



# Cambridge International AS & A Level

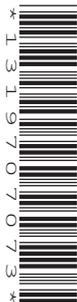
CANDIDATE  
NAME

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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	
<b>Total</b>	

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 investigate an electrical circuit.

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

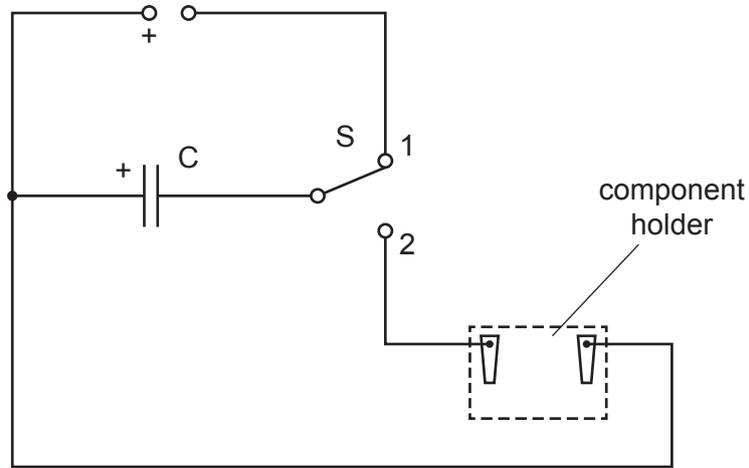


Fig. 1.1

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

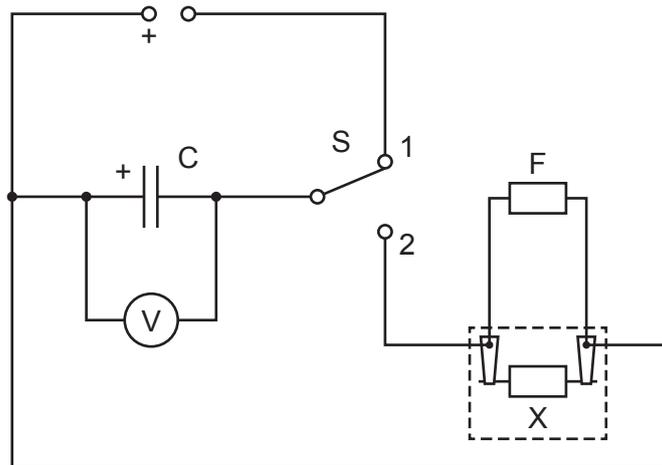


Fig. 1.2

- 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.

$R = \dots\dots\dots$

- 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]

(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.

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

[9]

[3]

(ii) Draw the straight line of best fit.

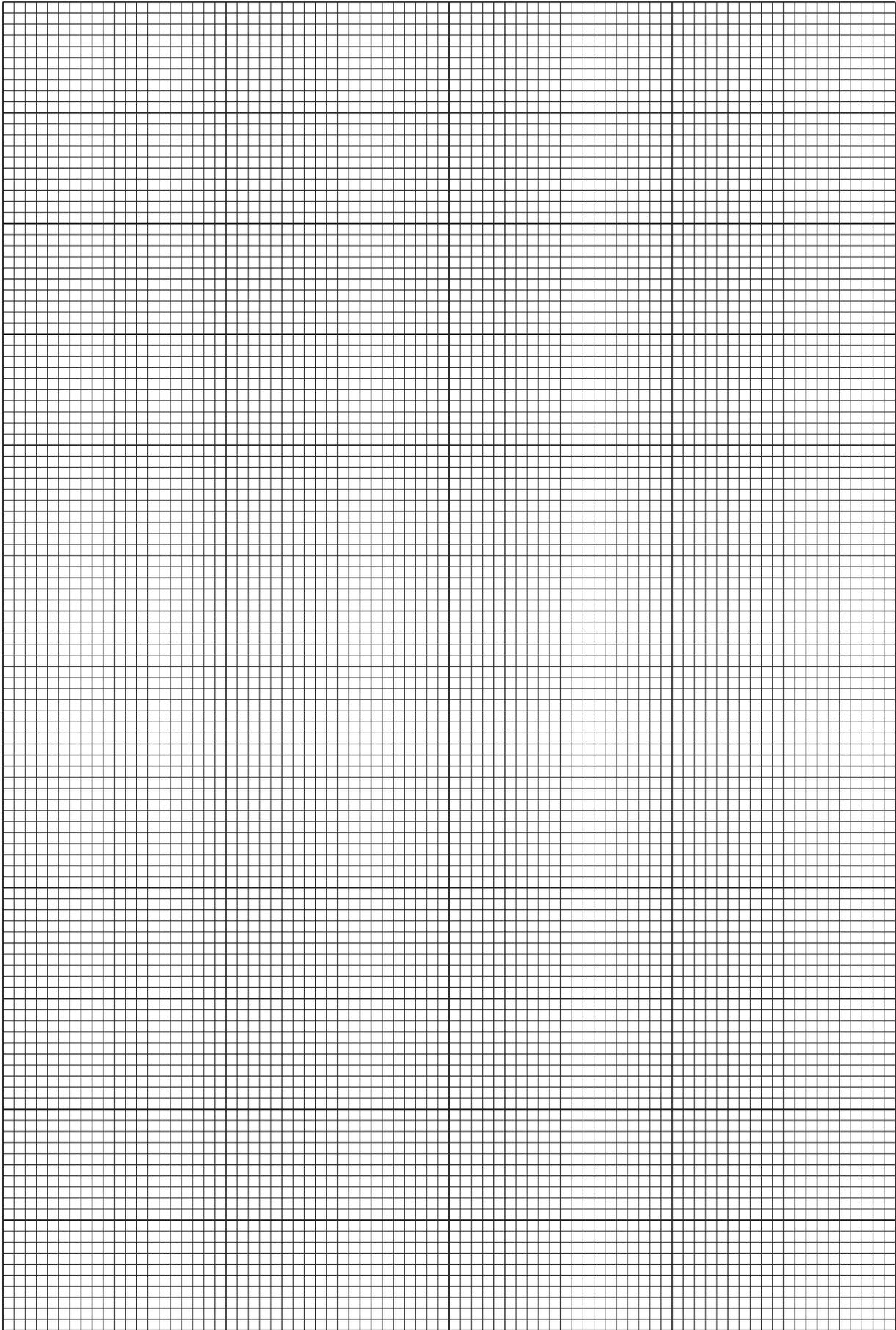
[1]

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

gradient = .....

$y$ -intercept = .....

[2]



(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.

$a =$  .....

$b =$  .....

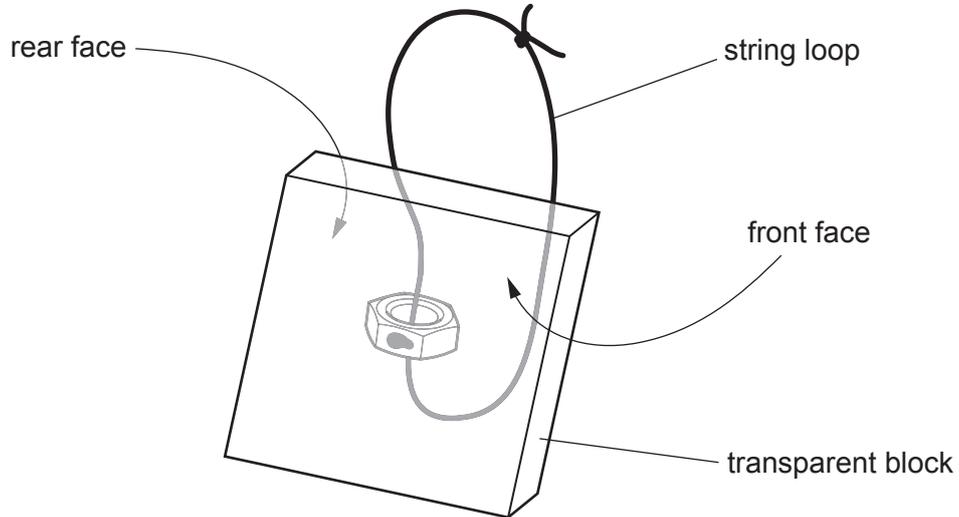
[2]

[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.

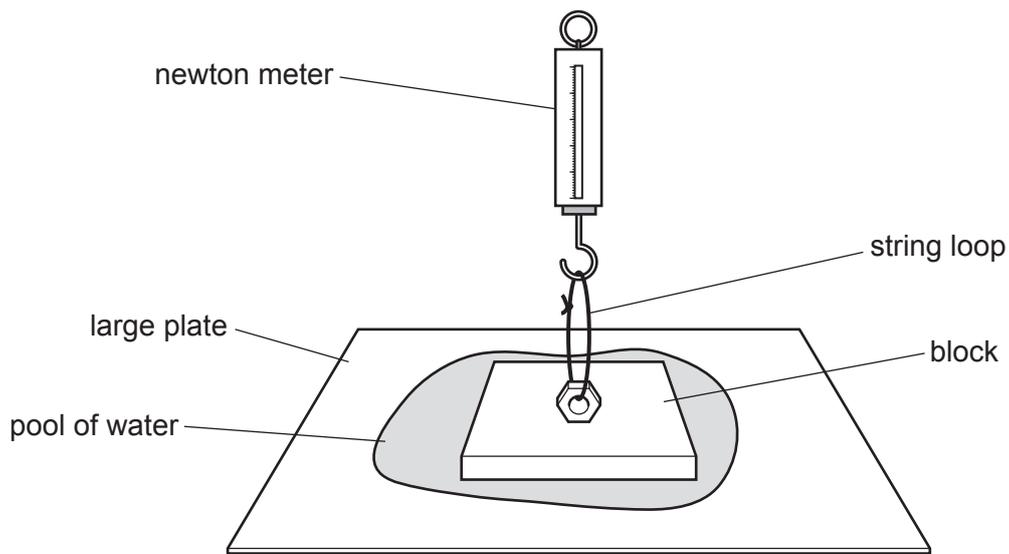


**Fig. 2.1**

- 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]

- (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.

$$F = \dots\dots\dots \text{ N [2]}$$

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

$$\text{percentage uncertainty} = \dots\dots\dots \% [1]$$

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

$$E = \dots\dots\dots \text{ N [1]}$$

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

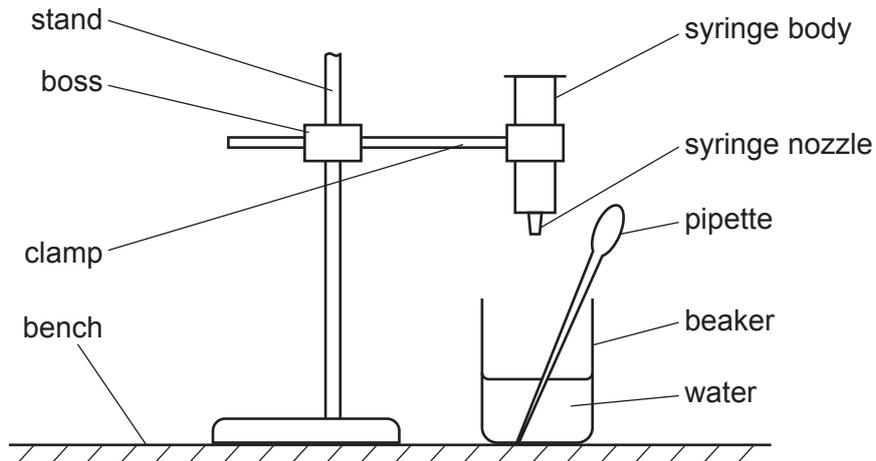


Fig. 2.3

- Cover the nozzle with a finger.
- Use the pipette to fill the syringe with water until the level is above the 10 cm<sup>3</sup> mark.
- Uncover the nozzle and start the stop-watch when the level passes the 10 cm<sup>3</sup> mark.
- Stop the stop-watch when the level passes the 1 cm<sup>3</sup> 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]

- (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  $k = \dots\dots\dots$

second value of  $k = \dots\dots\dots$

[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 .....

.....

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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