The Tiny Launcher

Model a nematocyst, test a design, and imagine a new use

ZOO.2.8 "Enrichment: Utilize an engineering design process to create a simulated nematocyst, including possible biomimicry use.*"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the nematocyst features the team tried to model, circle the team's design choices, and number each test and revision in order. Use your marks to compare the model with the real structure.

A Capsule That Fires Once

1. A sea anemone catches prey with cells called cnidocytes. Inside many of these cells is a nematocyst, a tiny capsule that holds a tightly packed tubule. Contact and chemical cues can trigger the capsule to discharge. Stored pressure helps the tubule turn inside out and extend rapidly. Depending on the nematocyst, the tubule may stick to, wrap around, or pierce a target. One capsule fires only once. Engineers can study this sequence, storage, triggering, and rapid deployment, without copying its harmful effects. A classroom model should show the sequence clearly while keeping every part blunt and contained.

2. A student team wants its model to catch a felt target 10 centimeters away. The team folds a ribbon inside a cardboard tube and attaches a soft foam tip covered with hook-and-loop tape. Pulling a tab releases a weak spring, which pushes the tip outward and draws the ribbon from the tube. The ribbon stays attached, so the tip cannot fly free. The goal is to catch the target in at least four of five trials at 10 centimeters. The model has no venom or sharp parts. Unlike a real nematocyst tubule, its ribbon unfolds rather than turning inside out, and students can reset it.

3. In the first five trials at 10 centimeters, the tip caught the felt three times. The team noticed that a tight fold sometimes stopped the ribbon inside the tube. They changed only the fold, leaving the spring and tip unchanged. In five more trials at 10 centimeters, the tip caught the felt four times. At 20 centimeters, it caught the felt once in five trials. These results give the team evidence to judge its goal, but ten close-range trials cannot show that the model always works. A future tool might use a similar quick, tethered motion to reach an object in a narrow space.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do the model's stored ribbon and release tab represent two stages of nematocyst discharge? Name one important difference between the ribbon and a real tubule.

2. State the team's measurable success goal. Which two design choices help keep the test safe?

3. Did changing the fold meet the team's goal at 10 centimeters? Use both sets of results to support your answer.

4. How could a tool for reaching an object in a narrow space borrow from this design? Use the 20-centimeter result to explain one limit engineers would need to test.

3 YOUR TURN

Your own words

Design a different safe use for a simulated nematocyst, not catching felt. Describe what it stores, what triggers it, and what deploys; then give a measurable success goal, a test, and one revision you would try if the test fails.

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PART 1 · READ AND MARK

Underline the nematocyst features the team tried to model, circle the team's design choices, and number each test and revision in order. Use your marks to compare the model with the real structure. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do the model's stored ribbon and release tab represent two stages of nematocyst discharge? Name one important difference between the ribbon and a real tubule.	**The packed ribbon represents a stored tubule, and pulling the tab represents triggering discharge. The ribbon unfolds, while a real tubule turns inside out.**
2	State the team's measurable success goal. Which two design choices help keep the test safe?	**The tip must catch the felt in at least four of five trials at 10 centimeters. The foam tip is blunt, and the ribbon keeps it attached to the tube.**
3	Did changing the fold meet the team's goal at 10 centimeters? Use both sets of results to support your answer.	**Yes. The tip caught the felt three of five times before the change and four of five times afterward, meeting the four-of-five goal.**
4	How could a tool for reaching an object in a narrow space borrow from this design? Use the 20-centimeter result to explain one limit engineers would need to test.	**A tool could deploy a tethered tip quickly toward an object. Because the model caught the target only once in five trials at 20 centimeters, engineers would need to test whether the tool works at the required distance.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

My tool would place a reusable marker on a paper target across a narrow gap. A soft pad and its tether would rest inside a tube. Pressing a button would release a weak spring, pushing the pad toward the paper while the tether keeps it attached. The tool must place the marker inside a 3-centimeter circle in four of five trials from 15 centimeters away. I would test it five times at that distance. If it misses the circle too often, I would try a wider pad and repeat the test.

Accept other accurate comparisons between nematocyst discharge and the model. For the open task, look for a distinct, safe use and a test that can measure the stated goal.