

# Interference, resonance and the Doppler shift

AP Physics 2 (algebra-based) · Lab answers

Model answers use the sample table above. Your own values will differ a little, and the key skill is to show the gradient method, the unit conversions and an honest comment on uncertainty.

**Level:** AP Physics 2 (algebra-based) · **Curriculum:** AP P2 Unit 14

## Question 1 Calculate the fringe spacings

$\Delta y$  = (distance across 10 gaps) / 10, so 26 mm gives **2.6 mm** and so on, as in the table. Measuring 10 gaps spreads the reading error of about  $\pm 1$  mm over 10 fringes, so the error in  $\Delta y$  falls to about  $\pm 0.1$  mm.

## Question 2 Plot the graph

The points lie close to a **straight line through the origin**, which shows that  $\Delta y$  is directly proportional to  $L$ , as  $\Delta y = (\lambda/d)L$  predicts.

## Question 3 Gradient

Gradient =  $(7.9 - 2.6) \text{ mm} / (3.00 - 1.00) \text{ m} = 5.3 / 2.00 = \mathbf{2.65 \text{ mm/m}} = \mathbf{2.65 \times 10^{-3}}$  (no unit, mm per m).

## Question 4 Wavelength

$\lambda$  = gradient  $\times d = 2.65 \times 10^{-3} \times 2.5 \times 10^{-4} \text{ m} = 6.6 \times 10^{-7} \text{ m} = \mathbf{660 \text{ nm}}$ .

## Question 5 Compare with the label

Difference =  $(660 - 650) / 650 \times 100 = \mathbf{1.5 \%}$ , within the experimental uncertainty.

## Question 6 Uncertainty

Sources: (1) judging the fringe centres on the paper (largest,  $\pm 1$  mm over blurred edges); (2) measuring  $L$  from the slide to the screen ( $\pm 5$  mm). Improvement: **use a longer L and mark more fringes**, or photograph the pattern against a ruler.

## Question 7 Predict a green laser

$\Delta y = \lambda L / d = 532 \times 10^{-9} \times 2.00 / 2.5 \times 10^{-4} = \mathbf{4.26 \text{ mm}}$ , smaller than the red value of 5.3 mm, because  $\Delta y$  is proportional to wavelength and green light has a shorter wavelength.