Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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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.

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.

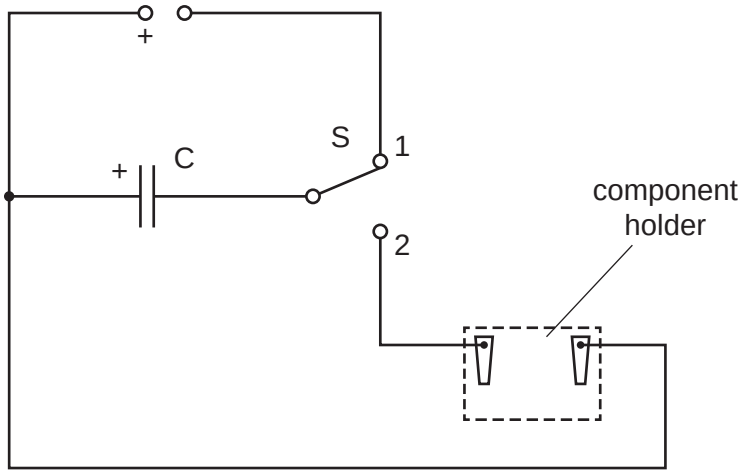


Fig. 1.1

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

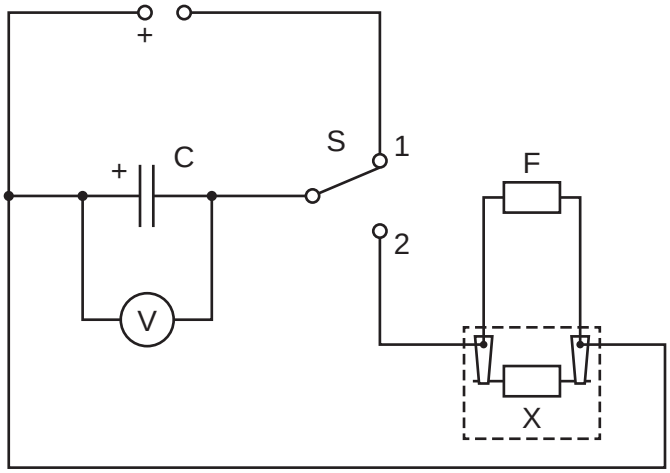


Fig. 1.2

- 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 = ...

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

V = ... [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 = ...

- 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.

[9]

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

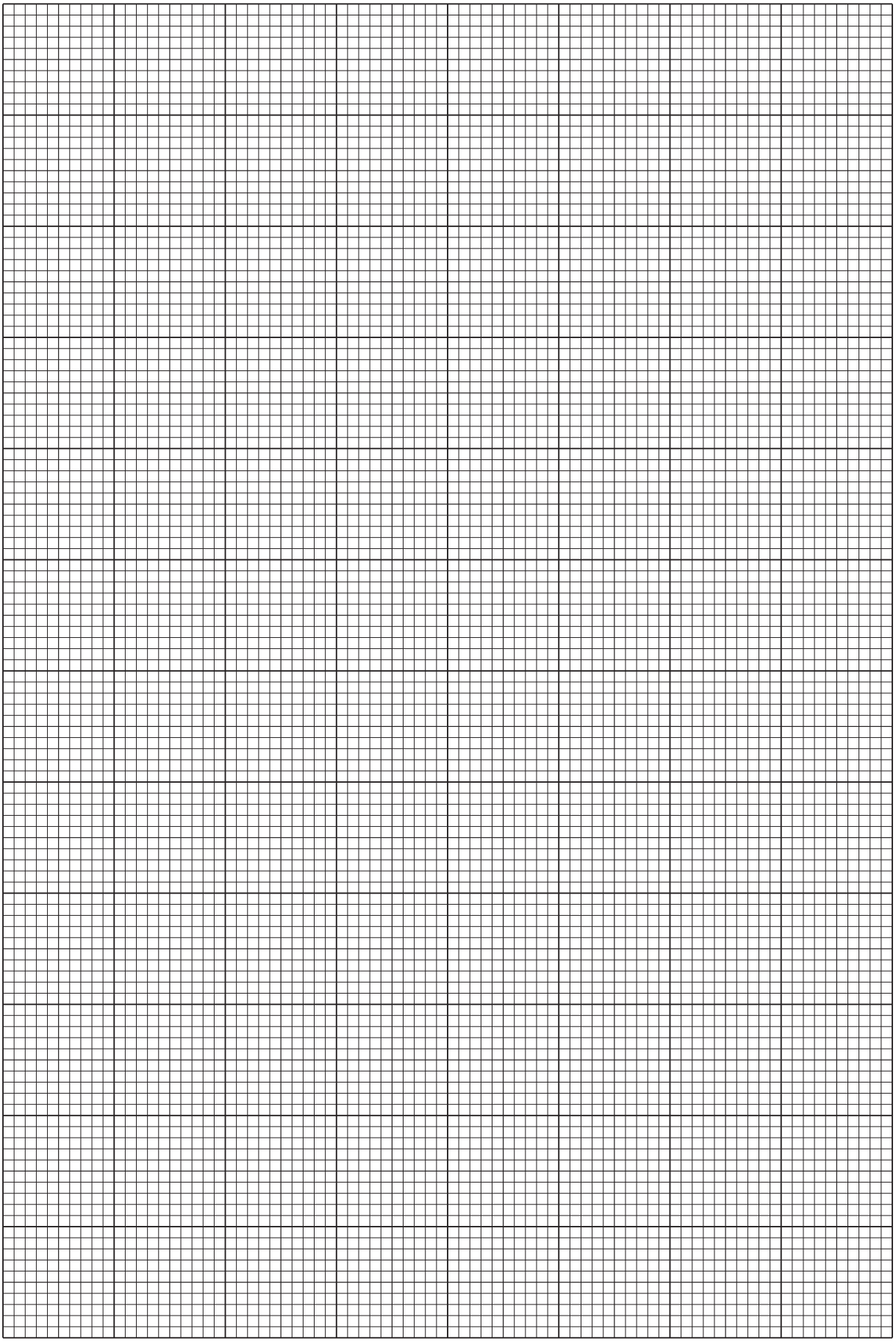
(ii) Draw the straight line of best fit. [1]

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

gradient = ...

y-intercept = ...

[2]



(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.

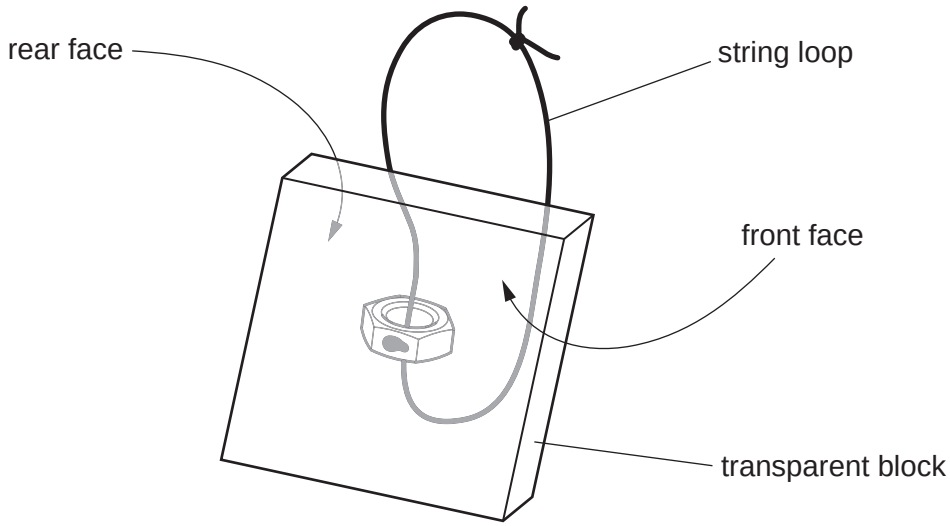


Fig. 2.1

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

W = ... 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.

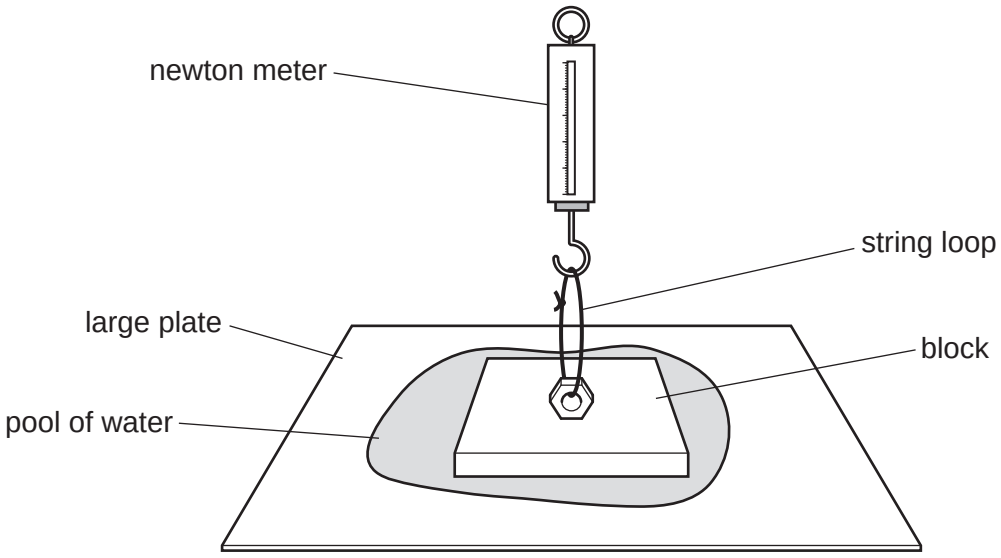


Fig. 2.2

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

F = ... N [2]

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

percentage uncertainty = ...% [1]

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

E = ... 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.

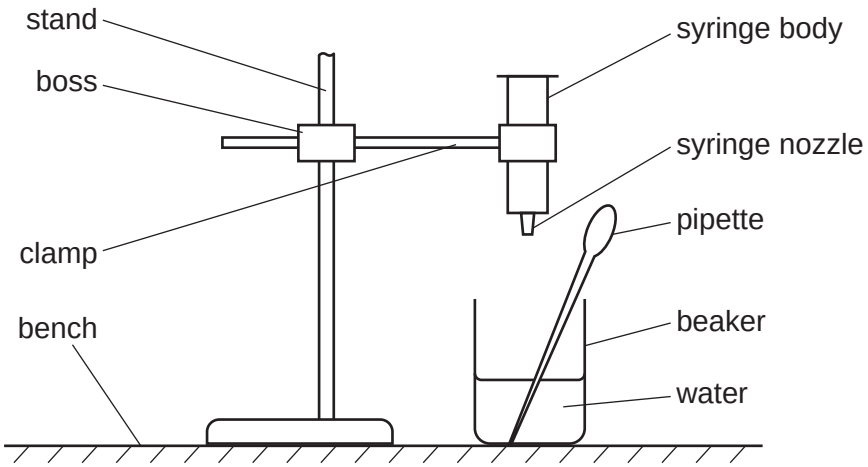


Fig. 2.3

- Cover the nozzle with a finger.
- Use the pipette to fill the syringe with water until the level is above the 10 cm^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 = ... 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 = ... N

E = ... N

T = ... 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 = ...

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 .....

.....

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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