Waves: Progressive Waves, Intensity and Polarisation

Waves · 4 questions · step-by-step answers at the end

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USEFUL EQUATIONS

$v = f\lambda \quad I = P / A \quad I \propto A^2 \quad I = I_0 \cos^2 \theta$

Questions

Show your working in the space under each question.

1. Polarised light of intensity I_0 passes through a polariser at 60° to its plane of polarisation. What intensity emerges?

2. A 100 W lamp radiates equally in all directions. Find the intensity 2.0 m away. By what factor does the amplitude change at 4.0 m?

3. On an oscilloscope set to 0.50 ms per division, one wave is 4.0 divisions wide. Find the frequency.

4. Unpolarised light of intensity I_0 passes through one polariser, then a second at 90° to the first. What intensity emerges from each?

Step-by-step answers

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1. $I_0 \cos^2 60° = \mathbf{0.25\ I_0}$.

2. 1. $I = P/(4\pi r^2) = 100/(4\pi \times 2.0^2) = \mathbf{2.0\ W\ m^{-2}}$.
2. Doubling the distance quarters the intensity.
3. $I \propto A^2$, so the amplitude **halves**.
Answer: 2.0 W m⁻²; amplitude halves

3. T = 2.0 ms, so f = 1/0.0020 = **500 Hz**.

4. After the first: $\mathbf{I_0/2}$. After the second: **zero**.