

Cambridge International AS & A Level

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

PHYSICS

Paper 3 Advanced Practical Skills 1

October/November 2023

2 hours

9702/35

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

INSTRUCTIONS

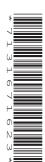
- Answer all questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each guestion in the space provided.
- Do not use an erasable pen or correction fluid.
- Do not write on any bar codes.
- You will be allowed to work with the apparatus for a maximum of 1 hour for each question.
- You should record all your observations in the spaces provided in the question paper as soon as these
 observations are made.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [].

For Exam	iner's Use
1	
2	
Total	

This document has 12 pages. Any blank pages are indicated.



You may not need to use all of the materials provided.

- 1 In this experiment, you will determine the resistivity of a metal.
 - (a) Set up the circuit shown in Fig. 1.1.

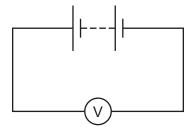


Fig. 1.1

• The voltmeter reading is *E*.

Record E.



• Set up the circuit shown in Fig. 1.2.

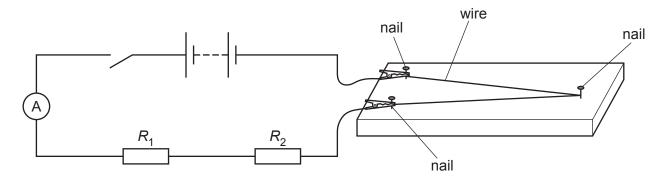


Fig. 1.2 (not to scale)

- You have been provided with several resistors, each with a different value of resistance. Select resistors and connect them so that R_1 = 33 Ω and R_2 = 56 Ω .
- Record R_1 and R_2 .

• Calculate $(R_1 + R_2)$.

$$(R_1 + R_2) = \dots$$



	Close the switch.		
•	The ammeter reading is I .		
	Record I .		
		<i>I</i> =	mA

[1]



Open the switch.

/h\	Change the values of R.	and D to	provide aix differen	typhyse of (D + D)
(D)	Change the values of R.	anu Kalo	provide six dillerer	t values of $(R_A + R_A)$
\ <i>'</i>		1		

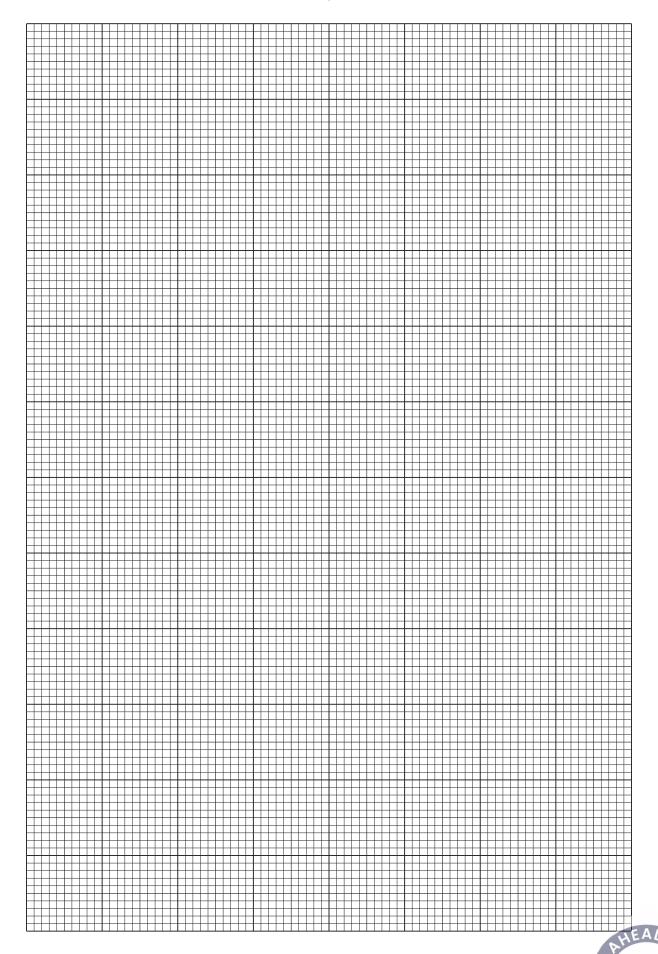
For each arrangement, record values of R_1 , R_2 and I in a table. Include values of $(R_1 + R_2)$ and $\frac{1}{I}$ in your table.

- (c) (i) Plot a graph of $\frac{1}{I}$ on the *y*-axis against $(R_1 + R_2)$ on the *x*-axis. [3]
 - (ii) Draw the straight line of best fit. [1]
 - (iii) Determine the gradient and *y*-intercept of this line.

gradient =

y-intercept =





(4)	It is suggested that the	ruantitios T D	and D	are related by	the equation
(u)	It is suggested that the o	Juanililies 1, ∧₁	allu Λ_2	are related by	ille equation

$$\frac{1}{I} = F(R_1 + R_2) + G$$

where F and G are constants.

Using your answers in **(c)(iii)**, determine the values of F and G. Give appropriate units.

G =	

(e) (i) Use the micrometer to measure the diameter *d* of the wire.

(ii) It is suggested that G is given by the equation

$$G = \frac{4\rho L}{\pi d^2 E}$$

where *L* is $0.560\,\mathrm{m}$ and ρ is the resistivity of the metal of the wire.

Using your answers in (a), (d) and (e)(i), determine a value for ρ .

$$\rho$$
 = Ω m [1]

[Total: 20]



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You may not need to use all of the materials provided.

- 2 In this experiment, you will investigate the movement of a mass hanger.
 - (a) You are provided with a number of paper clips.

Use the top-pan balance to determine the mass m of **one** paper clip.

 $m = \dots g [1]$

(b) (i) ● Set up the apparatus as shown in Fig. 2.1.

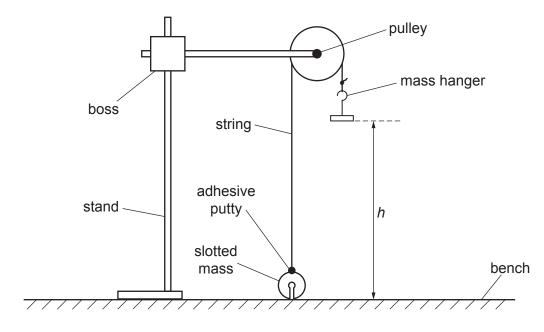


Fig. 2.1 (not to scale)

- Lower the slotted mass until it just touches the bench.
- The distance between the bottom of the mass hanger and the bench is *h*, as shown in Fig. 2.1.

Measure and record h.

 $h = \dots$ cm [1]



(ii)	•	Add just enough paper clips to the mass hanger so that it falls smoothly to the bench without stopping.
	•	Record the total number <i>N</i> of paper clips on the mass hanger.
		A
		N =[1]
(iii)	•	Adjust the position of the slotted mass so that it is just touching the bench again.
	•	Release the slotted mass and measure the time t for the mass hanger and N paper clips to fall to the bench.
		<i>t</i> =[2]
(iv)	Est	imate the percentage uncertainty in your value of t. Show your working.
		percentage uncertainty = % [1]
(v)	The	e acceleration a of the mass hanger is given by the relationship
		$a=\frac{2h}{t^2}.$
	Cal	culate a.
		$a = \dots cm s^{-2} [1]$
(vi)	.lus	tify the number of significant figures that you have given for your value of <i>a</i> .
(*1)	ouc	any the number of digitilicant figures that you have given for your value of a.
		IEAD.
		AHEAS

((c)	•	Add two	more i	paper	clips to	the	mass	hanger.
۸	•	-	, taa tiio	1110101	papoi	Olipo to		111400	11011901

•	Record the	total number	N of naner	clins on the	mass hanger.
•	Trecold life	total Hullibel	IV OI DADEI		illass Halluci.

N =

• Repeat (b)(iii) and (b)(v).

t =

 $a = \dots cm s^{-2}$ [2]

(d) It is suggested that the relationship between a, m and N is

$$\frac{k}{a} = 1 + \frac{2Z}{Nm}$$

where Z is the mass of the slotted mass and has the value 10.0 g, and k is a constant.

Using your data, calculate two values of *k*.

first value of $k = \dots$

second value of $k = \dots$ [1]



	ra:
	Using this uncertainty, explain whether your results support the relationship in (d).
9)	It is suggested that the percentage uncertainty in the values of <i>k</i> is 25%.



(f)

(i)	Describe four sources of uncertainty or limitations of the procedure for this experiment.
	For any uncertainties in measurement that you describe, you should state the quantity being measured and a reason for the uncertainty.
	1
	2
	3
	4
	[4]
(ii)	Describe four improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.
	1
	2
	2
	2

[Total: 20]

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