THE STRIVING

MUSLIM ACADEMY

Islamic and Academic Education

YEARS 7 TO 9 · SCIENCE

Sound waves

Why sound needs a medium, pitch against loudness, the limits of hearing, and using an echo.

WHAT IS INSIDE

- Sound is a wave in something
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The Striving Muslim Academy

1 sets · a hint on every question

Written for a parent teaching at home. No training assumed, and nothing else to buy.

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Sound is a wave in something

Read this, then answer the questions on it.



SOUND IS A WAVE IN SOMETHING

A sound wave comes from a source vibrating at a frequency, and it travels by passing energy from particle to particle. So it needs a medium, and in a vacuum there is nothing to pass it along.

Frequency is how many vibrations a second, measured in hertz. Pitch is the perception of frequency, and it is not greatly affected by how intense the sound is. Loudness grows as the amplitude grows, but it is not related to intensity alone: frequency has a major effect on how loud a sound seems, so two sounds of the same intensity at different pitches do not seem equally loud.

The speed of sound depends on the medium, not on the loudness. What decides it is the medium's rigidity, or how hard it is to compress, together with its density. Because solids and liquids are relatively rigid and very difficult to compress, sound is generally faster in them than in gases.

Generally, not always. Sound travels at about 54 metres per second in vulcanised rubber, a solid, against about 331 in air at nought degrees Celsius. Air itself changes with temperature: at twenty degrees the figure is 343. So the rule follows rigidity and density together, not simply which state something is in.

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Hearing, and the limits of it

Read this, then answer the questions on it.



HEARING, AND THE LIMITS OF IT

Normal human hearing covers frequencies from 20 to 20,000 hertz, which is an impressive range. Sounds below 20 hertz are called infrasound and those above 20,000 hertz are ultrasound.

Neither is perceived by the ear, though infrasound can sometimes be felt as vibrations. Ultrasound is the range some animals use and the range medical imaging uses.

The ear itself is in three parts: the outer ear, or ear canal; the middle ear, which runs from the eardrum to the cochlea; and the inner ear, which is the cochlea. A hearing threshold is measured in decibels relative to the normal threshold, and a 40-phon loss at all frequencies still allows a person to understand conversation, although it will seem very quiet. High noise exposure is hazardous to hearing.

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How each one is answered

Mark it together. Where a question asks for a list, the order does not matter.



SOUND, HEARING AND ECHOES

1. Explain why sound cannot travel through a vacuum.

1. A sound wave passes energy from particle to particle.
2. A vacuum has no particles.
3. So there is nothing to pass the disturbance along, and no sound.

Answer: **because sound passes from particle to particle and a vacuum has no particles**

2. Pitch is the perception of frequency. Say what loudness depends on, and why it is not simply amplitude.

1. Loudness increases as amplitude increases.
2. But it is not related to intensity alone: frequency has a major effect on how loud a sound seems.
3. So two sounds of equal intensity at different pitches do not seem equally loud.

Answer: **on amplitude and on frequency together, so equal intensities at different pitches do not seem equally loud**

3. Sound is generally faster in solids than in gases. Name the property that decides it, and give the exception in the pack.

1. The speed is decided by the medium's rigidity, or how hard it is to compress, together with its density.
2. Solids and liquids are rigid and hard to compress, so sound is generally faster in them.
3. The exception: sound travels at about 54 metres per second in vulcanised rubber, a solid, against about 331 in air.

Answer: **rigidity and density decide it, and vulcanised rubber is slower than air**

4. Give the range of normal human hearing, and name what lies on each side of it.

1. Normal human hearing covers 20 to 20,000 hertz.
2. Below 20 hertz is infrasound; above 20,000 hertz is ultrasound.

Answer: **20 to 20,000 hertz, with infrasound below and ultrasound above**

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SAMPLE PAGES

You have read a few pages. The pack is longer.

What you are holding is a short sample, taken from different parts of the pack so that you can see how a week is planned and what a child is actually asked to do, before you decide.

The complete pack, and the rest of the academic materials, are on our website: schemes of work for a parent teaching at home, and practice packs for the skills children get stuck on.

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Our Islamic Education classes are free. These packs are part of what pays the teachers who teach them.