Anglican High School
Secondary Four
Preliminary Examination 2019

S4

CANDIDATE NAME

CLASS 4

CLASS INDEX

PHYSICS

6091/03

Paper 3 Practical Test

16 September 2019

1 hour 50 minutes

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index 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.

Answer **all** questions.
All of your answers should be written in this Question Paper: scrap paper must **not** be used.
Graph paper is provided in this Question Paper. Additional sheets of graph paper should be used only if it is necessary to do so.

You will be allowed to work with the apparatus for a maximum of 55 minutes for each section.
You are expected to record all your observations as soon as they are made.
An account of the method of carrying out the experiments is **not** required.

The use of an approved scientific calculator is expected, where appropriate.

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.

Shift
Laboratory

For Examiner's Use	
1	
2	
3	
Total	

This document consists of **12** printed pages.

This paper is adapted from the 2018 GCE O Level Physics Paper 3

Section A

1 *In this experiment, you will investigate the amplitude of a simple pendulum.*

You are provided with

- a pendulum bob attached to a length of string,
- a split cork,
- a stand, boss and clamp,
- a stopwatch,
- a metre rule,
- a counterweight to prevent the stand from toppling,
- a piece of card marked with a series of parallel lines, drawn at 2 cm intervals.

The apparatus has been set up for you, as shown in Fig. 1.1(a) and Fig. 1.1(b).

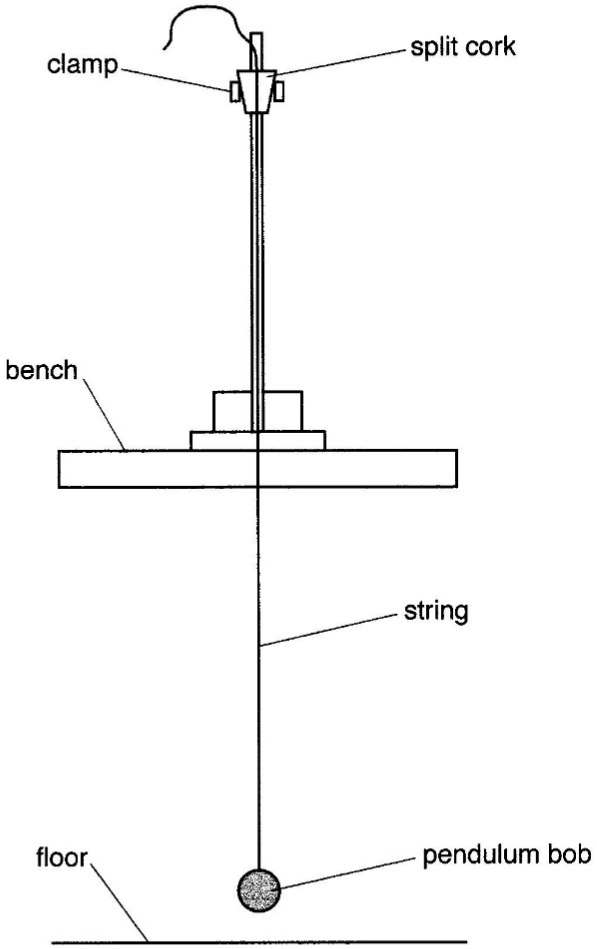

Fig. 1.1(a) (front view)

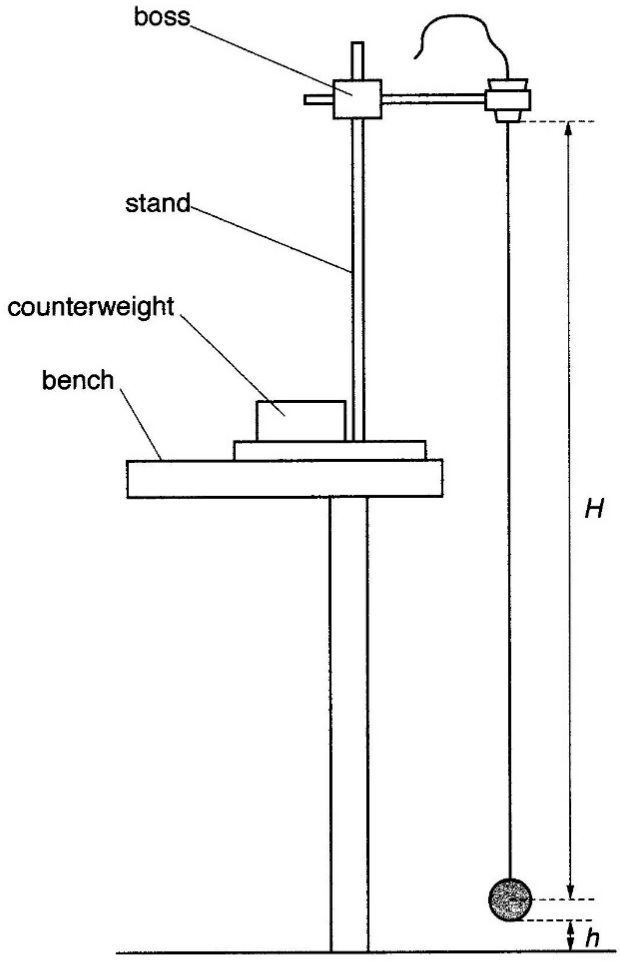

Fig. 1.1(b) (side view)

(a) (i) The distance from the bottom of the split cork to the centre of the pendulum bob is *H*. Loosen the clamp and adjust the string until *H* is equal to 1.25 m. Tighten the clamp.

(ii) Adjust the boss so that the distance *h* from the bottom of the pendulum bob to the floor is 2.0 cm.

(b) View the pendulum from the front, as shown in Fig. 1.1(a).
Move the pendulum bob a few centimetres to the side. Release the pendulum bob so that it swings freely.

Determine an accurate value for the period T of the pendulum.

T = ...[2]

(c) **(i)** Stop the pendulum.
Place the piece of card on the floor beneath the pendulum bob. The lines on the card are drawn at 2 cm intervals.

Adjust the position of the card until the right hand edge of the pendulum bob is aligned with the 0 cm mark on the card, when viewed from above, as shown in Fig. 1.2.

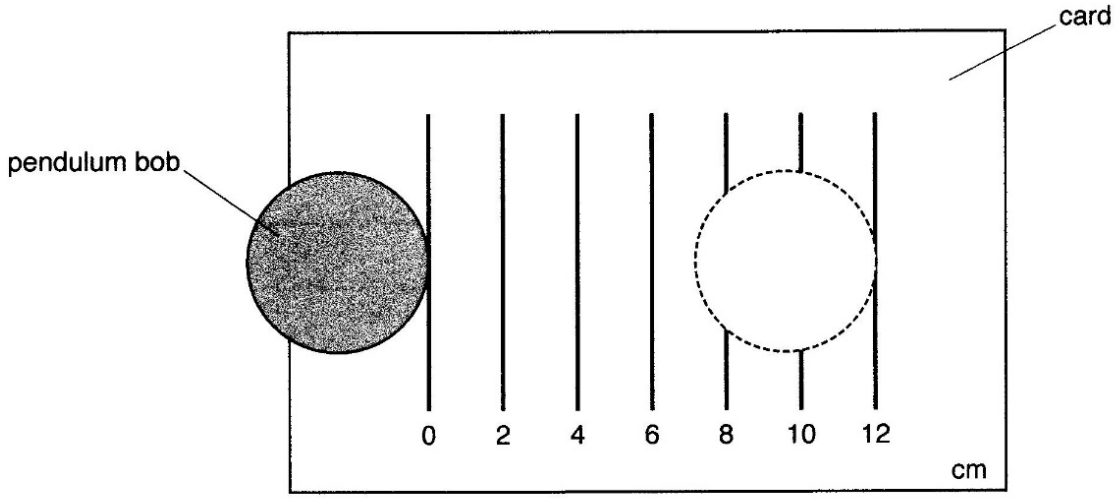

Fig. 1.2 (view from above)

(ii) Move the pendulum bob to the side until the right hand edge of the bob is aligned with the 12 cm mark on the card, as shown by the dotted line in Fig. 1.2.

Release the pendulum bob. Measure and record the time t for the amplitude of the pendulum to decrease from 12 cm to 10 cm.

t = ...[1]

(iii) Suggest why the amplitude of the pendulum decreases.

.....

.....[1]

(d) Plan

A student suggests that the time taken for the amplitude to decrease, as in **(c)(ii)**, is directly proportional to the mass of the pendulum bob.

Plan an experiment to investigate this relationship.

Your plan should include

- the quantities that you will keep constant,
- a detailed description of how you will perform the investigation,
- an indication of how you will achieve accurate results,
- a statement of the graph you would plot to test the relationship,
- a sketch of the graph you would obtain if the suggested relationship is correct.

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2 *In this experiment, you will investigate the extension of a spring.*

You have been provided with

- a length of string tied to a spring,
- an S-hook,
- a stand, boss and clamp,
- a piece of plastic pipe,
- a mass of weight 1.5 N,
- a set square,
- a 30 cm ruler,
- a 50 cm rule,
- a metre rule fixed to the bench with Blu-tac,
- a loop of string on the metre rule.

(a) (i) Measure and record the unstretched length l_o of the spring, as shown in Fig. 2.1.

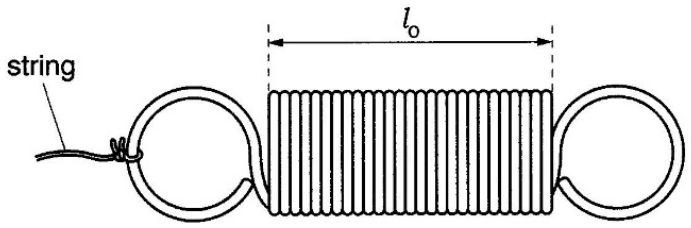


Fig. 2.1

l_o = ...[1]

(ii) Place one of the loops of the spring onto the rod of the clamp, as shown in Fig. 2.2. Suspend the mass on the other loop.

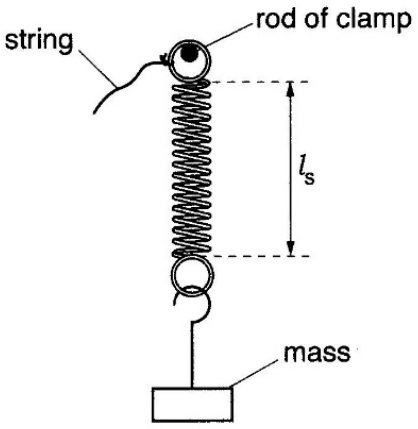


Fig. 2.2

Measure and record the stretched length l_s of the spring.
Determine the extension e_o of the spring using the equation $e_o = l_s - l_o$.

l_s = ...

e_o = ...
[2]

(b) Use your value of e_o from **(a)(ii)** and the equation $F = ke_o$, where $F = 1.5\,N$, to determine the spring constant k for the spring.

k = ...[1]

(c) Remove the spring from the rod of the clamp. Place the plastic pipe in the clamp. Adjust the height of the boss so that the centre of the plastic pipe is 50 cm above the bench. Adjust the position of the clamp stand so that the centre of the plastic pipe is aligned with the 50 cm mark on the metre rule.

Attach the S-hook to the loop of string on the metre rule. Attach the spring to the S-hook. Place the string over the plastic pipe and suspend the mass from the loop at the end of the string, as shown in Fig. 2.3.

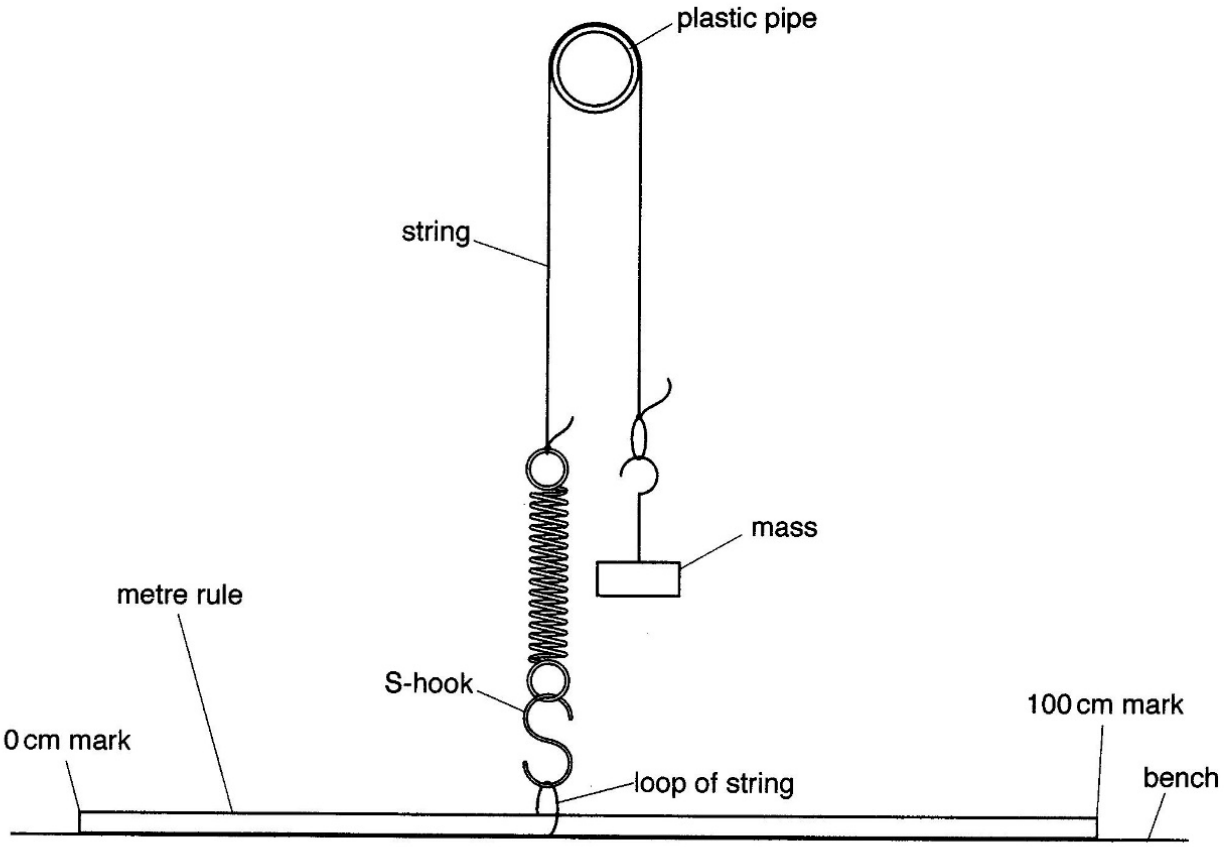


Fig. 2.3

(i) Adjust the position of the loop of string on the metre rule until the spring is vertical.

Measure and record the stretched length l_1 of the spring.
Determine the extension e_1 of the spring using the equation $e_1 = l_1 - l_o$.

l_1 = ...

e_1 = ...
[1]

(ii) With the mass still suspended from the string, carefully move the loop of string on the metre rule so that it is at the 15 cm mark.

Measure and record the stretched length l_2 of the spring.
Determine the extension e_2 of the spring using the equation $e_2 = l_2 - l_o$.

l_2 = ...

e_2 = ...
[1]

(d) Use your value of k, values of e_1 and e_2 and the equation from **(b)** to calculate the forces F_1 and F_2 in the spring with the loop in the two different positions on the metre rule.

F_1 = ...

F_2 = ...
[2]

(e) Explain why neither F_1 nor F_2 are equal to the weight of the mass on the spring.

.....

.....

.....[2]

Section B

3 *In this experiment, you will investigate the potential difference (p.d.) across a resistance wire.*

You are provided with

- a resistance wire taped to a metre rule
- an ammeter
- a voltmeter
- a power supply
- a switch
- a jockey
- six leads with crocodile clips at both ends

A small length of the resistance wire is coiled around a piece of wood.

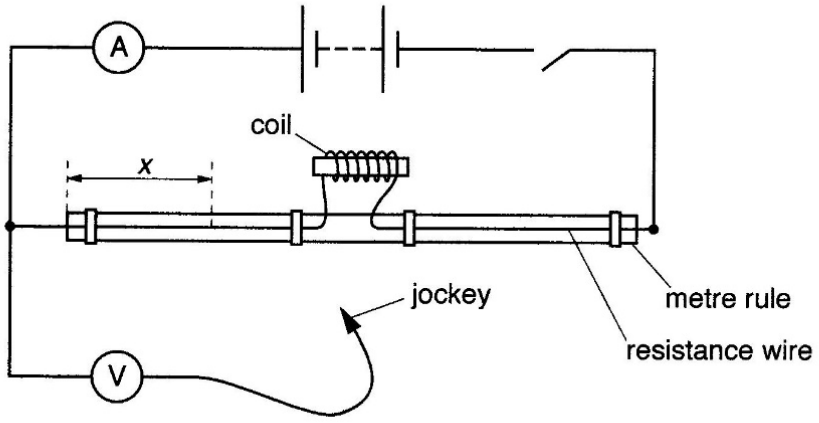


Fig. 3.1

(a) Assemble the apparatus as shown in Fig. 3.1. Close the switch.
Record the current I shown on the ammeter.

I = ...[1]

(b) Place the jockey on the wire at $x = 10\,\text{cm}$.
Record the potential difference (p.d.) V shown on the voltmeter.

V = ...[1]

(c) Repeat **(b)** with the jockey placed on the wire at $x = 15\,cm$, 25 cm, 35 cm, 45 cm, 60 cm, 65 cm, 75 cm, 85 cm and 90 cm. Open the switch.

Record your values for V and x in a suitable table. Include your values from **(b)**.

[4]

(d) Using the grid provided, plot a graph of V against x. Start your axes at the origin (0, 0). The x-axis must start at 0 cm and end at 100 cm.

Draw **two** lines of best fit,

- one for $x = 10\,cm$ to $x = 45\,cm$, label this **A**,
- one for $x = 60\,cm$ to $x = 90\,cm$, label this **B**. [4]

(e) **(i)** Determine the gradient G_A of line **A**.

G_A = ...

(ii) Determine the p.d. V_A when $x = 0\,cm$ for line **A**.

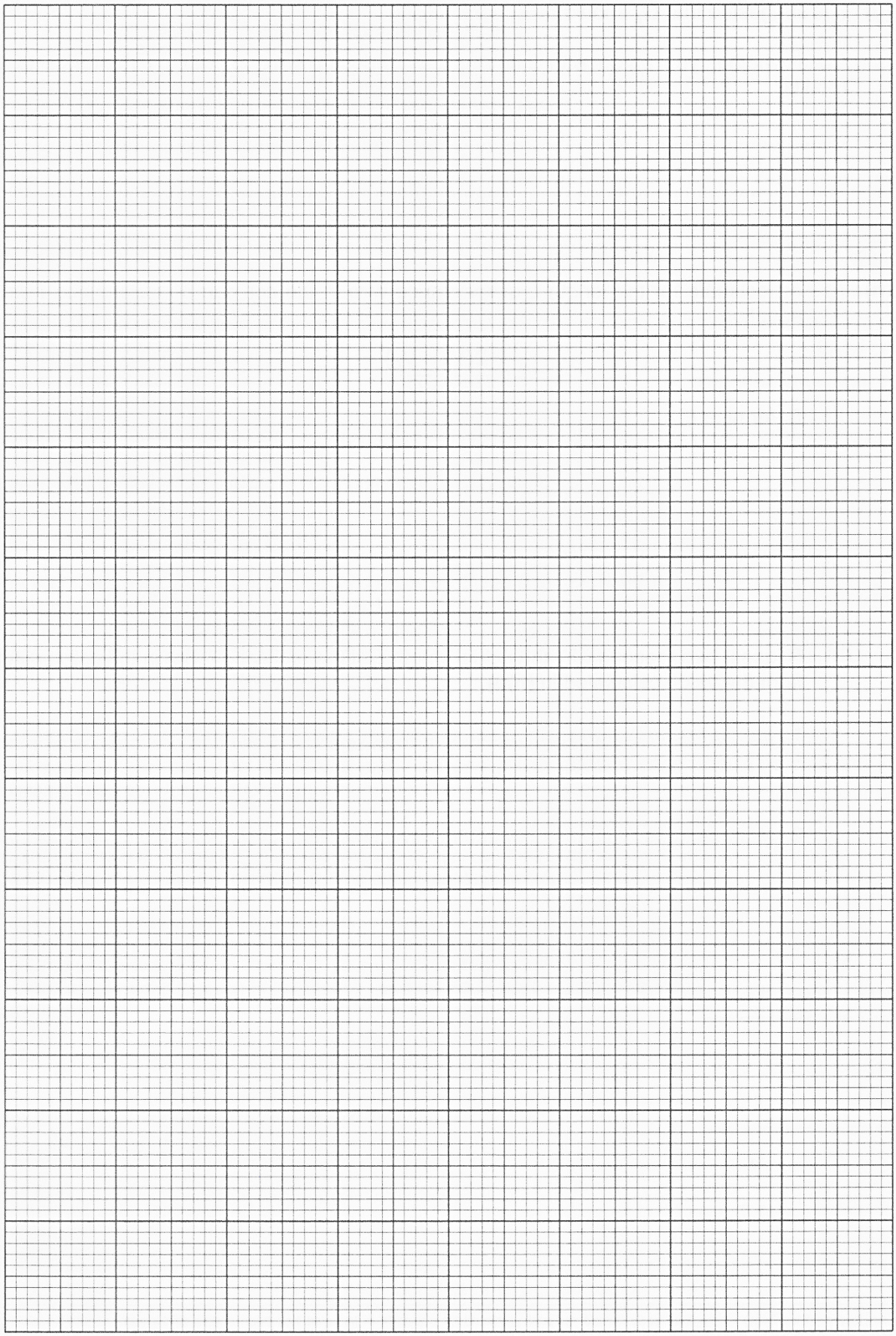
V_A = ...
[2]

(f) **(i)** Determine the gradient G_B of line **B**.

G_B = ...

(ii) Determine the p.d. V_B when $x = 0\,cm$ for line **B**.

V_B = ...
[2]



(g) It is suggested that G_A should be equal to G_B.

State whether you agree with this suggestion. Justify your answer by reference to your results.

.....

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.....[2]

(h) **(i)** An estimate for the length L of resistance wire in the coil can be determined from the equation

$$L = \frac{2(V_B - V_A)}{(G_A + G_B)}.$$

Determine L.

L = ...[2]

(ii) Suggest **two** reasons why the actual length L of the resistance wire in the coil is different from the value calculated in **(h)(i)**.

1. .....

.....

2. .....

.....

[2]

- End of paper -