Stationary waves Mark Scheme 2

Level	International A Level
Subject	Physics
Exam Board	CIE
Торіс	Superposition
Sub Topic	Stationary Waves
Paper Type	Theory
Booklet	Mark Scheme 2
Time Allowed:	53 minutes
Score:	/44
Percentage:	
	/100

A*	Α	В	С	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1	(a	waves (travels along tube) reflect at <u>closed end / end of tube</u> incident and reflected waves or these two waves are in <u>opposite directions</u> interfere or stationary wave formed if tube length equivalent to				
		λ/-	$^{\prime}$ 4, 3 λ / 4, etc.			[3]
	(b)	(i)	1.	no motion (as node) / zero amplitude	B1	[1]
			2.	vibration backwards and forwards / maximum amplitude along length	B1	1
		(ii)	λ = L = L =	330 / 880 (= 0.375 m) $3\lambda / 4$ $3 / 4 \times (0.375) = 0.28 (0.281) m$	C1 A	[3]

2	(a)	two san resi	waves travelling (along the same line) in opposite directions overlap/meet ne frequency / wavelength ultant displacement is the sum of displacements of each wave /	M1 A1	
		pro	duces nodes and antinodes	B1	[3]
	(b)	арр	paratus: source of sound + detector + reflection system	B1	
		adji	ustment to apparatus to set up standing waves – how recognised	B1	
		me	asurements made to obtain wavelength	В1	[3]
	(c)	(i)	at least two nodes and two antinodes	A1	[1]
		(ii)	node to node = $\lambda / 2$ = 34 cm (allow 33 to 35 cm) c = $f\lambda$	C1 C1	
			f = 340 / 0.68 = 500 (490 to 520) Hz	A1	[3]

3	(a)	wa (re	aves esulta	overlap ant) displacement is the sum of the displacements of each of the waves	B1 B1	[2]
	(b)	way ove (all way	ves erlap ow s ves h	travelling in opposite directions overlap / incident and reflected waves uperpose or interfere for overlap here) have the same speed and frequency	B1 B1	[2]
	(c)	(i)	time f =	e period = 4 × 0.1 (ms) 1 / <i>T</i> = 1 / 4 × 10 ⁻⁴ = 2500 Hz	C1	[2]
		(ii)	1. 2.	the microphone is at an antinode and goes to a node and then an antinode / maximum amplitude at antinode and minimum amplitude at node $\lambda / 2 = 6.7 \text{ (cm)}$ $v = f\lambda$ $v = 2500 \times 13.4 \times 10^{-2} = 335 \text{ m s}^{-1}$	C1 C1 A1	[1] [3]
				incorrect λ then can only score second mark		



4	(a	e.g. no energy transfer amplitude varies along its length/nodes <u>and</u> antinodes neighbouring points (in inter-nodal loop) vibrate in phase, etc.		
		(any two, 1 mark each to max 2	B2	[2]
	(b)	($\lambda = (330 \times 10^2)/550$ $\lambda = 60 \mathrm{cm}$	M1 A0	[1]
		(ii) node labelled at piston antinode labelled at open end of tube additional node and antinode in correct positions along tube	B1 B1 B1	[3]
	(c)	at lowest frequency, length = $\lambda/4$	C1 C1 A1	[3]
5 ((a) (frequency f	B1	[1]
	(ii	i) amplitude A	B1	[1]
((b) π	rad or 180°(unit necessary)	B1	[1]
((c) (i	i) speed = $f \times L$	B1	[1] [
	(ii	 i) wave is reflected at end / at P <i>either</i> incident and reflected waves interfere <i>or</i> two waves travelling in opposite directions interfere speed is the speed of incident or reflected wave / one of these waves 	B1 M1 A1	[3]
			[Tot	al: 7]