

Ultrasound

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1. Put the following in order, from lowest to highest: speed of sound in water, speed of sound in metal, speed of sound in air.
2. Explain what an ultrasound wave is.
3. If an ultrasound wave used for sonar on a ship has a frequency of 15 MHz (high frequencies are used so that the beam stays narrow), and the speed of sound in water is about 1550 m s^{-1} , calculate the wavelength of this wave.
4. How is ultrasound used in pre-natal scanning?
5. Ultrasound is much safer than using X-rays. However, doctors were only sure it was safe after experiments on mice. Explain whether or not you think these experiments were justified.
6. A dentist may use an ultrasonic oscillator which generates ultrasound waves to descale teeth. Explain how this works.
7. How can ultrasound detect flaws in welded joints?
8. A pulse of ultrasound is sent along the length of a piece of metal which is suspected to have an internal crack. The reflected pulse is picked up by a detector beside the transmitter. The diagram below shows the trace on a CRO which picks up the echo of the sound. The “tick marks” on the time axis are 0.2 ms apart. What is the length of the bar, and how far along is the crack? Remember the speed of sound in typical metal is 5000 m/s.

