Catch the Pattern

Plan and interpret a standing-wave investigation

PHY.4.5 "Design, investigate, and collect data on standing waves and waves in specific media (e.g., stretched string, water surface, and air) using online simulations, probe systems, and/or laboratory experiences."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the two settings kept fixed, circle the two kinds of data recorded, and number the setup, sweep, and repeat-check actions in the order they happen.

Finding Waves on a String

1. A physics class models a stretched string fixed at both ends. The simulation lets students set the string length and tension, then apply a periodic force to the string. They keep the length at 1.20 meters and the tension at one setting throughout the trial. The fixed ends cannot move, so each is a node.

2. The class starts with a low driving frequency and increases it slowly. At some frequencies, a stable pattern grows large: a standing wave. Students record the driving frequency and the number of loops, regions that move strongly between nodes. Their results appear in the table. Between these frequencies, the pattern stays small and less distinct.

STABLE PATTERNS IN THE STRING SIMULATION

Driving frequency (Hz)	Number of loops
40	1
80	2
120	3
160	4

3. To check whether the pattern is repeatable, the class lowers the frequency and sweeps upward again, keeping length and tension unchanged. The same large patterns return near the recorded frequencies. Each additional loop appears at a higher frequency. A second sweep matters because a single sighting could be a brief motion rather than a sustained standing wave.

2 ANSWER WITH EVIDENCE

Use the passage

1. Which two settings should another class match to repeat this frequency sweep? Why must they match them?

2. Use three successive rows to show how much the resonance frequency changes when one loop is added.

3. A large pattern appears at 120 Hz. What should students observe and check before calling it a standing-wave resonance?

4. What does the passage suggest students will see between 80 and 120 Hz? What should they record to compare that result with the resonances?

3 YOUR TURN

Your own words

Design an investigation using a simulation of an air column open at both ends. In one paragraph, state what you will change, what you will keep fixed, how you will find the first resonance, and what data you will collect for at least three trials.

Catch the Pattern

PART 1 · READ AND MARK

Underline the two settings kept fixed, circle the two kinds of data recorded, and number the setup, sweep, and repeat-check actions in the order they happen. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Which two settings should another class match to repeat this frequency sweep? Why must they match them?	**Match the 1.20-meter string length and the tension setting so changes in the patterns can be compared without those settings changing.**
2	Use three successive rows to show how much the resonance frequency changes when one loop is added.	**From one to two loops, the frequency rises from 40 to 80 Hz. From two to three loops, it rises from 80 to 120 Hz. Each increase is 40 Hz.**
3	A large pattern appears at 120 Hz. What should students observe and check before calling it a standing-wave resonance?	**They should observe a stable, large three-loop pattern and check that it returns near 120 Hz on a second sweep.**
4	What does the passage suggest students will see between 80 and 120 Hz? What should they record to compare that result with the resonances?	**They should see a smaller, less distinct pattern. They should record the driving frequency and whether a stable loop count can be observed.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I will test open air columns that are 0.30, 0.40, and 0.50 meters long. I will keep the air temperature and speaker volume setting fixed. At each length, I will sweep the driving frequency upward and use a microphone reading to find the lowest clear resonance peak. I will record the column length and the frequency of that first peak, then repeat each sweep to check the result.

Accept equivalent descriptions of the fixed settings and recorded data. For the open task, look for at least three lengths, a method for locating the first resonance, controlled conditions, and a plan to record both length and frequency.