Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

0150880739

PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **October/November 2020**

2 hours

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 question 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 Examiner's Use	
1	
2	
Total	

This document has **12** pages. Blank pages are indicated.

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

1 In this experiment, you will investigate combinations of resistors in an electrical circuit.

Fig. 1.1 shows how resistors of resistance 68.0 Ω can be arranged to give different values of total resistance *R*.

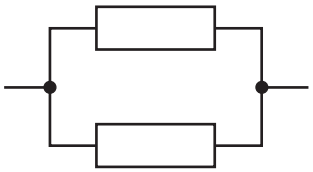
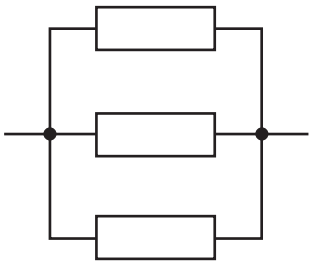
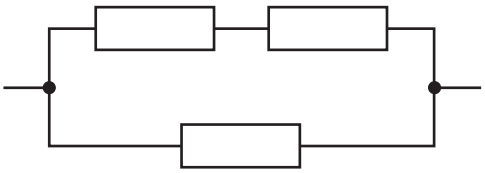
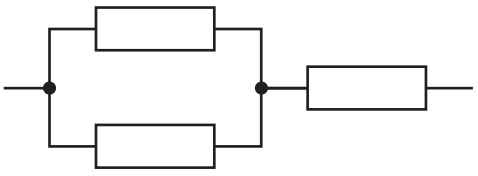
resistor arrangement	R/Ω
	68.0
	136
	204
	34.0
	22.7
	45.3
	102

Fig. 1.1

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(a) ● Set up the circuit as shown in Fig. 1.2 with a resistor of resistance 68.0 Ω between F and G.

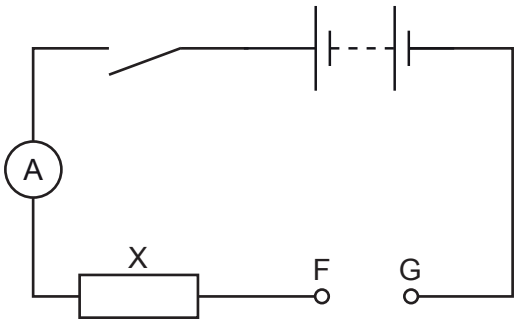


Fig. 1.2

● Record the total resistance R between F and G.

R = ... Ω

● Close the switch.

● Record the ammeter reading I.

I = ...

● Open the switch.

[1]

(b) Use six different arrangements of the 68.0 Ω resistors to provide six different total resistances between F and G.

For each arrangement, record R and I in a table. Include values of $\frac{1}{I}$ in your table.

[10]

(c) **(i)** Plot a graph of $\frac{1}{I}$ on the *y*-axis against R on the *x*-axis. [3]

(ii) Draw the straight line of best fit. [1]

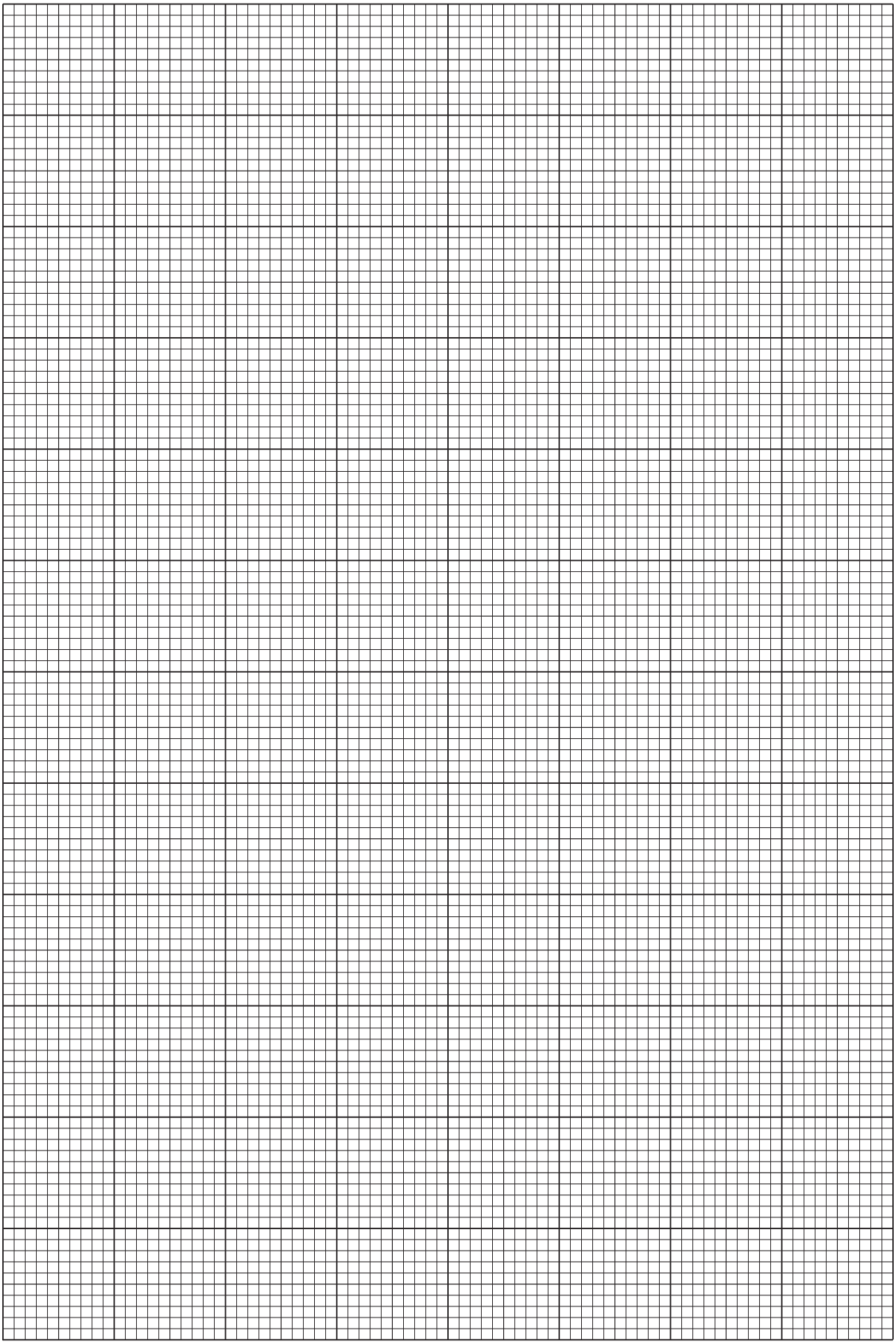
(iii) Determine the gradient and *y*-intercept of this line.

gradient = ...

y-intercept = ...

[2]

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(d) It is suggested that the quantities I and R are related by the equation

$$\frac{1}{I} = \frac{R}{E} + \frac{X}{E}$$

where E is the electromotive force (e.m.f.) of the power supply and X is the resistance of resistor X.

Using your answers to **(c)(iii)**, determine values for E and X.
Give appropriate units.

E = ...

X = ...
[3]

[Total: 20]

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

2 In this experiment, you will investigate the equilibrium of an L-shaped card.

(a) (i) The dimensions p, q and w of the card are shown in Fig. 2.1.

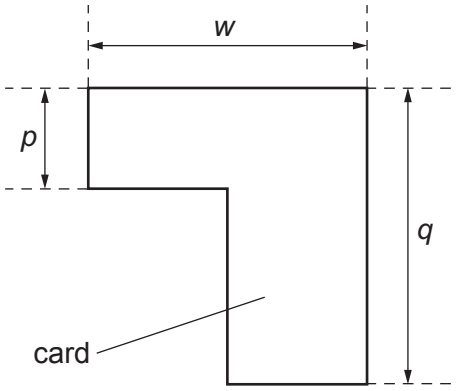


Fig. 2.1 (not to scale)

Measure and record lengths p, q and w.

p = ... cm

q = ... cm

w = ... cm
[2]

(ii) Calculate $\frac{2q}{p+q}$.

$\frac{2q}{p+q}$ = ... [1]

(b) (i) ● Set up the apparatus as shown in Fig. 2.2.

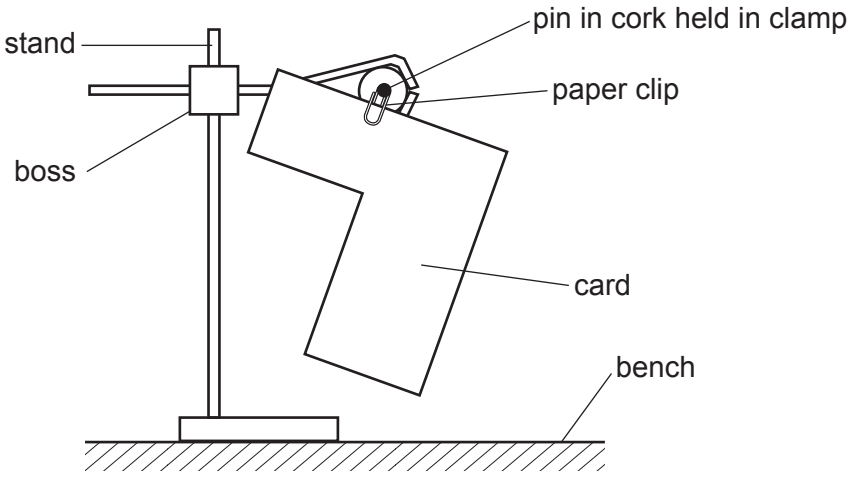


Fig. 2.2 (not to scale)

● Adjust the position of the paper clip so that the top edge of the card is horizontal, as shown in Fig. 2.3.

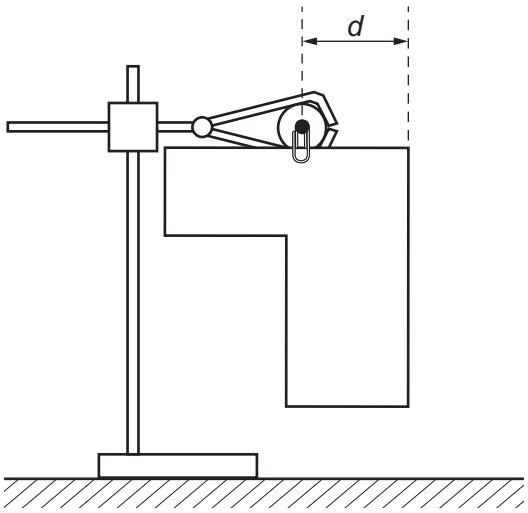


Fig. 2.3 (not to scale)

● The distance *d* is the distance from the centre of the paper clip to the right-hand edge of the card when the top edge of the card is horizontal.

● Measure and record *d*.

d = ... cm [1]

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(ii) Estimate the percentage uncertainty in d. Show your working.

percentage uncertainty = ... [1]

(iii) Calculate $(w - d)$.

$(w - d)$ = ... cm [1]

(c) (i) Explain how you would accurately reduce q to half of its original value.

.....

.....

..... [1]

(ii)
- Remove the card from the paper clip.
- Cut the card so that q is half of its original value.
- Measure and record the new value of q.

q = ... cm

- Calculate $\frac{2q}{p + q}$.

$\frac{2q}{p + q}$ = ...
[1]

(iii) Repeat **(b)(i)** and **(b)(iii)**.

d = ... cm

$(w - d)$ = ... cm
[2]

(d) It is suggested that the relationship between d and q is

$$(w - d) = k\left[1 + \left(\frac{2q}{p + q}\right)\right]$$

where k is a constant.

(i) Using your data, calculate two values of k.

first value of k = ...

second value of k = ...
[1]

(ii) Explain whether your results support the suggested relationship.

.....

.....

.....

..... [1]

(e) (i) Describe four sources of uncertainty or limitations of the procedure for this experiment.

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. .....

.....

3. .....

.....

4. .....

.....

[4]

[Total: 20]

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