Eduqas Physics GCSE
Topic 5.2: Waves at material interfaces, applications in exploring
Mark Schemes for Questions by topic

1.

(a	pressure high / increased OR molecules / particles close(r / st together)	B1
(b) (i)	1.7 m	B1
(ii)	v = f λ in any form OR (f =) v / λ OR 5 / 0.025 200 Hz	A1
(c)	three compressions at 23° – 33° to wall	B1
	constant and correct wavelength by eye only scored if at 8° – 48° to wall	B1
(d)	(wavelength) greater	B1
	change of speed correctly related to change of wavelength	B1

[Total: 8]

2.

(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
(iii)	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
(b)	no sound heard / quieter sound	B1
	medium/air required to transmit sound **OR** sound does not travel through a vacuum	B1

[Total: 8]

3.

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

Question Number	Answer	Acceptable answers	Mark
1(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)**

Question Number	Answer	Acceptable answers	Mark
1(c)	P-wave = 8 (minutes) (1) S-wave = 14.5 (minutes) (1) time difference = 6.5 (minutes) (1)	award full marks for correct answer (6.5) **with no working** (since 13 small squares = 6.5 mins) 7.5 – 8.5 (minutes) inclusive 14.0 - 15.0 (minutes) inclusive **ecf** for difference of wrong readings from graph **accept** time shown as m:ss (e.g. 6:30) if correct construction lines are shown on graph but no values written, the score is maximum of 1 of the three	**(3)**

Question Number		Indicative Content	Mark
QWC	***1 (d)**	A description including some of the following points **Data collection** • S and P arrival times found • Use or collect data from more than one station **Manipulation / Calculation for one station** • Circle drawn on map with station at centre • Circle drawn on map at appropriate distance from station • Earthquake on that circle • (Distance found from) S minus P time **Triangulation** • Repeat calculation / drawing with at least three stations • Epicentre / earthquake at point of intersection of all three (or more) circles • Triangulation • Meaning of triangulation **If no other marks scored** • Strength greatest nearer earthquake = Level 1 • Time shortest nearest the earthquake = Level 1	**(6)**

Level	**0**	No rewardable content
1	**1 - 2**	• a limited description of process involving isolated fact(s) from one section. e.g. Circle drawn on map with station at centre OR "triangulation" • 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 description of process involving linked facts from two sections e.g. the S and P arrival time is recorded, and the difference noted. • 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 description of process involving elements from all three sections e.g. showing how three stations can identify the epicentre of an earthquake using a calculation and intersecting circles. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

4.

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	an explanation linking: • frequency / Hz (1) • above 20 000 (1)	Pitch too high to be heard by the man "it is above 20kHz" 2 marks "The frequency is too loud" gets 1st mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	substitution: (1) 140/0.42 evaluation: (1) 330 m/s (1)	award full marks for correct answer with no working allow 333(.333) independent mark allow ms^{-1}	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	A infrasound wave (1)		**(1)**

5.

Question			Marking details	Mark
5.	(a)	(i)	[surface and] longitudinal / P waves [arrive between B and C]. (DO NOT ACCEPT "It is a shadow zone for S waves")	1
		(ii)	Surface waves / none [are detected between C and D]. (Accept it is in the shadow zones of S and P waves)	1
	(b)		Any 4 x (1): in the mantle stiffness increases with depth (1) so wave speed increases / refraction (1), solid mantle, liquid core (1) [entering the liquid core] the stiffness decreases / density increases (1) so the wave speed decreases / refracts the other way (1)	4
			Question total	**[6]**

6.

Question			Marking details	Mark
3.	(a)		**Indicative content:** A surface seismic wave travels across the surface of the Earth as opposed to through it. Surface waves usually have larger amplitudes and longer wavelengths than body waves, and they travel more slowly than body waves do. A P wave is a seismic body wave [that shakes the ground back and forth in the same direction and the opposite direction to the direction the wave is moving]/longitudinal wave. An S wave is a seismic body wave [that shakes the ground back and forth perpendicular to the direction the wave is moving]/transverse wave. S waves do not travel through fluids, [so do not exist in Earth's outer core [or molten rock (magma)]. S waves travel slower than P waves in a solid and, therefore, arrive after the P wave. **5 – 6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3 – 4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1 – 2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6

(b)	(i)	Describe use of trace to find time delay of 3 mins (1) **Accept** 5 – 2 = 3 mins STN2 distance from epicentre = 2 000 [km] (1) **ecf** from their lag time e.g. lag time of 2.5 mins (0) distance 1 650 [km] (1) If no description present **or** indications on the diagrams only **award 1 mark** maximum.	2
	(ii)	To locate the **earthquake** candidate stated "draw arcs of the appropriate (scaled) radius from the monitoring stations" **or** shown calculations that generate answers of 1.8 cm and 4.0 cm **(ecf) or** these arcs **shown** on the diagram (1) and locate the epicentre where the three circles intersect **or** point of intersection shown on the diagram (1). Reasonable attempt at finding epicentre with 2 (rough) arcs drawn **or** scale lines that cross circle given. (1) N.B. Point only indicated **award 1 mark** only 1 arc shown for STN3 and point indicated **award 2 marks** only	3
		Question total	**[11]**

7 (HIGHER).

(a) (i) It is a thin membrane which detects the vibrations of the sound waves in the air. The drum converts the sound waves in the air to vibrations in the drum. Then these can be passed on to the ossicles.

(ii) The cochlea has three fluid-filled sections. It transfers the sound vibrations into electrical impulses which can be processed by the brain.

(b) These are for balance. They contain fluid which can provide information to the brain on rotation or orientation.

(c) When we speak, the vocal chords cause vibrations in the throat and mouth. Some of the sound passes out through the air and into our ears. However, some of it causes internal bones to vibrate which is picked up by the ear. So, the vibrations are received from two paths and therefore it sounds different. Other people will only hear the vibrations which come out of the mouth.

(d) Hearing aids capture the sound vibrations from the air and amplify them. They play them back into the ear canal and the ear does the rest of the work. A cochlea implant is a system which can help a person hear unlike a hearing aid. They produce electrical signals from the vibrations around the ear and these are sent to the nerves near the cochlea and the brain can interpret these as sound.