文礼中学 BLS

BOON LAY SECONDARY SCHOOL

PRELIMINARY EXAMINATION

2021

Name	( )
Class	

Subject	:	**PHYSICS**
Paper No	:	**3**
Subject Code	:	**6091/03**
Level	:	**SECONDARY FOUR EXPRESS**
Date/Day	:	**31 AUGUST / TUESDAY**
Time	:	**0815-1005**
Duration	:	**1 HOUR 50 MINUTES**

READ THESE INSTRUCTIONS FIRST

Write your name and index number on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

The Practical Examination is divided into **two sections**.
You are advised to spend no more than **55 minutes** per section.

You will start with one section and there will be a **changeover of equipment**, 55 minutes after the start of the paper.

You are expected to record all your observations as soon as they are made.
An account of the method of carrying out the experiment is **not** required, unless otherwise stated.
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.

For Examiner's Use	
1	
2	
3	
Total	**40**

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)

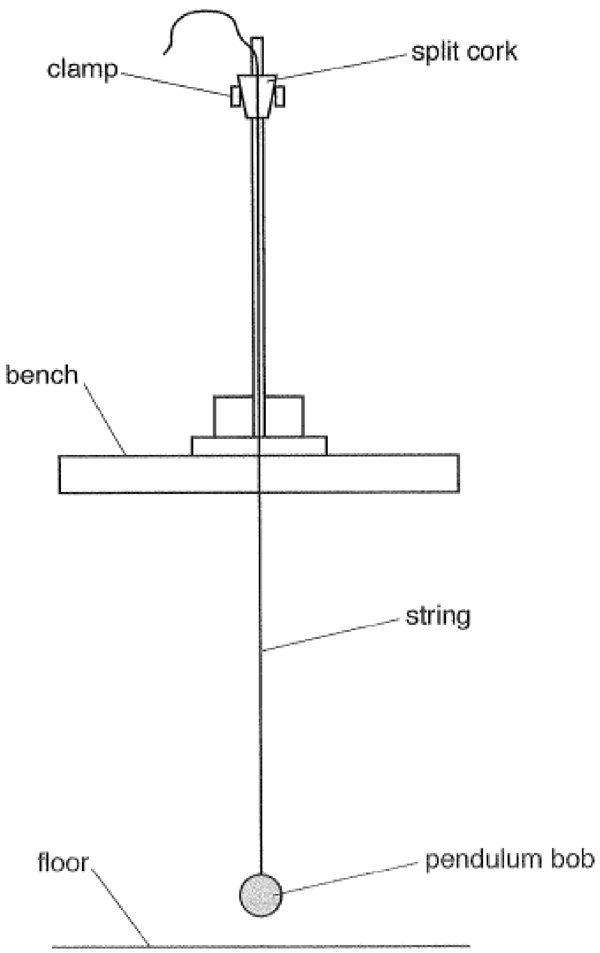

Fig. 1.1(a) (front view)

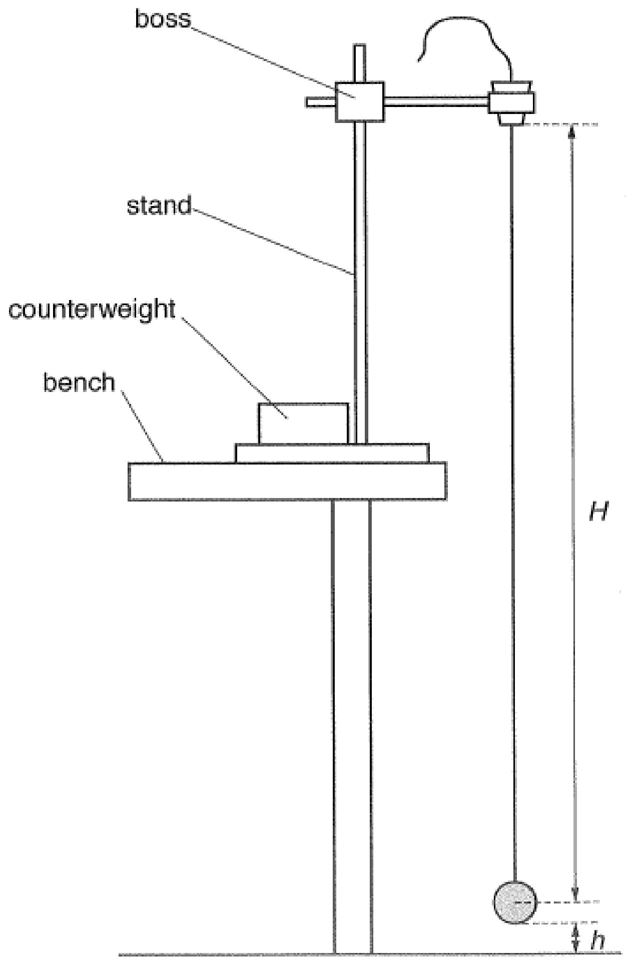

Fig. 1.1(b) (side view)

(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.

1 (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.

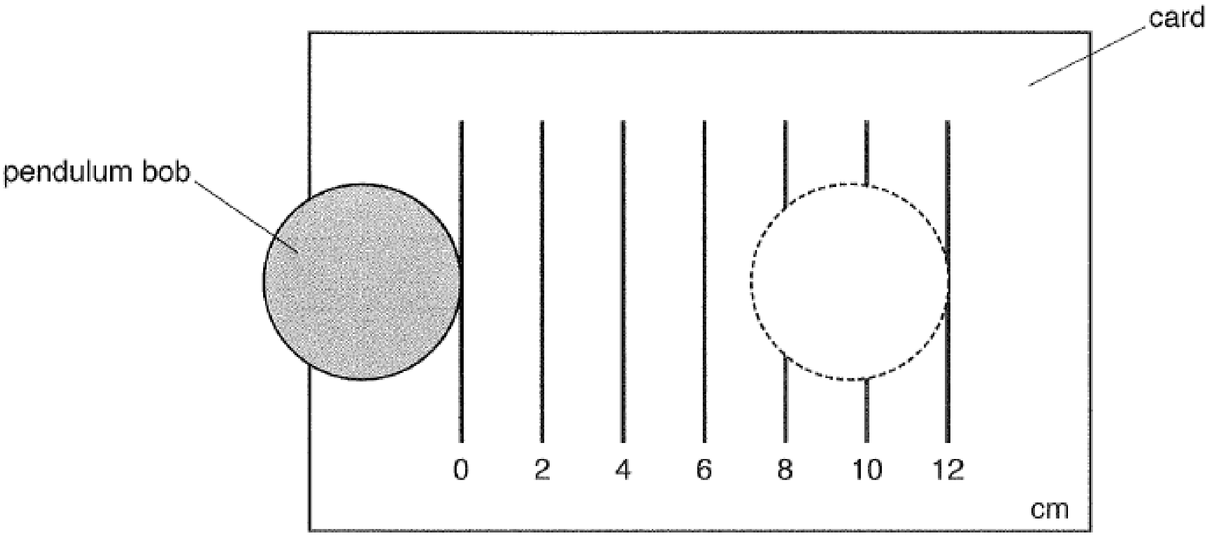

Fig. 1.2 (view from above)

(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.

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....
[1]

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-Tack,
- a loop of string on the metre rule.

(a) **(i)** Measure and record the unstretched length l_0 of the spring, as shown in Fig. 2.1.

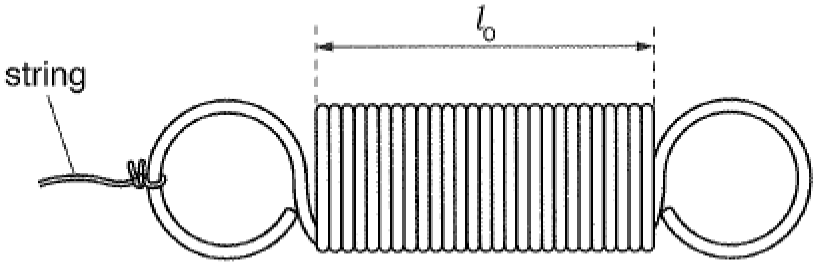

Fig. 2.1

l_0 = ... [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.

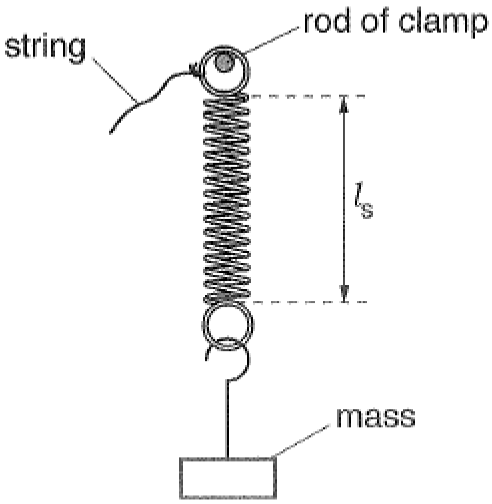

Fig. 2.2

Measure and record the stretched length l_s of the spring.
Determine the extension e_0 of the spring using the equation $e_0 = l_s - l_0$.

l_s = ... [1]

e_0 = ... [1]

2 **(b)** Use your value of e_0 from **(a)(ii)** and the equation $F = ke_0$, 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 the 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.

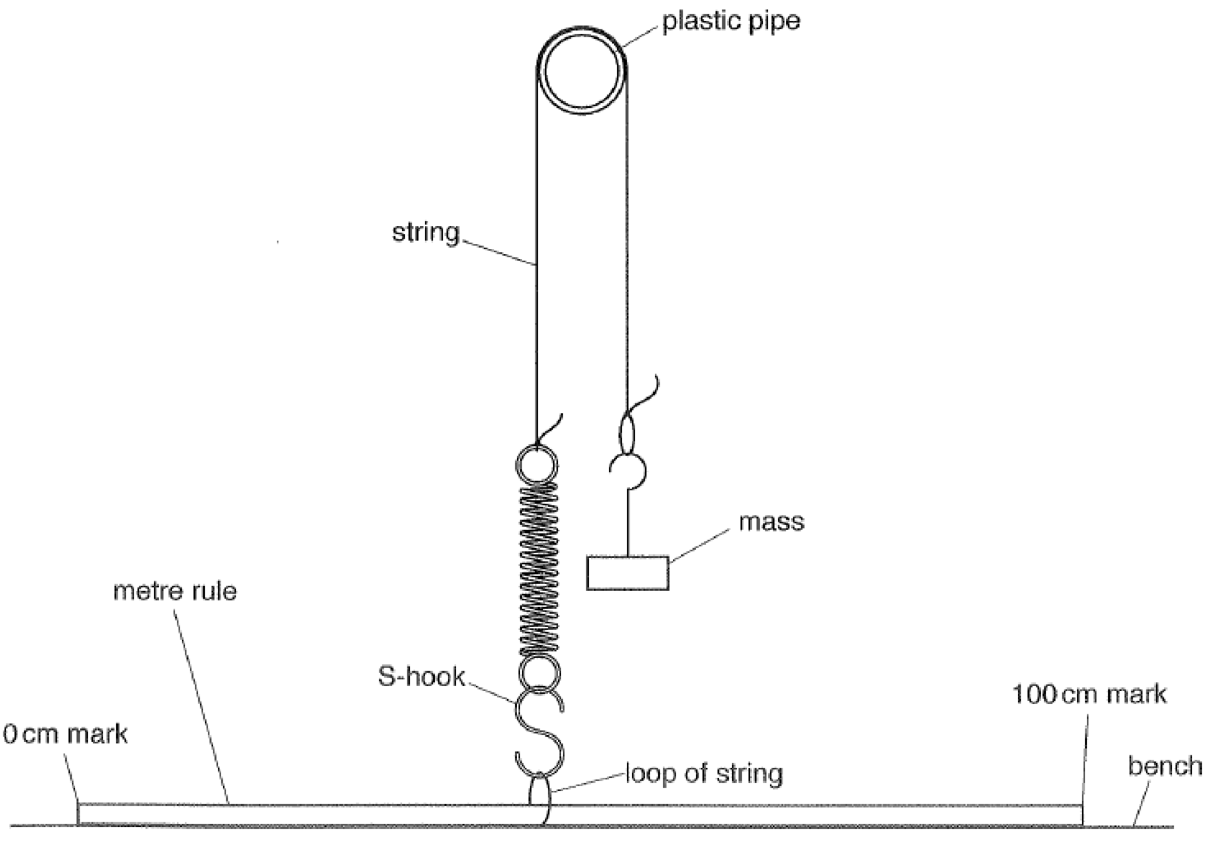

Fig. 2.3

2 (c) (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 $e_1 = l_1 - l_0$.

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 $e_2 = l_2 - l_0$.

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 = ... [1]

F_2 = ... [1]

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

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.... [2]

Section B

3.

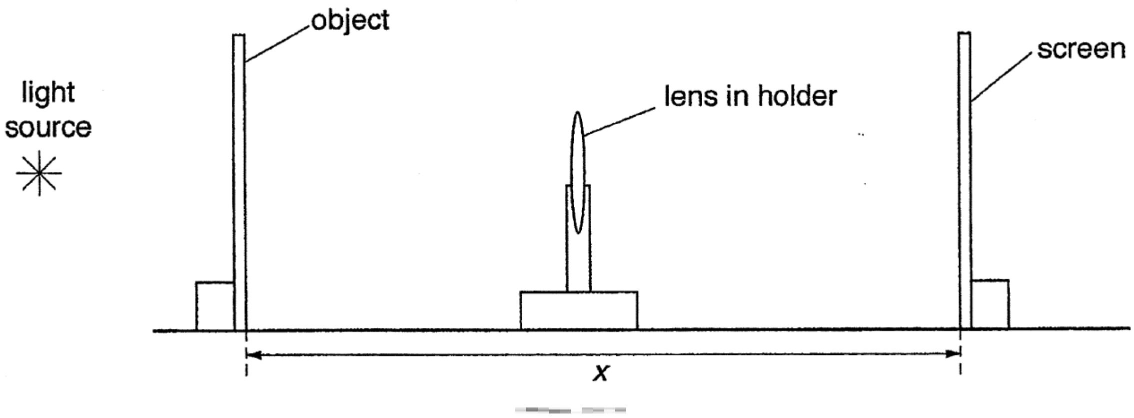
In this experiment, you will determine the focal length of a lens.

You have been provided with
- A converging lens,
- an illuminated cross-wire object,
- a lens holder,
- a screen,
- a metre rule,
- a 30 cm ruler,
- a set square.

(a) Determine the average diameter d of the hole forming the cross-wire object.

d = ... [2]

(b) Set up the apparatus as shown in Fig. 3.1.



Place the metre rule between the object and the screen.

Ensure that the object is at 0.0 cm mark on the rule and that the screen is at the 100.0 cm mark so that the distance *x* between the object and the screen is 100.0 cm.

(c) Move the lens along the rule until a sharply-focused **magnified** image of the object is formed on the screen.

(i) Measure the distance *v* between the centre of the lens and the screen.

v = ... [1]

(ii) Determine average diameter *D* of the image formed on the screen.

D = …………………………….. [1]

(iii) Calculate the magnification *m* of the image, using the relationship $m = \frac{D}{d}\frac{D}{d}$

m = …………………………….. [1]

(d) Repeat **(c)** using different values of *x* in the range *x* > 60.0 cm. The object should remain at the 0.0 cm mark on the rule and the position of the screen should be changed to give different values of *x*.

Record your results for *x*, *v* and *D* in a table below. Include a column for m. Also include your results from **(c)** in the table. [5]

(e) Using the graph paper provided, plot a graph of m against v. [4]

(f) **(i)** Determine the gradient *G* of your graph.

G = ……………………………... [2]

(ii) The numerical value of the focal length, *f* of the lens is given by the formula $f = \frac{1}{G}\frac{1}{G}$. Calculate the focal length *f* of the lens.

f = ……………………………... [1]

(g) **(i)** Identify one source of error in this experiment. [1]

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(ii) Suggest an improvement to this experiment. Explain why your suggestion would reduce this error. [1]

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(iii) State one precaution for this experiment. [1]

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