Name: _____

Waves

9-1 Higher

Date:

Time:

Total marks available:

Total marks achieved: _____

Mark Scheme

Q1.

Question Number	Answer	Acceptable answers	Mark
	conversion of time 4x60 (1) substitution (1) 1608 / (4x60) **ecf if conversion shown** evaluation (1) 6.7 (m/s)	award full marks for correct answer with no working [1608 / 4 for 1 mark for these two] **allow** 402 for 2 marks **accept** for 2 marks: 5.36 (t=300 s 60→120→180→240→300, i.e. 4 steps of 60) 4.02 (t=400 s based on the misconception of 100 s to 1 minute) **allow** maximum of 1 mark for any other power of 10 error if no working	**(3)**

Q2.

	Answer	**Acceptable answers**	**Mark**
	☒ **D** both transverse and longitudinal waves		**(1)**

Q3.

	Answer	**Acceptable answers**	**Mark**
	Substitution into correct equation(1) $v = 15 \times 125$ Evaluation (1) 1875	Power of 10 error max 1 mark for numerical answer 2 marks for correct numerical answer even with no working shown	**(3)**

	Unit (1) m/s	ms^{-1} **not** mps 1.875 km/s or 6750 km/h gain 3 marks If numerical answer incorrect, accept any correctly-written unit of speed: eg **k**m/s or km/hr or miles per hour / mph	

Q4.

	Answer	**Acceptable answers**	**Mark**
	transposition $\lambda = v/f$ (1) substitution $\lambda = 3 \times 10^8/7 \times 10^9$ (1) evaluation 0.043 (m) (1) Ignore any unit given by candidate	Subst. and transform. either order 1 mark only can be scored for correct substitution after incorrect transposition. $3 \times 10^8/7 \times 10^9$ gains 2 marks Accept any number of sig.figs. that rounds to 0.04 0.04 , 0.0428 (m) (1) Give full marks for correct answer with no working. 0.04 × any other power of 10 = 2 marks	**(3)**

Q5.

	Answer	**Acceptable answers**	**Mark**
(i)	Substitution v = 1920/6.0 (1) Evaluation (1)	 300 (m/s) give full marks for correct	**(2)**

	320 (m/s)	answer, no working (2) Power of 10 error max. 1 mark.	
(ii)	Suggestions including the following: • recognition of any difference in speed / velocity (1) • correct difference in speed (1)	e.g. sound travels faster / quicker than light (1) c>v / v<c / c>320 (m/s) Light travels (much) faster (2) RA **Ignore**'sound takes longer' or other references to time.	**(2)**

Q6.

Question Number	Answer	Acceptable answers	Mark
	Substitution (1) (Speed =) $6.67 \times 10^{14} \times 4.5 \times 10^{-7}$ Transposition AND substitution (1) (time =) $\frac{4 \times 10^{16}}{(6.67 \times 10^{14} \times 4.5 \times 10^{-7})}$ Evaluation (1) 1.33×10^{8} (s)	Award full marks for correct answer with no working 3×10^{8} (m/s) seen anywhere $\frac{4 \times 10^{16}}{3 \times 10^{8}}$ ECF candidate's speed maximum 2 marks Allow answers which round to 130 000 000 IGNORE Power of Ten error until evaluation	**(3)**

Q7.

Question Number	Answer	Acceptable answers	Mark
(a)	**A** longitudinal : yes		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)	An explanation linking any two of: 1. A cause or description of earthquakes (1) 2. why timing of earthquake is uncertain / complex (1) 3. we cannot see {what is happening deep inside the Earth / where the plates are rubbing} (1)	The release of {energy / pressure/friction force} (in Earth's surface) (caused when tectonic) plates slide past each other any idea of relative movement of plates e.g. move over each other, collide (movement of plates is) {sudden / random / jerky} it is too difficult to {work out / measure} when release of energy will happen "it is difficult to measure when the plates will collide" = 2 marks	**(2)**

Q8.

	Answer	**Acceptable answers**	**Mark**
	relevant values 110 and 10 seen anywhere(1) 100 (s) (1) **acceptable range 95 to 105** (s)	(could be on chart) tolerance +/- 5 s give full marks for correct answer, no working	**(2)**

Q9.

	Answer	**Acceptable answers**	**Mark**
	Substitution		**(2)**

	1.7 × 8 (1) Evaluation 14 (cm/s) (1)	13.6 (cm/s) give full marks for correct answer, no working Power of 10 error max. 1 mark.	

Q10.

	Answer	Acceptable answers	Mark
(i)	B seismic waves (1)		**(1)**
(ii)	(there is a) difference/change in density (1)	more/less/too dense (reach a) boundary (between different materials) Ignore 'the waves cannot travel through liquids/oil'	**(1)**

Q11.

	Answer	Acceptable answers	Mark
	2100/500 = 4.2 (1) 4.2 × 150 = 630 (million km) (1) Accept ratios as speed is constant 150/500 = distance to Jupiter/2100 OR Distance to Jupiter = (150/500) × 2100 Either for 1 mark	Power of 10 error maximum of 1 mark (speed of light) about 150 000 000 ÷ 500 = 300 000 (km/s) (1) (distance to Jupiter)= 300 000 × 2100 = 630 000 000 km (1) / = 630 (million km) An answer with no calculation of 630 (million km) gains 2 marks If an answer of 630 million/ 630 000 000 is given with correct working award both marks	**(2)**

Q12.

	Answer	Acceptable answers	Mark
(i)	5 (cm) (1) 8 (cm) (1)	+5 -5 0.08 m 80 mm	**(2)**
(ii)	B		**(1)**

Q13.

	Answer	Acceptable answers	Mark
(i)	(number of waves =) 5 (1)		**(1)**
(ii)	**Either** 60 ÷ 5 (1) **or** 60 ÷ (their answer to 2(b)(i)) (1)	12 (cm) **or** ecf from number of waves	**(1)**

Q14.

	Answer	Acceptable answers	Mark
(b)(i)	A description including the following: • magnifies • the image • <u>refracts</u> the light	brings nearer / zooms in / looks closer / makes bigger / enlarges intermediate / real image	**(2)**
(b)(ii)	☒ B energy		**(1)**

Q15.

Question Number	Answer	Acceptable answers	Mark
(i)	**X** amplitude (1) **Y** wavelength (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
(ii)	**A**  (1)		**(1)**

Q16.

Question Number		Indicative Content	Mark
QWC	*	An explanation including some of the following points • Longitudinal {vibrations/oscillations} are {along/parallel to/in the same direction as} the direction of {travel/energy transfer} • Transverse {vibrations/oscillations} are {across/perpendicular to/90° to/right angles to} the direction of {travel/energy transfer} • Ultraviolet waves are transverse • Ultrasound waves are longitudinal (ignore sound – not on list) • Some seismic waves are longitudinal and some are transverse • P waves are longitudinal • S waves are transverse • Longitudinal waves need a material for the vibrations whereas electromagnetic waves can pass through a vacuum **IGNORE** irrelevant material	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited explanation of: EITHER the {vibration/movement} direction and direction of {travel/movement} for transverse or longitudinal wave OR correctly identifying the wave type for at least one example from the list, e.g. o Longitudinal waves move in the same direction as the wave moves o Ultraviolet waves are transverse • the answer communicates ideas using simple language and uses limited scientific terminology
2	3 - 4	• a simple explanation linking: EITHER directions of {vibration/oscillation} and wave travel for both types of wave OR direction of {vibration/oscillation} and wave travel of one type of wave with at least one example of a wave from the list OR the direction of 'movement' and direction of {travel/movement} for transverse AND longitudinal waves AND correctly identifying the wave type for at least one example from the list e.g. o In longitudinal waves the vibrations are in the same direction as the wave travels. In transverse waves the vibrations are at right angles to the direction the wave travels. o In longitudinal waves the vibrations are in the same direction as the wave travels. Ultraviolet waves are transverse. o Longitudinal waves move in the same direction as the wave moves. Transverse waves move at right angles to the direction the wave moves. Ultrasound waves are longitudinal. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	5 - 6	• a detailed explanation clearly differentiating between the directions of {vibration/oscillation} for longitudinal AND transverse waves AND at least one example of each type of wave from the list, e.g. o In longitudinal waves the vibrations are in the same direction as the wave travels. In transverse waves the vibrations are at right angles to the direction the wave travels. Ultrasound waves are longitudinal and ultraviolet waves are transverse. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Q17.

	Answer	Acceptable answers	Mark
(a)(i)	☒ **A** on the finger		**(1)**
(a)(ii)	infrared (1)	red light	**(1)**
(a)(iii)	89/60 (1)		**(2)**

	1.5 (beats/second) (1)	1.48 (beats/second) Allow 1.49 1.483333etc Accept correct answer no working for 2 marks	
(a)(iv)	1/1.5 (1) 0.67(s) (1)	ecf 1/ 89 one mark only Accept correct answer no working for 2 marks	**(2)**

		Indicative Content	
QWC	***(b)**	A description including some of the following points: what the information / signal is • electrical signals • small difference in potential (mV) between one body and another • signal changes as the heart beats • are started in the heart (right atria) • caused by nervous impulse • action potentials signal in • electrodes attached to the skin • water in the body conducts electricity / signal • at least two electrodes used • electrodes conduct electricity / contain gel signal out • shows heart rate on a screen / paper • shows a waveform on a screen / paper • receives small signals which have to be amplif	
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation e.g. it shows your heart beat on a screen • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanation e.g. it shows if your heart is working properly by measuring heart beat which you can see on a screen • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation e.g. connects electrodes/wires on the skin to measure (electrical) signals of the heart in order to assess the heart beat/heart performance/heart condition • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	