Answers - Waves 3

1.

(a) slits act as coherent sources ✓
waves/light diffract at slits ✓
waves overlap/superpose/meet/cross ✓
bright patches : constructive/waves in phase/reinforce ✓
dark patches : destructive/waves out of phase/cancel ✓ $_{max}(3)$

(b)(i) spacing $w = \dfrac{76 \pm 1(\text{mm})}{26} = 3.0$ or 2.9 mm ✓ $(2.92 \pm 0.04$ mm$)$
15 or more fringes used ✓

(b)(ii) (use of $\lambda = \dfrac{ws}{D}$ gives) $\lambda = \dfrac{2.92 \times 10^{-3} \times 0.90 \times 10^{-3}}{4.2}$ ✓
$= 6.26 \times 10^{-7}$ ✓
(allow C.E. for sensible value of w from (i)) (4)
(7)

2.

(a) interference or superposition ✓
reflection from metal plate ✓
two waves of the same frequency/wavelength ✓
travelling in opposite directions (or forward/reflected waves) ✓
maxima where waves are in phase or interfere constructively ✓
minima where waves are out of phase/antiphase
or interfere destructively ✓
nodes and antinodes or stationary waves identified ✓ $_{max}(4)$

(b)(i) (distance between minima $= \dfrac{\lambda}{2}$)
$\left(\dfrac{\lambda}{2} = \dfrac{144}{9} \text{ gives}\right)$ $\lambda = 32.0$ mm ✓

(b)(ii) $c = f\lambda$ and $c = 3 \times 10^8$ (m s^{-1}) ✓
$f = \dfrac{3 \times 10^8}{32 \times 10^{-3}} = 9.38 \times 10^9$ Hz ✓
(allow C.E. for value of λ from (i)) (3)
(7)

3.

(a)		same wavelength or frequency ✓ (same phase or) constant phase difference ✓	**2**
(b)	(i)	narrow slit gives wide diffraction ✓ (to ensure that) both S_1 and S_2 are illuminated ✓	**Max 4**
	(ii)	slit S acts as a point source ✓ S_1 and S_2 are illuminated from same source giving monochromatic/same λ ✓ paths to S_1 and S_2 are of constant length giving constant phase difference ✓ [or $SS_1 = SS_2$ so waves are in phase]	
(c)		graph to show: maxima of similar intensity to central maximum ✓ [or some decrease in intensity outwards from centre] all fringes same width as central fringe ✓	**2**

4.

(a)	(i)	$\lambda = \left(\frac{ws}{D}\right) = \frac{2.0 \times 3.2}{16} = 0.40\,\text{m}$ ✓	**2**
	(ii)	$c\ (= f\lambda) = 850 \times 0.40 = 340\,\text{ms}^{-1}$ ✓	
(b)	(i)	speakers act as coherent sources or have constant phase relation ✓ light is emitted from sources in (incoherent) bursts ✓ light sources are not coherent or phase relation not constant ✓	**max 5**
	(ii)	use of double slit ✓ wavefronts are divided at slits ✓ slits act as coherent sources ✓ slit sources have the same frequency ✓ slit sources have a constant phase relation ✓	