

Can Drops Travel in Air?

Figure out how many water drops can reach a wall that is six feet away



Healthy Actions • Community Knowledge • Science

FOR GRADES
K-2 3-5

OVERVIEW

Students will investigate the number of water droplets that make “contact” with a wall from different distances when propelled in a manner that simulates a sneeze or cough.

The virus that causes COVID-19 travels mostly in water droplets that we expel when we sneeze, cough, talk and sing. Experts advise that we keep a “social distance” of at least six feet away from others to minimize the possibility of droplets being passed between us and those nearby. This physical distance, along with wearing masks and frequent handwashing, help us to slow and stop the spread of coronavirus and similar microbes.

According to the Centers for Disease Control and Prevention (CDC), respiratory droplets of various sizes are the principal mode by which people are infected with SARS-CoV-2 (a coronavirus that causes COVID-19). Large droplets, which may even be visible, fall out of the air rapidly, within seconds to minutes. Smaller droplets and particles, referred to as aerosols, can remain suspended in air for hours and travel with air currents. The epidemiology of SARS-CoV-2 suggests that most infections are spread through “close contact” (being within six feet of an individual with the infection for more than 15 minutes).

Microbes can be transmitted in water droplets, because water molecules are attracted very strongly to one another, and they also hold onto many other substances. Water molecules act like tiny magnets with each other. Every liquid water molecule has a positive end and a negative end. The forces of attraction between these opposite charges bring the molecules together very tightly. Attraction among molecules of the same kind is called cohesion. The forces of attraction among the molecules in most liquids are not as strong as those observed in water molecules. The “stickiness” of water accounts for much of its behavior, including the formation of rounded droplets, and the ability to creep upward inside a narrow tube (capillary action).

LEARNING OBJECTIVES

Students will describe the distance traveled by water droplets and explain how their findings demonstrate the importance of physical distancing to prevent transmission of infectious diseases by respiratory droplets, such as with COVID-19.

SCIENCE, HEALTH AND MATH SKILLS

- Observing
- Comparing
- Measuring
- Interpreting

NGSS SCIENCE AND ENGINEERING PRACTICES

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations

TIME

- Activity: 45 minutes
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MATERIALS FOR SCIENCE INVESTIGATION

Teachers

- [Can Drops Travel in Air? Slide Deck](http://www.bioedonline.org) (www.bioedonline.org)

Students

- Small mirror
 - Water (small amount to create water droplets and additional water to explore how far droplets travel)
 - Spoon
 - Large plastic cup or container (large enough for students to submerge an entire hand)
 - Wall or wooden fence outdoors
 - Ruler, yardstick or measuring tape
 - 3 sheets of blank paper (8.5 x 11 in)
 - Tape
 - Science notebook or additional paper for recording observations
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PROCEDURE

■ ENGAGE

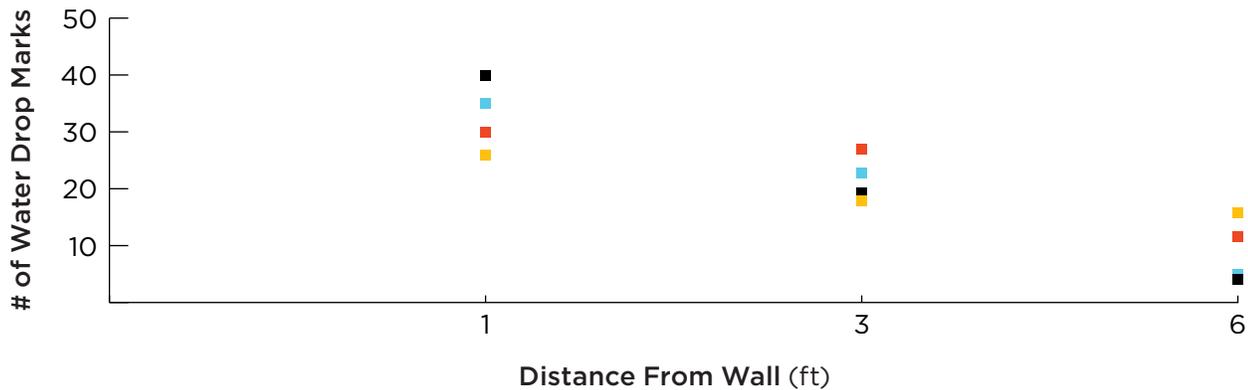
1. Ask, *Have you ever been near someone when they sneezed? What happened?* [Responses may vary, but someone may say that they felt the force of the sneeze or even got wet! Accept all answers.]
2. Explain that they may have felt droplets of saliva and mucus that were projected into the air when the person sneezed. Yuk! Point out that saliva and mucus from the mouth and nose mostly consist of water.
3. Follow by asking, *Have you ever looked closely at a water drop?* Direct students to use the spoon to place a small amount of water onto the surface of the mirror, creating one or more droplets.
4. Tell students to observe the drop(s) carefully, draw one drop in their science notebooks, and write three words describing the appearance of the drop.

■ EXPLORE

5. Refer to the student activity description and sheet, [Investigating Droplets](#). You may have students do Part 1 together with you (the teacher) if they are participating with you outdoors or online at home. They will need to have a mirror handy. (Note: During the COVID-19 pandemic, it is not advisable that students remove their masks in the classroom to breathe on a mirror.)
6. If possible, have each student breathe onto the mirror. Ask, *What do you see on the surface of the mirror?* If not mentioned by students, point out that the fog on the mirror consists of tiny water droplets, smaller but similar to the ones they observed. Follow by asking, *How far do you think these water drops might be able to travel in the air?*
7. Part 2 must be conducted outside, either at school with your supervision or at home, with students working with an older child or adult. Students will write their observations to share in class.
8. Read the instructions together.

■ EXPLAIN

9. Have students share their recorded observations of numbers of drops at each distance: 1 foot, 3 feet and 6 feet. If possible, create a class graph that includes each student's counts. Have students calculate the average number of drops counted for each distance. (See example below.)

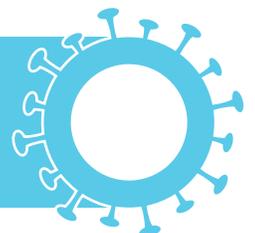


- 10.** Ask, *What does this information tell us about how far water droplets, which are large enough to see, can travel in the air?* Students should be able to conclude that fewer drops of this size are able to travel as far as six feet.
- 11.** Follow by asking, *How can we use this information to help us keep one another healthy?* Use the accompanying slides to guide a discussion with the class
- Small mirror
- Cough and sneeze into a disposable tissue or your elbow (demonstrate). Then wash your hands!
 - When around others during the COVID-19 pandemic, wear a mask that covers your nose and mouth.
 - Stay at least six feet away from people who are not part of your household and avoid large gatherings.
- 12.** If not mentioned by students, conclude by pointing out that scientists know droplets can enter another person through their mouth, nose and eyes. Droplets also can be breathed in or land on something that someone else touches afterward. This is how many microbes that cause illness and disease can be spread. During the COVID-19 pandemic, we must be extra careful not to spread the virus or catch it from someone else.

EVALUATE AND EXTEND

- 13.** Watch one of the following videos with your students. Have each student write three ways they are going to protect themselves and keep others around them healthy.
- Cover Coughs and Sneezes (younger students). Centers for Disease Control and Prevention. <https://www.youtube.com/watch?v=mQINuSTP1jl>.
 - COVID-19 Stop the Spread of Germs (older students). Centers for Disease Control and Prevention. <https://www.youtube.com/watch?v=kEhNyxKopsg>.

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THE SCIENCE

Remember that this activity “models” how water droplets travel. In real life, Coronavirus (SARS-CoV-2) spreads mainly through person-to-person contact—especially through very fine droplets and particles released into the air when a person with the infection coughs, sneezes, sings or talks. These droplets can land in the mouths or noses of other people nearby and possibly be inhaled into the lungs. The virus also is believed to spread through contact with contaminated surfaces or tiny droplets or particles that linger in the air as aerosols. The greatest risk of spreading the virus occurs when people are close together (within about six feet). A person with SARS-CoV-2 infection can develop the illness known as COVID-19..

■ RELATED SCIENCE TEACHING ACTIVITIES

What Makes Water Special? The unique physical properties of water.

- <http://bioedonline.org/lessons-and-more/lessons-by-topic/ecology/water/what-makes-water-special/>.

How Much Water Do Humans Need? Demonstration of the daily water intake and loss by a single person.

- <http://bioedonline.org/lessons-and-more/lessons-by-topic/ecology/water/how-much-water-do-humans-need/>

■ RESOURCES

- Smithsonian Science Education Center. Covid-19! How can I Protect Myself and Others? <https://ssec.si.edu/covid-19>.
- Centers for Disease Control and Prevention (CDC). SARS-CoV-2 and Potential Airborne Transmission <https://www.cdc.gov/coronavirus/2019-ncov/more/scientific-brief-sars-cov-2.html>.

COVID HEALTHY ACTIONS, COMMUNITY KNOWLEDGE AND SCIENCE

■ A SCIENCE-BASED CURRICULUM FOR THE COVID-19 PANDEMIC

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Investigating Droplets



Healthy Actions • Community
Knowledge • Science

LEARNING OBJECTIVES

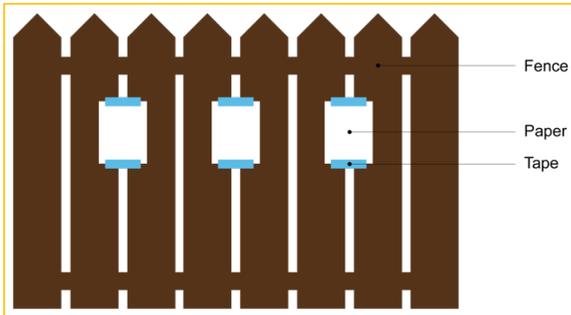
- Describe the distance traveled by water droplets
 - Explain how the findings demonstrate the importance of physical distancing
 - Prevent transmission of infectious diseases by respiratory droplets
-

PART 1

1. Stand very close in front of a mirror, or hold a mirror right up to your face.
2. Breathe on the mirror. *What do you see?*
3. The “fog” you see on the mirror is made up of tiny droplets of water from your breath!
4. The virus that causes COVID-19 is so small that lots of it can “ride” inside these droplets and cause infection in others when someone coughs, sneezes, or even talks.
5. *How far can they go?* Let’s use a model to find out.

PART 2

1. Fill a large plastic cup or container with water.
2. Go outside and find a wall or a wooden fence (a darker color of wall or fence will work best).
3. If you don't have a dark wall or fence, you can use three sheets of notebook paper taped to any wall or fence. Be sure the sheets are spaced apart and taped on the top and bottom, as shown in the illustration below.



4. Measure a distance of 1 foot away from the wall and use tape to mark the location. Using the mark, stand about 1 foot away from the wall, fence or paper. Dip your whole hand into the container of water. Get your hand really wet, and then quickly flick it one time at the wall, fence, or one sheet of paper.
 - *How many droplets can you see?* Count the number of wet drop marks and record the number.
5. Move sideways to a dry part of the wall or fence (or to the next paper). Measure a distance of 3 feet away from the wall and mark it with tape. As before, stand at the measured distance. Wet your hand again and flick the water off at the wall, fence, or a second sheet of paper.
 - *How many droplets can you see?* Count and record the number.
6. Move sideways again. Then measure a distance of 6 feet and repeat the process. Wet your hand and flick the water off again at the wall, fence, or the last sheet of paper.
 - *How many droplets can you see?* Count and record the number of drop marks.
7. Compare the numbers of droplets you counted at each distance.
 - *At which distance did you record the most wet drop marks? At which distance did you record the fewest?*
8. If your droplets were from a sneeze, cough, or talking:
 - *How far away from other people would you have to stand to prevent getting sick or getting anyone else sick?*