Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

3325297299

PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **May/June 2018**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **both** questions.
You will be allowed to work with the apparatus for a maximum of one hour for each question.
You are expected to record all your observations as soon as these observations are made, and to plan the presentation of the records so that it is not necessary to make a fair copy of them.
You are reminded of the need for good English and clear presentation in your answers.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

Additional answer paper and graph paper should be used only if it becomes necessary to do so.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **11** printed pages and **1** blank page.

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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) **(i)** You have been provided with some masses.

Set up the apparatus as shown in Fig. 1.1.

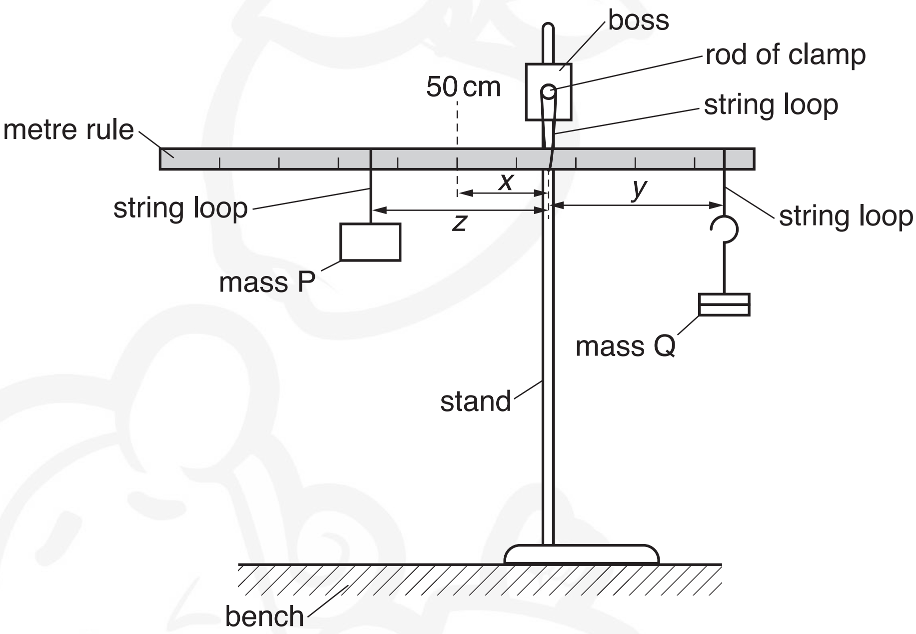

Fig. 1.1

- Mass Q should be 200 g.
- The distance between the 50 cm mark on the rule and the string loop supporting the rule is *x*. Adjust the position of the metre rule so that *x* is approximately 15 cm.
- The distance between the string loop supporting mass P and the string loop supporting the rule is *z*. Adjust the position of mass P so that *z* is approximately 30 cm.
- The distance between the string loop supporting the rule and the string loop supporting mass Q is *y*. Adjust the position of mass Q until the rule is balanced.
- Measure and record *z*.

z = ... [1]

(ii) • Measure and record *x*.

x = ...

- Measure and record *y*.

y = ...
[1]

(b) • Write down your value of *z* from **(a)(i)**.

z = ...

• **Keeping *z* constant**, change *x* and adjust *y* until the rule is balanced. Repeat until you have six sets of values of *x* and *y*. Record your results in a table.

You may include readings where *x* is measured to the left of the 50 cm mark. In such cases *x* has a negative value.

[8]

(c) **(i)** Plot a graph of *y* on the *y*-axis against *x* 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 x are related by the equation

$$y = Ax + B$$

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) The mass of P is p. The mass of Q is q, where $q = 0.200\,\text{kg}$.

The constants A and B are related to p, q and z by

$$A = \frac{p}{q} \quad \text{and} \quad B = \frac{pz}{q}.$$

Calculate p.

p = ... kg [1]

(f) The experiment is repeated using the same equipment but a smaller value of z.
For this experiment, draw a second line on the graph to show the expected results.
Label this line W. [1]

[Total: 20]

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

2 In this experiment, you will investigate the current in a coil.

(a) (i) You have been provided with a bar magnet, masses and Blu-Tack.

- The total mass of the mass hanger and mass should be 200 g. Use the Blu-Tack to fix the bar magnet to the mass hanger, as shown in Fig. 2.1.

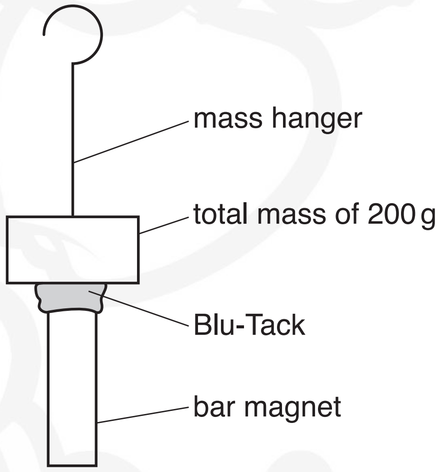

Fig. 2.1

- Set up the apparatus as shown in Fig. 2.2.

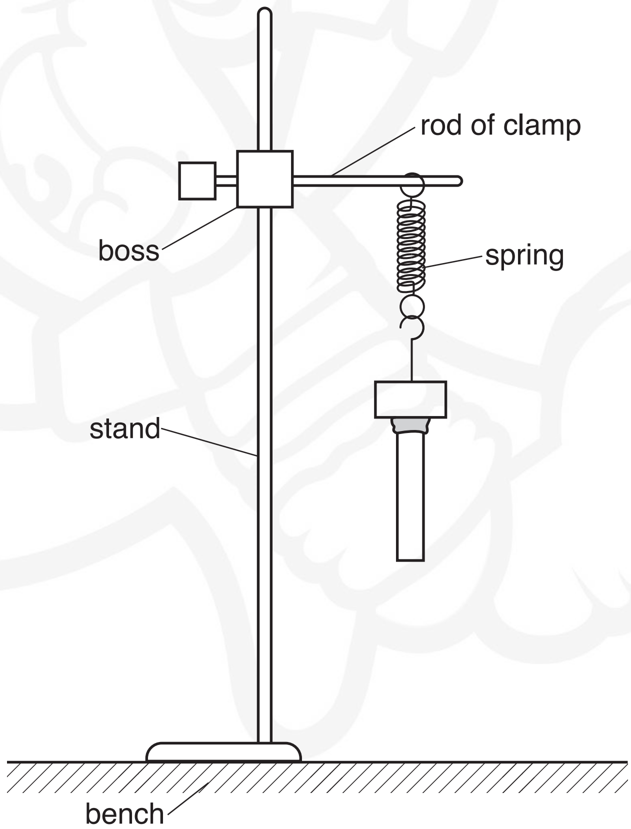

Fig. 2.2

- Pull the mass down through a short distance. Release the mass. The mass and magnet will oscillate.
- Determine the period T of these oscillations.

T = ... [1]

(ii) Calculate the frequency f of the oscillations where

$$f = \frac{1}{T}.$$

f = ... Hz [1]

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

....

....

....[1]

(b) **(i)**
- Take the cardboard tube with **more** turns of wire.
- Count and record the number *n* of turns of wire around the tube.

n = ... [1]

(ii)
- Connect the ammeter to the ends of the wire around the tube and place the tube below the magnet.
- Adjust the height of the bottom of the magnet so that it is level with the top of the tube as shown in Fig. 2.3.

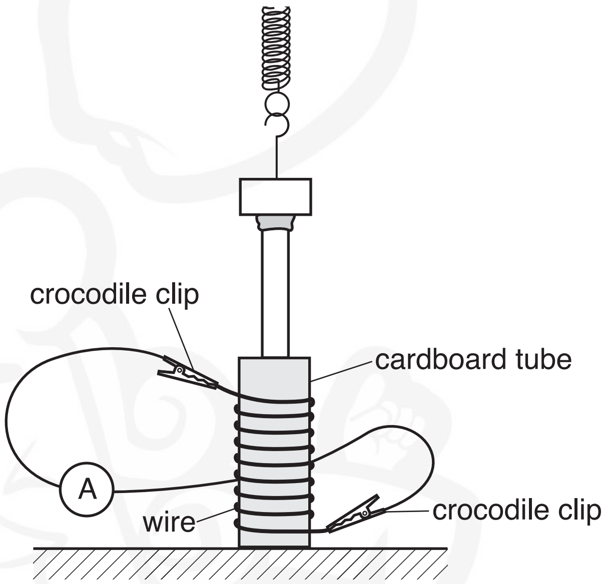

Fig. 2.3

- Pull the mass down so that it rests on the top of the tube with the magnet passing centrally through the tube. Release the mass. The mass will oscillate.
- Measure and record the maximum current I shown by the ammeter.

I = ... μA [1]

(iii) Estimate the percentage uncertainty in your value of I.

percentage uncertainty = ... [1]

(c) **(i)**
- Remove the tube.
- Increase the total mass to 500 g.
- Take measurements to determine the period *T* and frequency *f* of the oscillations of the mass and the magnet.

T = ...

f = ... Hz [2]

(ii) Keep the mass as 500 g and use the tube with **fewer** turns of wire to repeat **(b)(i)** and **(b)(ii)**.

n = ...

I = ... μA [2]

(d) It is suggested that the relationship between I, n and f is

$$I = knf$$

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]