Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

PHYSICS **9702/05**

Paper 5 Planning, Analysis and Evaluation **For Examination from 2016**

SPECIMEN MARK SCHEME

1 hour 15 minutes

MAXIMUM MARK: 30

This document consists of **3** printed pages and **1** blank page.

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Question 1 Planning

Defining the problem

P Vary pressure.

P For different values of pressure, measure frequency.

D Keep frequency of sound wave generated constant.

D Keep temperature of the air constant.

Methods of data collection

M Labelled diagram of apparatus: container with source of sound.

M Method of varying *p*: e.g. use of pump to remove air/valve to allow air in.

M Method of measuring *p*: e.g. Bourdon gauge/pressure gauge/manometer.

M Use microphone connected to oscilloscope to measure frequency.

D Method to determine the period of the wave including the use of the timebase.

D $f = 1/\text{period}$.

Method of analysis

A Plot f against p^2; allow lg f against lg p.

A Relationship is correct if graph is a straight line through the origin.

A k = gradient.

Safety considerations and additional detail

D Use a safety screen/goggles to prevent glass entering eyes if glass container shatters.

D Use of *y*-axis on c.r.o. to check that initial sound has constant amplitude.

D Need to seal points where wires pass through bell jar.

D Use loud sound to obtain measurable readings at low pressures.

D Check temperature with a thermometer.

Award P, M and A marks where seen. Award a maximum of 6 D marks. **[Total: 15]**

Question 2 Analysis, conclusions and evaluation

	Mark	Expected Answer	Additional Guidance	
(a)	A	Gradient = c^2		[1]
(b)	T1	R^2/ 10^{-4} m^2 and E^3 / MeV^3	Allow R^2 (10^{-4} m^2) and E^3 (MeV^3)	
	T2	16.0 or 16.00 | 156 or 155.7 18.9 or 18.92 | 183 or 183.3 23.0 or 23.04 | 221 or 221.4 25.5 or 25.50 | 248 or 247.7 32.5 or 32.49 | 310 or 310.3	Values must correspond to table.	
	U1	From ± 0.4 to ± 0.6	Allow more than one significant figure.	[3]
(c)(i)	G1	Five points plotted correctly	Must be within half a small square. Penalise 'blobs'. Ecf allowed from table.	
	U2	All error bars in R^2 plotted correctly	Must be accurate within half a small square.	[2]
(c)(ii)	G2	Line of best fit	Allow ecf from points plotted incorrectly – examiner judgement.	
	G3	Worst acceptable straight line. Steepest or shallowest possible line that passes through <u>all</u> the error bars.	Line should be clearly labelled or dashed. Should pass from top of top error bar to bottom of bottom error bar **or** bottom of top error bar to top of bottom error bar. Mark scored only if all error bars are plotted.	[2]
(c)(iii)	C1	Gradient of best fit line	The triangle used should be at least half the length of the drawn line. Check the read-offs. Work to half a small square. Do not penalise POT. (Should be about 1.1×10^{-5})	
	U3	Uncertainty in gradient	Method of determining absolute uncertainty Difference in worst gradient and gradient.	[2]
(d)	C2	$c = \sqrt{\text{gradient}}$	Gradient must be used. Should be about 0.0033. Do not penalise POT.	
	C3	m MeV$^{-3/2}$		
	U4	Absolute uncertainty in c	Check working.	[3]
(e)(i)	C4	E given to 2 or 3 s.f.		[1]
(e)(ii)	U5	Percentage uncertainty in E	$\frac{2}{3}\left(\frac{\Delta R}{R}+\frac{\Delta c}{c}\right)\times 100 = \frac{1}{3}\left(2\frac{\Delta R}{R}+\frac{\Delta m}{m}\right)\times 100$	[1]

[Total: 15]

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