Question 28 (Answer: **C**)

- Five bright fringes enclose *four* fringe separations, so $x = 34/4 = 8.5$ mm.
- Rearranging $x = \lambda D/a$ gives $a = \lambda D/x$.
- $a = (680 \times 10^{-9})(2.4)/(8.5 \times 10^{-3}) = 1.9 \times 10^{-4}$ m; dividing by five instead gives B.

A-Level Physics: **w25 12**

Question 31 (Answer: **C**)

- Two loudspeakers driven by one signal generator are coherent sources.
- Their waves superpose, reinforcing at some points and cancelling at others.
- Walking through that fixed pattern is what makes the loudness rise and fall.

A-Level Physics: **w25 14**

Question 31 (Answer: **B**)

- Coherent means the phase difference between the two waves stays constant in time.
- It need not be zero – a steady 180° is just as coherent, so D is too strict.
- Equal frequency is necessary but not sufficient, and equal intensity is not required at all.

A-Level Physics: **w25 22**

4(a)	light diffracts / spreads (at slit(s))
	light (from each slit) superposes / interferes (at screen)
	when phase difference is 0 / path difference is $n\lambda$ (where n is an integer) a bright fringe is formed **or** when phase difference is 180(°) / path difference is $(n + 1)\lambda / 2$ (where n is an integer) a dark fringe is formed
4(b)	$\lambda = ax / D$
	$\lambda = 1.0 \times 10^{-3} \times 3.3 \times 10^{-3} / 4.8$ $(= 6.875 \times 10^{-7}$ m)
	$f = v / \lambda$
	$= 3.0 \times 10^{8} / 6.875 \times 10^{-7}$ $= 4.4 \times 10^{14}$ Hz
4(c)	the light / beams (have different frequencies so) are not coherent / do not have constant phase difference

A-Level Physics: **s25 12**

Question 31 (Answer: **C**)

- Fringe separation is $x = \lambda D/a$, so it is proportional to the slit-to-screen distance.
- That distance rises from 0.60 m to $0.60 + 0.90 = 1.50$ m, a factor of 2.5.
- $x = 1.8 \times 2.5 = 4.5$ mm; B uses only the extra 0.90 m.

A-Level Physics: **s25 13**

Question 28 (Answer: **B**)

- The path difference is $110 - 70 = 40$ cm.
- The sources are in *antiphase*, so a maximum needs an odd number of half-wavelengths: $40 = (n + \frac{1}{2})\lambda$.
- That gives $\lambda = 80/(2n + 1)$ – 80, 26.7, 16, ... cm – and only 16 cm is offered.

A-Level Physics: **s25 14**

Question 27 (Answer: **B**)

- Fringe separation is $x = \lambda D/a$.
- Reducing the slit separation a makes x larger.
- A reduces D and C shortens the wavelength – both push the fringes closer together.

A-Level Physics: **s25 21**

4(a)	(when two or more) waves meet / overlap (at a point)
	(resultant) displacement is sum of the individual displacements
4(b)(i)	Fringe width, $x = 3.2 \times 10^{-2} / 8$ $= 4.0 \times 10^{-3}$ (m)
	$D = ax / \lambda$ $= (4.0 \times 10^{-3} \times 0.16 \times 10^{-3}) / 7.2 \times 10^{-7}$
	= 0.89 m
4(b)(ii)	Curved line with a negative gradient of decreasing magnitude throughout, from slit separation 0.04 mm to 0.16 mm
	Line of negative gradient ending at (0.16, 0.4), from slit separation 0.04 mm
	Line of negative gradient passing through (0.08, 0.8) <u>and</u> (0.04, 1.6)

A-Level Physics: **m25 12**

Question 27 (Answer: **C**)

- Observable fringes need a constant phase relationship between the two sets of waves – coherence.
- Without it the pattern shifts about too quickly to be seen.
- Equal amplitudes only sharpen the contrast, and polarisation is not the issue here.

A-Level Physics: **w24 21**

6(a)(i)	for maximum intensity, waves must be in phase (at detection)
	(phase difference at source means) waves are not in phase / have a 90° phase difference <u>at O</u>
6(a)(ii)	point B labelled on the line PQ below O
	distance OB = distance OA
6(b)(i)	$v = f\lambda$
	$\lambda = (3.00 \times 10^{8}) / (2.5 \times 10^{10}) = 0.012$ m
6(b)(ii)	$\Delta x = 0.012 / 4$ $= 0.0030$ m
6(b)(iii)	$\lambda = ax / D$
	distance $= \lambda D / a = 0.012 \times 2.3 / 0.18$ $= 0.15$ m