

1.

- (a) constant phase difference B1 [1]
 (b) allow wavelength estimate 750 nm → 550 nm C1
 separation = $\frac{\lambda D}{x}$ C1
 $= \frac{650 \times 10^{-9} \times 2.4}{0.86 \times 10^{-3}}$
 $= 1.8 \text{ mm.. A1 [3]}$
 (allow 2 marks from inappropriate estimate if answer is in range 10 cm → 0.1 mm)
 (c) no longer complete destructive interference /
 amplitudes no longer completely cancel.. M1
 so dark fringes are lighter.. A1 [2]

2.

- (a) $\frac{\sin i}{\sin r}$ or $\frac{c}{v}$ with terms for each expression defined; 1

- (b) $\frac{3.0 \times 10^8}{2.1 \times 10^8}$;
 $= 1.4$; 2

- (c) speed of light in a medium depends on frequency;
 the refractive index depends on frequency;
 light of different frequencies refracted by different amounts / OWTTE; 3

[6]

3.

- (i) superposition of two waves / OWTTE;
 of same frequency and amplitude travelling in opposite directions; 2
- (ii) stationary/standing wave is set up in the tube;
 heaps form at the (displacement) nodes / powder pushed
 away from antinodes; 2
- (iii) wavelength = $(2 \times 9.3 =)$ 18.6 cm;
 speed = $(1800 \times 0.186 =)$ 330 m s⁻¹;
 ECF if value of wavelength wrong. 2
- (c) heaps further apart means longer wavelength;
 hence speed increases (as temperature rises);

Do not award if there is no reasoning or reasoning is fallacious or misleading. 2

4.

(i) the phase difference between light leaving S_1 and S_2 is constant; 1

Do not penalize the candidate if they state "has the same phase".

(ii) to produce **sufficient** diffraction;
for the beams to overlap;
OWTTE; 2 max