

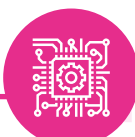
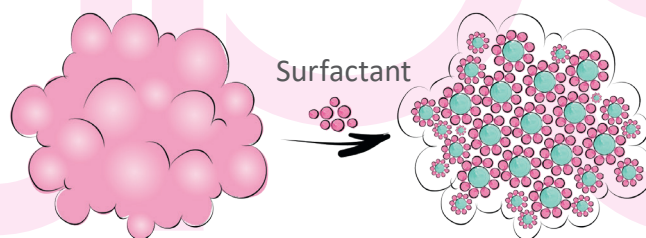
STEAM Experiment #5

The Beauty of Shampoo



Science

Have you ever wondered how shampoo actually works to make your hair silky and clean? The answer is surfactants. Surfactants are short for “surface-acting agents” and are one of many different compounds in personal-care products. The surfactant in shampoo reduces the surface tension of water to help it spread and move around our hair to remove the oil and dirt. Surfactant molecules have two different ends. One end of the molecule attracts water (hydrophilic). The other end of the molecule repels water (hydrophobic). Therefore, hydrophilic end of the molecule cleans and rinses away oil and dirt that is attached to the hydrophobic the end. The image below shows the surfactants surrounding the oil and dirt. The outside of the molecule will attract the water, taking the oil and dirt down the drain.



Technology

Think about your favorite brand of shampoo. Write the name of it down below. Use the Internet to research the active ingredients in your favorite shampoo. Write down the top 3 ingredients below. Using your science knowledge from above, identify which ingredients might be the surfactants and explain their function.

- My favorite shampoo is _____ .
- The top 3 active ingredients are _____ , _____ and _____ .
- Based on my research, the ingredient that is the surfactant is the _____ .
- The function of the surfactant is to _____ .

Create a spreadsheet in Microsoft Excel that has 3 columns and 3 rows. Label each column.

1. Brand of shampoo
2. The first 3 ingredients
3. List the ingredient that might be a surfactant

NOTE! Use the B.O.S. resource folder to learn more about Microsoft Excel.



Engineering

Now that you know how shampoo works and what ingredients are needed to make it, you will engineer (design and create) your own shampoo. Follow the procedure below and be sure to think about your final product along the way. Good engineers are constantly thinking of new ways to make their product better and more advanced!

| EQUIPMENT IN YOUR KIT | QUANTITY | CLASSROOM EQUIPMENT | QUANTITY |
|---------------------------|-------------|-----------------------|-------------|
| 2 oz Shampoo Bottle | 1 | None needed | N/A |
| 8 oz Beaker | 1 | | |
| Pipette | 1 | | |
| INGREDIENTS IN YOUR KIT | FORMULATION | CLASSROOM INGREDIENTS | FORMULATION |
| Natural Organic Soap Base | ½ oz | Distilled Water | 1 oz |
| Essential Oil | 1-3 drops | | |
| Colorant (optional) | 1-3 drops | | |
| Q-Pearl | 1-3 drops | | |

Part 1: Imagine Your Product

In order to make your own shampoo, you need to determine how much of each ingredient you will need. Answer the questions below to make decisions about your final product.

? *What color will you select for your shampoo? Why did you choose this color?*

? *Do you want your shampoo to have a strong scent? Why or why not?*

Part 2: Plan Your Product

Based on your responses above, determine how much of each ingredient you will need.

? *You will need the following ingredients and the amounts listed.*

1. ½ oz of natural organic soap base
2. 1 oz of distilled water

? *Determine how much of the Essential Oil you will need based on your product design. Circle which amount you think is appropriate.*

1. 1 drop of Essential Oil (faint scent); or
2. 2 drops of Essential Oil (medium scent); or
3. 3 drops of Essential Oil (strong scent).

NEXT



? Determine how much of the following ingredient you will need based on your product design. Circle which amount you think is appropriate.

1. 1 drop of colorant (light color); or
2. 2 drops of colorant (medium color); or
3. 3 drops of colorant (dark color).

Part 3: Create Your Product

Follow the procedure below using the 4 ingredients and the amounts you selected.

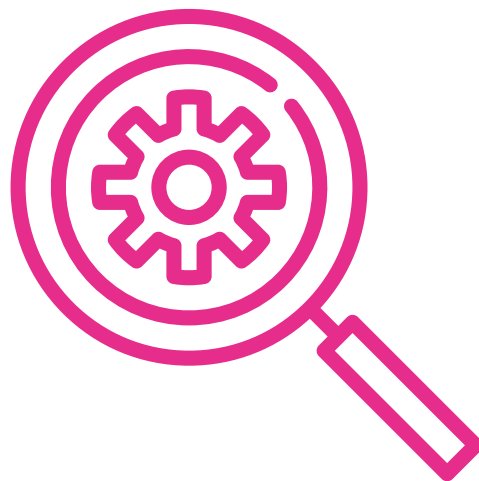
1. Pour ½ oz of the Natural Organic Soap Base into your beaker.
2. Add 1 oz distilled water.
3. Add the desired amount of Essential Oil to the soap and water mixture.
4. Add the desired amount of colorant of your choice.
5. Stir the mixture until mixed well.
6. Add 1-3 drops of Q-Pearl.
7. Pour the mixture into your shampoo bottle, screw the top on tightly and shake vigorously.

Part 4: Evaluate Your Product

Reflect on the final product you have created. Answer the questions below in order to consider changes you could make that would improve your product.

? Did your product turn out the way you imagined it would be in Part 1? Why or why not?

? What are some additions you could make to the formula of your product? Are there any ingredients you would like to add that would improve the quality? Give an explanation for each addition.





Art

Now that your product has been created, let's design a shampoo holder to hang in the shower!

Materials that you will need:

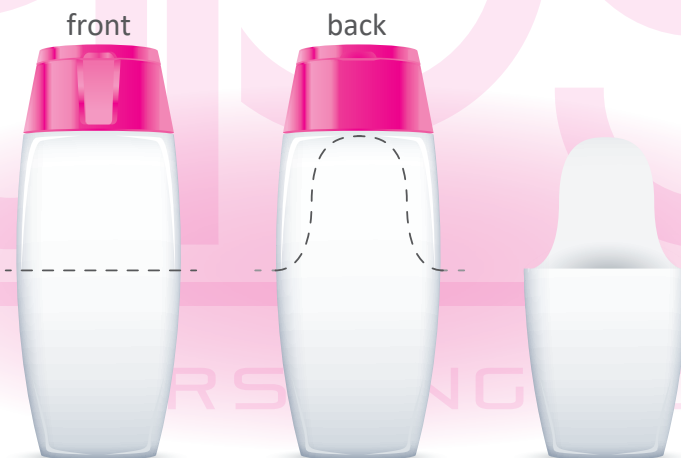
- An empty product bottle
- Scissors
- Markers

! **Instructions:**

Step 1: Bring an empty bottle from home like the one shown below:



Step 2: With adult supervision, cut the bottle in the pattern as shown below (front and back):



Step 3: Cut a hole in the back as shown:



Step 4: Use the color markers to decorate it!





Mathematics

Once your product has been created, your job now is to use your mathematics skills to determine the right selling price for your shampoo. Mathematicians consider two questions while computing the cost of products: How much did the product cost to make? How much can you sell it for to make a profit?

- ? **Calculate the cost of the product based on your price list and calculations below.**
(To calculate, take the amount of each ingredient you used and multiply it by the price.)

Example: 1 drop of colorant = \$0.25 What is the cost of colorant if I use 3 drops?

$$\$0.25 \times 3 = \$0.75 \text{ for colorant}$$

| | | |
|---------------------------|-------------------|-----------------|
| Natural Organic Soap Base | \$1.00 per oz | Your Cost _____ |
| Lavender Essential Oil | \$0.75 per drop | Your Cost _____ |
| Distilled Water | \$0.50 per oz | Your Cost _____ |
| Colorant | \$0.25 per drop | Your Cost _____ |
| 2 oz Shampoo Bottle | \$0.23 per bottle | Your Cost _____ |

- ? **Calculate the total cost of your product by adding all the individual ingredient costs.**

Total Cost of Your Product _____

- ? **Based on the total cost, determine a price that people will pay that will cover your total cost and pay you a profit. You may want to research the price of other similar products in order to be competitive.**

Price you will charge _____

Cost to manufacture your product _____

Profit for each bottle sold (calculate the difference between the cost and price above).

- ? **If you sold 100 bottles, what would be your profit? Show your work in the space below.**

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- ? **How many bottles would you have to sell to make a profit of over \$1,000? Show your work in the space below.**

