

- M1.** (a) K 1
- (b) Decreases 1
- (c) use a metre rule / 30 cm ruler to measure across 10 (projected) waves  
*accept any practical number of waves number for 10* 1
- and then divide by 10 1
- (d) 1.2 cm = 0.012 m 1
- $18.5 \times 0.012 = 0.22(2)$  (m / s) 1
- allow 0.22(2) with no working shown for 2 marks*
- typical walking speed = 1.5m / s  
*accept any value e.g. in the range 0.7 to 2.0 m / s* 1
- so the water waves are slower (than a typical walking speed)  
*this cannot score on its own* 1

**[8]**

M2. (a) (i)

*correct order essential*

(A =) a microphone

1

(B =) an oscilloscope

*or cathode ray oscilloscope or CRO*

1

(ii) the amplitude

*accept any unambiguous indication*

1

(iii) quieter / softer

*do **not** accept less (which could refer to the amplitude, frequency or wavelength)*

1

(b) sound cannot travel through a vacuum / (empty) space / free space

*accept there is no medium for the sound to travel through*

1

(because) there is / are nothing / no particles to vibrate

*accept (because) there is / are nothing / no particles between them and the source (of the sound)*

1

[6]

- M3.** (a) (i) 25 (%)  
*do not accept ¼* 1
- (ii) increases 1
- (b) tick (✓) in top and bottom box  
*both required* 1
- (c) SHINY surfaces are good reflectors of infra-red radiation  
*accept white for shiny*
- or black surfaces are POOR reflectors of infra-red radiation  
*accept bad for poor*  
*accept insertion of 'not' before 'good' in statement*
- or black surfaces are good EMITTERS of infra-red radiation
- or black surfaces are good ABSORBERS of infra red radiation 1

[4]

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M4. (a) (i) J and L  
*both required, either order* 1

(ii) K 1

(iii) L 1

highest frequency  
*reason does not score if L not chosen*  
*accept most waves (on screen)*  
*do not accept frequency above 20 000(Hz)*  
*do not accept cannot hear it* 1

(b) transmitter  
detector  
computer  
*all three in correct order*  
*allow 1 mark for one correct* 2

[6]

- M5.** (a) vibrate  
*allow move more (vigorously) but **not** just move* 1
- dirt / muck / grit / rust / dust etc.  
*do **not** accept bacteria* 1
- (b) any **one** medical use eg  
*ignore incorrect biological detail*
- scanning unborn babies
  - destroying (kidney) stones 1
- (c) (i) 2 1
- (ii) C 1

[5]

- M6.** (a) (i) bat(s) 1
- (ii) any example in the inclusive range  $5 \leftrightarrow 29$  Hz / hertz  
*appropriate number and unit both required* 1
- (b) (i) A, C, D  
*all three required and no other* 1
- (ii) D, E  
*both required and no other* 1
- (c) sound cannot travel through a vacuum / (empty) space / free space  
*accept there is no medium (for the sound to travel through)*  
*do **not** accept there is no air (for the sound to travel through)* 1
- (because) there is / are nothing / no particles to vibrate  
*accept because there is / are nothing / no particles between them and the source (of the sound)* 1

[6]

- M7.** (a) (i) wavelength  
*accept frequency*  
*accept speed* 1
- (ii) amplitude  
*accept energy*  
*height is insufficient* 1
- (iii) sound 1
- (b) 0.12  
*allow 1 mark for correct substitution, ie  $8 \times 0.015$  provided no subsequent step shown* 2
- metre per second **or** m/s **or** metre/second  
*do not accept mps*  
*units must be consistent with numerical answers* 1

[6]

- M8.** (a) pitch 1
- loudness 1
- (b) (i) as length (of prongs) decreases frequency / pitch increases  
*accept converse*  
*accept negative correlation*  
*ignore inversely proportional* 1
- (ii) 8.3 (cm)  
*accept  $8.3 \pm 0.1$  cm* 1
- (iii) (8.3 cm is) between 7.8 (cm) and 8.7 (cm)  
*ecf from part (ii)* 1
- (so  $f$  must be) between 384 (Hz) and 480 (Hz) 1
- 410 (Hz)  $\leq f \leq$  450 (Hz)  
*if only the estimated frequency given, accept for 1 mark an answer within the range* 1
- (c) (i) electronic 1
- (ii) frequency is (very) high  
*accept frequency above*  
*20 000 (Hz) or audible range* 1



so tuning fork **or** length of prongs would be very small (1.2 mm)

1

(d) 285.7 (Hz)

*accept any correct rounding 286, 290, 300*

*allow 2 marks for 285*

*allow 2 marks for correct substitution  $0.0035 = 1 / f$*

*allow 1 mark for  $T = 0.0035$  s*

*allow 1 mark for an answer of 2000*

3

[13]