Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

PHYSICS **9702/34**

Paper 3 Advanced Practical Skills 2 **October/November 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.

[Turn over

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

1 In this experiment, you will investigate the stability of a cylinder.

(a) (i)
- Use some of the sheets of paper to make a pile of approximate thickness 3 mm.
- Using the calipers, measure and record the thickness T of the pile.

T = ... [1]

(ii)
- Position the apparatus on the bench as shown in Fig. 1.1.

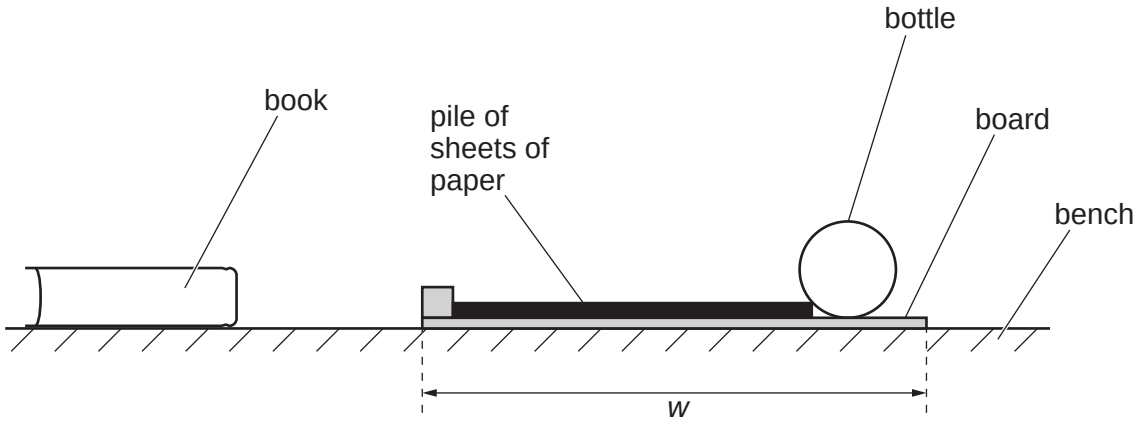


Fig. 1.1

- Measure and record the width w of the board, as shown in Fig. 1.1.

w = ... [1]

(b) ● Use the stand and clamp to hold the rule vertically on the bench.

● Slowly raise the end of the board, as shown in Fig. 1.2.

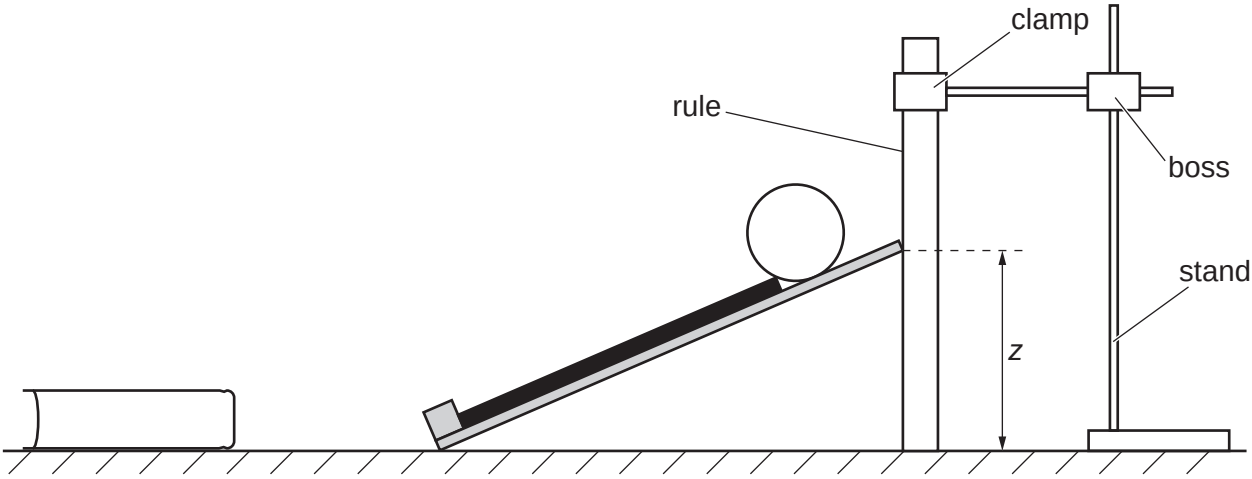


Fig. 1.2

● Measure and record the height z of the raised end of the board when the bottle rolls over the pile of paper.

z = ...

● Calculate θ using

$$\theta = \sin^{-1}\left(\frac{z}{w}\right).$$

θ = ...

[1]

(c) Change the number of sheets of paper in the pile. Measure T and z. Repeat until you have six sets of values of T and z.

Record your results in a table. Include values of θ and $\cos\theta$ in your table.
Give your values of $\cos\theta$ to three significant figures.

[9]

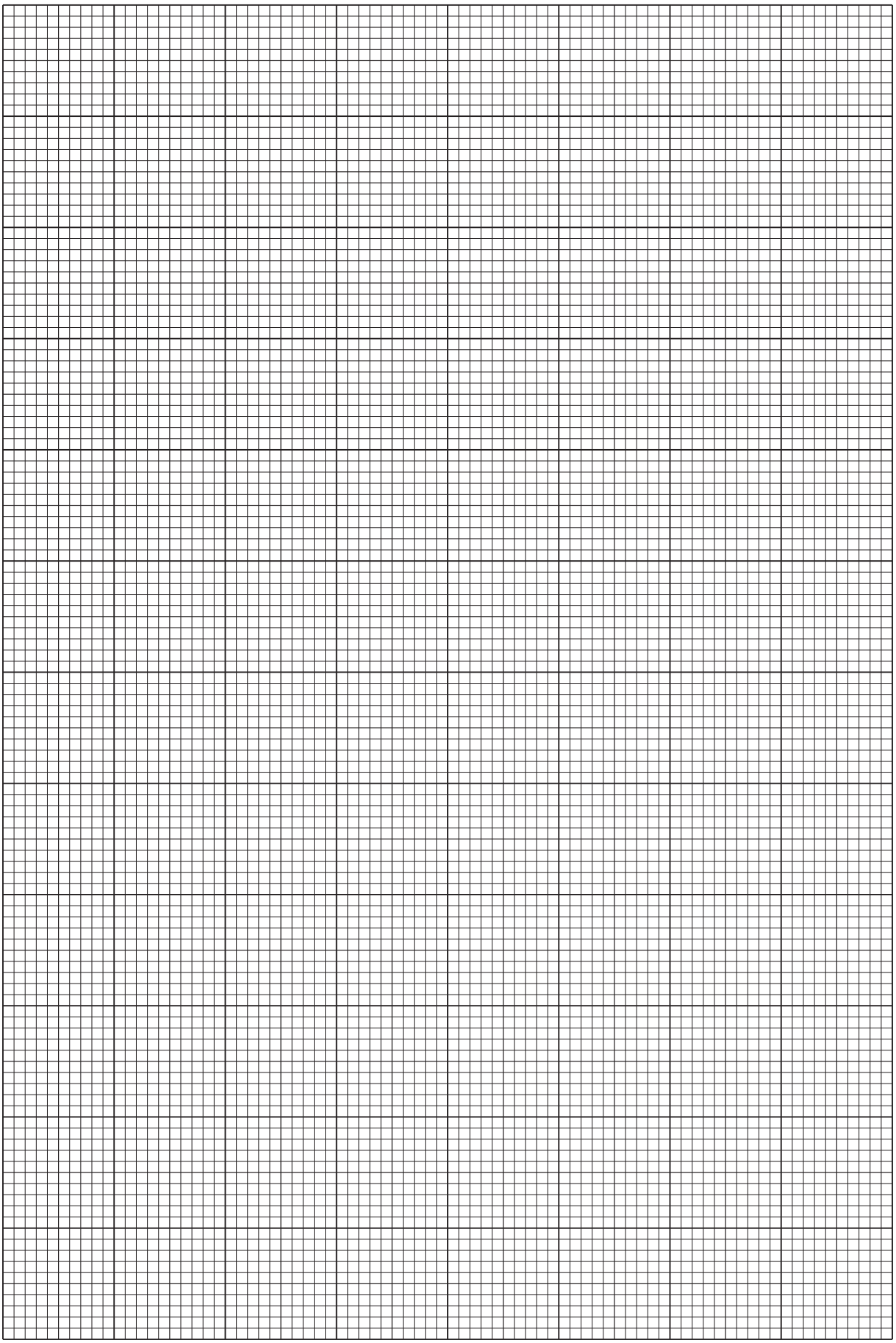
(d) **(i)** Plot a graph of $\cos\theta$ on the y-axis against T on the x-axis. [3]

(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 θ and T are related by the equation

$$\cos\theta = a - bT$$

where a and b are constants.

Using your answers in **(d)(iii)**, 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 investigate the force acting on a magnet.

(a) (i) You have been provided with some of the apparatus already assembled, as shown in Fig. 2.1.

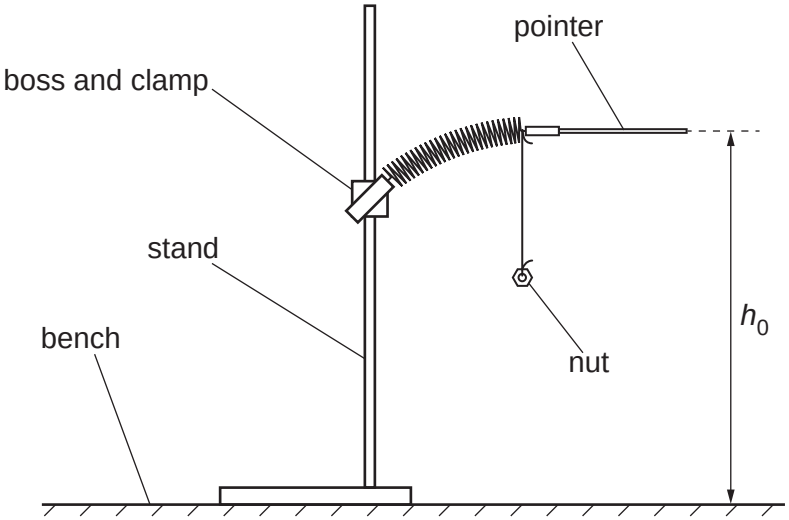


Fig. 2.1

Measure and record the height h_0 of the end of the pointer above the bench.

h_0 = ... [1]

(ii) ● Attach the small magnet to the nut, as shown in Fig. 2.2.

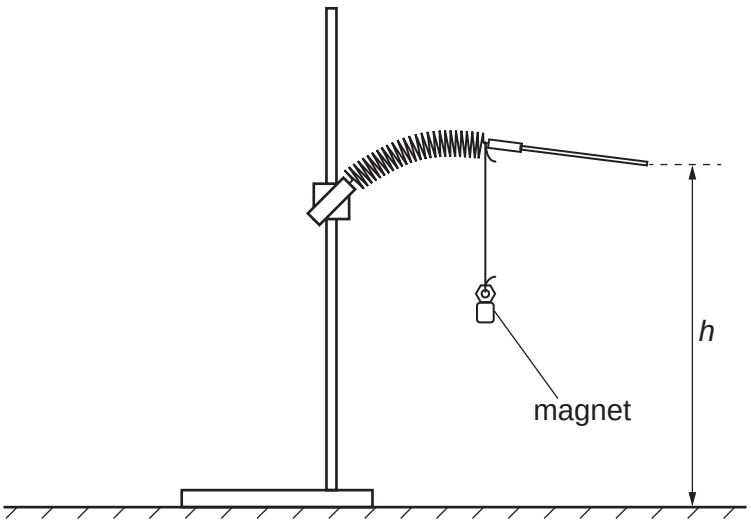


Fig. 2.2

● Measure and record the height *h* of the end of the pointer above the bench.

h = ... [1]

[Turn over

(iii) ● Calculate the deflection d_m caused by the magnet, using

$$d_m = h_0 - h.$$

d_m = ...

● Estimate the percentage uncertainty in your value of d_m. Show your working.

percentage uncertainty = ... %
[1]

(b) (i) You have been provided with a card showing the mass m of the magnet in g.

● Determine the value of m in kg.

m = ... kg

● Calculate S using

$$S = \frac{mg}{d_m}$$

where g is 9.81 N kg^{-1}.

S = ...
[1]

(ii) Justify the number of significant figures that you have given for your value of S.

.....

.....

..... [1]

(c) (i) You have been provided with a wire coil wound around a tube and connected to a component holder.

- Use the second boss and clamp to position the tube so that the magnet hangs **inside** the tube, as shown in Fig. 2.3.

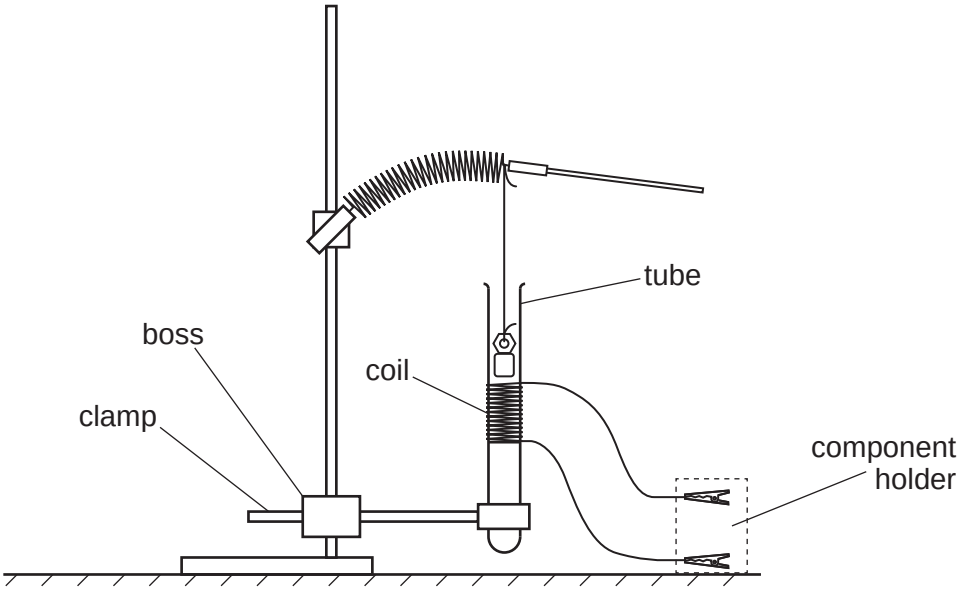


Fig. 2.3

- Adjust the position of the tube so that the magnet is just above the coil and is not touching the walls of the tube.

- Attach the circuit shown in Fig. 2.4.

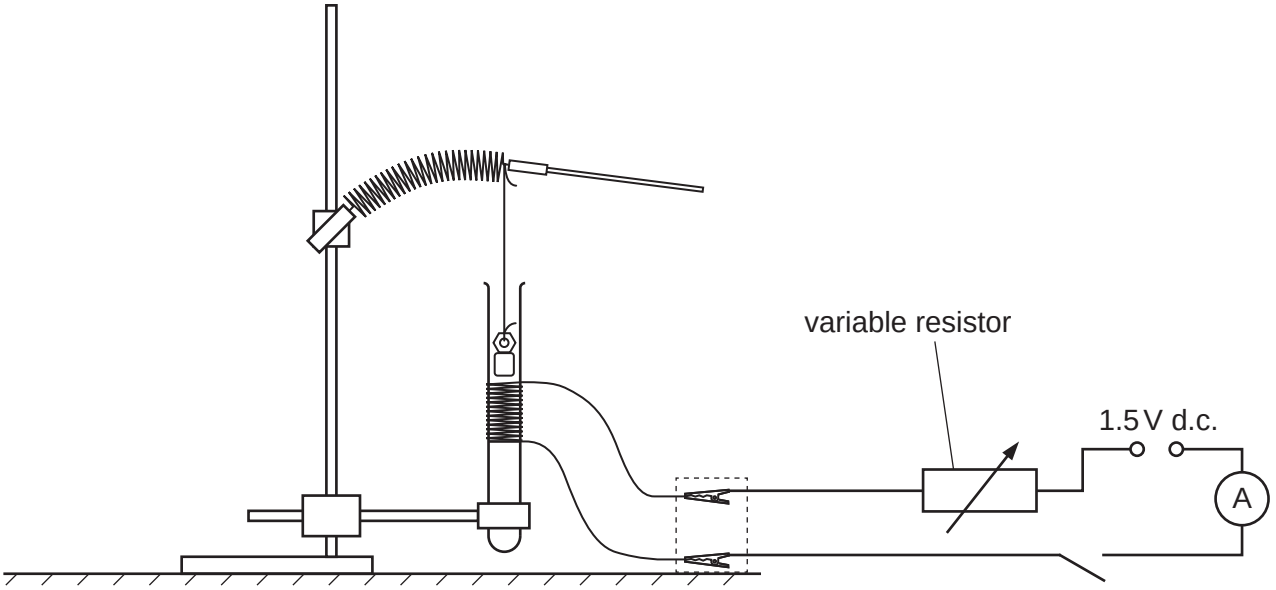


Fig. 2.4

- Close the switch and adjust the variable resistor until the ammeter reads approximately 0.3A, then open the switch.

- The magnet should have been pulled down when the current was flowing.
  If the magnet was not pulled down when the current was flowing, reverse the connections to the power supply.

- Close the switch.

- Measure and record the height *H* of the end of the pointer above the bench.

H = ...

- Record the ammeter reading *I*.

I = ...

- Open the switch.

[2]

(ii) ● Close the switch and adjust the variable resistor until the ammeter reads approximately 0.7 A.

● Measure and record the height H of the end of the pointer above the bench.

H = ...

● Record the ammeter reading I.

I = ...

● Open the switch.

[3]

(d) It is suggested that the relationship between S, h, H and I is

$$S(h - H) = kI$$

where k is a constant.

Using your data, calculate two values of k.

first value of k = ...

second value of k = ...

[1]

(e) It is suggested that the percentage uncertainty in the values of k is 20%.

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

.....

.....

.....

..... [1]

(f) (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]