UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2008 question paper

9702 PHYSICS

9702/05

Paper 5 (Planning, Analysis and Evaluation), maximum raw mark 30

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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1 Planning (15 marks)

Definin P1 P2 P3	g the problem (3 marks) A is the independent variable or vary A. R is the dependent variable or determine R for different A. Keep the temperature (of glass) constant. Do not allow "controlled variable".	[1] [1] [1]
Method	ds of data collection (5 marks)	
M1	Basic circuit diagram.	[1]
	Ammeter and voltmeter with power supply, or	
	ohmmeter <u>without</u> power supply, or	
	bridge methods.	
M2	Correct orientation of glass between electrodes – largest cross-sectional area.	[1]
M3	A distance (thickness) measured using a micrometer/vernier scale/vernier callipers.	[1]
M4	Method of determining area <u>perpendicular</u> to current flow.	[1]
	Distances measured and multiplied together.	
	This mark may only be scored if it is clear that the correct dimensions are being used	
M5	Method of determining resistance.	[1]
	Ohmmeter.	
	R = V/I justified.	
	Description of balancing bridge with correct equation.	

Method of analysis (2 marks)

A1	A2
R against 1/A	ρ = gradient/ l
R against 1/A	ho = gradient
1/A against R or 1/R against A	ρ = 1/(gradient × l)
1/A against R or 1/R against A	ρ = 1/gradient
lg R against lg A	$\rho = 10^{l \times y-intercept}$

[2]

[1]

Safety considerations (1 mark)

S1 Relevant safety precaution <u>related</u> to:

EHT power supply (>100 V) – switch off before changing circuit/use of rubber gloves; or handling glass – wear (thick) gloves.

Additional detail (4 marks)

D1/2/3/4 Relevant points might include

[4]

Calculation of typical resistance of glass using value of resistivity given.

Range of ammeter or ohmmeter with reasoning.

Use of EHT or power supply >1000 V or microammeter/galvanometer.

Take many readings of thickness <u>and</u> average.

Good contact between circuit and glass e.g. metal plates, foil, conducting putty.

Metal plates/foil/conducting putty to cover <u>all</u> of the cross-sectional area in use.

Method of securing good contact between circuit and glass, e.g. g clamps, weights.

Clean/dry the glass.

[Total: 15]

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2 Analysis, conclusions and evaluation (15 marks)

(a) gradient = $-\rho\eta$ y-intercept = $\ln R_0$ or $\log_e R_0$ [1]

(b)

In (R/s ⁻¹)	Errors in In R
6.620 or 6.62	± 0.02 – 0.03
6.363 or 6.36	± 0.03
6.064 or 6.06	± 0.05
5.799 or 5.80	± 0.06
5.521 or 5.52	± 0.08
5.247 or 5.25	± 0.10 – 0.11

	2 o	umn heading for In (<i>R</i>); In <i>R</i> calculated. All correct for one mark. r 3 dp scores one mark as shown. ors in In <i>R</i> : Ignore no. of sf in errors.	[1] [1] [1]
(c)	(i)	Points plotted correctly. All six within half a small square required for this mark. Error bars in R plotted correctly. Check $x = 0.0300$ m. Allow ecf.	[1] [1]
	(ii)	Line of best fit. Must be within tolerances. Worst acceptable straight line. Line should be clearly labelled.	[1] [1]
	(iii)	Gradient of best-fit line. Must be negative. Award this mark if in range –54.0 to –56.0. If out of range, check the read offs. Work to half a small square. The triangle used should be greater than half the length of the drawn line.	[1]
		Error in gradient Method of determining absolute error. Expect to see difference between gradient from best-fit line and the worst acceptable line correctly evaluated.	[1]
(d)	(d) Value of η Award mark for method η = candidate's gradient/11300 evaluated. Error in η		[1]
			[1]
		thod of determining absolute error. t of η: m² kg ⁻¹ .	[1]
(e)	Val	ue of <i>x</i> in the range 0.0410 m to 0.0425 m	[1]

[Total: 15]

[1]

If x in the range **0.0410 m to 0.0425 m**, then method of determining error in x.