



Cambridge International AS & A Level

CANDIDATE
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PHYSICS

9702/34

Paper 3 Advanced Practical Skills 2

May/June 2022

2 hours

You must answer on the question paper.

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

INSTRUCTIONS

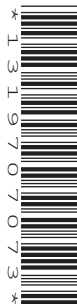
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction 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. Any blank pages are indicated.

2

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

1 In this experiment you will investigate an electrical circuit.

(a) You have been provided with the circuit shown in Fig. 1.1.

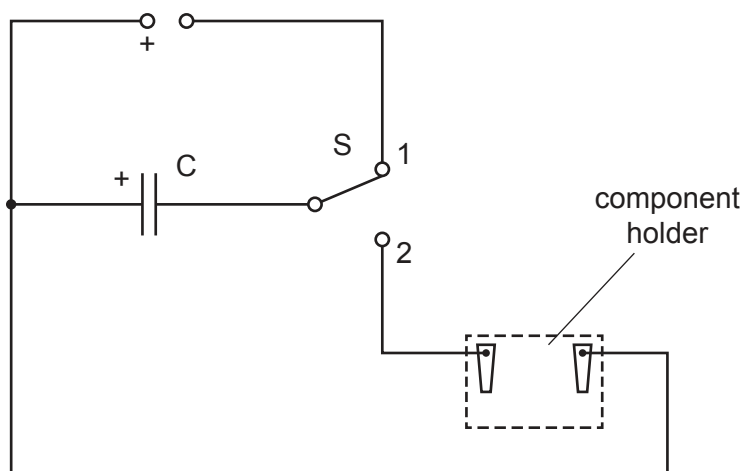


Fig. 1.1

- Connect the voltmeter in parallel with component C, as shown in Fig. 1.2.

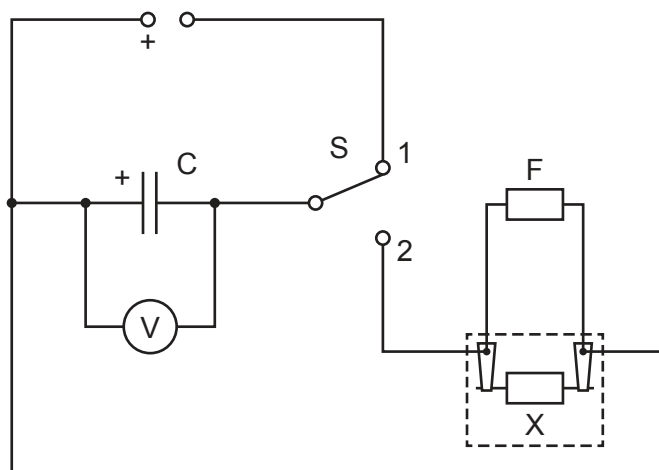


Fig. 1.2

- Connect the resistor labelled F in parallel with the component holder, as shown in Fig. 1.2.
- Connect one of the labelled resistors into the component holder as resistor X, as shown in Fig. 1.2. Record the resistance R of resistor X.

$R = \dots\dots\dots$

3

- Switch on the power supply.
- Move S to position 1.
- Record the voltmeter reading V .

 $V = \dots\dots\dots$ [1]

- (b)
- Ensure S is at position 1.
 - Move S to position 2 and start the stop-watch. The voltmeter reading will gradually decrease.
 - Stop the stop-watch when the voltmeter reading passes 0.8 V.
 - Record the time t shown by the stop-watch.

 $t = \dots\dots\dots$

- Move S to position 1.

[2]

4

- (c)** Change X and repeat **(b)** until you have six sets of values of R and t .

Record your results in a table. Include values of $\frac{1}{R}$ and $\frac{1}{t}$ in your table.

[9]

- (d) (i)** Plot a graph of $\frac{1}{t}$ on the y -axis against $\frac{1}{R}$ on the x -axis.

[3]

- (ii)** Draw the straight line of best fit.

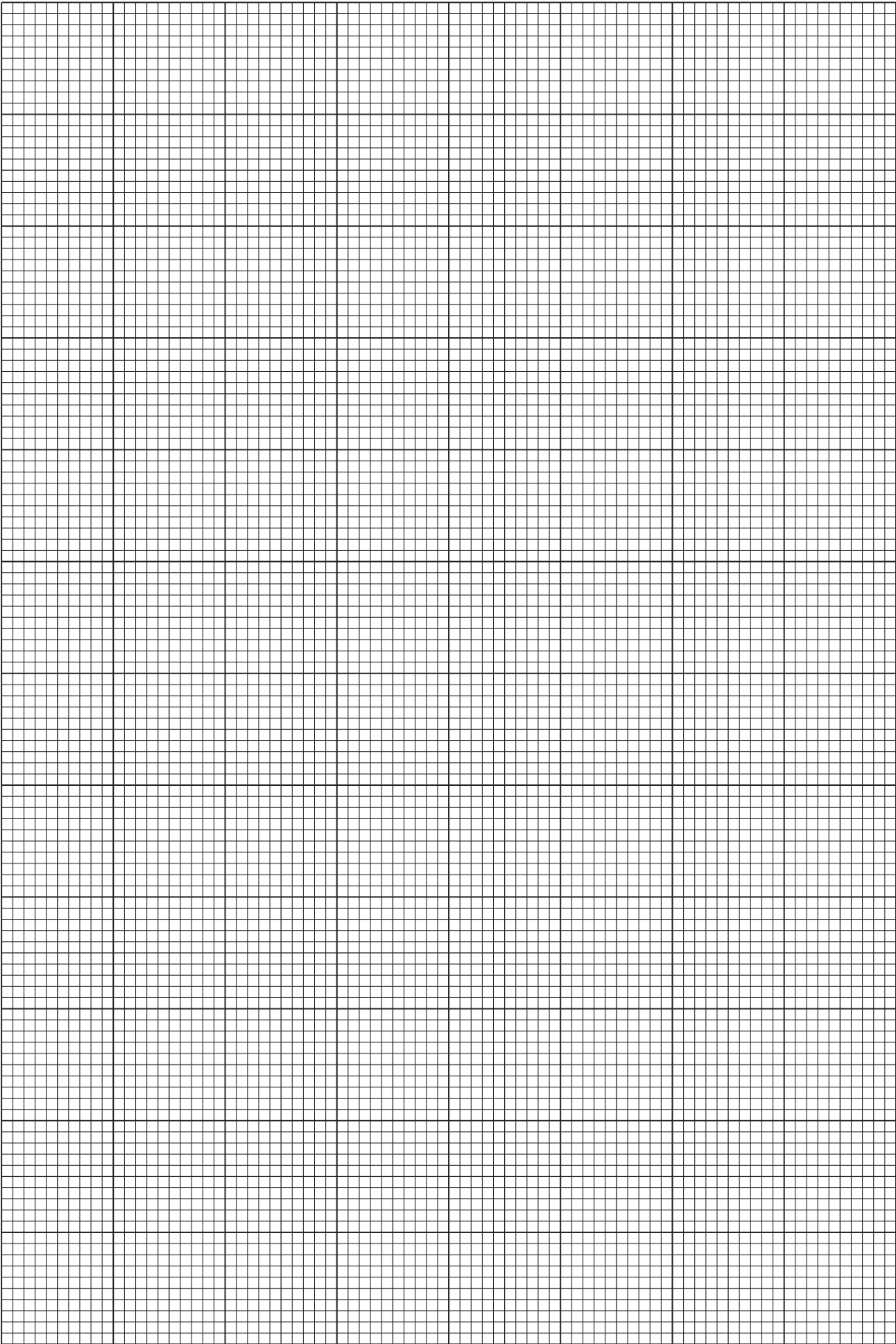
[1]

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

gradient =

y -intercept =

[2]



6

(e) It is suggested that the quantities t and R are related by the equation

$$\frac{1}{t} = \frac{a}{R} + b$$

where a and b are constants.

Use your answers in **(d)(iii)** to determine the values of a and b .
Give appropriate units.

$a =$

$b =$

[2]

[Total: 20]

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

2 In this experiment, you will compare some of the properties of two liquids.

(a) You are provided with a block of transparent material with a string loop attached to its rear face, as shown in Fig. 2.1.

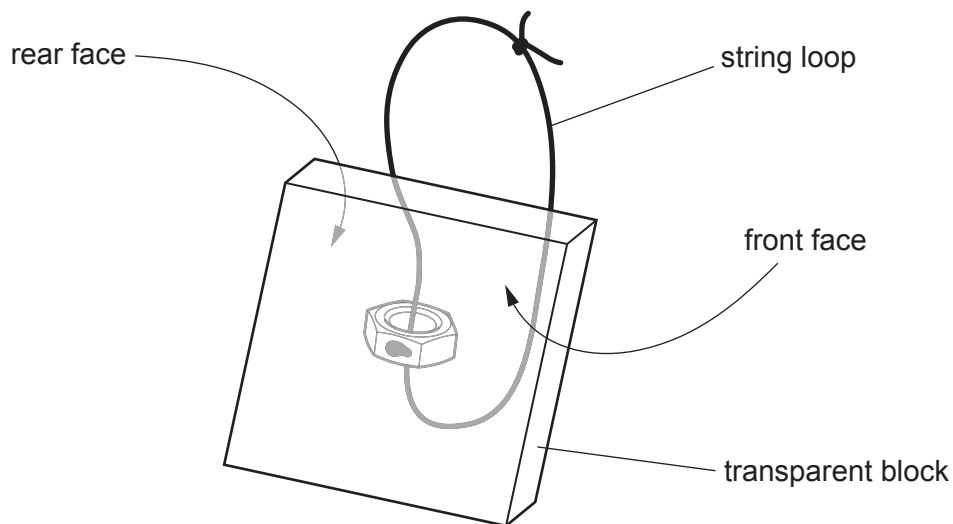


Fig. 2.1

- Hook the newton meter through the string loop.
- Record the weight W of the block shown by the newton meter.

$W = \dots\dots\dots$ N [1]

8

- (b) (i)
- Place the large transparent plate flat on the bench.
 - Use the beaker labelled WATER and its pipette to make a pool of water of approximate diameter 5 cm near the centre of the large plate.
 - Place the front face of the transparent block on the pool of water. There should be a film of water over the whole of the front face of the block, as shown in Fig. 2.2.
 - Hold the large plate down on the bench.
 - Hook the newton meter through the string loop and slowly pull up vertically on the block.

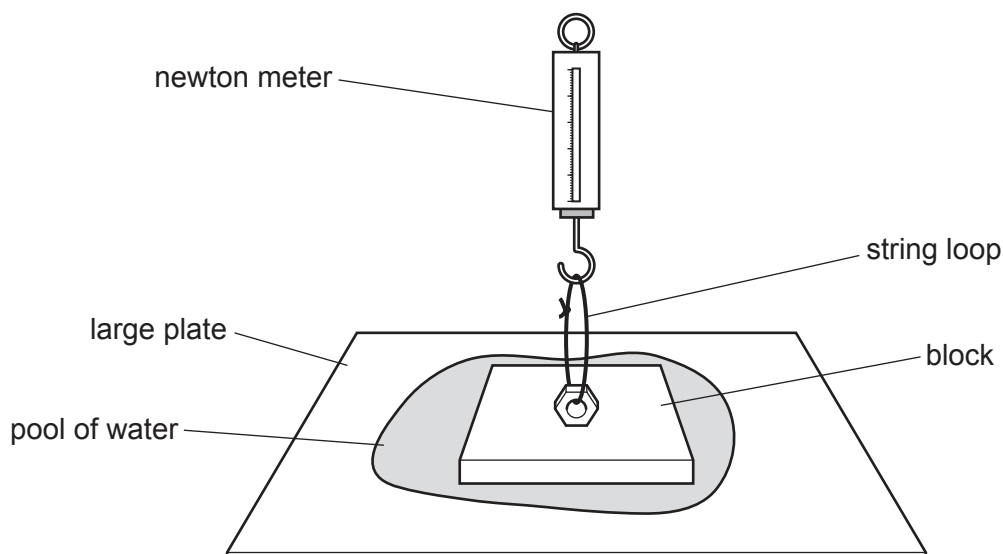


Fig. 2.2

- Record the newton meter reading F at the moment the block is detached from the plate.

$F = \dots\dots\dots$ N [2]

- (ii) Estimate the percentage uncertainty in your value of F . Show your working.

percentage uncertainty = $\dots\dots\dots$ % [1]

- (iii) Calculate E using $E = F - W$.

$E = \dots\dots\dots$ N [1]

9

- (c) • Use the stand, boss and clamp to position the syringe body above the beaker of water, as shown in Fig. 2.3.

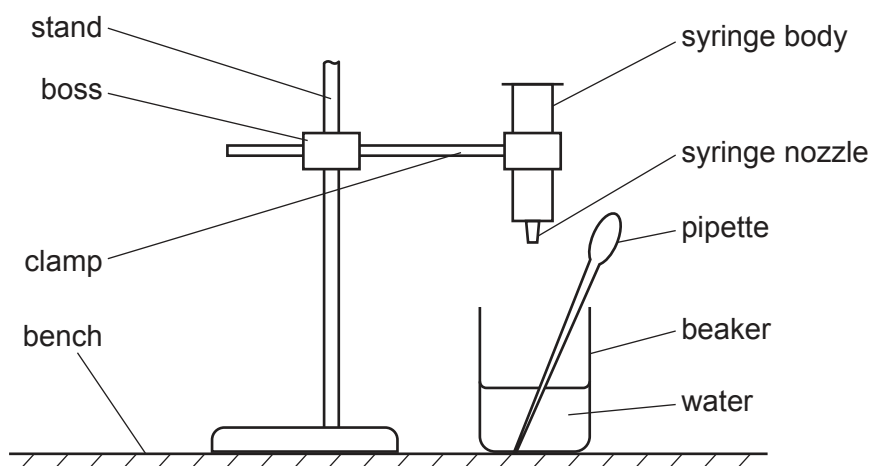


Fig. 2.3

- Cover the nozzle with a finger.
- Use the pipette to fill the syringe with water until the level is above the 10 cm^3 mark.
- Uncover the nozzle and start the stop-watch when the level passes the 10 cm^3 mark.
- Stop the stop-watch when the level passes the 1 cm^3 mark.
- Record the stop-watch reading T .

$T = \dots\dots\dots$ s [2]

- (d) • Use paper towels to dry the water from the large plate, the block and the syringe body.
- Repeat (b)(i), (b)(iii) and (c) with oil, using the beaker labelled OIL and its pipette.

$F = \dots\dots\dots$ N

$E = \dots\dots\dots$ N

$T = \dots\dots\dots$ s
[2]

10

- (e)** It is suggested that the relationship between E and T is

$$kE^2 = T$$

where k is a constant.

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

first value of k =

second value of k = [1]

- (ii)** Justify the number of significant figures that you have given for your values of k .

.....
.....
..... [1]

- (f)** It is suggested that the percentage uncertainty in the values of k is 40%.

Using this uncertainty, explain whether your results support the relationship in **(e)**.

.....
.....
.....
..... [1]

(g) (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

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2

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3

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4

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[4]

(ii) Describe **four** improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.

1

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4

.....

[4]

[Total: 20]

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