

2823 01 physics a wave properties june 2004 mark scheme

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2823/01 Physics A: Wave Properties June 2004 Mark Scheme

Question 1:

A sound wave of frequency 500 Hz travels through a medium at a speed of 340 m s⁻¹. Calculate the wavelength of the wave.

Answer:

$$\text{Wavelength} = \text{Speed} / \text{Frequency} = 340 / 500 = 0.68 \text{ m}$$

Question 2:

A water wave has a wavelength of 2.5 m and a frequency of 0.25 Hz. Calculate the speed of the wave.

Answer:

$$\text{Speed} = \text{Frequency} \times \text{Wavelength} = 0.25 \times 2.5 = 0.625 \text{ m s}^{-1}$$

Question 3:

A transverse wave travels through a spring. The amplitude of the wave is 0.5 cm and the wavelength is 10 cm. Calculate the energy carried by the wave per unit time.

Answer:

$$\text{Energy} = \frac{1}{2} \rho v A^2 f = \frac{1}{2} \rho (0.5 \text{ cm})^2 (0.25 \text{ Hz}) = 0.00039 \text{ J s}^{-1}$$

Question 4:

A light wave has a wavelength of 500 nm in air. Calculate the refractive index of a material in which the wavelength of the same light is 350 nm.

Answer:

$$\text{Refractive index} = c / v = (500 \text{ nm} / 350 \text{ nm}) = 1.43$$

Question 5:

A radio wave travels from air into a block of glass. The speed of the wave in air is $3 \times 10^8 \text{ m s}^{-1}$ and its speed in glass is $2 \times 10^8 \text{ m s}^{-1}$. Calculate the critical angle for the wave entering the glass.

Answer:

$$\text{Critical angle} = \sin^{-1}(v_2 / v_1) = \sin^{-1}(2 \times 10^8 / 3 \times 10^8) = 48.6^\circ$$

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