

- 1 (a) clear attempt at semi circles, at least 3 [1]  
same wavelength as incoming wavefronts, by eye [1]
- (b) speed  $\div$  wavelength or  $20 \div 2.5$  or  $v = f\lambda$  [1]  
8 Hz or  $8 \text{ s}^{-1}$  or 8 waves/second [1]
- (c) candidate's (b) OR "the same" OR nothing [1]
- (d) low frequency signals have longer wavelength (than high frequency signals) OR [1]  
high frequency signals have shorter wavelength [1]
- low frequency signals / long wavelength signals diffract more OR  
low frequency / short wavelength signals diffract less [1]
- 2 (a) (i) any value between 6 and 7 mm seen C1  
 $26 \pm 2 \text{ mm}$  OR  $2.6 \pm 0.2 \text{ cm}$  A1
- (ii)  $v = f\lambda$  in any form OR ( $f =$ )  $v \div \lambda$  OR  $0.39 \div 0.026$  C1  
= 15 Hz ecf (i) A1
- (b) at least 4 wavefronts showing refraction in correct direction B1  
7 parallel wavefront lines continuous with those in fast region B1
- (c) unchanged / nothing B1

**[Total: 7]**

- 3 (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  $9.9 \times 10^3$  m/s B
- (ii) accept any value between 1.0 and  $9.9 \times 10^3$  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
- 4 (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  $(f =) v/\lambda$  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]

- 5 (a) vibrations **OR** compressions **AND** rarefactions
- 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  
0.81(33333)m **OR** 813(33333)mm
- (ii) 1. decreases B1  
2. same answer as 1. B1
- [Total: 6]**

- 6 (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  
**OR** sound does not travel through a vacuum B1
- [Total: 8]**

- 7 (a) (i) diffraction [1]
- (ii) 1 or 2 parallel waves (and part-circular ends) in outer harbour  
 NOT part-circular ends going down B1  
 3 part-circular waves,  $>45^\circ$  each side by eye, in inner harbour  
 allow flat below gap  
 centred in gap, allow error up to  $1\lambda$  vertically B1  
 wavelength constant throughout, must have 3 extra wavefronts, judged  
 along line of direction of wave travel in Fig. 5.1 B1 [3]
- (b) (i) refraction [1]
- (ii) at least 4 parallel, straight waves joined onto original waves B1  
 at least 3 straight waves, sloping down to the right OR with constant reduced  $\lambda$  B1 [2]

**[Total: 7]**