



Cambridge International AS & A Level

CANDIDATE
NAME

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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.

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 $68.0\ \Omega$ can be arranged to give different values of total resistance R .



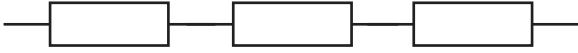
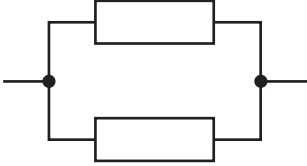
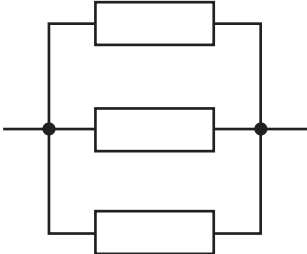
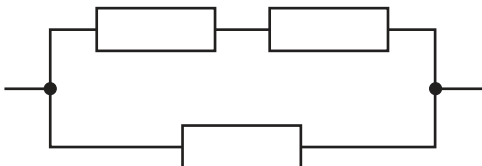
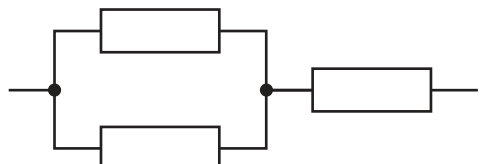
| resistor arrangement | R/Ω |
|---|------------|
|  | 68.0 |
|  | 136 |
|  | 204 |
|  | 34.0 |
|  | 22.7 |
|  | 45.3 |
|  | 102 |

Fig. 1.1

- (a) • Set up the circuit as shown in Fig. 1.2 with a resistor of resistance $68.0\ \Omega$ between F and G.

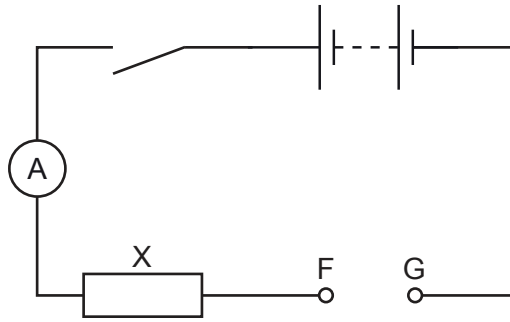


Fig. 1.2

- Record the total resistance R between F and G.

$R = \dots\dots\dots \Omega$

- Close the switch.
- Record the ammeter reading I .

$I = \dots\dots\dots$

- Open the switch.

[1]

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

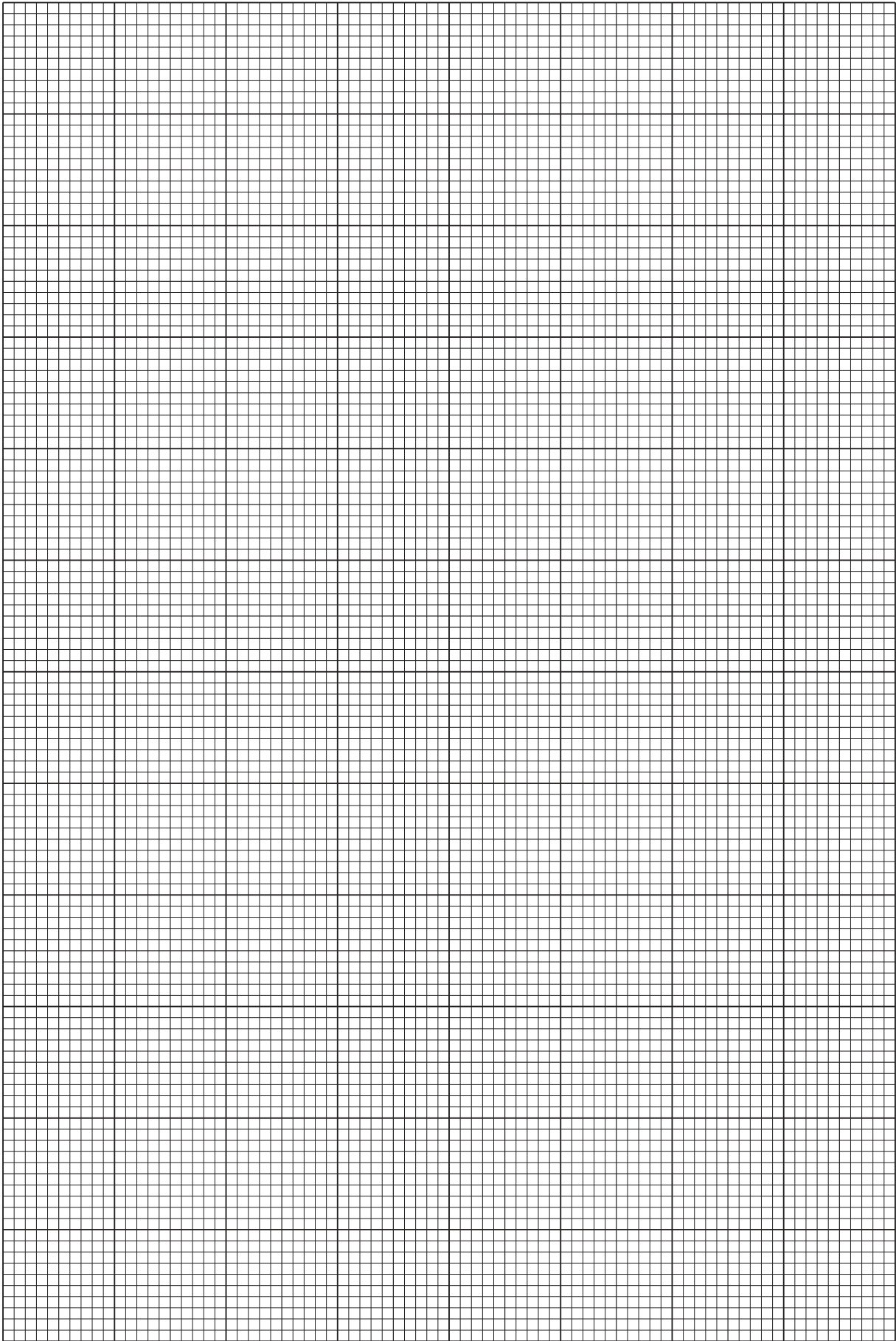
For each arrangement, record R and I in a table. Include values of $\frac{1}{I}$ in your table.

- [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]



(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.

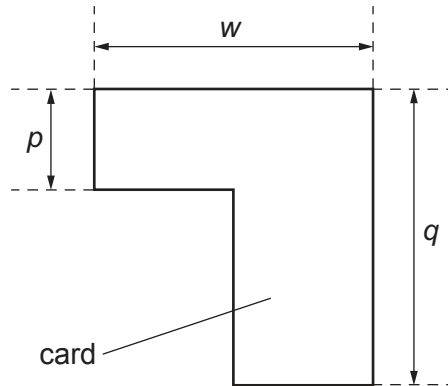


Fig. 2.1 (not to scale)

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.

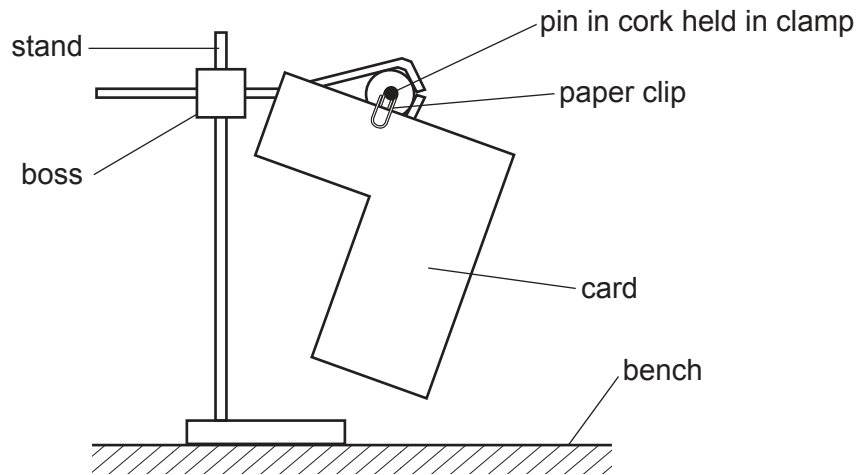


Fig. 2.2 (not to scale)

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

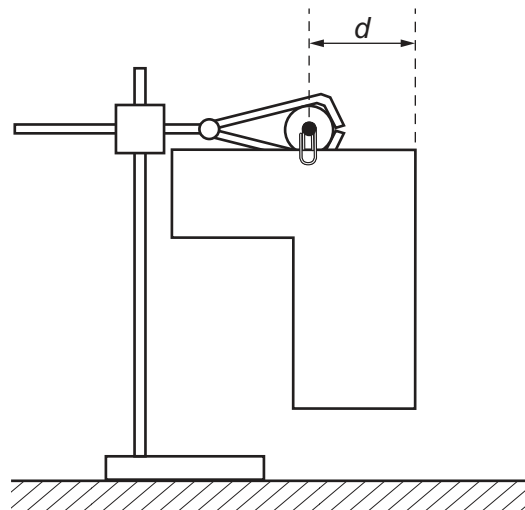


Fig. 2.3 (not to scale)

- 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 .

$d = \dots\dots\dots$ cm [1]

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

percentage uncertainty = [1]

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

$(w - d) = \dots\dots\dots$ 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 .

$q = \dots\dots\dots$ cm

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

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

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

$d = \dots\dots\dots$ cm

$(w - d) = \dots\dots\dots$ 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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