

WJEC Physics GCSE
Topic 1.7: Seismic waves
Mark Schemes for Questions by
topic

1.

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]

2.

Question		Marking details	Mark
9.		<p>Indicative content:</p> <p>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 as 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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.</p>	6
		Question total	[11]
		Foundation tier paper total	[60]

3.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	3	Speed = $\frac{1958(1)}{240(1)} = 8.1583 / 8.16$ [km/s] (1)	8.2 [km/s]		8.15 [km/s]
(b)	6	<p>Indicative content:</p> <p>Similarities:</p> <ul style="list-style-type: none"> P and S waves will both arrive at Tokyo and Hawaii. P waves will always arrive before S waves. <p>Differences:</p> <ul style="list-style-type: none"> Tokyo and Hawaii traces will start later than Hong Kong because they have further to travel. <p>Tokyo calculation for arrival of P waves:</p> $\text{Time} = \frac{4100}{8.16} \text{ecf} = 502.6 \text{ s (8.4 min) [so trace starts at 2:36:24]}$ <p>Hawaii Calculation:</p> $\text{Time} = \frac{11020}{8.16} \text{ecf} = 1351 \text{ s (22.5min) [so trace starts at 2:50:31]}$ <ul style="list-style-type: none"> Tokyo trace to have a greater gap (than Hong Kong trace) between P and S waves arriving. <p>Hawaii trace to have an even longer gap between P and S waves arriving.</p> <p>Delay Calculations:</p> <p>From Hong Kong data:</p> <p>Speed of S wave: $\frac{1958}{485} = 4.04$ km/s</p> <p>Tokyo time for S waves: $\frac{4100}{4.04} = 1015.6$ [s]</p> <p>[So Tokyo lag time: $1015.6 - 502.6 = 513$ [s]]</p> <p>Hawaii time for S waves: $\frac{11020}{4.04} = 2729$ [s]</p> <p>[So Hawaii lag time: $2729 - 1351 = 1378$ [s]]</p> <p>Amplitude at Tokyo less than Hong Kong and less still at Hawaii (These figures are within a range of 30 s depending on rounding off.)</p> <p>5-6 marks</p> <p>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.</p> <p>3-4 marks</p> <p>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.</p> <p>1-2 marks</p> <p>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.</p> <p>0 marks</p> <p>The candidate does not make any attempt or give a relevant answer worthy of credit.</p>			
(c)	1	The earth in San Francisco may have a different stiffness or different density.	Incorrect change in velocity for a correct property. Waves travel faster in some rocks than others.		Different materials
Total Mark		10			

4.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	2	distance = 6×25 (1-sub) = 150 [km] (1-ans)	Use of scale – $3 \times 50 =$ 150 [km]		
	(ii)	1	<p>The circle should be crossed in the position of the X marked above i.e. on the N, A or T of "NATIONAL"</p>			
(b)	(i)	1	P waves travel faster than S waves or converse		Reference to surface waves in addition to S waves	They set out later / surface waves are slower than P waves / S waves take longer to travel
	(ii)	1	6 hours [0]1 minute 42 seconds			01 min 42 secs or just 42 secs
Total		5				