# Waves Backstage

Follow sound and light through a school play rehearsal.

**P.8.6** "Students will demonstrate an understanding of the properties, behaviors, and application of waves. Interpret the characteristics and behaviors of sound and light waves to determine the relationship between matter and energy..."

NAME _____ DATE _____

## 1 READ AND MARK

Read it twice

**YOUR JOB** Underline what happens when a wave meets a material, and circle each material named. Use your marks to explain why the sound or light changes.

### A Rehearsal Full of Waves

1. At a school play rehearsal, a student plucks a guitar behind the curtain. The string vibrates, making nearby air vibrate in a repeating pattern that reaches the audience as sound. Sound needs matter, such as air, to travel, so it cannot cross empty space. A stronger pluck makes a wave with greater amplitude, which listeners hear as a louder note. A faster vibration has a higher frequency, which listeners hear as a higher pitch. Neither change makes sound travel faster through the same air.

2. The crew notices that spoken lines echo near a hard backstage wall but sound dull near thick curtains. The wall reflects more sound toward the actors, while the curtains absorb more sound energy. To test whether a tighter guitar string makes a different pitch, a student records notes while changing only the string's tension. The student plucks the same string at the same spot each time and keeps its vibrating length fixed. Increasing tension makes that string vibrate faster, raising its resonant frequency and the pitch heard.

3. Next, a white spotlight shines through a red plastic filter onto a white costume. The filter transmits much of the red light but absorbs many other visible colors. The costume reflects the light that reaches it, so it looks red rather than white. Unlike sound, light can travel through empty space as well as through air. A microphone nearby turns sound vibrations into changing electrical signals: sound moves a thin part called a diaphragm, which moves a coil near a magnet. The changing magnetic field produces an electrical signal.

## 2 ANSWER WITH EVIDENCE

Use the passage

1. Why do spoken lines echo more near the hard wall than near the thick curtains?

2. If the student plucks the guitar string harder but it vibrates at the same frequency, what happens to the note's loudness and pitch?

3. Why does the white costume look red under the filtered spotlight? Describe what the filter and costume each do to the light.

4. Could the microphone turn the guitar's sound into an electrical signal if empty space separated it from the guitar? Explain why light from the spotlight could cross that space.

## 3 YOUR TURN

Your own words

Plan a test to find out how the amount of water in identical bottles affects the pitch when you blow across their openings. In three or four sentences, name what you change, two things you keep the same, how you compare the sounds, and what the result would show about wave frequency.

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## PART 1 · READ AND MARK

Underline what happens when a wave meets a material, and circle each material named. Use your marks to explain why the sound or light changes. Accept any marking that follows this job and points at the right text.

## PART 2 · ANSWERS

| # | QUESTION | ANSWER |
|---|---|---|
| 1 | Why do spoken lines echo more near the hard wall than near the thick curtains? | **The hard wall reflects more sound toward the actors, while the curtains absorb more sound energy.** |
| 2 | If the student plucks the guitar string harder but it vibrates at the same frequency, what happens to the note's loudness and pitch? | **The greater amplitude makes the note louder. Its pitch stays the same because its frequency does not change.** |
| 3 | Why does the white costume look red under the filtered spotlight? Describe what the filter and costume each do to the light. | **The filter transmits much of the red light and absorbs many other visible colors. The costume reflects the red light that reaches it.** |
| 4 | Could the microphone turn the guitar's sound into an electrical signal if empty space separated it from the guitar? Explain why light from the spotlight could cross that space. | **No. Sound needs matter to travel to the microphone and move its diaphragm. Light can travel through empty space.** |

## PART 3 · YOUR TURN (SAMPLE ANSWER)

I would put different amounts of water in identical bottles and blow across each opening. I would keep the bottle shape and my blowing method the same, then use a pitch-measuring app to compare the notes. If bottles with more water make higher notes, the sound waves have higher frequencies.

Accept a fair test that changes water level while keeping bottle shape and blowing method consistent. Students may compare pitches by listening carefully or by using a pitch-measuring tool.