



# Lotus Leaves & Shave Cream



**Subject:** Biomimicry

**Grade Level:** K-12

**Topic:** Hydrophobic and Hydrophilic Properties

**Time:** 45-60 minutes

## Learning Objectives

Students will:

- identify the difference between hydrophobic and hydrophilic properties.
- apply and analyze hydrophobic and hydrophilic properties as they create marbled paper.
- evaluate uses for hydrophobic and hydrophilic surfaces.

## Materials

computer paper (1 piece per student), watercolor paper (1 whole piece cut in half per student), shave cream, bottles of food coloring, toothpicks, water in a small spray bottle, a squeegee, paper towels and waste basket (for cleanup)

## Procedure

**Engage:** To promote student curiosity, have a discussion with students about how soap works. Soap is used all the time, but students do not typically know what makes it effective for cleaning items. Watch this video to promote a discussion [It's a Wash: The Chemistry of Soap](#)

**Ask:** *Have you ever seen shaving cream? What do you know about it?* Eventually help students to understand that shaving cream is a type of soap.

**Explore:** Help students build an understanding of hydrophilic and hydrophobic properties of shave cream by having students complete the following activity.

1. Cover half the computer paper with shave cream.
2. Use smooth it out evenly.
3. Put a few drops of different food coloring in different spots of the shave cream. No more than 6 drops.
4. Take a toothpick and swirl the colors throughout the shave cream. Mixing colors is encouraged.
5. Take one 1/2 sheet piece of watercolor paper and press it into the colorful shave cream.
6. Take a piece of cardboard or a squeegee and wipe the shave cream away. It works best if you scrape the shave cream right into a trash can. Put that paper aside.
7. Next, lightly wet the other 1/2 sheet of watercolor paper with the spray bottle.
8. Repeat steps 5 & 6.
9. Compare the 2 papers. The first paper should have absorbed the color well, the second paper (the wet one) should have much more muted colors.

**Explain:** Have students begin to show what they have learned by having students provide an explanation for the difference in the two sheets of paper. Have students look at other's work to see if they got the same results. Ask: *Which sheet has brighter colors (wet or dry)? Why do you think that sheet has brighter colors?*

**Elaborate:** Have students use their new knowledge to think of ways that hydrophobic and hydrophilic surfaces would be useful. Share the following video with students so they can see how scientists have looked at things like the lotus leaf (biomimicry) which is very hydrophobic and tried to copy its structure to solve human problems. [▶ The Lotus Effect: Breakthrough Junior Challenge 2016](#)

Have students work in groups to come up with uses for hydrophobic or hydrophilic materials or surfaces. Encourage them to think about anything they can think of in nature that may have a hydrophobic or hydrophilic surface that could be used to solve human problems.

## Assessment

**Evaluate:** Evaluate student learning by having students share and politely critique each other's ideas.

## Extension Activities

- If available, have students work with "Magic Sand". Ask: *Is Magic Sand hydrophobic or hydrophilic?*
- Compare how water droplets behave on hydrophilic surfaces like cotton and hydrophobic surfaces like vinyl.
- Experiment with cleaning oil spills using different methods and materials

## NGSS Alignment

## **K-2**

2-PS1-1 – Plan and conduct an investigation to describe and classify materials by observable properties.

K-2-ETS1-2 – Develop a simple sketch or model to solve a problem.

## **3-5 Alignment**

5-PS1-3 – Make observations and measurements to identify materials based on their properties.

3-5-ETS1-2 – Generate and compare multiple solutions to a problem.

4-LS1-1 – Structure and function in living organisms.

## **Middle School (6-8)**

MS-PS1-2 – Analyze and interpret data on properties of substances before and after interaction.

MS-ETS1-1 – Define design problems with criteria and constraints.

MS-LS1-1 – Structure and function.

## **High School (9-12)**

HS-PS2-6 – Communicate scientific and technical information about molecular interactions.

HS-PS1-3 – Plan and conduct investigations to gather evidence of molecular-level interactions.

HS-ETS1-3 – Evaluate solutions to complex real-world problems.



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