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2011

Physics

Assessment Unit A2 3
Practical Techniques (Internal Assessment)
Session 2

[AY232]

WEDNESDAY 11 MAY, MORNING

MARK SCHEME

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General Instructions for Internal Assessment

1 **Mark strictly according to this mark scheme.** Do not agonise over awarding "charity" or "benefit of doubt" marks. Give credit for numerical answers only if they are within the ranges indicated in this mark scheme. Remember, every script will be checked later to ensure that candidates are not disadvantaged.

2 Mark in **red** ball-point pen. For each correct point in the scheme you are rewarding, place a tick in the text of the script; for each incorrect point, place a cross. Then add up the ticks for each part of a question for which there is a sub-total in square brackets, and write this total in the "Teacher Mark" column to the right of the text. When you have finished marking a question, write the total for the question as a ringed mark at the beginning of the question and in the appropriate box on the front of the script.

3 In marking graphs you will have to exercise some professional judgment, but other features must be marked strictly according to the scheme. In labelling the axis, candidates should give the label/unit. The mark for "Scales" is normally awarded only if the plotted points occupy at least half of the printed graph grid along each axis. In addition, the scale must be to an easily manageable factor, such as 1:2, 1:4, 1:5, 1:10, 1:20. A factor of, for example, 10 mm to represent 30 cm does not score because of the difficulty of accurately plotting or reading off values.
The credit for plotting the points is, following the normal tariff, 2 marks for plotting 5 points correctly and 1 mark for plotting 4. "Correctly" means to within ± one small square (± 2 mm) on the printed grid in either *x*- or *y*-direction. The marker's professional judgment comes in here. One tick is to be awarded for drawing the best straight line through the points. Do not agonise over scoring (or not) this mark; your professional judgment will allow you to come to a decision very quickly.
In measuring the gradient, one mark is reserved for a "large triangle". This means that either rise or run (or both) must be at least 5 cm on the printed graph grid. Some candidates do not draw their triangle, but use points read off from the line. Provided the rise and/or run in this virtual triangle meet the 5 cm criterion, the mark is scored. Beware of candidates who read off their gradient points directly from a table. The marker must check that the points used actually **lie on the line** and meet the 5 cm test.

4 When you have finished marking the paper, add up the marks for the questions in the "Teacher Mark" column in the box on the front page of the booklet and enter the total. Check this total by adding up all the sub-total marks for parts of questions throughout the script (**not** the ringed total question marks). The totals arrived at in these two different ways should agree. If you cannot get agreement after a re-count, go back to counting the individual ticks throughout the text of the script.

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				AVAILABLE MARKS
1 **(a)** 5 pairs of results all to 1 mm ([−1] for any mm violation, apply once) • use of $(u+v)$: max [3]/[5] check: for $u = 200$ mm, $v < 240$ mm • × 0.5 factor for *d*: – 1 mark only Don't accept if $d \leqslant 6$ mm • *d* values not consistently decreasing: – 1 mark • *v* values not consistently decreasing: – 1 mark			[5]	
(b) scales + axes labelled correctly		[1]		
points plotted correctly ([−1] any wrong plot, apply twice)		[2]		
best-fit line		[1]	[4]	
(c) gradient + large triangle or values		[1]		
– consistent value		[1]		
intercept value or use of equation		[1]		
both units (one mark per correct unit)		[2]	[5]	
(d) **(i)** position of sharp image		[1]		
measurement of distances	accept reading errors	[1]	[2]	
(ii) uncertainty in $v \geqslant \pm 3$ mm (max 50 mm)			[1]	
(iii) Re-determine *F* (greatest or least extreme fit to find maximum or minimum drawn intercept or gradients)		[1]		
difference in *F* values calculated		[1]	[2]	
(iv) percentage difference calculated $\frac{\lvert 150-F \rvert}{150} \times 100$			[1]	20
2 **(a)** 10 sets of results with I decreasing for 60s Ignore first reading if lower than second			[5]	
(b) $\ln I = \ln I_o - t/CR$ shown		[1]		
compared with $y = mx + c$		[1]	[2]	
(c) **(i)** ln (I/μA) in table (do not allow ln I/μA) or equivalent units		[1]		
Values consistent with candidate's I values (Penalty of [−1] if $\log_{10}$ used)		[1]	[2]	
(ii) Scales		[1]		
Axes labelled (ecf from table)		[1]		
Points plotted correctly		[2]		
Best fit line		[1]	[5]	
(iii) gradient – large triangle and values		[1]		
consistent gradient value		[1]		
inversion to find *CR*		[1]		
unit		[1]	[4]	
(d) candidate's C_{Total} $\left(= \frac{CR}{56 \times 10^3} \approx 500\,\mu F\right)$		[1]		
series		[1]	[2]	20

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					AVAILABLE MARKS
3	**(a)**	**(i)**	• measure length of liquid in tube with e.g. string and metre rule or liquid volume/CSA tube with detail • set liquid into gentle oscillation • time n oscillations n ⩾ 5 • repeat and average • divide by n for periodic time • repeat for different liquid lengths ([1] each)	[6]	
		(ii)	friction damping oscillations or small number of oscillations [1] difficulty measuring curved length [1]	[2]	
		(iii)	handle glass carefully or care not to suck liquid up or blow out goggles, if qualified	[1]	
	(b)	**(i)**	y-axis T , x-axis $l^{1/2}$ or T^2, l or inverses or correct alternatives straight line through origin (conditional on first mark)	[2]	
		(ii)	gradient is $2\pi\sqrt{\frac{1}{2g}}$ or $\frac{2\pi^2}{g}$ (consistent with **(i)**) [1] Algebra to show g = [1]	[2]	
	(c)	**(i)**	Density = 13.8 (13800) [1] Unit = g cm^{-3} (kg m^{-3}) independent [1] (Don't accept g/cm^3)	[2]	
		(ii)	Diameter [1] % uncertainty doubled or d is squared [1] $\left(\frac{0.01 \times 100}{1.81} = \right)$ 0.55% (accept 1.1%) [1]	[3]	
		(iii)	Evaluating $\frac{F}{A}$ = kg m^{-1} s^{-2} [1] Evaluating 2hρg = kg m^{-1} s^{-2} [1]	[2]	20
				Total	**60**