Rain Does the Washing

Model and test a design inspired by lotus leaves

BIO.5.9 "Enrichment: Use an engineering design process to investigate and model current technological uses of biomimicry to address solutions to real-world problems.*"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the problem, circle the lotus feature used in the design, and number one model, one test, and one improvement in order to trace the design process.

A Cleaner Wall, Inspired by a Leaf

1. After a dusty week, a building's exterior can look stained. Washing tall walls uses water, labor, and equipment. Engineers have studied lotus leaves for another approach. A lotus leaf has microscopic bumps coated with water-repellent wax. Rain forms droplets that roll across the surface and pick up loose dirt. This effect does not mean the leaf destroys dirt or cleans itself without water. The engineering problem is to help rain remove loose dust from building paint, reducing some washing. Designers must also ask whether a coating lasts through sun, wind, and repeated rain.

2. Some exterior paints sold today use water-repellent, finely textured surfaces inspired by lotus leaves. To investigate the idea, a team builds two plastic wall models coated with the same water-repellent material. One has tiny raised dots; the other stays smooth. They set both at the same angle and spread 1.0 gram of dry dust on each. Then they pour 20 milliliters of water over each model and weigh the dust left behind. Holding material, slope, starting dust, and water volume constant helps isolate the effect of surface texture. These models test an idea, not the full performance of a painted wall.

3. In one trial, 0.4 gram of dust remains on the dotted model and 0.7 gram remains on the smooth model. The dotted model lost more dust, but one trial is not enough to show that a real coating will work for years. The team repeats the test, then exposes samples to simulated sunlight and rubbing before testing again. If the dots wear down, the team might change their shape or spacing and retest. This cycle links a biological structure to a useful design while checking trade-offs. In a dry climate, even a durable coating may need occasional washing.

2 ANSWER WITH EVIDENCE

Use the passage

1. How does the proposed wall coating use a feature of the lotus leaf to address the building's problem?

2. Why does the team keep the coating material, slope, starting dust, and water volume the same on both models?

3. How much dust did each model lose in the trial, and what can the team conclude from that comparison?

4. If rubbing wears down the dots, what design change and follow-up test does the passage suggest?

3 YOUR TURN

Your own words

Choose a biological structure other than a lotus leaf and propose a technology inspired by it. In four or five sentences, explain the problem and the structure's useful feature, describe a model and a fair comparison test, and name one limitation you would investigate.

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PART 1 · READ AND MARK

Underline the problem, circle the lotus feature used in the design, and number one model, one test, and one improvement in order to trace the design process. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How does the proposed wall coating use a feature of the lotus leaf to address the building's problem?	**Its water-repellent texture imitates the leaf's wax-coated bumps, helping rain droplets roll off and carry away loose dust.**
2	Why does the team keep the coating material, slope, starting dust, and water volume the same on both models?	**Keeping those conditions the same helps the team test whether the raised dots, rather than another difference, affect dust removal.**
3	How much dust did each model lose in the trial, and what can the team conclude from that comparison?	**The dotted model lost 0.6 gram, and the smooth model lost 0.3 gram. The dots helped remove more dust in this trial, but one trial cannot establish long-term performance.**
4	If rubbing wears down the dots, what design change and follow-up test does the passage suggest?	**Change the dots' shape or spacing, then rub the revised sample and test its dust removal again.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

A gecko's toe pads have tiny hairs that help them make close contact with surfaces. I would design a reusable wall hook with a dry adhesive pad inspired by those hairs. I would compare a patterned pad with a smooth pad of the same material and size by measuring how much weight each holds on identical clean tiles. I would repeat the test after adding the same amount of dust to both tiles. If dust weakens the patterned pad, I would investigate whether cleaning it restores its grip.

Accept other biologically accurate structures and feasible models. A fair test should identify what changes between models and what is measured.