

## Shampoo Properties Evaluation

### General Science

It is difficult to obtain exact information on the formulation of commercial shampoos. These facts are held by the manufacturer to protect their product. It is possible to get some data about the relative effectiveness of a shampoo by performing some simple tests. In this lab we will test the pH of the shampoo, Percent of solids, Foam formation and stability, Viscosity, and Dirt dispersion. We will break into 6 groups to test 6 different shampoos.

**Preparation:** Record the brand of shampoo \_\_\_\_\_

**Procedure:** Prepare a 1% solution of your shampoo. Mix 2 milliliters (40 drops) of shampoo with 200 ml of distilled water. Put the shampoo in the beaker first and add the water slowly. Swirl the beaker to mix the shampoo and water. Don't shake it. You don't want to create foam.

**Test A Determination of pH:** Record the pH of your 1% shampoo solution \_\_\_\_\_

**Procedure:** Take your 1% shampoo solution to the strips of pH paper. Dip one strip of pH paper in the solution and compare the color of the strip to key.

**Information:** Most shampoos are neutral or slightly acidic. Acidic solutions cause the cuticle (outer layer) of the hair to shrink and lay flatter on the shaft of the hair. Basic solutions cause the cuticle to swell and open up. Acidic solutions make the hair seem smoother. Basic solutions make hair seem frizzier.

Neutral pH = 7    Acidic pH < 7    Basic pH > 7

**Test B Determine Percent of Solids:** Record the percent of solids of the shampoo. \_\_\_\_\_

**Procedure:** Weigh a clean dry evaporating dish and record the result below (2).

Add approximately 4 grams of shampoo (not the 1% solution) to the evaporating dish.

(4 grams is a little less than the weight of a nickel.)

Weigh the dish and shampoo and record your result below (1).

Calculate the exact weight of the shampoo only and record the result below (3).

Put the evaporating dish with shampoo on the hot plate until the liquid portion has evaporated.

(You want to dry the shampoo not burn it so watch it carefully)

After drying, weigh the dish and shampoo solids and record your result below (4).

Calculate the weight of the shampoo only (solids) after drying and record your result (5)

Calculate the percent of solids in the shampoo and record your work below (6)

Record the Percent of solids in your shampoo above.

1. Initial weight of shampoo and dish = \_\_\_\_\_ grams

2. Initial weight of evaporating dish = \_\_\_\_\_ grams

3. Initial weight of shampoo only = \_\_\_\_\_ grams

4. Final weight of shampoo and dish = \_\_\_\_\_ grams

5. Final weight of shampoo only (solids) = \_\_\_\_\_ grams

6. Calculate the percent of solids

**Information:** If a shampoo has too many solids it will be hard to work into the hair or too hard to wash out. If it doesn't have enough it will be too watery and wash away quickly. A good shampoo will be between 20% – 30% solids.

**Test C Shake Test - Determination of Foam Formation:** Record bubble size \_\_\_\_\_

Record volume of foam \_\_\_\_\_

Procedure: Test C and Test D are done together make sure your read Test D before you start.  
Put approx 50 ml of the 1% shampoo solution into a 250ml graduated cylinder and record the volume below (2).  
Cover the cylinder with your hand and shake 10 times.  
Record the total volume of the contents after shaking (1)  
Calculate the volume of the foam only (3) and record your answer above.  
Record the size of the bubbles as small, medium, or large

1. Total volume of contents after shaking = \_\_\_\_\_ ml

2. Volume of initial 1% solution = \_\_\_\_\_ ml

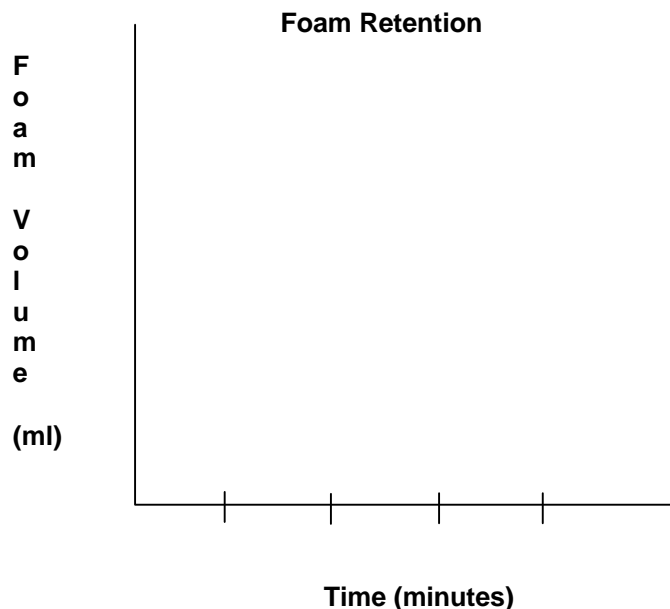
3. Volume of foam only = \_\_\_\_\_ ml

Information: A good shampoo should have a foam volume of 100 ml or more in the shake test. Bubbles should be small. The smaller the bubbles the longer the foam will persist.

**Test D Foam Quality and Retention:** Record foam volume after 4 minutes \_\_\_\_\_

Procedure: Immediately after the Shake Test (Test C), Begin timing.  
Record the volume of foam at 1-minute intervals for 4 minutes in the table below.  
Graph your results below.

Foam Retention	
Time	Volume of Foam (ml)
Initial Volume	
1 minute	
2 minutes	
3 minutes	
4 minutes	



Information: In a good shampoo, foam retention should remain stable for at least 5 minutes.

**Test E Determination of Relative Viscosity:** Record the relative viscosity \_\_\_\_\_

Procedure: Fill one small test tube with water and one with shampoo (not the 1% solution)  
 Drop a BB into each test tube and Record the time it takes to fall to the bottom in the table below  
 Repeat the test 2 more times  
 Average the three speeds for each tube and record in the table below.  
 Calculate the average relative viscosity and record the result.

	Water	Shampoo
<b>Trial 1 (time)</b>		
<b>Trial 2 (time)</b>		
<b>Trial 3 (time)</b>		
<b>Average Time</b>		
<b>Relative Viscosity = <math>\frac{\text{Ave Time Shampoo}}{\text{Ave Time Water}}</math> of Shampoo</b>	-----	

Information: Viscosity is the thickness or stickiness of a liquid. For example, maple syrup is has a higher viscosity than water. The viscosity of a shampoo is related at least in part to the amount of solids that are present. Many shampoo manufactures make tout the viscosity of their product although it probably has little to do with how well the shampoo actually works.

**Test F Dirt Dispersion:** Record the amount of foam contamination \_\_\_\_\_

Procedure: Put two drops of shampoo in a large test tube  
 Add 10 ml of distilled water  
 Add 1 drop of India Ink  
 Stopper the test tube and shake it ten times.  
 Estimate the amount of ink in the foam as (None, Light, Moderate, or Heavy) and record above

Information: Shampoos that cause the ink to concentrate in the foam are considered poor quality. The dirt should stay in the water portion. Dirt that stays in the foam will be difficult to rinse away. It will redeposit on the hair.

**Results and Conclusions:**

Record Your Results on the Class Data Sheet

Was there a shampoo that was clearly better or worse than the others? Explain your choice.

Better -

Worse -

Does quality seem to be related to cost?

What other things might you want to measure or know about a shampoo? How would you find out or test these things?

## Shampoo Lab Follow-Up

1. In the Consumer Reports article “Head Games” Sept 2000, what were they trying to determine?
2. What were their results?
3. How did the price of the shampoo affect its performance? (Did more expensive shampoos work better?)
4. Do you agree with their results? Why or Why not?
5. List the ingredients from a bottle of shampoo. From pg 19 of the article, the internet activity, and the lab, explain what the ingredients do (or are supposed to do.)

Shampoo \_\_\_\_\_

Ingredients

## The Great Wash Off

Use the Scientific Method to solve the following problem. The experiments we did and the article we read explored the properties of various shampoos. But which shampoo is really better on your hair day after day?

Define the problem:

Does expensive shampoo really do a better job of cleaning your hair?

Hypothesis:

\_\_\_\_\_

Test the Hypothesis: Research and Controlled Experiment

Research: What does the research we did (Consumer Reports Article and Shampoo Properties Evaluation) tell you about the problem?

Controlled Experiment:

Variable: \_\_\_\_\_

Control Procedure: \_\_\_\_\_

Experimental Procedure: \_\_\_\_\_

Collect Observations:

What information should we collect?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_

Is the data quantitative or qualitative?

Are criteria needed for the information we collect?

How should we organize our data? (What types of tables and graphs will we need?)

Run the experiment and collect the observations

Draw Conclusions:

Compile the entire class data.

What conclusions can you reach from your experiment?



