

**Introduction:**

Over a month ago you and your group made soap. Today we are finally going to use your soap! We will look at how effective your soap is under specific conditions. The experiments you perform on your soap you'll also perform on regular store bought soap. (Reference: "CHEMFAX!" Soap-Making Kit, Flinn Scientific, Inc.)

**Student Materials:**

- Olive Oil, 1 mL
- Distilled water, 100 mL
- Homemade soap
- Commercial soap
- Test tubes (7)
- Test tube stoppers (7)
- China Marker
- Test tube rack
- Hot plate
- Cold Bath
- Calcium Chloride,  $\text{CaCl}_2$  0.1 M, 10 mL
- Balance
- Forceps
- pH paper
- Pipet (2)
- Watch glass
- Cotton swab

**Test 1. Determination of pH**

1. Place about 0.5 grams of your homemade soap into a test tube labeled "homemade soap." Use forceps to handle the soap sample until the pH has been determined.
2. Place about 0.5 grams of commercial bar soap into a second test tube labeled "commercial soap."
3. Add 10 mL of distilled water to each test tube and stopper the test tubes. Shake both tubes to dissolve the soap in the water.
4. Immerse a stirring rod into each test tube. Remove the stirring rod and touch the wet end of the rod to a strip of pH paper.
5. Compare the resulting color to the chart on the container of the pH paper to determine the pH of the solution. Record the pH of both samples.
  - a. If the pH of the homemade soap sample is higher than the pH of the commercial soap sample, do not handle it with your bare hands and continue to use the forceps.
6. Save these soap solutions for Test 2.

### **Test 2. Lathering Ability**

1. Use the same samples used in Test 1.
2. Stopper both test tubes and shake each one vigorously 25 times. Record your observations of the lathering abilities. Allow both tubes to sit until the liquid below the soap bubbles appears clear (roughly one minute).
3. Record the amount of lather formed by measuring the height of the later in cm above the water with a ruler, then discard solutions down the drain and rinse out test tubes for Test 3.

### **Test 3. Behavior of Soap in Hard Water**

1. Place about 0.5 grams of your soap sample into a test tube labeled "homemade soap."
2. Place about 0.5 grams of a commercial bar soap into a test tube labeled "commercial soap."
3. Add 10 mL of a 0.1 M calcium chloride solution to each test tube and stopper the test tubes. The calcium chloride solution is very similar to hard water.
4. Shake each test tube vigorously 25 times. Record your observations.

### **Test 4. Ability to Cut through Grease**

1. Drip about 5 drops of oil onto a watch glass with a pipet. Rub the oil on the watch glass with a cotton swab.
2. Hold the watch glass over the sink or a large beaker. Using a clean pipet, rinse the watch glass with water. Allow the water to run down the watch glass in an attempt to rinse the oil. Record your observations.
3. Cut a small piece of the "homemade" soap sample and rub it on the watch glass. Run water over the watch glass again to rinse the oil/soap mixture. Record your observations.
4. Repeat steps 1-3 using the commercial soap sample to clean the watch glass. Record your observations.

### **Test 5. Temperature's Effect on Soap Test – Design Experiment**

Design experiments to test three different temperature conditions to see which allows soap to work the best. You can use a hot plate to heat water and an ice bath to cool water. *List your procedure below then check with your teacher before beginning your experiment.* (5 pts)

**Data Tables (5 pts)**

**Observations of Soap Sample**

|                    | <u>Homemade Soap</u> | <u>Commercial Soap</u> |
|--------------------|----------------------|------------------------|
| Smell              | _____                | _____                  |
| Color              | _____                | _____                  |
| Texture            | _____                | _____                  |
| Other Observations | _____                | _____                  |

**Test 1. Determination of pH**

|    | <u>Homemade Soap</u> | <u>Commercial Soap</u> |
|----|----------------------|------------------------|
| pH | _____                | _____                  |

**Test 2. Lathering Ability**

|                     | <u>Homemade Soap</u> | <u>Commercial Soap</u> |
|---------------------|----------------------|------------------------|
| Observations        | _____                | _____                  |
| High of Lather (cm) | _____                | _____                  |

**Test 3. Behavior of Soap in Hard Water**

|                            | <u>Homemade Soap</u> | <u>Commercial Soap</u> |
|----------------------------|----------------------|------------------------|
| Observations in Hard Water | _____                | _____                  |
|                            | _____                | _____                  |
|                            | _____                | _____                  |

**Test 4. Ability to Cut through Grease**

|   | <u>Homemade Soap</u> | <u>Commercial Soap</u> |
|---|----------------------|------------------------|
| Observations of rinsing oil with water only | _____                | _____                  |
|   | _____                | _____                  |
|   | _____                | _____                  |
| Observations of rinsing oil with soap       | _____                | _____                  |
|   | _____                | _____                  |
|   | _____                | _____                  |

Test 5 is on the next page →

**Test 5. Temperature's Effect on Soap Test – Design Experiment**

1. State your findings from your experiment (2 pts):

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2. State your conclusions based on your findings (WHY do you think the results are as they are) (2 pts):

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**Post-Lab Questions:**

Suppose you work for a major corporation that manufactures soap. The VP of Research asks you and your chemists to make the soap you made with the same exact ingredients and procedure. Based on the results of your experiments, honestly answer the following questions your boss has for you.

3. What were the similarities and differences between your homemade soap and our competitor's soap? (4 pts)

4. Create a list of properties you and your researchers think are important to consumers when buying soap (think about the brands you buy and why you buy them). (2 pts)

5. *Based on your data, do you and your researchers believe your homemade soap would sell as it? Support your answer with evidence from your experimental results. (5 pts)*

6. *What do you recommend should change about the soap if we are to mass produce it and sell it to consumers? (2 pts)*

7. *Design a name and a slogan for your new soap. Draw a logo and write a slogan to market your soap. A drawn micelle must be present in your design. (4 pts)*