Name: _____ Date: _____ Class: _____

Engineering Self-Cleaning Hydrophobic Surfaces Student Sheet

Your engineering team has been tasked with creating a product that makes any surface both dirt and stain resistant. You will use your knowledge of hydrophobicity and work with your team to decide who needs your product (for example, construction industry, automotive industry, urban planners, clothing manufacturers, or consumer use.) Your team will choose methods for modifying a surface. After modification, you will test the surfaces to determine hydrophobicity. To begin you need to do some research and gain background knowledge. Examine the materials that have been provided; you may touch the materials or test them out on your skin. You may choose **two of these materials** to modify your surfaces. Next you will create a prototype and test it on your surfaces. After testing, your team will evaluate your design and propose improvements for next time. Let's get started!

Explore and Design Stage

As a group, discuss and decide who your targeted user will be and what materials you will test.

Target User: _____

User Problem: _____

Chosen test material: Circle one: **Wood** or **Cotton**

Use the box to describe your solution and list the materials you will use to solve the problem. Explain your thinking.

Prototype 1

Your plan and hypothesis:

Materials Needed:

Creating Notes:

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Prototype 2

Your plan and hypothesis:

Materials Needed:

Creating Notes:

Create Your Prototypes

Modify your chosen surfaces. Make sure to note any changes or issues you have during your design stage.

Investigate and Test

Surface Observations

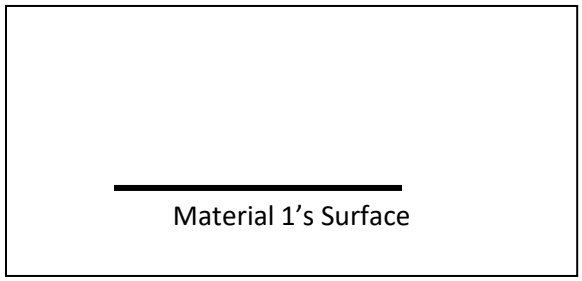
If you have access to a handhelds magnifying lens, examine each or your materials and in the box below describe what you see, noting both similarities and differences. Consider whether the surfaces appear smooth, bumpy, convex, concave, or have other characteristics.

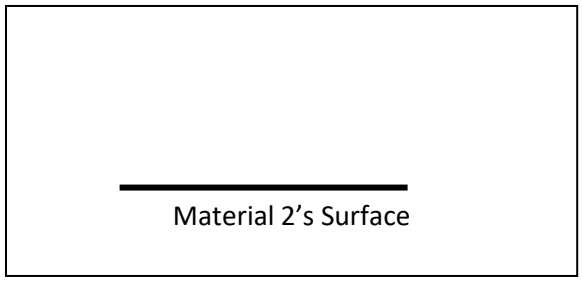
Surface 1	Surface 2

Drop Profile /Contact Angle

1. Place a drop of water on the modified surface.

2. Look at the drop from the side and sketch the drops profile.





Tilt/ Roll Off Angle

1. Tape the bottom edge of clipboard to lab table.
2. Clip your material onto the clipboard.
3. Place a drop of water on the material.
4. Person 1: Begin to raise the clipboard slowly. Person 2: Observe the drop of water at eye level and record the angle of the clipboard from the table top when the drop of water begins to roll.
5. Using the protractor, record the angle when the water drop begins to slide. If it did not slide, record no roll off angle. Repeat three times and calculate the average roll off angle.

Material	Roll Off Angle			Avg.
1				
2				

Self-Cleaning Properties

1. You will be provided with "dirt" to make your surfaces dirty.
2. Sprinkle the "dirt" on your surface.
3. Measure the initial mass of the "dirt" and the material. Record in the data table below.
4. "Clean" your surface: Over a sink/ bucket pour 30 ml of water over your material.
5. Measure final mass of the "dirt" and material after "cleaning". Record in data table below.
6. Repeat steps 2-5 for material 2.

Material	Initial Mass (g)	Final Mass (g)
1		
2		

Reflections and Improvements

1. What type roll off angle works best for self-cleaning surfaces?

2. What type of water drop profile/contact angle works best for self-cleaning surfaces?

3. Would you consider your surface to be self-cleaning/super hydrophobic? Explain using a claim, evidence from your experiment and reasoning from any information you have been provided with today.

4. If you had to improve your modification method, how would you do this and why?