Name: _____

Waves

Mark Scheme

Date:

Time:

Total marks available:

Total marks achieved: _____

Mark Scheme

Q1.

Question Number	Answer	Mark
	C - polarisation	**1**
	Incorrect Answers: A – diffraction is exhibited by sound waves B – interference is exhibited by sound waves D – refraction is exhibited by sound waves	

Q2.

Question Number	Acceptable answers	Additional guidance	Mark
	D transverse, longitudinal		**1**

Q3.

Question Number	Acceptable answers	Additional guidance	Mark
	A Sound can travel through a solid.		**1**

Q4.

Question Number	Answer	Mark
	C	1

Q5.

Question Number	Answer	Mark
	D	1

Q6.

Question Number	Answer	Mark
	B	1

Q7.

Question Number	Answer	Mark
	C	1

Q8.

Question Number	Answer	Mark
	C	1

Q9.

Question Number	Answer	Mark
	C	1

Q10.

Question Number	Answer		Mark
(a)	Use of $c = f\lambda$ with $c = 3.00 \times 10^8$ m s^{-1} $\lambda = 1.37$ m Example of calculation $\lambda = 3.00 \times 10^8$ m s^{-1} / 2.186×10^8 Hz $\lambda = 1.37$ m	(1) (1)	2
(b)	Frequency – number of oscillations/vibrations/cycles/waves per second **Or** number of oscillations/vibrations/cycles in unit time (ignore 'complete') (do not accept 1/period, unless period is defined appropriately) [accept number of wavelengths per second] Wavelength – distance travelled during one complete oscillation/vibration/cycle **Or** shortest distance between two points at the same stage of the cycle/in phase **Or** distance between identical points on adjacent waves (Accept distance between adjacent/neighbouring peaks/crests/troughs but not just 'distance between peaks' or 'length of wave')	(1) (1)	2
	Total for question		4

Q11.

Question Number	Acceptable Answers		Additional guidance	Mark
(a)	• Sound travels as a longitudinal wave **Or** in a series of compressions **and** rarefactions • With oscillations/vibrations of (air) particles/molecules parallel to the direction of energy transfer	(1) (1)	Accept: Direction of energy transfer **Or** propagation of the wave **Or** direction of wave travel/motion	2

Question Number	Acceptable Answers		Additional guidance	Mark
(b)(i)	• the idea that there is a wide variation in the first two readings	(1)		1

Question Number	Acceptable Answers		Additional guidance	Mark
(b)(ii)	• uses $\frac{\text{half the range of values}}{\text{mean value}}$ • percentage uncertainty = 8.5%	(1) (1)	Example of Calculation $\frac{0.5 \times (0.51\ s - 0.43\ s)}{0.47\ s} \times 100\% = 8.5\%$ Accept calculations based on $\frac{\text{range of values}}{\text{mean value}}$ (17%)	2

Question Number	Acceptable Answers		Additional guidance	Mark
(b)(iii)	• attempt to calculate Δv (1) • $\Delta v = 7.4\ m\ s^{-1}$ or $8.0\ m\ s^{-1}$ (1)		Example of Calculation $\frac{160\ m}{0.46\ s} - \frac{160\ m}{0.47\ s} = 7.4\ m\ s^{-1}$ Use of 80 m (Δv =3.7) scores MP1 only	2

Question Number	Acceptable Answers		Additional guidance	Mark
(b)(iv)	**Max 2:** • insufficient number of results (1) • identifies one other variable to take into account (1) • difference (in t or v) could be due to human reaction times (1) • uncertainty in results may account for the difference		Do not accept take readings over more days MP2 examples:wind speed/direction, humidity, air pressure MP3 do not credit human error	2

Q12.

Question Number	Answer		Mark
(a)	To be able to distinguish which reflection comes from which emission **Or** so one pulse returns before the next one is emitted	(1)	1
(b)	Use of $v = s/t$ Correct use of factor of 2 (double distance or double time) Pulse duration = 2.4×10^{-3} s (0.0024 s, 2.4 ms) Example of calculation Time = $2 \times 0.4\ m \div 330\ m\ s^{-1}$ Pulse duration = 2.4×10^{-3} s	(1) (1) (1)	3
(c)	(Ultrasound) reflected away from the sensor **Or** (Ultrasound) reflected towards the floor	(1)	1
	Total for Question		5

Q13.

Question Number	Acceptable answers	Additional guidance	Mark
	• use of $f = 1/T$ (1) • use of $v = f\lambda$ (1) • wavelength = 7.5×10^6 m (1)	MP3: accept variations e.g. 1.75 waves or two wavelengths averaged with correct calculation Example of calculation 2 waves $2T = 0.05$ s $T = 0.025$ s $f = 1/0.025$ s $= 40$ Hz $\lambda = 3.00 \times 10^8$ m s^{-1} ÷ 40 Hz $= 7.5 \times 10^6$ m	3

Q14.

Question Number	Answer	Mark
	Oscillations/vibrations of (air) particles/molecules/atoms (1) Oscillations/vibrations/displacement parallel to direction of propagation **Or** Oscillations/vibrations/displacement parallel to direction of energy transfer (1) (Producing) compressions and rarefactions **Or** regions of high and low pressure **Or** it is a longitudinal wave (1)	3
	Total for question	**3**

Q15.

Question Number	Answer		Mark
(a)	Oscillations/vibrations (of molecules) parallel to direction of propagation **Or** oscillations parallel to direction of wave travel **Or** oscillations parallel to direction of energy transfer Produces compressions and rarefactions	(1) (1)	2
(b)	Otherwise there wouldn't be a way of telling which bit of reflected sound originated with which bit of emitted sound **Or** so one returns before one emitted	 (1)	1
(ci)	time (= 1÷16 Hz) = 0.063 (s) (at least 2 sf)	(1)	1
(cii)	Use of factor of 2 Use of $v = s/t$ distance = 48 m (Use of 'show that' value gives 46m) <u>Example of calculation</u> 2 × distance = 1530 m s^{-1} × 0.063 s distance = 48 m	(1) (1) (1)	3
(ciii)	A shorter time between clicks because the distance is shorter **Or** more frequent clicks allow rapid motion to be perceived. **Or** allow position to be determined precisely/accurately.	 (1)	1
(d)	Speed in air lower than speed in water So wavelength in air shorter than wavelength in water **Or** pulse length in air is shorter than pulse length in water **Or** attempt at numerical comparison of wavelength or pulse length So bat echolocation will detect smaller targets **Or** detect smaller differences in position (conditional on MP2) (Accept 'show more detail' or 'better resolution')	(1) (1) (1)	3
	Total for question		11