The Stent Test

Use model evidence to improve a cardiovascular treatment.

HAP.10.7 "Enrichment: Use an engineering design process to develop, model, and test effective treatments for cardiovascular diseases (e.g., methods to regulate heart rate, artificial replacement valves, open blood vessels…"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the two flow targets and the leak limit, circle the four test results for the inserts, and number the proposed redesign and its next test. These marks will help you trace how the team uses evidence to improve its design.

Keeping a Narrowed Artery Open

1. When plaque narrows a coronary artery, less oxygen-rich blood may reach heart muscle. An engineering team is exploring a stent, a small mesh tube that can hold a narrowed vessel open. Their classroom model uses water to represent blood and flexible tubing pinched at one spot to represent the narrowed artery. It cannot show clotting, healing, or how living tissue reacts to an implant. The team sets two success criteria: collect at least 40 milliliters of water in 30 seconds with the tubing straight and at least 30 milliliters when it bends. The model must not leak.

2. The team builds insert A from a narrow, flexible plastic mesh and insert B from a wider, stiffer mesh. They place each insert at the pinch in identical tubing. For each trial, they use the same water height to keep pressure similar, collect water for 30 seconds, and repeat the test with the tubing bent. Without an insert, the pinched tube passes 20 milliliters when straight and 18 when bent. Insert A passes 35 milliliters straight and 32 bent. Insert B passes 45 milliliters straight but only 22 bent. Neither setup leaks.

3. A higher straight-flow reading does not make insert B the winner. B meets the straight-flow target but misses the bent-flow target, while A shows the reverse. The team notices that the stiff insert presses against the bend and partly closes the tubing beside it. They propose a revised version of B with shorter mesh segments joined by flexible links. They predict it will keep the opening wide while allowing the tube to bend. Next they will test it against A with the same pinch, water height, timing, and bend. They will also check for leaks.

2 ANSWER WITH EVIDENCE

Use the passage

1. Does insert A meet the team's success criteria? Use its test results to support your answer.

2. Does insert B meet the team's success criteria? Use its test results to support your answer.

3. Which test conditions does the team keep the same when comparing inserts? Explain why keeping them the same matters.

4. How does the team's proposed change address a problem seen in the test? What results would show that the revised insert works?

3 YOUR TURN

Your own words

A different team models a leaky heart valve: water slips backward through a one-way flap between pump strokes. In 4 to 5 sentences, propose a new flap design, a measurable success target, one constraint, a fair test against the old flap, and a revision you would make if the target is missed.

ANSWER KEY

The Stent Test

PART 1 · READ AND MARK

Underline the two flow targets and the leak limit, circle the four test results for the inserts, and number the proposed redesign and its next test. These marks will help you trace how the team uses evidence to improve its design. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Does insert A meet the team's success criteria? Use its test results to support your answer.	**No. A passes 32 milliliters when bent and does not leak, but its 35 milliliters when straight falls below the 40-milliliter target.**
2	Does insert B meet the team's success criteria? Use its test results to support your answer.	**No. B passes 45 milliliters when straight and does not leak, but its 22 milliliters when bent falls below the 30-milliliter target.**
3	Which test conditions does the team keep the same when comparing inserts? Explain why keeping them the same matters.	**The team uses identical tubing, the same pinch, water height, collection time, and bend. Keeping conditions the same makes the inserts the main difference between tests.**
4	How does the team's proposed change address a problem seen in the test? What results would show that the revised insert works?	**Flexible links could let the tubing bend without closing beside the stiff insert. The revision would need to pass at least 40 milliliters straight and 30 milliliters bent in 30 seconds, without leaking.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would cut a flexible silicone flap that covers the opening of a model valve in a clear tube. My target is less than 5 milliliters of backward water flow over 10 pump strokes. The new flap must fit the same valve housing as the old flap. I would test each flap with the same pump strokes and water height, measuring backward flow each time. If the new flap misses the target, I would widen its sealing edge and repeat the test.

Accept other feasible redesigns and measurable targets for the valve model. Responses should compare designs under the same conditions and use test results to guide a revision.