Your notes

KS3 Science: revision notes

P3.3 Sound and waves

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Waves

- **Waves** transfer energy (and information) without transferring matter.
- In a **transverse wave**, the oscillations are at right angles to the direction the energy travels: light, water **waves** and all electromagnetic **waves**.
- In a **longitudinal wave**, the oscillations are parallel to the direction the energy travels, making **compressions** and **rarefactions**: sound is longitudinal.
- **Amplitude** is the maximum displacement from the rest position. **Wavelength** is the distance from one point on a **wave** to the same point on the next (crest to crest). Frequency is the number of waves each second, in hertz (Hz). The period is the time for one wave: period = 1 ÷ frequency.

Wave speed

- **Wave speed** = **frequency** × **wavelength** ($v = f \times \lambda$), in m/s.
- Sound travels at about 340 m/s in air, faster in liquids and faster still in solids. It can't travel through a **vacuum**, because there are no particles to vibrate.
- Light travels at 300 000 000 m/s (3×10^8 m/s).

Sound and hearing

- Sound is made by vibrations. A higher **frequency** gives a higher **pitch**; a bigger **amplitude** gives a louder sound.
- Humans can hear from about 20 Hz to 20 000 Hz. **Ultrasound** has a **frequency** above 20 000 Hz.
- In the ear, the eardrum vibrates, the tiny bones pass the vibrations to the cochlea, and nerves carry signals to the brain.
- An oscilloscope shows sound **waves** as traces on a screen.

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Reflection, refraction and uses

- **Waves** can be reflected (an **echo** is a reflected sound), refracted, absorbed or transmitted.
- Refraction happens when a **wave** changes speed as it enters a different material: water **waves** slow down and their **wavelength** gets shorter in shallow water.
- **Ultrasound** is used for scans of unborn babies and for sonar. Distance = speed × time ÷ 2, because the pulse travels there and back.
- Seismic **waves** from earthquakes tell scientists about the inside of the Earth.
- Derived units are made from other units: m/s comes from metres and seconds.

Key terms

Wave	A way of transferring energy without transferring matter.
Transverse wave	A wave whose oscillations are at right angles to the direction of energy transfer.
Longitudinal wave	A wave whose oscillations are parallel to the direction of energy transfer.
Amplitude	The maximum displacement of a wave from its rest position.
Wavelength	The distance from one point on a wave to the same point on the next wave.
Frequency	The number of waves each second, measured in hertz (Hz).
Period	The time taken for one complete wave.
Wave speed	How fast a wave travels: frequency × wavelength.
Compression	A region in a longitudinal wave where particles are close together.
Rarefaction	A region in a longitudinal wave where particles are spread out.
Echo	A reflected sound.
Ultrasound	Sound with a frequency above 20 000 Hz, too high for humans to hear.
Pitch	How high or low a sound is.
Vacuum	A space with no particles in it.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What do waves transfer?
2. Which of these is a longitudinal wave?
3. In a transverse wave, which way do the oscillations go?

Your notes

4. What is the amplitude of a wave?
5. What is frequency measured in?
6. A wave has a frequency of 50 Hz and a wavelength of 2 m. What is its speed?
7. What is the approximate speed of sound in air?
8. Why can't sound travel through space?

Answers

1. Energy
2. Sound
3. At right angles to the direction of energy transfer
4. The maximum displacement from the rest position
5. Hertz (Hz)
6. 100 m/s
7. 340 m/s
8. Space is a vacuum, with no particles to vibrate

What to do next

Practise 15 questions on this topic

Try 4 exam questions, with mark schemes

Read the lesson, one step at a time

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