



WHY ARE BLUEBERRY FLOWERS DIFFERENT?

Observe First. Use the structure of the flower to figure out the pollination problem.

NAME: _____

TAKE A CLOSER LOOK



BLUEBERRY FLOWER



STRAWBERRY FLOWER

OBSERVE

- What do you notice that is unique about the blueberry flower?

- How is the blueberry flower different from the the other flower?

- How might its shape affect the way pollen is collected and transferred?

LOOK INSIDE A BLUEBERRY FLOWER:

Notice that the anthers are shorter than the stigma. This structure helps protect the pollen from wind and water. Label the stigma, anthers, and pollen on the diagram your teacher provides.

WATCH: BUZZ POLLINATION

- What did you observe the bee doing?

- Why is buzz pollination especially effective for blueberry flowers?

- What might happen to production if buzz-pollinating bees became rare or disappeared from an area?



DISCOVER:

Buzz pollination (sonification) occurs when rapid vibrations from a bee release pollen from specialized anthers.

YOUR ENGINEERING CHALLENGE:

How could you mimic buzz pollination to design a device that collects pollen from one blueberry flower and transfers it to another?

DEFINE THE ENGINEERING PROBLEM

Your client has a problem. Before you build anything, define what your solution needs to accomplish.

YOUR CLIENT: BLUEBELL, INC. –

Bluebell, Inc. produces blueberries along with apples, tomatoes, and strawberries. The company wants to investigate whether a handheld device using vibration could help collect and transfer pollen between blueberry flowers. Hand-pollination methods have been used with other crops, but blueberry flowers have a different structure. Your engineering team must develop a solution designed for blueberry pollination. Your engineering team has been hired to investigate the problem and design a possible solution.

1 | ASK — DEFINE THE PROBLEM

- In your own words, what problem has Bluebell, Inc. asked you to solve?

CRITERIA + CONSTRAINTS:

CRITERIA — WHAT MUST IT DO?

- ☐ Release pollen using vibration
- ☐ Pick up pollen
- ☐ Transfer pollen
- ☐ _____

CONSTRAINTS — WHAT LIMITS THE DESIGN?

Available materials: _____

Time: _____

Other: _____

2 | RESEARCH — LEARN FROM NATURE

- Why must you consider both the pollen and the pollinator when designing your device?

- How does nature solve this problem?

- How could your design mimic insect hairs or other features of a bee?

BEFORE YOU DESIGN...

You need evidence to make two decisions: 1) What vibration source works best?
2) What material works best for collecting and transferring pollen?



INVESTIGATE BEFORE YOU DESIGN

Test vibration and pollen-transfer materials. Use evidence, not guesses, to guide your design.

INVESTIGATION 1 |

WHICH TOOTHBRUSH VIBRATES BEST?

Use water to visualize how vibration transfers energy & causes movement.

PREPARE YOUR MODEL FLOWER

Follow your teacher's directions to build or prepare the model flower you will use during testing.

POLLEN PACKETS → STIGMA → HANGING FLOWER MODEL

TEST IT

1. RECORD the brand/type.
2. OBSERVE its sound and vibration.
3. TEST the brush head in water.
4. MEASURE splatter dist. from bowl center.
5. REPEAT for 3 trials.
6. COMPARE averages.

TOOTHBRUSH	OBSERVATIONS	TRIAL 1	TRIAL 2	TRIAL 3	AVERAGE

- Which toothbrush would you choose? Why?

INVESTIGATION 2 | WHICH MATERIAL MOVES POLLEN BEST?

Test at least three materials. Before you begin, decide how you will keep the test fair.

How will you make sure each material receives a fair test?

MATERIAL	POLLEN PICKUP OBSERVATIONS	POLLEN DROP-OFF OBSERVATIONS

USE YOUR EVIDENCE

Best vibration source: _____ Why? _____

Best pollen-transfer material: _____ Why? _____



TURN YOUR RESEARCH INTO A SOLUTION

Generate options first. Then choose, plan, get approval, and build.

3 | IMAGINE — BRAINSTORM FOUR POSSIBLE SOLUTIONS

IDEA 1:	IDEA 2:
IDEA 3:	IDEA 4:

CHOOSE:

- Which idea will your group develop? **Idea #:** _____
- Why did you choose it? Use evidence from your research.

4 | PLAN — DRAW YOUR WORKING PROTOTYPE

Label the vibration source, pollen pickup/transfer material, and other important parts.

MATERIALS:

- ☐ Electric toothbrush
- ☐ _____
- ☐ _____
- ☐ _____

CHECK BEFORE YOU BUILD:

- ☐ My design uses available materials.
- ☐ My design meets the criteria and constraints.
- ☐ My teacher has approved my plan.

Teacher Approval: _____

5 | CREATE IT!

Retrieve your materials and build your prototype. Follow your plan, but pay attention to what you learn while building.



HOW WELL DOES YOUR DESIGN MOVE POLLEN?

Measure pollen pickup and drop-off. Then use the evidence to improve your design.

6 | TEST — POLLEN PICKUP

1. WEIGH BEFORE Beginning Device Mass _____ g	2. COLLECT Use vibration to collect pollen from the model flower.	3. WEIGH AFTER Final Device Mass _____ g
CALCULATE: Final Device Mass - Beginning Device Mass = Pollen Picked Up _____ g - _____ g = _____ g pollen picked up		

POLLEN DROP-OFF

1. WEIGH BEFORE Beginning Paper Mass _____ g	2. TRANSFER Vibrate the pollinator over the paper to simulate transfer.	3. WEIGH AFTER Final Paper Mass _____ g
CALCULATE: Final Paper Mass - Beginning Paper Mass = Pollen Dropped Off _____ g - _____ g = _____ g pollen dropped off		

TRACK YOUR TESTS

DESIGN/TEST	POLLEN PICKED UP	POLLEN DROPPED OFF	OBSERVATIONS
TEST 1			
TEST 2			
TEST 3			

7 | IMPROVE

- What worked well? _____
- What needs to change? _____
- What will you change and why? _____



WHAT DID YOUR ENGINEERING TEAM DISCOVER?

Communicate your final design and support your recommendation with evidence.

YOUR FINAL PROTOTYPE

SKETCH AND LABEL YOUR FINAL HAND-POLLINATION DEVICE.	
POLLEN PICKED UP: _____ G	POLLEN DROPPED OFF: _____ G

COMPARE YOUR RESULTS

- Which designs were most successful? _____
- What did successful designs have in common? _____
- How were they different? _____
- What difference did the electric toothbrush make? _____

MAKE YOUR RECOMMENDATION TO BLUEBELL, INC.

- Based on your evidence, what features should a hand-pollination device for blueberry crops include? _____

SUPPORT IT WITH EVIDENCE

OUR BEST DESIGN PICKED UP: _____ G	OUR BEST DESIGN DROPPED OFF: _____ G
MOST EFFECTIVE MATERIAL: _____	MOST EFFECTIVE VIBRATION SOURCE: _____

FINAL REFLECTION

- How did studying the way bees pollinate blueberry flowers help you engineer a human-made solution? _____