Your notes

GCSE Physics: revision notes

Sound, ultrasound and seismic waves

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Sound waves

- **Sound waves** are longitudinal. They can travel through solids, liquids and gases, but not through a vacuum.
- Sound travels faster in solids than in liquids, and faster in liquids than in gases.
- (Higher) **Sound waves** can travel through solids, causing vibrations in the solid. In the ear, **sound waves** make the eardrum and other parts vibrate, which causes the sensation of sound.
- Humans can hear frequencies from about 20 Hz to 20 kHz. The conversion of **sound waves** to vibrations of solids only works over a limited range of frequencies.

Ultrasound (Higher)

- **Ultrasound** waves have a frequency higher than the upper limit of human hearing (above 20 kHz).
- **Ultrasound** is partially reflected when it meets a boundary between two different media. The time taken for the reflection to reach a detector shows how far away the boundary is.
- This is used in medical imaging (such as scanning a fetus) and industrial imaging (such as finding cracks in metal).
- Distance = speed × time ÷ 2, because the wave travels there and back.

Echo sounding (Higher)

- Ships use **echo sounding**: high-frequency **sound waves** are sent down and the echoes detected.
- This finds the depth of water and detects objects such as shoals of fish or wrecks.

Seismic waves (Higher)

- Earthquakes produce **seismic waves**. **P-waves** are longitudinal and can travel through solids and liquids. **S-waves** are transverse and cannot travel through a liquid.
- P- and **S-waves** travel at different speeds through different materials and are refracted as their speed changes.
- An S-wave **shadow zone** on the opposite side of the Earth shows that the outer core is liquid. The pattern of **P-waves** provides evidence for the size of the core.

Key terms

Sound wave	A longitudinal wave caused by vibrations, which needs a medium to travel through.
Ultrasound	Sound with a frequency above 20 kHz, too high for humans to hear.
Echo sounding	Using reflected sound waves to measure water depth or find objects.
Seismic waves	Waves produced by earthquakes that travel through the Earth.
P-waves	Longitudinal seismic waves that travel through solids and liquids.
S-waves	Transverse seismic waves that cannot travel through liquids.
Shadow zone	A region where seismic waves are not detected after an earthquake.
Hearing range	The frequencies humans can hear: about 20 Hz to 20 kHz.

Quick questions

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

1. What is the range of human hearing?
2. Why can't sound travel through space?
3. What is ultrasound?
4. Why is ultrasound useful for medical imaging? (Higher)
5. An echo from the sea bed returns after 0.4 s. Sound travels at 1500 m/s in water. How deep is the sea? (Higher)
6. Which seismic waves cannot travel through liquids? (Higher)
7. What type of wave is a P-wave? (Higher)
8. What does the S-wave shadow zone tell us about the Earth? (Higher)

Answers

1. About 20 Hz to 20 kHz

Your notes

2. There are no particles to vibrate
3. Sound above 20 kHz
4. It is partially reflected at boundaries between tissues
5. 300 m
6. S-waves
7. Longitudinal
8. The outer core is liquid

What to do next

Practise 10 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

Free revision for GCSE and KS3 at lycolearn.co.uk. Some notes are for one exam board only, and say so in brackets.

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