

Experimenting with Hand Cleaners

Organisms called bacteria surround us. They are present on our skin, in the food we eat, and inside of our bodies. Many types of bacteria are important to life processes on Earth. Certain bacteria change nitrogen gas into a form that plants can use. Other bacteria live in the digestive systems of animals, breaking down nutrients into vitamins. Others act as decomposers, breaking down organic material in the soil and making nutrients available for living things. Harmful bacteria, however, can cause diseases like tuberculosis and pneumonia, as well as food poisoning.

The warm, moist conditions of the human body make it an ideal place for bacteria to grow. Bacteria can reproduce quickly, producing toxic waste products that can make you feel sick. One of the easiest and most effective ways to keep harmful bacteria from entering the body is to wash your hands often. Antibacterial soaps and antibacterial gels are designed to kill bacteria found on the body.

In this activity, you will design and conduct an experiment that compares the effectiveness of an antibacterial soap and an antibacterial gel at killing bacteria on your hands.

OBJECTIVES

Design an experiment that compares the effectiveness of two hand cleaners.

Compare the growth rate of bacteria collected under three test conditions.

Evaluate the effectiveness of two hand cleaners at killing bacteria on the skin.

MATERIALS

- agar plates (3)—Petri dishes filled with sterile nutrient agar (disposable, plastic)
- antibacterial hand gel
- incubator
- liquid antibacterial soap
- new scrub brush
- wax pencil



Procedure

PART I—DAY 1: DESIGNING AND CARRYING OUT THE EXPERIMENT

1. With your group, study the materials available. Discuss the goal of the experiment. What is your group trying to discover?

2. The independent variable in this experiment is the type of hand cleaner. What is the dependent variable?

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- 3.** Establish an experimental control. To what condition will you compare the results of the experiment?

- 4.** List experimental constants. What conditions should be held the same throughout the experiment?

- 5.** On a separate piece of paper write a brief procedure outlining the steps of this experiment. Use the experimental variables, constants, and control you have established as a guide. Have your teacher check your procedure before beginning the experiment.

- 6.** Form a hypothesis. What do you think the relationship is between the type of hand cleaner used and the amount of bacteria it kills on the skin?

- 7.** Once you have collected bacteria on the agar, secure the lid of each Petri dish to its bottom half with tape. Label your group's dishes with the wax pencil. Place all three dishes upside down in the incubator. Incubate overnight at 37°C.

PART II—DAY 2: ANALYZING EXPERIMENTAL RESULTS

- 8.** Remove the Petri dishes from the incubator. Turn them right side up, and study each plate for the presence of bacterial colonies. Count the number of colonies present on each plate, and record this information in Table 1.

TABLE 1: BACTERIA CULTURES

Conditions	Number of Bacterial Colonies
unwashed hand / hand washed with only water	
hand washed with antibacterial soap	
hand covered with antibacterial gel	

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9. Dispose of agar plates as directed by your teacher. Wash hands thoroughly and apply antibacterial hand gel after handling Petri dishes.
10. Clean up your work area before leaving the lab.

Analysis

1. **Examining Data** Compare the number of bacterial colonies on the three agar plates. Which test condition produced the most bacteria? On which agar plate were the fewest bacteria growing?

2. **Analyzing Data** Between which two agar plates was there the least difference in the amount of bacteria present?

Conclusions

3. **Drawing Conclusions** Which hand cleaner is most effective at killing bacteria on the skin? What is the reasoning behind your answer?

4. **Evaluating Data** What effect might the brand of antibacterial soap and antibacterial hand gel used in the experiment have had on the results?

5. **Making Predictions** How might the experimental results have changed had you waited one hour after applying the hand gel and washing your hands with antibacterial soap before applying your hand to the agar?
