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 × 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]

-

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 ↔ 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 × 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 ± 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) ≤ *f* ≤ 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]