

## **Lesson 4, Activity 1**

### **Hand Washing Experiment** (55 minutes)

**Section**  
Diseases

#### **Investigative Questions**

How can disrupting the environmental conditions stop the spread of infectious disease?  
How can thorough hand washing limit the spread of infectious diseases?

#### **Description of Content**

In this activity, students will conduct an experiment on washing their hands. They will learn that “clean” hands may not be so clean after all and the critical importance of washing their hands as a way to prevent the spread of disease.

#### **Relevant Standards**

This activity fulfills [science and health education standards](#).

#### **Objectives**

Students will:

- Relate the importance of hand washing
- Describe that germs may be present even if they are not seen

#### **Safety**

As students work on this activity, make sure they do not spill water on the floor so it becomes slippery. Clean up spills immediately. Students should wash their hands after the experiment, especially before eating.

#### **Teacher Background**

##### *Environment*

This lesson gives students further information about the third vertex of the Epidemiologic Triangle, Environment. In this context, environment is defined as the physical surroundings of the hosts and agents such as altitude, climate, geography, dust, amount of sunlight, etc. The season of the year or the time of day, week, or month that illnesses or deaths occur also can be considered as an environmental factor.

##### *Hand Washing*

Do your students wash their hands? Do they use soap? Observations in public rest rooms reveal that only about 68 percent of Americans wash up before leaving.

Each year, nearly 22 million school days are lost each year to the common cold alone. Yet when children practice healthy habits, they miss fewer days of school. (For students who want to learn more about techniques for stopping the spread of germs at school, visit the CDC Web site at [www.cdc.gov/germstopper/home\\_work\\_school.htm](http://www.cdc.gov/germstopper/home_work_school.htm).)

Thoroughly washing hands is the single most important thing students can do to keep from getting sick, or to keep from infecting others. The typical person's hands contain millions of microbes. Most are naturally occurring and are harmless, but some may be disease-causing germs. Vigorous hand washing, for at least 20 seconds, and using soap, is the best way to lift off the microbes and rinse them away.

Here are two experiments that show students graphically the importance of hand washing. The first uses a germ-simulating powder or gel and a black or UV light. If you do not have access to these materials in your classroom, you can use Method 2, which uses water-soluble paint. *Both of these experiments are based on an activity developed by the National Association of Biology Teachers.*

Once your students have completed the experiment, they can learn more about hand washing by reading the *Buzz on Scuzz* at [www.bam.gov/sub\\_yourbody/yourbody\\_buzz\\_how.html](http://www.bam.gov/sub_yourbody/yourbody_buzz_how.html).

## **Hand Washing Experiment—Method 1**

### **Materials**

- Powder or gel that simulates the presence of germs on students' hands. These products are commercially available:
  - β Glo Germ ([www.glogerm.com](http://www.glogerm.com))
  - β Germ Juice ([www.germjuice.com](http://www.germjuice.com))
  - β GlitterBug (Brevis) ([www.brevis.com](http://www.brevis.com))
- Black light or ultraviolet light
- Sink
- Pen/crayons
- Towels

### **Procedure**

#### *Engagement* (5 minutes)

1. Ask students, "How do you think germs are spread? If one person has a cold, how can you catch it?"
2. Students will give many answers: "If you sit next to them," "if you drink out of their cup," "if they sneeze on you." Write these down.

#### *Exploration* (30 minutes)

1. Have students develop a chart that will help them score how clean their hands are. Divide a piece of paper into four sections. Trace the outline of a hand in each section. Now have students use pens or crayons to shade their idea of completely dirty, very dirty, dirty, and slightly dirty. Label the completely dirty hand as +++, the very dirty hand as ++, and so on. Use a minus sign ( - ) to represent “completely clean.” For consistency, choose one or two students to act as the judge. Other students can act as recorders.
2. Have students construct a data table to record their results.

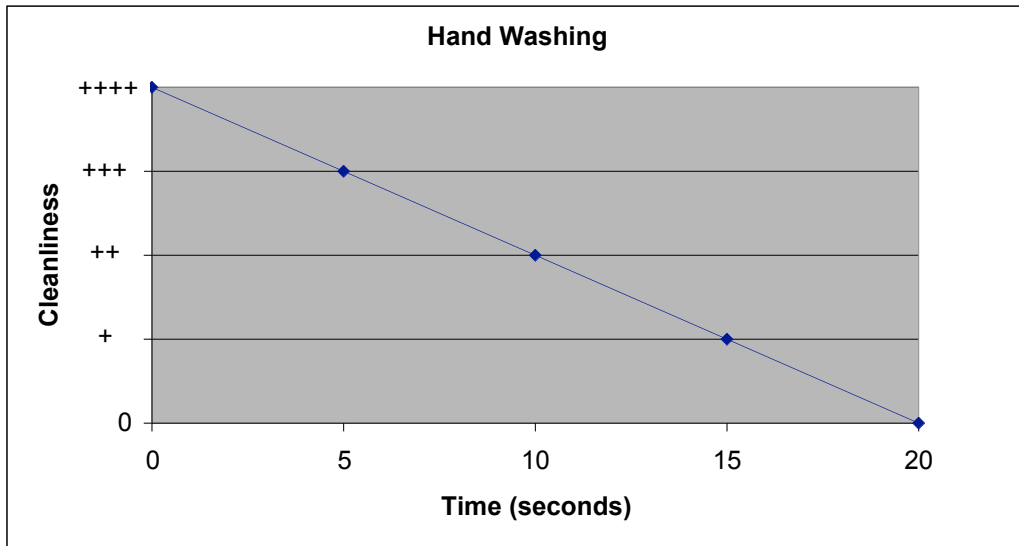
Washer	Washing Time in Seconds				
	0	5	10	15	20
Student 1					
Student 2					
Student 3					
Student 4					
Average					

3. Spread some of the germ-simulating powder or gel on a student’s hands. Spread it evenly over both hands, including the backs of the hands and the skin next to and under the fingernails. Allow hands to dry completely (this should take a minute or two). Then place the student’s hands under the black or UV light.
4. Under the light, the “germs” will show up. Have students use the chart to determine the cleanliness of the washer’s hands. Enter it on their data table. Label this “0 seconds.”
5. Have the student wash hands for five seconds. Stop and check the cleanliness of the hands under the black or UV light. Record this as “5 seconds.”
6. Have the student wash hands for five additional seconds. Stop and check under the black or UV light. Record this as “10 seconds.”
7. Repeat the procedure twice more, for 15 and 20 seconds. Each time, have students record the level of cleanliness.
8. Change roles and repeat the activity until everyone (including the judges) has had a turn being the hand washer.
9. Have students graph their results. Put the time on a horizontal line going across the page. Mark every number between 0 and 20 seconds. Put the average cleanliness scores on the vertical line.

**Sample data table:**

Washer	Washing Time in Seconds				
	0	5	10	15	20

Maria	++++	+++	++	+	-
LaToya	++++	+++	++	+	-
James	++++	++++	+++	++	+
Jacob	++++	+++	++	+	-
Average	++++	+++	++	+	-



### Hand Washing Experiment—Method 2: Paint

#### Materials

- Apron or smock for each person (or just wear old clothes)
- Timer or watch that counts seconds
- Sink
- Blindfold
- 1 tube of washable paint
- Towels
- Soap
- Newspaper

## Procedure

### *Engagement (5 minutes)*

1. Ask students, “How do you think germs are spread? If one person has a cold, how can you catch it?”
2. Students will give many answers: “If you sit next to them,” “if you drink out of their cup,” “if they sneeze on you.” Write these down.

### *Exploration (30 minutes)*

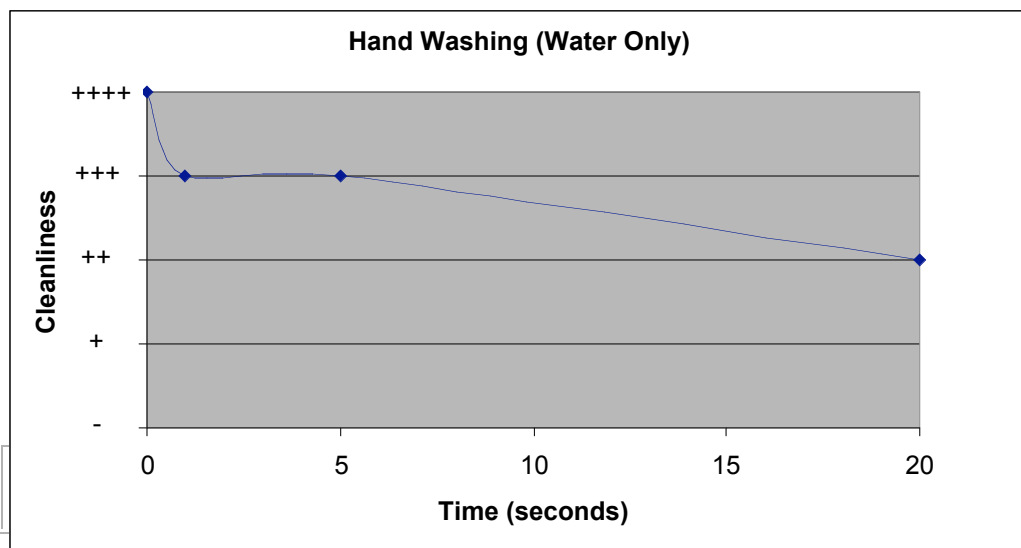
1. Have students develop a chart that will help them score how clean their hands are. Divide a piece of paper into four sections. Trace the outline of a hand in each section. Now have students use pens or crayons to shade their idea of completely dirty, very dirty, dirty, and slightly dirty. Label the completely dirty hand as +++++, the very dirty hand as +++, and so on. Use a minus sign (–) to represent “completely clean.” For consistency, choose one or two students to act as the judge. Other students can act as recorders.
2. Have students construct a data table to record their results.

Washer	Washing Time in Seconds				
	0	5	10	15	20
Student 1					
Student 2					
Student 3					
Student 4					
Average					

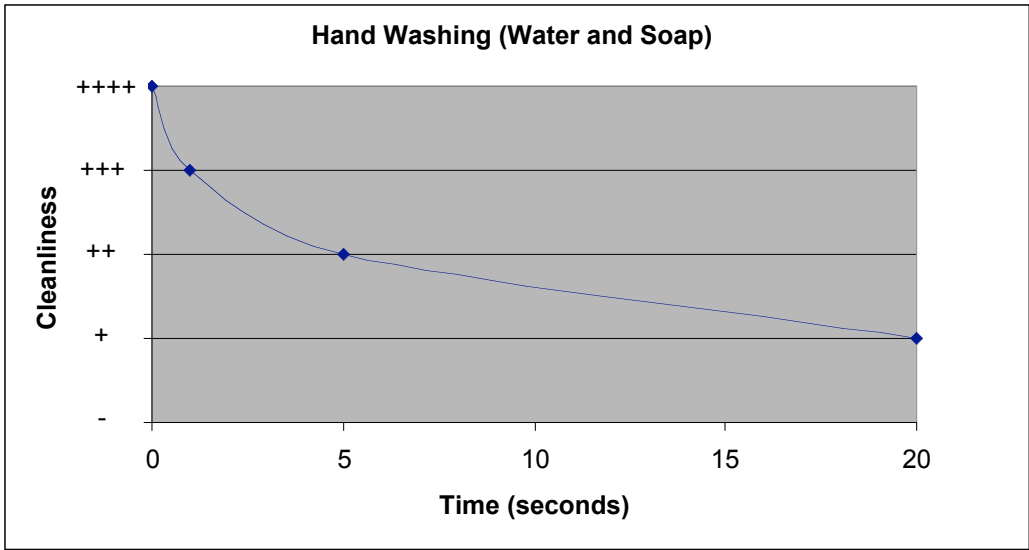
3. Cover a workspace with newspaper. Divide students into pairs. One will be the hand washer and one will be the timekeeper.
4. Have the washer put one teaspoon of washable paint on the palm of one hand. Spread it evenly over both hands, including the backs of the hands and the skin next to and under the fingernails. Allow hands to dry completely (this should take a minute or two). Close the paint.
5. Go to the sink. Place a blindfold over the hand washer’s eyes. Have the washer wash just with water for one second. After one second, have the timekeeper blot the washer’s hands dry by lightly touching a towel to the skin. **Do not rub.** Do not let the hand washer see his or her hands or give away any hints about how clean they are.
6. Have the judge use the chart to judge the cleanliness of the washer’s hands. Enter it on the data table. Label this “Water Only.”

7. Have the washer wash for four more seconds with just water. Again, lightly blot the washer's hands and record their cleanliness.
8. Have the washer wash for fifteen seconds more with water. Once again, blot and record the cleanliness.
9. After the first student in each pair has finished and has recorded the scores, have the other student in the pair try the same experiment, this time using soap. Use a new data table labeled "Water and Soap."
10. Have students graph their results. Create two graphs showing the average cleanliness score at each time interval. One graph will show the results with water only. The other graph will show results with soap and water. Put the time on a horizontal line going across the page. Mark every number between 0 and 20 seconds. Put the average cleanliness scores on the vertical line. A data table might look like this:

Washer	Washing Time (in seconds) with Water Only			
	0	1	5	20
Margaret	++++	++++	++++	+++
Jose	++++	++++	+++	++
Kiesha	++++	+++	+++	++
Average	++++	+++	+++	++



	0	1	5	20
Jennifer	++++	+++	++	+
Madison	++++	++++	+++	++
Juan	++++	+++	+	+
Average	++++	+++	++	+



*Explanation (10 minutes)*

1. Discuss with students what they have learned from the hand washing experiment. (It is not easy to remove germs. It is necessary to use both soap and water, to wash hands for at least 20 seconds, and to rub vigorously.)
2. Discuss with students how germs can be picked up or spread through inadequate hand washing. Cold viruses can be spread by touching people or objects. The flu virus may be spread by contact with infected people. In a preschool, a child can put a toy in his mouth and then give it to another child, who picks up germs from the toy. Think about other examples. Hand washing protects you from illness, but also protects those people you may encounter. For more information on hand washing, visit the BAM! Web site and read the *Buzz on Scuzz* at [www.bam.gov/sub\\_yourbody/yourbody\\_buzz\\_how.html](http://www.bam.gov/sub_yourbody/yourbody_buzz_how.html).
3. Explain to students that because microbes are living organisms, they require certain conditions to live. The environment is the favorable surroundings and conditions *external* to the host that cause or allow the disease to be transmitted.

Some diseases live best in dirty water. Others survive in human blood. Still others, such as *E. coli*, thrive in warm temperatures but are killed by high heat.

*Elaboration and Evaluation (10 minutes)*

1. Ask students what they learned about microbes from this experiment. Answers may include, “They are there even if you don’t see them,” to “I thought my hands were clean, but they weren’t.”

**Performance Descriptors**

Here is an evaluation sheet you may wish to use with students:

<b>Hand Washing</b>		
<b>Student Names:</b>		
1.		
2.		
3.		
4.		
<b>Category</b>	<b>Performance Criteria</b>	<b>Total Points</b>
Data collection (up to 15 points)	Students recorded information accurately and in the appropriate place on the chart	
Graphing (up to 15 points)	Students created a graph based on the data	
Analysis (up to 20 points)	Students drew conclusions about the importance of proper hand washing and the prevalence of germs based on their data	

*Extension*

1. You may want to print out and hang or distribute CDC posters for kids on stopping the spread of germs, available at [www.cdc.gov/germstopper/materials.htm](http://www.cdc.gov/germstopper/materials.htm).

**Text Correlations**



Glencoe, *Teen Health, Level 1*, Chapter 12: Understanding Communicable Diseases  
Glencoe, *Teen Health, Level 2*, Chapter 7: Preventing Diseases  
Glencoe, *Teen Health, Level 3*, Chapter 17: Communicable Diseases

### **Web Resources**

CDC *BAM! Body and Mind*<sup>™</sup>: [www.cdc.gov/bam](http://www.cdc.gov/bam) or [www.bam.gov](http://www.bam.gov)

*BAM! Body and Mind* is brought to you by the Centers for Disease Control and Prevention (CDC), an agency of the U.S. Department of Health and Human Services (DHHS). *BAM!* was created to answer kids' questions on health issues and recommend ways to make their bodies and minds healthier, stronger, and safer. *BAM!* also serves as an aid to teachers, providing them with interactive activities to support their health and science curriculums that are educational and fun.

Centers for Disease Control and Prevention (CDC): [www.cdc.gov](http://www.cdc.gov)

The CDC Web site provides a comprehensive overview of the latest research on infectious diseases. From research studies on infectious diseases to information for travelers, this site provides a wealth of information. Some is written for medical professionals, but much of the information is written for health care consumers.

School Network for Absenteeism Prevention (SNAP): [www.itsasnap.org/index.asp](http://www.itsasnap.org/index.asp)

SNAP is a hands-on initiative for middle schools designed to help keep students in school and learning by improving overall health through promoting clean hands. The Web site includes a free, downloadable educational kit and poster that teachers can use in classrooms to promote hand washing.

NSF International Scrub Club: [www.scrubclub.org/home.php](http://www.scrubclub.org/home.php)

Kids can learn about health and hygiene and become members of the Scrub Club<sup>™</sup> at [www.scrubclub.org](http://www.scrubclub.org). The site features a fun and educational animated Webisode with seven "soaper-heros" who battle nasty villains who represent germs and bacteria. Kids learn the six key steps to proper hand washing through a webisode, hand washing song, interactive games. Activities for kids and educational materials for teachers are also available to download.

## **Relevant Standards**

### *National Science Education Standards*

#### Content Standard A, Grades 5-8: Science as Inquiry

As a result of activities in grades 5-8, all students should develop:

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

### *National Health Education Standards*

#### Standard 1

Students will comprehend concepts related to health promotion and disease prevention.

- Explain the relationship between positive health behaviors and the prevention of injury, illness, disease and premature death.
- Analyze how environment and personal health are interrelated.

#### Standard 3

Students will demonstrate the ability to practice health-enhancing behaviors and reduce health risks.

- Demonstrate strategies to improve or maintain personal and family health.