TAMPINES MERIDIAN JUNIOR COLLEGE
JC2 Practical Preliminary Examination
Higher 2

H2 Physics 9749/04

Paper 4 Practical **22 Aug 2024**

2 hours 30 minutes

Candidates answer on the Question Paper.
No Additional Materials are required.

	Class	Index No
Candidate Name: _____		

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces at the top of this page, page **9** and page **15**.
Write in dark blue or black pen on both sides of the paper.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.

Answer **ALL** the questions.

You are allowed 1 hour to answer Questions 1 and 2; and you are allowed another 1 hour to answer Question 3.

Question 4 is a question on the planning of an investigation and does not require apparatus.

Write your answers in the space provided in the question paper. The use of an approved scientific calculator is expected, where appropriate. You may lose marks if you do not show your working or if you do not use appropriate units.

Give details of the practical shift and laboratory where appropriate in the boxes provided.

The number of marks is given in brackets [ ] at the end of each question or part question.

Shift
Laboratory

For Examiner's Use	
1	**/8**
2	**/14**
3	**/21**
4	**/12**
Total	**/55**

1 In this experiment, you will investigate how the frictional force between a plastic pipe and string varies with the length of string in contact with the pipe.

(a) Use the vernier calliper to measure and record the outer diameter d of the plastic pipe.

d = ...cm [1]

(b) Estimate the percentage uncertainty in your value of d.

percentage uncertainty in d = ... [1]

(c) Assemble the apparatus as shown in Fig. 1.1.

Tie the 20 g mass to the one end of the string and the 50 g mass hanger to the other end.

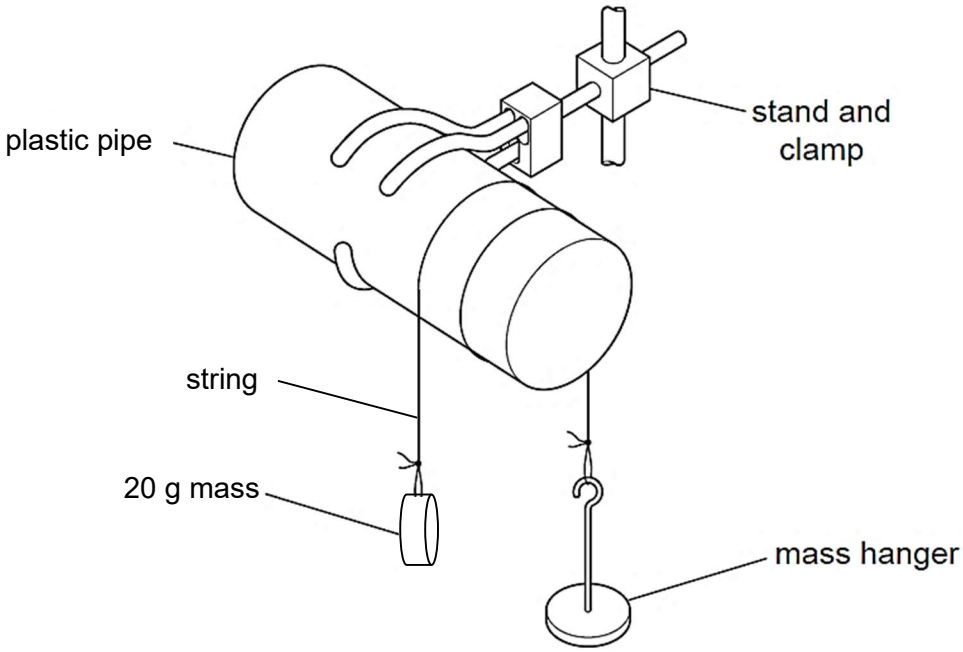

Fig. 1.1

Wrap the string 1.5 times around the pipe. The turns of string must not touch each other.

(d) Use your values from **(a)** to calculate the length l of string in contact with the pipe.

l = ... [1]

(e) Gently add masses to the hanger until the hanger just starts to move down to the bench.

Record this mass m (including the mass of the hanger).

m = ... [1]

(f) Remove the masses from the hanger and then wrap the string one more time around the pipe, so that it is now wrapped around the pipe 2.5 times.

Repeat steps **(d)** and **(e)**.

l = ...

m = ... [2]

(g) It is suggested that m and l are related by the equation

$$m^2 = k\, l^3$$

where k is a constant.

(i) Use your values from **(d)**, **(e)**, and **(f)** to determine two values of k.

first value of k = ...

second value of k = ... [1]

(ii) State whether or not the results of your experiment support the suggested relationship. Justify your conclusion by referring to your value in (**b**).

.....

..... [1]

[Total: 8]

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2 In this experiment, you will investigate the relationship between the potential difference across a resistance wire and a filament bulb.

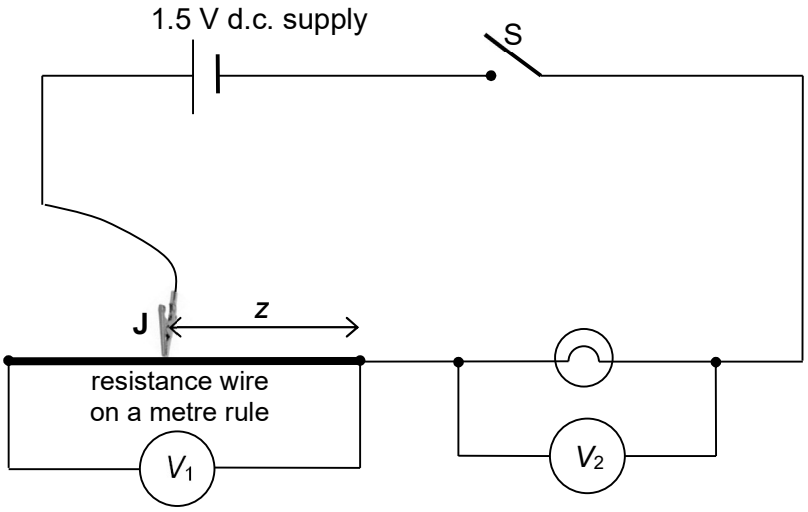


Fig. 2.1

Fig. 2.1 shows a circuit consisting of a resistance wire on a metre rule and a light bulb arranged in series.

(a) **(i)** Connect the circuit as shown in Fig. 2.1.

(ii) Position the clip **J** at a position half way along the wire. Close the switch S.

Record the length z, voltmeter reading V_1 across the resistance wire and the voltmeter reading V_2 across the light bulb.

z = ...

V_1 = ...

V_2 = ... [1]

(b) Repeat steps **(a)(ii)** to obtain further sets of values of z, V_1 and V_2.

[5]

(c) It is suggested that z, V_1 and V_2 are related by the equation

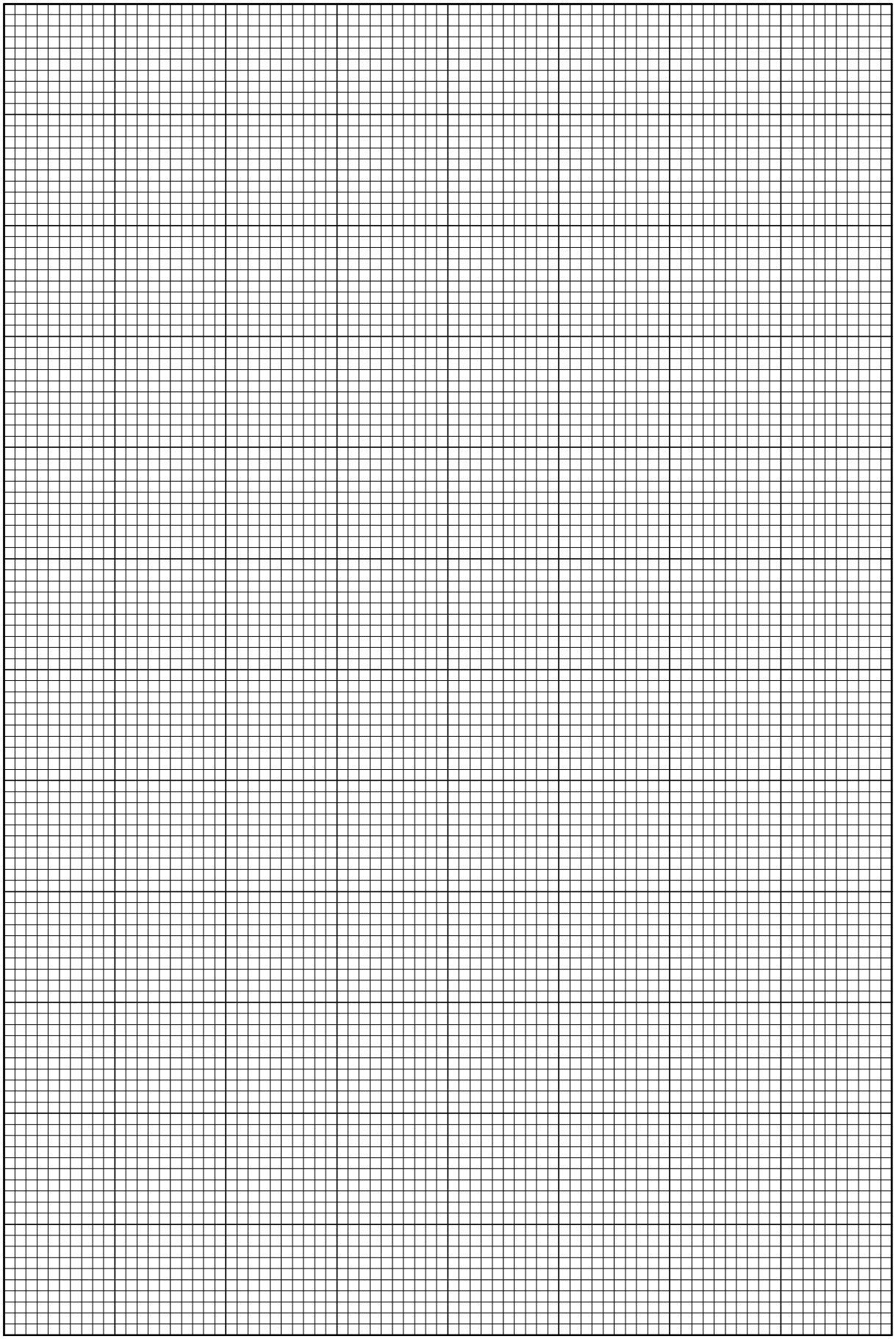
$$\frac{V_2}{V_1} = \frac{G}{z} + H$$

where G and H are constants.

Plot a suitable graph to obtain values for G and H.

G = ...

H = ... [6]



(d) Determine the value of z when $V_1 = 100\ V_2$. Comment on this value of z.

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…….. [2]

[Total: 14]

Candidate Name: _____ **Civics Group:** _____

3 In this experiment, you will investigate how the motion of two pendulum depends on the tension in a spring connecting them.

(a) A spring is suspended by two loops of strings to the retort stands.

Measure and record the unstretched length l_0 of the coiled part of the suspended spring as shown in Fig. 3.1.

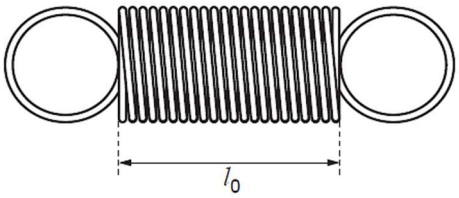


Fig. 3.1

l_0 = ... [1]

(b) Set up the apparatus as shown in Fig. 3.2 by tying the two pendulum bobs to the ends of the horizontal spring with each pendulum having a length of approximately 25 cm.

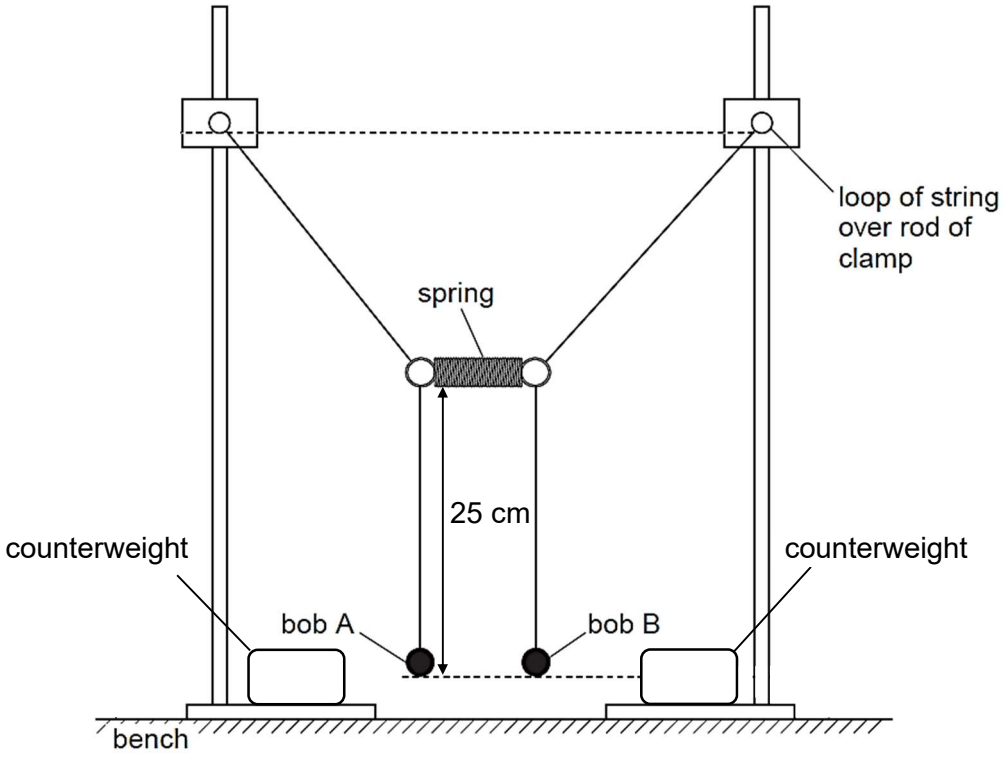


Fig. 3.2

(i) Position the stands so that the coiled part of the spring is extended by approximately 2 cm.

(ii) Measure and record the extended length l of the coiled part of the spring.

Calculate the extension x of the spring.

l = ...

x = ... [2]

(iii) Pull bob A towards you, perpendicular to the plane containing both bobs. Release the bob. Bob A will swing then bob B will start to swing.

Bob B will eventually stop and start moving again. It will then stop for a second time.

Determine and record the time T between these two stops.

T = ... [1]

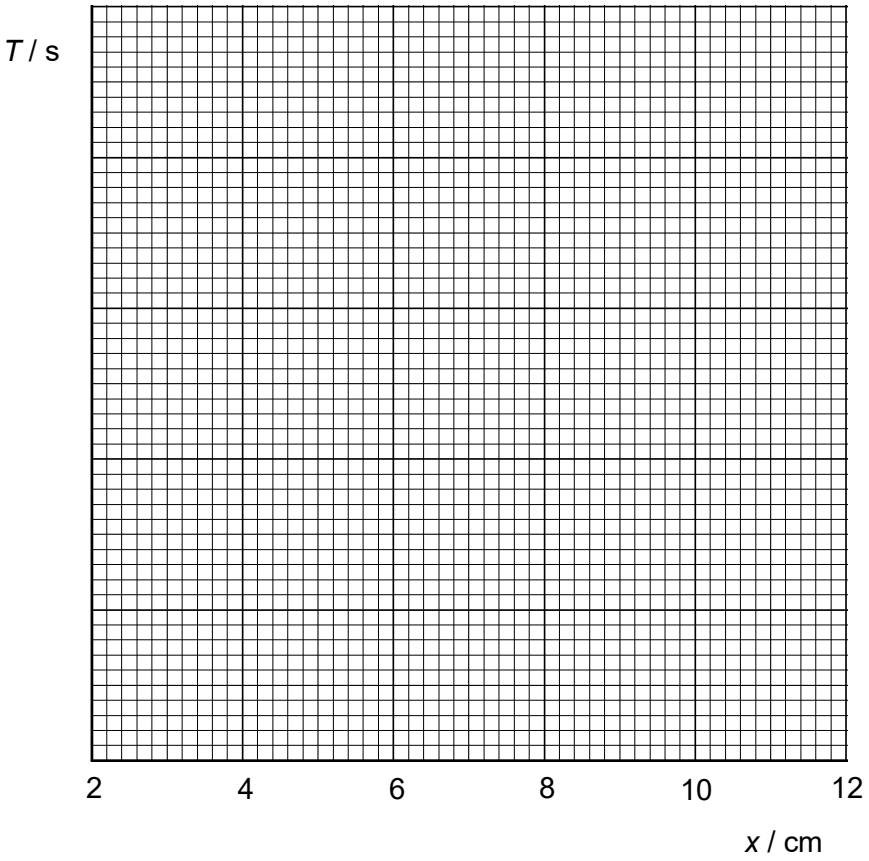
(iv) Estimate the percentage uncertainty in your value of T.

percentage uncertainty in T = ... [1]

(c) **(i)** By moving the stands further apart, repeat **(b)(ii)** and **(b)(iii)** to obtain further sets of values of l, x and T, with x in the range of 2 cm $\leq x \leq$ 12 cm.

[5]

(ii) Plot T against x on the grid and draw the straight line of best fit.



[2]

(iii) Use your graph to determine T when the length of the coiled part of the spring is l_0.

Present your working clearly.

T = ... [3]

(d) The behaviour of the oscillating system depends on the distribution of mass in the system.

In an investigation, Fig. 3.3 shows two pendulums of equal length separated by a spring with an extension x. The pendulum bobs consist of a number of slotted masses.

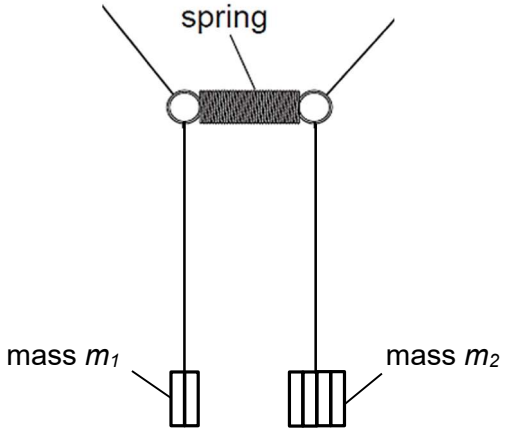


Fig. 3.3

(i) Suggest one value of x from the values in **(c)** you would use in the investigation. Record and explain your choice of x.

x = ……

……

……

…… [1]

(ii) Plan an investigation to examine the relationship between T and the distribution of masses ($m_2 - m_1$).

Your account should include:

- your experimental procedure
- control of variables
- how you would use your results to verify the linear relationship
- one suggestion to improve the accuracy of the results.

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…… [5]

[Total: 21]

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Candidate Name: _____ Civics Group: _____

4 Fig. 4.1 shows a light-dependent resistor (LDR) submerged under water.

A source of light shines towards the LDR through the water.

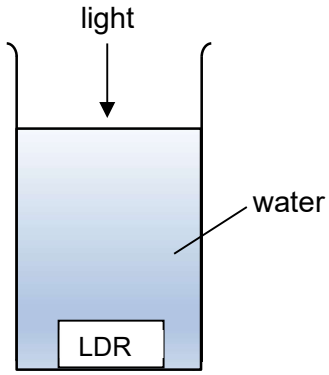

Fig. 4.1

The resistance R of the LDR depends on the power P of the light and the depth h of water within the container.

The resistance R is given by:

$$R = K\ P^x h^y$$

where K, x and y are constants.

Design an experiment to determine the values of x and y.

You are provided with a LDR and a light bulb. You may also use any of the other equipment usually found in a physics laboratory.

Draw a diagram to show the arrangement of your apparatus. You should pay particular attention to:

- the equipment you would use
- the procedure to be followed
- the control variables
- any precautions that should be taken to improve the accuracy and safety of the experiment.

Diagram

[Total: 12]

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