Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1583679674

PHYSICS **9702/33**

Paper 3 Advanced Practical Skills 1 **May/June 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 the equilibrium of a metre rule.

(a) You have been provided with a metre rule with a string attached to it.

- Set up the apparatus as shown in Fig. 1.1.

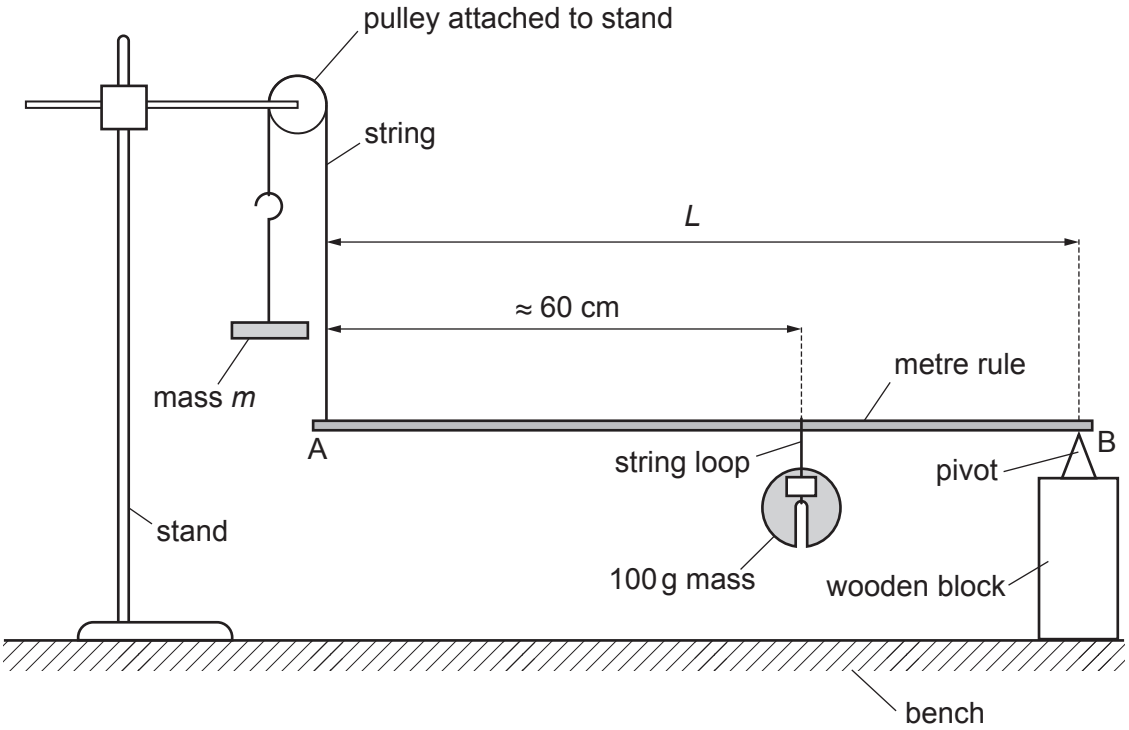


Fig. 1.1

- Add masses to the mass hanger so that mass *m* is 80 g.
- Adjust the pivot so that it is 5 mm from end B of the rule. The distance between the string at end A and the pivot is *L*.
- Measure and record *L*.

L = ...

- Adjust the string loop supporting the 100 g mass so that it is approximately 60 cm from end A.
- Hold the rule at end A so that the rule is approximately horizontal.

- Adjust the position of the string loop to find the position where end A is just about to move **upwards** when the rule is released. The distance between the string at end A and the string loop is y_1 as shown in Fig. 1.2.

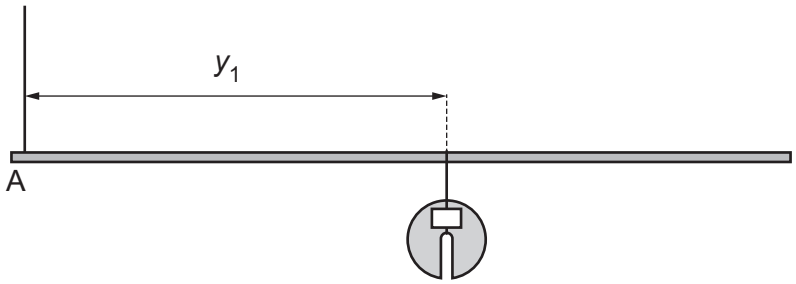


Fig. 1.2

- Measure and record y_1.

y_1 = ...

- Adjust the position of the string loop to find the position where end A is just about to move **downwards** when the rule is released. The distance between the string at end A and the string loop is y_2.

- Measure and record y_2.

y_2 = ...

- Calculate y where

$$y = \frac{y_1 + y_2}{2}.$$

y = ...
[3]

(b) Increase m. Measure the new values of y_1 and y_2.

Repeat until you have five sets of values of m, y_1 and y_2.

Record your results in a table. Include values of y in your table.

[8]

(c) **(i)** Plot a graph of y on the y-axis against m on the x-axis. [3]

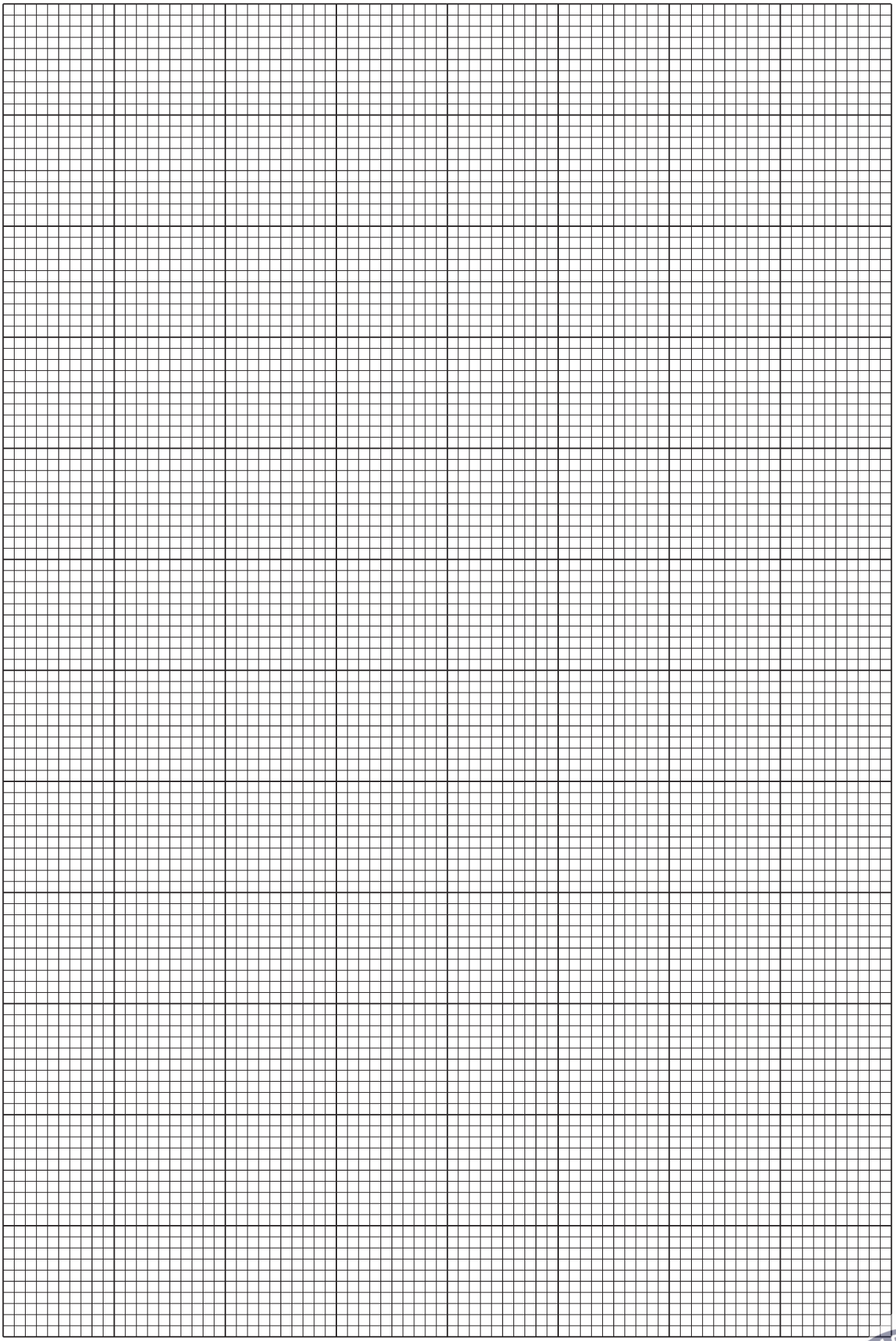
(ii) Draw the straight line of best fit. [1]

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

gradient = ...

y-intercept = ...

[2]



(d) It is suggested that the quantities y and m are related by the equation

$$y = Am + B$$

where A and B are constants.

Using your answers in **(c)(iii)**, determine the values of A and B.
Give appropriate units.

A = ...

B = ...
[2]

(e) Theory suggests that

$$B = L - \frac{RA}{2}$$

where R is the mass of the metre rule.

Determine a value for R.
Give your answer to three significant figures.

R = ... [1]

[Total: 20]

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

2 In this experiment, you will investigate the result of a collision between two cylinders.

(a) ● The wooden cylinder labelled A has diameter *D*.

Measure and record *D*.

D = ...

● The wooden cylinder labelled B has diameter *d*.

Measure and record *d*.

d = ...
[2]

(b) (i) You have been provided with a wooden strip with a line drawn on one face.

● Use the stand, boss and clamp to set up the wooden strip in the position shown in Fig. 2.1. The end near the line should touch the bench and the other end should be approximately 5 cm above the bench.

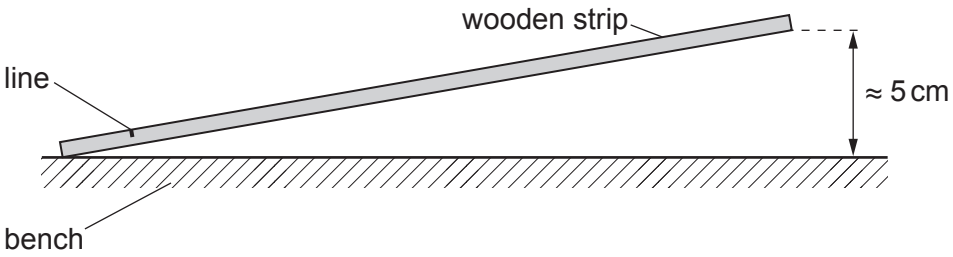


Fig. 2.1

● Place cylinder B approximately 30 cm from the end of the strip.

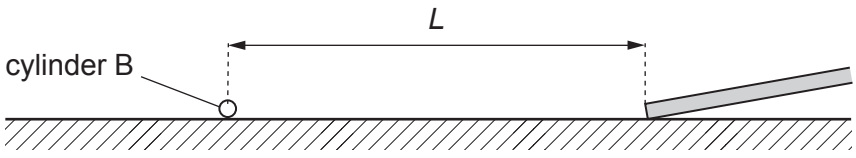


Fig. 2.2

● The distance between the end of the strip and B is *L*, as shown in Fig. 2.2.

Measure and record *L*.

L = ... [1]

(ii) ● Place cylinder A on the line on the strip as shown in Fig. 2.3.

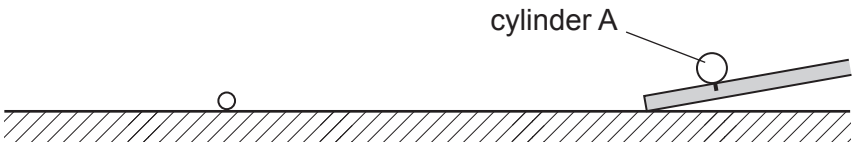


Fig. 2.3

● Release A.

● A will roll down the strip and along the bench until it collides with B.

B will roll and then come to rest as shown in Fig. 2.4.

The distance between B and the end of the strip is l, as shown in Fig. 2.4.

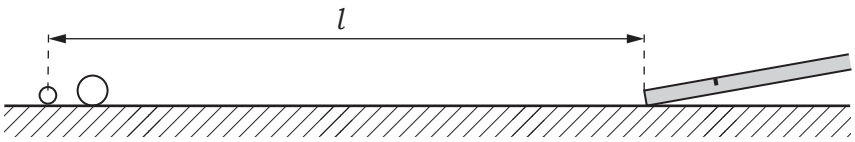


Fig. 2.4

Measure and record l.

l = ... [2]

(iii) Estimate the percentage uncertainty in your value of l. Show your working.

percentage uncertainty = ... [1]

(iv) Calculate $(l - L)^2$.

$(l - L)^2$ = ... [1]

(c) ● Measure and record the diameter D of cylinder C.

D = ...

● Using cylinder C instead of cylinder A on the wooden strip, repeat **(b)(i)**, **(b)(ii)** and **(b)(iv)**.

L = ...

l = ...

$(l - L)^2$ = ...
[3]

(d) It is suggested that the relationship between l, L, D and d is

$$(l - L)^2 = k(D - d)^3$$

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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