When Strings Sing

Investigate how changes to a string affect its sound

P.8.6.5 "Conduct scientific investigations that describe the behavior of sound when resonance changes (e.g., waves in a stretched string and design of musical instruments)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each feature the student changes and circle the resulting changes in pitch or vibration so you can trace each cause and effect.

Testing a String's Sound

1. At the makers' lab, a student stretches one string across a wooden box. A pluck makes the string vibrate, pushing the air and creating sound. The string has natural vibration rates, called resonant frequencies. Plucking supplies energy at many rates, but the string keeps vibrating most strongly at its resonant frequencies. A phone tuner can show the pitch of the strongest low note. Pitch describes how high or low a sound seems. To investigate a change in resonance, the student must change one feature at a time.

2. First, the student plucks the full string three times and records the pitch each time. Then the student presses the string against a fret halfway along its length and plucks the shorter section three times. The shorter section produces a higher pitch because its resonant frequencies are higher. The student keeps the string's tension, the plucking spot relative to the vibrating section, and the tuner's distance the same. Repeated trials help reveal a pattern instead of a result caused by one unusual pluck.

3. Next, the student returns to the full string and gently tightens the tuning peg. After each small turn, the student plucks and records the pitch. With length unchanged, greater tension raises the string's resonant frequencies, so its pitch rises. The student also places a second string nearby and plucks only the first. When the strings are tuned to matching low notes, the second string vibrates noticeably. When tuned to nonmatching notes, it vibrates less. This response shows resonance: energy from one string makes another vibrate strongly at a shared frequency.

2 ANSWER WITH EVIDENCE

Use the passage

1. Why does the student keep the string's tension the same when testing its length? What pitch change does the student observe?

2. How do three plucks at each length make the student's conclusion about the pitch change more reliable?

3. The pitch rises after the student tightens the tuning peg but keeps the string's length unchanged. What does this result show about tension and resonant frequencies?

4. How does comparing matching and nonmatching notes help the student test whether the second string is resonating?

3 YOUR TURN

Your own words

Design a test using two identical bottles with different amounts of water. Blow across their openings to compare the pitches made by the air inside. In one paragraph, name what you change, two things you keep the same, how you collect repeated pitch measurements, and a result that would support your prediction.

When Strings Sing

PART 1 · READ AND MARK

Underline each feature the student changes and circle the resulting changes in pitch or vibration so you can trace each cause and effect. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Why does the student keep the string's tension the same when testing its length? What pitch change does the student observe?	**Keeping tension the same isolates length as the cause of the change. The shorter section produces a higher pitch.**
2	How do three plucks at each length make the student's conclusion about the pitch change more reliable?	**Repeated plucks show whether the higher pitch is a consistent pattern rather than the result of one unusual pluck.**
3	The pitch rises after the student tightens the tuning peg but keeps the string's length unchanged. What does this result show about tension and resonant frequencies?	**Increasing tension raises the string's resonant frequencies.**
4	How does comparing matching and nonmatching notes help the student test whether the second string is resonating?	**The student plucks only the first string. The second vibrates more with matching notes than with nonmatching notes, showing a stronger response at a shared frequency.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would put a little water in one bottle and more water in an identical bottle, changing the size of the air space. I would blow across each opening the same way and keep the tuner the same distance away. I would record the pitch from four blows on each bottle. I predict the bottle with more water will give a higher pitch because its smaller air space has a higher resonant frequency.

Accept a testable prediction supported by repeated pitch measurements and two controlled conditions. Blowing across identical bottle openings should produce a higher pitch in the bottle with more water.