Desert Design Lab

Test and revise a plant model for an extreme environment

BOT.5.4 "Enrichment: Use an engineering design process to design and build a plant model based on extreme environment criteria to overcome the difficulties presented by this environment. Identify revisions to the proposed model over time.*"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the two goals the team set for its model. Number each design change in the order it happened, then circle the test results that show whether the changes worked.

A Plant Model for a Windy Desert

1. On a rocky desert plain, rain can arrive in brief storms, but hot sun and steady wind dry the ground quickly. A real plant needs water for photosynthesis and roots that hold it upright. A student team set two criteria for a plant model: after receiving 20 grams of water, it must lose no more than 6 grams over six hours under a lamp and fan, and it must stay upright in three wind trials. Their first model used a damp sponge as a water-storing stem, broad paper strips as leaves, and pipe cleaners pushed into sand as roots.

2. The team weighed the dry model, added 20 grams of water, and weighed it again. After six hours under the lamp and fan, its mass had dropped by 11 grams. In three separate fan trials, the model tipped over twice. The broad paper leaves offered a large area for water to escape, while the short roots gave the stem little support. For revision one, the team replaced the broad strips with narrow ones and covered most of each strip with waxed paper. Small uncovered spots represented openings where a living leaf could exchange gases.

3. The team repeated the six-hour test with the same water amount, lamp, and fan. Revision one lost 5 grams, meeting the water criterion, but it still tipped over twice in three wind trials. For revision two, the team lengthened the pipe-cleaner roots and spread them farther through the sand. This time the model stayed upright in all three wind trials; a repeated six-hour test again showed a 5-gram water loss. The model cannot grow or photosynthesize, so the tests show how its parts imitate useful plant features, not whether a real desert plant would survive.

2 ANSWER WITH EVIDENCE

Use the passage

1. How does each of the team's two success criteria address a difficulty on the desert plain?

2. Did the first model meet either criterion? Use its test results to explain.

3. What did revision one change, and which test result shows that it helped?

4. Why did the team make revision two, and what evidence shows whether it worked?

3 YOUR TURN

Your own words

Design a different plant model for a flooded freshwater marsh with soggy soil and moving water. In one paragraph, state two measurable success criteria, name the materials and features you would use, explain how you would test them, and describe two revisions you would make over time if tests reveal problems.

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PART 1 · READ AND MARK

Underline the two goals the team set for its model. Number each design change in the order it happened, then circle the test results that show whether the changes worked. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How does each of the team's two success criteria address a difficulty on the desert plain?	**The water-loss limit addresses drying from sun and wind. The uprightness criterion addresses the risk of wind tipping the model.**
2	Did the first model meet either criterion? Use its test results to explain.	**No. It lost 11 grams, exceeding the 6-gram limit, and tipped over in two of three wind trials.**
3	What did revision one change, and which test result shows that it helped?	**The team made the leaves narrower and covered most of them with waxed paper. Water loss fell to 5 grams, meeting the water criterion.**
4	Why did the team make revision two, and what evidence shows whether it worked?	**Revision one still tipped over twice, so the team lengthened and spread the roots. Revision two stayed upright in all three wind trials.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

My model has hollow straws that run from above the water into wet sand to represent air reaching submerged roots. Flexible ribbon leaves bend with moving water, and wire roots anchor the model. One straw opening must stay above water for 10 minutes, and the model must remain anchored through three gentle water pours. I would test it in a tray of wet sand, checking the opening and pouring water three times. If water enters the straw, I would raise its opening and retest. If the roots pull loose, I would spread the wires farther through the sand and repeat the pours.

Accept other plausible materials and features if the student connects them to marsh conditions. The response should include two measurable criteria, a way to test each, and two revisions tied to possible test problems.