

Sound

Mark Scheme 4

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	Properties of Waves including Light and Sound
Sub-Topic	Sound
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 4

Time Allowed: 82 minutes

Score: /67

Percentage: /100

- 1 (a) (i) (number of complete) vibrations (of the strip) per second/unit time B1
- (ii) maximum displacement of end of strip from mid-position
OR XY OR ZY OR XZ \div 2 B1
- (b) (i) ($t =$) $d \div v$ OR $2d \div v$ C1
- 0.20 s OR 0.2 s A
- (ii) 0.60 s OR 0.6 s c.a.o. B1
- (c) (i) accept any value between 1.0 and 9.9×10^3 m/s B
- (ii) accept any value between 1.0 and 9.9×10^3 m/s B
- (d) $v = f\lambda$ in any form OR $v \div f$ C1
- correct evaluation from candidate's (c)(i) with unit, expect 0.016 m B
- 2 (a) pressure high/increased OR molecules/particles close(r/st together) B1
- (b) (i) 1.7 m B1
- (ii) $v = f\lambda$ in any form OR ($f =$) v/λ OR $5/0.025$
200 Hz A1
- (c) three compressions at $23^\circ - 33^\circ$ to wall B1
constant and correct wavelength by eye
only scored if at $8^\circ - 48^\circ$ to wall B1
- (d) (wavelength) greater B1
change of speed correctly related to change of wavelength B1

[Total: 8]

- 3 (a) vibrations **OR** compressions **AND** rarefactions M1
- vibrations parallel to direction of travel (of wave energy)
OR compressions move in direction of travel (of wave energy) A1
- (b) (i) $(\lambda =) v/f$ **OR** 6100/7500 **OR** 6100/7.5 C1
- 0.81(33333)m **OR** 813(33333)mm A1
- (ii) 1. decreases B1
2. same answer as 1. B1
- [Total: 6]**

- 4 (a) (i) longitudinal: oscillations/vibration of particles/molecules in direction of travel (of wave) B1
- transverse: oscillation/vibrations of particles/molecules perpendicular to direction of travel (of wave) B1
- (ii) 1. e.g. sound wave / compression wave on a spring B1
2. e.g. any named electromagnetic wave / ripples / water wave / wave on a stretched rope B1
- (b) use of $v = f\lambda$ in any form **OR** $(\lambda =) v/f$ **OR** 7200/30 **OR** 7.2/30
 240 m / 0.24 km A1
- (c) no sound heard / quieter sound B1
- medium/air required to transmit sound B1
- OR** sound does not travel through a vacuum B1
- [Total: 8]**

5	(a)	(i) diffraction		B1	
		(ii) waves travel slow(er)/water is shallow(er)		B1	
		(iii) angular spread of wavefronts increases o.w.t.t.e. OR amplitude of waves is smaller		B1	
	(b)	(i) oscillation/up and down motion (of rope) is at right angles to the direction of the wave OR motion of rope/particles is at right angles to the direction of the wave		B1	
		(ii) $\lambda = 2.4/2 = 1.2$ m		C1	
		$v = f\lambda$ in any form OR ($f =$) v/λ OR $3.2/1.2$		C1	
		2.7 Hz		A1	
		OR			
		$t = 2.4/3.2$		(
		$f = 2 \times 3.2/2.4$		(
		2.7 Hz		(A	
					[Total: 7]
6	(a)	light in air	BOX 5	3×10^8 m/s	B
		sound in air	BOX 2	300 m/s	B
		sound in water	BOX 3	1500 m/s	B [3]
	(b)	distance = speed \times time in any form NOT speed = $2d/t$			C1
		$t_{\text{air}} = 120 \div$ value for speed of sound in air			C1
		$t_{\text{rail}} (= 120/5000) = 0.024$ s			C
		(time difference =) candidate's t_{air} – candidate's t_{rail} correctly evaluated (expect $0.400 - 0.024 = 0.376$ s)			[4]
					[Total: 7]

- 7 (a) (i) 1. compressions and/or rarefactions closer together
OR more compressions and/or rarefactions
ignore wavelength shorter B1
2. layers closer together at compressions B1
layers farther apart at rarefactions B1
OR
compressions narrower (B1)
rarefactions wider (B1)
ignore wavelength shorter ignore 'amplitude greater' ignore 'maximum displacement greater'
- (ii) distance between 2 compressions or 2 rarefactions shown with reasonable accuracy
- (b) time taken by sound in air = $200 / 343 = 0.583\text{ s}$ C
time taken by sound in steel = $0.583 - 0.544 = 0.039\text{ s}$ C
5128 m/s A1 [7]

- 8 (a) value $3 \times 10\text{ m/s}$ A1 1
- (b) speed of light (much) greater than speed of sound or value for sound A1 1
- (c) (i) source and receiver arrangement with detail and labels C1 A1
(ii) distance between source and receiver B1
time between flash and bang B1
(iii) speed = distance/time B1 max 4
[6]

- 9 (a) idea of fine ray/beam shone into (glass) block / pins appropriately placed B1
 shown in diagram or described B1
 angles i & r or C measured OR correct i & r or C marked on diagram B1
 $\sin i / \sin r$ OR $\sin r / \sin i$ OR $1 / \sin C$ OR $\sin C$ B1
 $n = \text{speed in air} / \text{speed in glass}$ OR $c/v = \sin i / \sin r$ OR $n = 1 / \sin C$ OR $c/v = 1 / \sin C$ B1
- (b) (i) $v = f\lambda$ OR $240 / 1.9 \times 10^5$ OR $T = d/s$ AND $f = 1/T$ B1
 0.00126 Hz OR 0.0013 Hz NOT 0.0012 Hz
 ignore more than 3 s.f. accept s^{-1} A1
- (ii) distance = speed \times time in any form accept $s = 2d/t$ C1
 (time for tremor =) 240 (s) or 4 mins also gives first C1 C1
 (time for tsunami =) 2500 (s) or $41 \text{ mins } 40 \text{ s}$ also gives first C1 C1
 (warning time =) 2260 (s) or $37 \text{ mins } 40 \text{ s}$ A1 [10]