

General wave properties

Mark Scheme 2

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	Properties of Waves including Light and Sound
Sub-Topic	General Wave Properties
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 2

Time Allowed: 52 minutes

Score: /43

Percentage: /100

- 1 (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]
- 2 (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]

- 3 (a) (Molecule) moves up and down / rises and falls
OR oscillates perpendicular to direction of wave
OR describes a circle B1
- (b) (i) At least 3 circular arcs, angular spread greater than 90° (symmetrically above and below slit) B1
Centre of arcs at centre of slit and with same spacing (by eye) as incident waves B1
- (ii) Diffraction B1
- (c) $v = f \times \lambda$ OR $12 = f \times 1.4$ OR $f = v / \lambda$ OR $f = 12 / 1.4$ C1
 $f = 8.57$ Hz / per s / waves or vibrations per s A1
at least 2 s.f.

[Total: 6]

- 4 (a) CD B1
- (ii) any 3 points from
- wavefront changes direction/refracted OR wavefront bends B1
 - in Q distances travelled (by waves) shorter/wavelength less B1
 - wave spreads in region Q from B B1
 - all points on wavefront AB move to (corresponding) points on CD
 - in same time that/while end A of wavefront AB move to C and end B moves to D [4]
- (b) regions P and Q same depth/regions P and Q (now) one medium B1
same wavelength/wavefronts travel same speed/distance in each region
OR no refraction/change of direction OR no bending of waves B1 [2]

[Total: 6]

- 5 (a) idea of fine ray/beam shone into (glass) block / pins appropriately placed 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 mins 40s also gives first C1 C1
 (warning time =) 2260 (s) or 37 mins 40s A1 [10]
- 6 (a) (i) shake end of rope (e.g. from side to side / up and down) B1
- (ii) distance from crest to crest / trough to trough / any 2 adjacent points in phase, labelled λ B1
 distance from central horizontal line to peak or trough, labelled A B1
- (iii) increase rate of shaking end of rope (to increase frequency) / shake faster / move more quickly B1
- (b) in shallow water wavelength is smaller OR waves / lines are closer together B1
 frequency is constant B1
 (slower because) speed = frequency \times wavelength B1
 OR
 lines / waves closer together in shallow water / waves in shallow water lag behind B1
 smaller distance travelled in same time by waves in shallow water o.w.t.t.e. B1
 (slower because) speed = distance / time B1 [7]