Solutions

Each answer shows the steps, then the **result**.

2.1

- the **spreading** of a wave as it passes through a gap or around an obstacle

2.2

- the diffraction (spreading) **increases**

2.3

- sound has λ **close to** the doorway, so it diffracts a lot
- light's λ is **far smaller** than the gap, so it diffracts negligibly

2.4

- **all** waves (water, sound, light, microwaves, …)

3.1 B

- diffraction is only noticeable when the gap $\approx \lambda$
- **A** / **D**: a much wider gap lets the wave through almost unspread

3.2

- sound's λ is **similar** to the doorway width, so it diffracts strongly into the room
- light's λ is **much smaller**, so its diffraction is negligible

3.3

- send straight water waves at a barrier with a gap
- observe how much they spread after the gap
- make the gap narrower: the waves spread **more**

3.4

- both the **wavelength** and the **speed** are **unchanged**

3.5

(a) a wave passing through a **gap** (or round an edge) **spreads out** into the region beyond

(b) $n\lambda = d\sin\theta$ with $n = 1$

$$\sin\theta = \frac{540 \times 10^{-9}\ \text{m}}{5.0 \times 10^{-6}\ \text{m}} = 0.108 \Rightarrow \theta = \mathbf{6.2}^\circ$$

(c)

$$\sin\theta = \frac{2 \times 540 \times 10^{-9}\ \text{m}}{5.0 \times 10^{-6}\ \text{m}} = 0.216 \Rightarrow \theta = \mathbf{12}^\circ$$

(d) maxima at $\theta = 0$, $\pm 6.2^\circ$ and $\pm 12^\circ$

- intensity **zero** between them — separated peaks, not a continuous curve
- central peak intensity I_0; outer peaks $\leq I_0$

(e) the maxima stay at the **same angles** (filter changes neither λ nor d)

- every peak is **less intense** (the filter removes the perpendicular polarisation; unpolarised light roughly halves)