

Sound Ultrasound Seismic

GCSE Physics · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

State the range of human hearing and define ultrasound. (2 marks)

Step 1 · Human hearing

About 20 Hz to 20 000 Hz (20 kHz).

Step 2 · Ultrasound

Sound waves with a frequency higher than 20 kHz, above the range of human hearing.

Answer: 20 Hz–20 kHz; ultrasound is above 20 kHz

Check: The upper limit falls with age.

2. Now try one with the steps

A ship's sonar sends an ultrasound pulse to the sea bed. The echo returns after 0.40 s. Sound travels at 1500 m/s in sea water. Calculate the depth. (3 marks)

Step 1 · Total distance

Step 2 · Halve it

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. State the range of frequencies of normal human hearing. [2]

2. Define ultrasound. [1]

3. Give two uses of ultrasound. [2]

4. Describe how sound waves cause you to hear. [2]

5. Explain why ultrasound is partially reflected inside the body. [1]

6. A sonar echo returns after 0.40 s. Sound travels at 1500 m/s in sea water. Calculate the depth. [3]

7. Compare P-waves and S-waves. [2]

8. Explain why humans cannot hear ultrasound. [1]

9. Explain why ultrasound rather than X-rays is used to scan a developing baby. [1]

10. Explain why S-waves are not detected on the opposite side of the Earth from an earthquake. [2]

11. An ultrasound echo in tissue returns after 8.0×10^{-5} s. The speed in tissue is 1500 m/s. Calculate the depth of the boundary in cm. [3]

12. Ultrasound travels at 6000 m/s in steel. An echo from a crack returns after 2.0×10^{-5} s. Calculate the depth of the crack in cm. [3]

13. Calculate the wavelength of a 20 kHz sound in air, where the speed of sound is 330 m/s. Give your answer in metres to 2 significant figures. [3]

14. Explain why the paths of seismic waves through the Earth are usually curved. [1]

4. Before you hand it in

Using the full echo time to give the depth directly

Distance to the boundary = (speed × time) ÷ 2.

"Ultrasound is very loud sound."

Ultrasound is sound above 20 kHz; it can be quiet or loud.

"S-waves travel through the core."

P-waves pass through the liquid outer core; S-waves do not, which is the evidence it is liquid.

Using the speed of sound in air for underwater sonar

Sound travels about 1500 m/s in water, not 330 m/s.