



电子科技大学
格拉斯哥学院
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Score

Physical Experiment II

Prelab Report 13

Experiment Title: Measuring the Ultrasonic Speed

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Score

Answers to Questions (20 points)

(1) Ultrasonic sound producer, in fact, it is a piezoelectric transducer which transforms one type of energy to another by taking advantage of the piezoelectric effect. The direct piezoelectric effect which converts mechanical energy into electrical energy is the internal generation of electrical charge resulting from an applied mechanical force. While the reverse piezoelectric effect which converts electrical energy into mechanical energy is the internal generation of a mechanical strain resulting from an applied electric field. Besides, if there is an alternating voltage of high frequency, and then the crystal will vibrate at the same frequency as the applied voltage, emitting a beam of ultrasonic waves.

(2) Since $v = \lambda f$, and then we can get:

$$\lambda_L = \frac{v}{f} = \frac{343\text{m/s}}{20\text{Hz}} = 17.15\text{m}$$

$$\lambda_S = \frac{v}{f} = \frac{343\text{m/s}}{20\text{kHz}} = 0.017\text{m}$$

Thus, the range of wavelengths of sound wave is from 0.017m to 17.15m.

(3) Since $v = \lambda f$, and then we can get that $\lambda = \frac{v}{f} = \frac{343\text{m/s}}{4.5\text{MHz}} = 7.62 \times 10^{-5}\text{m}$.

Thus, the wavelength in air of such a sound wave is about $7.62 \times 10^{-5}\text{m}$.