Superposition: Stationary Waves, Diffraction and Interference

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

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USEFUL EQUATIONS

$\lambda = ax / D \quad d \sin\theta = n\lambda$

Questions

Show your working in the space under each question.

1. A grating has 500 lines per mm. At what angle is the second-order maximum for 600 nm light?

2. In a double-slit experiment the slits are 0.50 mm apart, the screen is 2.0 m away and the fringe spacing is 2.4 mm. Find the wavelength.

3. A pipe closed at one end is 0.25 m long (v = 340 m s^{-1}). Find its two lowest resonant frequencies.

4. A grating has 300 lines per mm. How many orders are visible for 600 nm light?

Step-by-step answers

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1. $d = 2.0 \times 10^{-6}$ m; $\sin\theta = 2 \times 6.0 \times 10^{-7}/2.0 \times 10^{-6} = 0.60$, so $\theta =$ **37°**.

2. 1. $\lambda = ax/D = (0.50 \times 10^{-3})(2.4 \times 10^{-3})/2.0$.
2. $\lambda = 6.0 \times 10^{-7}$ m = **600 nm** (orange light).
Answer: 600 nm

3. $\lambda = 4L = 1.0$ m: **340 Hz**; the next is three times that, **1020 Hz**.

4. $d = 3.33 \times 10^{-6}$ m; $n \leq d/\lambda = 5.6$, so **5 orders** on each side.