Sound in Motion

Use investigation results to explain what sound waves do.

P.7.b "Use results of investigations to explain the production and characteristics of sound waves including interferences, the Doppler effect, and standing waves."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline one observed result from each of the four investigations. Circle the words that help explain what caused each result.

Four Stops at the Sound Lab

1. At a school sound lab, a small speaker played a steady note beneath a sheet of thin plastic sprinkled with salt. The salt hopped while the speaker played and settled when the power went off. A microphone trace showed repeated pressure rises and falls in the air near the speaker. When students raised the note without changing the volume setting, the pressure pattern repeated more times each second. A vibrating speaker cone pushes nearby air together and then lets it spread out. These moving changes in air pressure carry energy to a listener; faster repetitions are heard as a higher pitch.

2. Next, two speakers played the same steady tone in step. A student walked a microphone across the room and found alternating places where the recorded signal was strong and weak. With only one speaker playing, the regular pattern of strong and weak spots disappeared. Sound from the two speakers traveled different distances to each spot. Where pressure rises arrived together, they added; where a rise met a drop, they partly canceled. Sound waves overlap without permanently changing each other. The quiet spots did not mean that either speaker had stopped vibrating, since moving the microphone a short distance restored a strong signal.

3. Outside, a cyclist rode toward and then past a stationary microphone while a buzzer on the bike produced a constant tone. The recorded frequency was higher as the bike approached and lower after it passed, although the buzzer setting never changed. Later, students played a steady tone into an open tube and moved a microphone along its length. At certain tone settings, the microphone found regularly spaced loud and quiet positions; changing the tone removed that stable pattern. Reflected sound can overlap with incoming sound, creating a standing wave with fixed high-motion and low-motion regions. Motion of a source changes how often wavefronts reach an observer.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do the salt and microphone results show that the speaker produces sound? What changed in the sound wave when students raised the note?

2. Why did the microphone find quiet spots with two speakers playing, even though neither speaker had stopped?

3. Use the cyclist's results to explain why the recorded frequency changed even though the buzzer setting stayed the same.

4. What result from the tube test supports the idea that a standing wave formed at certain tone settings?

3 YOUR TURN

Your own words

Choose an everyday vibrating object not used in the passage. Design a test in which you change one feature of its vibration, predict two measurable results, and explain what those results would show about sound production or pitch.

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PART 1 · READ AND MARK

Underline one observed result from each of the four investigations. Circle the words that help explain what caused each result. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do the salt and microphone results show that the speaker produces sound? What changed in the sound wave when students raised the note?	**The moving salt shows that the speaker vibrated, and the microphone detected the pressure changes its vibration produced in air. The higher note had more pressure cycles each second.**
2	Why did the microphone find quiet spots with two speakers playing, even though neither speaker had stopped?	**At those spots, a pressure rise from one speaker met a pressure drop from the other, so the waves partly canceled. This interference made the recorded signal weak.**
3	Use the cyclist's results to explain why the recorded frequency changed even though the buzzer setting stayed the same.	**As the cyclist approached, wavefronts reached the microphone more often, giving a higher recorded frequency. After the cyclist passed, they arrived less often, giving a lower frequency. This is the Doppler effect.**
4	What result from the tube test supports the idea that a standing wave formed at certain tone settings?	**The microphone found regularly spaced loud and quiet positions that stayed in place at certain tone settings, consistent with a standing wave.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would stretch a rubber band over a box, pluck it, and measure its frequency with a phone app. Then I would shorten the vibrating section while keeping its tension nearly the same and measure again. I predict the longer section would produce about 180 Hz and the shorter section about 250 Hz. The results would show that a vibrating object produces sound and that faster vibration gives a higher pitch.

Accept explanations that connect each observation to a wave mechanism, even if students use different wording. For the open task, look for one controlled change, two plausible measurements, and a conclusion supported by the predicted results.