adhesive tape (clear)
- Paper (4 letter-size white sheets)
- Hair dryer, clothes iron or other safe heating device
- Pencil or pen
- Optional: funnel or spoon

Grade Range

3-5
6-8

Topics/Skills

Biology; Sneezes; Hygiene;
Engineering; Experimentation

Learning Standards

NGSS: [Engineering Design From Molecules to Organisms](#)

Duration

30 minutes

Prep Time

10 Minutes

Observations

- What do you see on the paper after heating it? If you see a pattern, draw it in your STEAM notebook with a pencil or pen.
- Repeat steps 1 to 2 and steps 5 to 9, several times, increasing the distance from the paper each time. Record each distance in your STEAM notebook.
- At what distance can you no longer see any droplets?
- Would any droplets hit the paper if you placed the crook of your arm between the sprayer and the paper?

Extensions

- Guess/predict how far bodily liquids travel, potentially carrying viruses or bacteria, when a person sneeze. Research this topic and compare your findings with your prediction.
- What can a person do to prevent fluids, and **pathogens**, from landing on other people?
- Demonstrate how a person can prevent fluids and pathogens, from landing on other people.
- Design, draw, and label a new device that could model a human sneeze.
- Create a prototype (make a small model) of the design and test it.

The Science behind the Activity

A sneeze is a partially-involuntary forceful and rapid expulsion of air from your nose and mouth. It is one of your body's ways of expelling irritants and foreign matter from your respiratory tract. A still popular myth is that sneezing temporarily stops the heart and closes the eyes. Although it may feel like your heart has skipped a beat or you may experience changing pressure in your chest, scientists have proven that your heart continues to beat. You also may close your eyes, but scientists have shown that there is no physical necessity to close them. Nevertheless, there are still superstitions and myths associated with sneezing. Some people sneeze quite dramatically!

Germs, like viruses and bacteria, can be spread to others if they are in the mucus, saliva, and other bodily fluids projected from the mouth and nose. The fluids in a sneeze are in the form of droplets and **aerosols**. Aerosols are a suspension of fine particles in the air, whereas droplets tend to be larger and heavier liquids that tend to drop to the ground after traveling a short distance. Aerosols are more likely to be carried a much further distance.

To avoid spreading germs, always sneeze into the crook of your arm and wear a mask, when appropriate. Stay at least 6 feet from others at times when dangerous germs are likely to be present. Aerosols are more likely to be diluted and disbursed by the wind when outside, making it less likely to become infected when out of doors compared with being near other people when inside.

Lemon juice is a clear liquid that contains a high concentration of citric acid. Citric acid is absorbed by the fibers in the paper. When the paper is heated, the acid treated paper breaks down to reveal a brownish color from the chemical "burns" caused by oxidation.