Experiment Instructions

Chapter 9: Battle of the Bacteria: Which Cleaner Will Win?

Gather Your Materials and Mark Below

🗋 Agar Plates	🗍 Permanent Marker
Cotton Swabs	🗋 Ruler
Household Cleaners	🗋 Notebook
Distilled Water	Pen or Pencil

Overview

Detailed steps are in the student notebook pages.

Part 1: Set Up and Sample Collection

Start by gathering all your materials and checking that everything is clean and ready to use. Label your agar plates by dividing them into four sections—one for each cleaner (ammonia, vinegar, bleach, alcohol). Next, use cotton swabs to collect bacteria from different surfaces around you, such as desks or doorknobs. Carefully streak each sample onto the corresponding section of your labeled agar plate.

Part 2: Apply Cleaners and Incubate

After collecting your samples, use a new cotton swab for each cleaner and gently streak it over the matching section of the agar plate. Be careful not to mix the cleaners. Once all cleaners are applied, place your agar plates in a warm, dark place where they can sit undisturbed for 24–48 hours to allow bacteria to grow.

Part 3: Observe, Measure, and Record Results

Once incubation is complete, examine your agar plates closely. Look at the size, shape, and color of any bacterial colonies. Use a ruler to measure the growth in each section and record your data carefully in your notebook. Create a table to organize your observations so you can clearly compare which cleaner was most effective at reducing bacterial growth.

Title	Date
Objective	
Hypothesis	
Materials	
Check your materials and make su	ure you have everything you need.
🗋 Agar Plates	Permanent Marker
Cotton Swabs	Ruler
Household Cleaners	🗋 Notebook
Distilled Water	D Pen or Pencil
Make sure you have all the within easy reach. Check th ready to use.	materials laid out on a clean, flat surface hat everything is in good condition and
Use a permanent marker to drawing on the bottom of t three sections with the pan	o divide each agar plate into four sections b the dish. Label one section "none" and other me of one of the cleaners (Ammonia, Vinega
Bleach, Alcohol).	
 Use a second agar plate if y one area none. 	you want to test more cleaners. Always labe
none vinegar bleach ammonia	none alcohol water soap

Step 3: Collect Bacteria Samples

- Use a new cotton swab for each surface you want to test (e.g., doorknobs, desks, sinks).
- Gently rub the cotton swab over the surface to collect some bacteria.
- Streak the bacteria onto the agar plate by gently swiping the swab across the agar surface. Be careful not to press too hard.

Step 4: Apply Cleaners to Sections

- Use a new cotton swab for each cleaner.
- Dip the cotton swab into the cleaner and gently streak it over the corresponding section of the agar plate. Be consistent with the amount of cleaner you apply to ensure fair results.

Step 5: Incubate the Agar Plates

- Place the agar plates in a warm, dark place where they won't be disturbed. Ideal spots could be inside a cabinet or a warm room.
- Leave the plates to incubate for 24-48 hours. This will allow the bacteria to grow, and you'll see the effects of the cleaners.

Record Your Observations

Observe and Measure Bacterial Growth

- After the incubation period, carefully take out the agar plates.
- Use a ruler to measure the diameter of the bacterial growth in each
- section. Write down your measurements in your notebook.
- Look for clear areas where bacteria didn't grow (zones of inhibition) and note their sizes.

Cleaner	Bacterial Growth (cm)	Notes

Compare the Bacterial Growth

- Compare the size of the bacterial growth in each section to determine which cleaner was the most effective.
- Look for patterns or differences in how each cleaner affected the bacteria.

Use this space to draw your graph.

Analyze Your Data

- Compare your measurements to see which cleaner was the most effective.
- Create a graph to show the relationship between the cleaners and the bacterial growth.

Write Your Conclusions





Battle of the Bacteria: Which Cleaner Will Win?

Materials List

- Agar Plates
- Cotton Swabs
- Household Cleaners
 - Ammonia

RulerPencil

Distilled Water

Permanent Markers

- Vinegar
- Bleach
- Alcohol

Objectives

- Explore how bacteria grow and the conditions that promote their growth.
- Evaluate the effectiveness of different household cleaners in inhibiting bacterial growth.

Read and Research

• Review Facts About Bacteria

- Have students review facts about viruses, bacteria, and archaea. Discuss the differences between the three types of organisms.
- Learn About Agar Plates
 - Explain that agar plates are used to provide a growth medium for bacteria. Discuss why scientists use agar plates to study bacteria.

• Review Household Cleaners

- Introduce students to the four cleaners: ammonia, vinegar, bleach, and alcohol.
- Discuss their common uses and properties.

Question Formulation

- Step 1: Write Down Questions
 - **Instruction:** Encourage students to write down as many questions as they can about bacteria and the effectiveness of cleaners.
 - **Examples:** "How do bacteria grow on different surfaces?" "Which cleaner is most effective at killing bacteria?"

Step 2: Improve the Questions

- **Instruction:** Help students refine their questions to make them clearer and more focused.
- Examples: Open-Ended: "How do bacteria grow on different surfaces?" -> Closed-Ended: "Do bacteria grow more on surfaces cleaned with water than those cleaned with bleach?"
- Examples: Closed-Ended: "Is bleach effective at killing bacteria?" -> Open-Ended: "How effective is bleach compared to other cleaners at killing bacteria?"



• Step 3: Prioritize the Questions

- **Instruction:** Assist students in prioritizing their questions to focus on the most interesting or important one.
- Step 4: Record Your Question
 - **Instruction:** Have students write down their prioritized question in their notebook.

Test, Tinker, Try: Conducting the Experiment

• Step 1: Gather All the Materials

• **Instruction:** Ensure all students have the necessary materials laid out on a clean, flat surface within easy reach. Check that all equipment is in good condition and ready to use.

• Step 2: Prepare the Agar Plates

• **Instruction:** Have students use a permanent marker to divide each agar plate into four sections, labeling each section with the name of a cleaner (ammonia, vinegar, bleach, alcohol).

Step 3: Collect Bacteria Samples

• **Instruction:** Students should use cotton swabs to collect bacteria samples from various surfaces (e.g., doorknobs, desks) and gently streak each sample onto the four sections of the agar plate.

• Step 4: Apply the Cleaners

• **Instruction:** Students should apply a small amount of each cleaner to a separate cotton swab and gently streak it over the corresponding section of the agar plate.

• Step 5: Incubate the Agar Plates

• **Instruction:** Place the agar plates in a warm, dark place to incubate for 24-48 hours.

Observations

- Visual Inspection
 - **Guide students** to carefully examine each section of the agar plates. Look for bacterial colonies and note their size, shape, and color.
 - **Use tools** like magnifying glasses, if available, for more detailed inspection.
- Measurement
 - **Measure the Bacterial Growth:** Have students use a ruler to measure the diameter or radius of the bacterial colonies in each section of the agar plate.
 - Record Data: Ensure students record their measurements accurately in their notebook. They should label the data clearly, indicating the cleaner used for each section.

Organize Observations

 Create Tables: Assist students in creating tables to organize their observations and measurements. This helps in comparing the effectiveness of the different cleaners visually.

Analyze Data



Compare Measurements

• **Guide students** to compare the measurements of bacterial growth across the different cleaners. Discuss which cleaner had the least bacterial growth.

• Identify Patterns

- **Discuss Patterns:** Have students look for patterns in the data. For example, did one cleaner consistently show less bacterial growth compared to the others?
- **Consider Variables:** Encourage students to think about any variables that might have affected the results, such as the amount of cleaner used or the type of surface the bacteria were collected from.
- Calculate Averages:
 - If students have multiple trials, **help them calculate the average bacterial growth** for each cleaner to obtain a more reliable comparison.

Draw Conclusions

- Reflect on Hypothesis
 - **Ask students** to revisit their initial hypothesis. Was their hypothesis supported by the data? Why or why not?
- Summarize Findings
 - Guide students to summarize their findings in a clear and concise manner. They should explain which cleaner was most effective at inhibiting bacterial growth and why they think that is the case.

• Discuss Implications

• **Encourage students** to think about the broader implications of their findings. How can these results be applied in real-life situations? What are the benefits of using an effective cleaner?

Share Results

Presentations

- **Have students prepare presentations** to share their findings with others. They can use visual aids such as charts and graphs to illustrate their data.
- Written Reports
 - Encourage students to write a detailed report summarizing their experiment, including their research, question, hypothesis, methods, observations, data analysis, and conclusions.
- Group Discussions
 - Facilitate a discussion where students compare their results and discuss any differences or similarities. Encourage students to ask questions and share insights.