

## Science & Society: Preventing the Spread of Disease

**Grade Level:** 6-12 grades (a teacher-guided approach for younger students and a student-directed approach for older students)

**Description:** Students are introduced to vocabulary, and their prior knowledge about infectious diseases is assessed. They conduct a liquid exchange activity that models a spread of an infectious disease. An activity summary discussion helps students extend and apply their understanding of how an infectious disease may spread. Students work in small groups to examine real-life cases of infectious diseases from different countries and diverse approaches in solving the health problems caused by infectious diseases. Students learn about people and organizations that help prevent the spread of infectious diseases. Students also consider how to balance protecting the rights of those who have infectious disease and those who do not.

**Learning Outcomes:** Students will be able to:

- Simulate the spread of an infectious disease (Lesson 1).
- Describe some factors essential in the prevention of an infectious disease (Lesson 1).
- Identify health challenges and solutions in various case studies (Lesson 2).
- Apply their understanding of the spread of disease and prevention methods to health problems relevant to themselves or their communities (Lesson 2).

**Time Needed:** Two 45-minute class periods

### Vocabulary:

- Disease: a disorder or incorrectly functioning organ, part, structure, or system of the body; disease can result from genetic or developmental errors, infection, poisons, nutritional deficiency or imbalance, toxicity, or unfavorable environmental factors; an abnormal condition
- Germ: a microorganism that causes disease
- Infect: affect, contaminate, or taint
- Infectious: tending to spread from one to another
- Organism: a living being, a form of life considered an entity
- Symptom: a sign or indication of something
- Transmit: to send, spread, or pass on
- Transmission: the act or process of spreading

### Materials:

#### Lesson 1

- Disposable 4 oz. or medicine cups for all students and a few extras for a teacher demonstration
- Aprons and goggles for all students
- One or two plastic droppers or glass pipettes with squeezable tops (for teacher only)
- Calculator
- Handouts for students: [Word Scramble Game](#), [Word List and Questions](#), [Exchange Activity Notes](#), [Exchange Activity Summary](#)
- Teacher's keys and discussion highlights for student handouts: [Teacher's Word Scramble Game](#), [Teacher's Word List and Questions](#), [Teacher's Exchange Activity Notes](#), [Teacher's Exchange Activity Summary](#)
- Alkaline (basic) solution: Add ½ teaspoon or about 1 gram of sodium hydroxide (NaOH) to a half liter of tap water for a mild concentration, approximately 0.1 mole.
- pH indicator: phenolphthalein (C<sub>20</sub>H<sub>14</sub>O<sub>4</sub>), which turns alkaline solutions pink.

#### Lesson 2

- Case Studies: [Diarrheal diseases](#), [HIV/AIDS: Ryan White](#), [Smallpox](#), [Malaria](#)
- Handouts for students: [Case Study Notes](#), [Preventing Infectious Diseases](#)
- Teacher's keys and discussion highlights for student handouts: [Teacher's Case Study Notes](#), [Teacher's Preventing Infectious Diseases](#)

## Lesson 1 Procedures:

Preparation before the class:

- Number each cup for identification.
- Randomly select three cups and fill each one-third full with the sodium hydroxide solution. Record these cups' numbers for your reference later on.
- Fill the rest of each cup one-third full with tap water.
- Cut several [Word Scramble Game](#) sheets into single rows or groups of rows so that there are as many cutouts as the number of student pairs for each class.

Building vocabulary

1. Have students work in pairs and provide each pair with a cutout of the [Word Scramble Game](#). Ask student pairs to use the hints and definitions to unscramble letters to spell a word in each row of their cutouts.
2. Place a blank [Word Scramble Game](#) transparency on an overhead projector and have students share their answers.

Activating prior knowledge

3. Place a blank [Word List and Questions](#) transparency on an overhead and conduct a brief discussion using the questions on the transparency to assess students' prior knowledge and assumptions about infectious germs and diseases. Record student responses and correct any misconceptions—e.g., contagious vs. inherited illnesses. Discussion notes for teachers are provided on the [Teacher's Word List and Questions](#).

Simulation—the spread of disease

4. Inform students that they will use these words and the discussion points after conducting an exchange activity that simulates how an infectious germ may be transmitted quickly from one person to another.
5. Provide each student with a numbered cup pre-filled with a liquid (see alkaline solution preparation in "Materials" section above and an [Exchange Activity Notes](#) handout.
6. Place the [Exchange Activity Notes](#) transparency on an overhead projector and review the following key steps of the activity before students start their exchange activity:
  - a. Exchange liquid by pouring liquid from one cup into the other, then dividing the mixture evenly into the two cups (step 3).
  - b. Exchange your liquid with three other students, one at a time (step 3).
  - c. Record who (cup numbers), when (first, second or third) and what (color) for all three exchanges (steps 3 and 5).
7. Have students conduct the exchange activity and record data on the handout, following the steps in the [Exchange Activity Notes](#). Consider whether the activity should be teacher-guided or student-directed. The [Teacher's Exchange Activity Notes](#) provides guided facilitation and review-discussion suggestions for both options.

Debriefing of the simulation activity

8. Have students summarize their exchange activity using their completed [Exchange Activity Notes](#).
9. Tell students that the phenolphthalein ( $C_{20}H_{14}O_4$ ) that you added to their cups (activity step 5) is a pH indicator that turns pink in a basic/alkaline solution (pH greater than 7). If appropriate, introduce or review that pH measures the acidity (lower than 7) or alkalinity (greater than 7) of a solution.
10. Demonstrate how phenolphthalein ( $C_{20}H_{14}O_4$ ) stays clear in tap water with a neutral pH level (7), but turns pink in an alkaline sodium hydroxide (NaOH) solution.
11. Tell students that you handed out three cups with sodium hydroxide solution and that the rest contained tap water, at the beginning of the activity.

### Applying and extending

12. Distribute a copy of the [Exchange Activity Summary](#) sheet to each student.
13. Place a blank [Exchange Activity Summary](#) transparency on an overhead projector and fill out letters **a** and **c** on the top of the transparency as a whole class.
14. Put students in small groups (3-4 per group) to complete the Summary sheet.
15. Collect completed sheets and tell students that each group will present their summary during the next class.

### Lesson 2 Procedures:

#### Discussion

1. Return students' [Exchange Activity Summary](#) sheets collected from Lesson 1 and have students review their notes.
2. Place a blank [Exchange Activity Summary](#) transparency on the projector. And have groups share their notes and summarize them on the transparency. Use the notes provided in the [Teacher's Exchange Activity Summary](#) to extend the discussion to consider:
  - essential knowledge for preventing the spread of disease
  - protecting the rights of all people—those who have infectious diseases and those who do not
  - possible misuse of health information to discriminate

#### Case studies

3. Tell students that they will work on real-life cases that demonstrate different ways to prevent the spread of an infectious germ.
4. Divide students into four or more small groups and assign one of the following case studies to a group:
  - a. [Diarrheal diseases](#)
  - b. [HIV/AIDS-Ryan White](#)
  - c. [Smallpox](#)
  - d. [Malaria](#)
5. Hand out copies of the assigned case study and the [Case Study Notes](#) sheet to each student to work in their small groups and complete the Case Study sheet.
6. Have each group present their completed [Case Study Notes](#) to the class. Use the notes on the [Teacher's Case Study Notes](#) to help students consider multiple perspectives of understanding and solving health problems.

#### Summation

7. Distribute a copy of [Prevention of Infectious Diseases Worksheet](#) to each student. Direct students to complete the five sentences on the top half of the worksheet. Have students share their responses and refer to the notes on [Teacher's Prevention of Infectious Diseases](#) for discussion points.
8. Have students write a paragraph responding to a question—"How can you help prevent the spread of infectious disease?"—at the bottom half of the worksheet.
9. Collect the completed [Prevention of Infectious Diseases Worksheet](#) write-ups for evaluation.

#### Evaluation:

Lesson 1: Review student responses to items 1-3 on the [Exchange Activity Summary](#) to evaluate students' understanding of the simulation activity. This will also provide some clarifications and corrections that should be addressed in the next class.

Lesson 2: The group presentation of the [Case Study Notes](#) can be used to evaluate the students' understanding of diverse ways of preventing the spread of infectious diseases, how solutions to health problems may differ from place to place, and how everyone can participate in the prevention of infectious disease. Also, review students' completed [Prevention of Infectious Diseases](#) write-ups to evaluate how they have applied what they have learned to their own lives.

### Extension:

Extension Activity 1 (10-12 grades): Students participate in the [What's Your Perspective: Why Global Health?](http://getinvolved.against-the-odds.org/get_involved/perspective3.php) ([http://getinvolved.against-the-odds.org/get\\_involved/perspective3.php](http://getinvolved.against-the-odds.org/get_involved/perspective3.php)) online activity. Students read and evaluate the information provided online and at least two additional sources before writing and submitting online one-paragraph (minimum) comment that articulates his or her perspective on the topic.

Extension Activity 2 (6-12 grades): Students select one of the case studies or another health topic from the topics highlighted in the [Join the Conversation](http://apps.nlm.nih.gov/againsttheodds/get_involved/index.cfm#JTC) ([http://apps.nlm.nih.gov/againsttheodds/get\\_involved/index.cfm#JTC](http://apps.nlm.nih.gov/againsttheodds/get_involved/index.cfm#JTC)) to create an informational pamphlet or a PowerPoint presentation on the topic. The pamphlet or the PowerPoint slide show informs and identifies various causes and effective solutions for the health topic that students have selected and researched. The pamphlet or presentation may include, but is not limited to, the following basic information:

- What is the health problem and what are some of its causes?
- Who is mostly affected by it? Why? (Consider people, location and conditions.)
- Are current solutions for the health issue effective and sustainable? Why or why not?
- What do you propose as a new solution or an enhancement to the current solutions?
- Who should be involved in your proposed solution? Why?

### National Education Standards:

#### English Language Arts:

##### Reading for Perspective

- Students read a wide range of print and non-print texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment.

##### Evaluating Data

- Conduct research on issues and interests by generating ideas and questions, and by posing problems.
- Gather, evaluate, and synthesize data from a variety of sources to communicate their discoveries in ways that suit their purpose and audience

##### Participating in Society

- Participate as knowledgeable, reflective, creative and critical members of a variety of literacy communities.

##### Applying Language Skills

- Use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

#### Health Education:

- Students will comprehend concepts related to health promotion and disease prevention.
- Analyze how behavior can impact health maintenance and disease prevention
- Analyze how information from the community influences health
- Express information and opinions about health problems

#### Science:

Science in personal and social perspectives:

- The severity of disease symptoms is dependent on many factors, such as human resistance and the virulence of the disease-producing organism.
- Many diseases can be prevented, controlled, or cured. Some diseases, such as cancer, result from specific body dysfunctions and cannot be transmitted.

Personal and community health:

- Personal choices concerning fitness and health involve multiple factors

Science and technology in local, national and global challenges

- Progress in science and technology can be affected by social issues and challenges

## **Social Studies:**

### Culture

- Analyze and explain the ways groups, societies, and cultures address human needs and concerns.
- Construct reasoned judgments about specific cultural responses to persistent human issues.

### Global connections

- Explore the causes, consequences, and possible solutions to persistent, contemporary, and emerging global issues, such as health, security, etc.

### Science, Technology, and Society

- Examine and describe the influence of culture on scientific and technological choices and advancement, such as in transportation, medicine, and warfare.
- Identify and describe both current and historical examples of the interaction and interdependence of science, technology, and society in a variety of cultural settings.