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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Physics 6451

Specification A

PHAP Practical Examination

Mark Scheme

2008 examination - June series

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GCE Physics, Specification A, PHAP, Practical Examination

Question 1	AO3a: planning	
	measurements: (to measure the (amplitude if the) voltage induced in the ribbon) use a cro or (ac) voltmeter (connected to the ribbon [microphone]) ✓ [voltage sensor connected to data logger] (reject 'ammeter' or 'multimeter'; for the purposes of the exercise it is not necessary to make a distinction between peak and rms voltage) (to measure the frequency [period] of the incident sound) use a cro (connected to either the ac supply or to the ribbon) ✓ [accept (conventional) microphone connected to cro, sound sensor connected to data logger]	**2**
	strategy: measure period, T, [accept correct sketch]; determine frequency, f, using $f = \frac{1}{T}$ ✓ measure and record (amplitude of) the **voltage** induced in the ribbon for a range of input sound frequencies; plot a graph of (amplitude of) voltage against frequency ✓ determine the resonant frequency from the peak [turning point] on the graph ✓ (accept evidence from sketch of graph; no credit for $_3$S if $_2$S = 0)	**3**
	control: amplitude [intensity] of sound from loudspeaker by measuring with a decibel meter [microphone connected to a cro of voltmeter] or output pd of supply by measuring with a cro [voltmeter] or current in loudspeaker by measuring with an ammeter ✓ position [direction] of loudspeaker relative to ribbon by marking relative positions, fixing down equipment to bench, measuring with a ruler etc ✓ keeping constant one named characteristic of the ribbon that would logically affect the resonant frequency; accept length, width or tension (no further qualification required; reject 'use same ribbon [microphone], same strength [alignment] of magnet) ✓ keeping ambient noise to a minimum [eliminating background noise] by use of soundproofing ✓	**max 3**

	difficulties: *(difficulty + how overcome = 2)* any **two** of the following: reduce uncertainty in frequency [period] ✓ check that cro time-base is correctly calibrated by use of a signal source of known frequency and/or ✓ ensure that continuously variable time-base control is switched off [only use stepped time-base settings] and/or ✓ use large (horizontal) fraction of visible trace on cro display in calculating frequency; (i.e. 'measure T from nT, alternatively, adjust time base to expand width of one cycle; accept evidence from sketch of cro trace; allow 'more sensitive time base') ✓ reduce uncertainty in amplitude of output from ribbon microphone ✓ use suitable Y-gain setting so amplitude of trace is large (look for evidence in any sketch produced) [measure peak to trough [peak to peak] (i.e. 2 × amplitude)] ✓ (reject 'use strong magnet', 'switch off the time-base') reduce uncertainty in resonant frequency of ribbon ✓ increase frequency of measurements around peak of voltage ~ frequency graph and/or ✓ look for 2nd resonant peak in sensitivity at 2 × fundamental frequency for confirmation ✓	**max 4**
	Total	**max 8**

Question 2	**AO3b: implementing**		
(a)	*initial observations:*	x_0 to nearest mm in range 275 to 285 mm (allow '28 cm' but deduct SF mark in (b))	**1**
(b)	*tabulation:*	x/mm V/V ✓	**5**
	results:	at least 15 sets of x and V for 10 mm ≤ x ≤ 270 mm ✓✓ [at least 10 sets ✓] x range at least 250 mm ✓	
	significant figures:	all x to nearest mm (including part (a)) and all V to nearest 0.01 V or to nearest 0.001 V ✓ (allow mixed 3 and 4 figure V data for auto-ranging meters)	

(c)		*quality:* four points to ± 2 mm of (straight) best fit line in region where 10 mm ≤ x ≤ 70 mm ✓ four points to ± 2 mm of (curved) best fit line in region where 70 mm ≤ x ≤ 190 mm ✓ four points to ± 2 mm of (straight) best fit line in region where 190 mm ≤ x ≤ 270 mm ✓ } max 2 ✓✓✓ earns Q = 2, any ✓✓ earns Q =1, otherwise Q = 0 (Q is conditional on whether suitably-scaled graph drawn) **AO3c: applying evidence and drawing conclusions** *axes:* marked x/mm and V/V ✓✓ deduct ½ for each error or omission, rounding down *scales:* suitable (e.g. 8 × 8) ✓✓, [5 × 5, 2 × 8, 8 × 2 ✓] *points:* with continuous best-fit line consisting of two straight-line regions (these regions should be drawn with the aid of a ruler); the two straight line regions should be separated by shorter region of positive, decreasing gradient: no credit if this region is straight or not smooth (do not insist that the best fit line passes through (0, 0) or that it must be drawn to reach the V axis) minimum of ten points plotted; any point plotted incorrectly loses this mark (check any that look suspect) ✓	**7**
(d)	(i)/(ii)	G_1 and/or G_2 from suitable Δ (e.g. 8 × 8) – apply to larger Δ ✓ (if a curve is drawn, insist on a tangent for the hypotenuse of the Δ)	**3**
	(iii)	$\frac{G_1}{G_2}$, no unit, in range 2.25 to 2.75, or 2 s.f. in range 2.3 to 2.7 ✓✓ [2.00 to 3.00, 2 s.f. in range 2.1, 2.2, 2.8 or 2.9 ✓]	
(e)	(i)	**AO3d: evaluating evidence and procedures** sketch E is correct ✓ [for three straight lines of decreasing gradient, allow 'sketch F is correct'] (sketches A or D cannot be true, sketches B or C may gain credit if x is reversed) G is constant when the paper width is constant or reverse argument ✓ G is largest when width is smallest or reverse argument ✓ (accept 'cross-section' or 'area' for width and sensible ideas about resistance per unit length)	**4**
	(ii)	d in range 50 to 90 mm (do not penalise if wrong best-fit line is drawn) ✓	
(f)		$\frac{G_1}{G_2}$ is unchanged (or 0/2) ✓ because G_1 and G_2 are (proportionally) smaller ✓ [if axes are reversed allow 'G_1 and G_2 are (proportionally) larger']	**2**
		Total	**22**