Name:	Class:	Class Index No.:

Anglo-Chinese School (Barker Road)

PRELIMINARY EXAMINATION 2024

SECONDARY FOUR EXPRESS

PHYSICS 6091

PRACTICAL

1 HOUR 50 MINUTES

INSTRUCTIONS TO CANDIDATES:

Write your name, class and exam index number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Read the instructions carefully.

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

For Examiner's Use	
Q1	
Q2	
Q3	
Total	40

*This question paper consists of **13** printed pages.*

Section A

1 *In this experiment, you will investigate an electric motor.*

You have been provided with

- a battery
- a switch
- an ammeter
- a length of resistance wire attached to a metre rule
- an electric motor clamped to a stand
- a piece of thin card
- a voltmeter
- connecting leads
- a jockey

Assemble the circuit shown in Fig. 1.1.

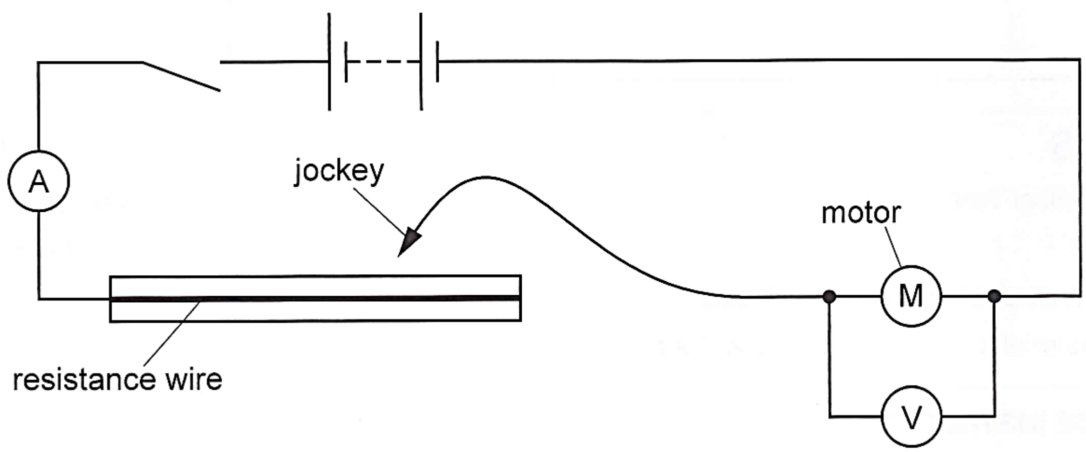

Fig. 1.1

The jockey can be connected at different points along the length of the resistance wire.

You are also provided with:

- a load made from a 50 g mass hanger and three 50 g masses
- an elastic band.

Place the shaft of the motor through the elastic band and suspend the load from the elastic band. Put the piece of thin card onto the shaft of the motor, as shown in Fig. 1.2.

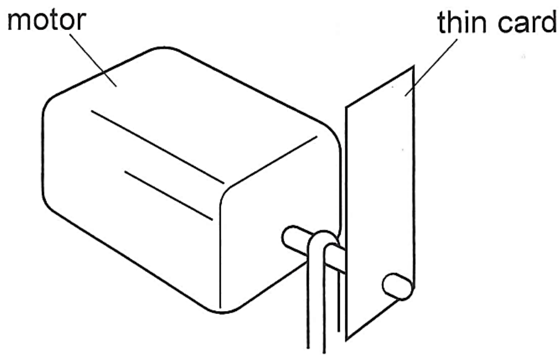

Fig. 1.2

Tilt the motor very slightly, as shown in Fig. 1.3, to ensure that the elastic band does not slip off when the shaft of the motor is turning.

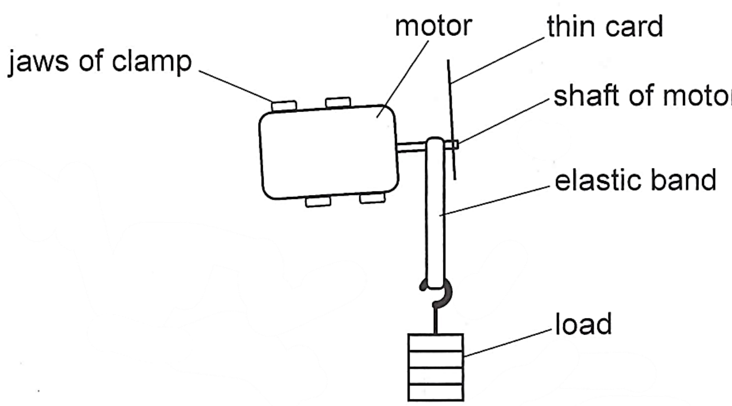

Fig.1.3

Close the switch.

Connect the jockey to the resistance wire. Adjust the position of the jockey until the shaft of the motor rotates as slowly as possible without stopping. The piece of thin card can help you judge when the motor starts to rotate.

(a) Record the potential difference V across the motor and the current $\boldsymbol{I}$ in the circuit.

V = ...

$\boldsymbol{I}$ = ...
[2]

(b) Open the switch. Disconnect the jockey from the resistance wire.

Calculate:

(i) the power P input to the motor, using the equation $P = V\boldsymbol{I}$

P = ... [1]

(ii) the ratio R of the potential difference to the current, using the equation

$$R = \frac{V}{\boldsymbol{I}}$$

.

R = ... [1]

(c) Remove **one** 50 g mass from the load.

Close the switch.

Connect the jockey to the resistance wire. Adjust the position of the jockey until the shaft of the motor rotates as slowly as possible without stopping.

(i) Calculate new values of P and R for this load.

P = ...

R = ...
[1]

(ii) The load has decreased by 25%.

Compare the decrease in the load with the change in *P* and with the change in *R*.

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

……………………………………………………………………………………………………[2]

(d) Other students perform the same experiment.

Describe **three** reasons why the readings obtained may be different.

1 …………………………………………………………………………………………………….

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2 …………………………………………………………………………………………………….

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3 …………………………………………………………………………………………………….

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[3]

[Total: 10]

2 *In this experiment, you will investigate the oscillation of a metre rule.*

You have been provided with:

- a metre rule with a loop of thread attached
- a boss attached to a stand
- a spring
- an S-hook
- a 200 g mass
- adhesive putty
- a 50 cm rule
- a stop-watch.

Assemble the apparatus shown in Fig. 2.1.

Secure the 100 cm end of the rule to the bench with adhesive putty.

Use adhesive putty to attach the centre of the 200 g mass at the 2 cm mark on the metre rule.

Use the S-hook to attach the lower loop of the spring to the loop of thread on the metre rule.

Adjust the position of the boss on the stand until the height *h* of the bottom of the metre rule at the 0 cm end is approximately 3 cm above the bench. The extension of the spring is now *x*.

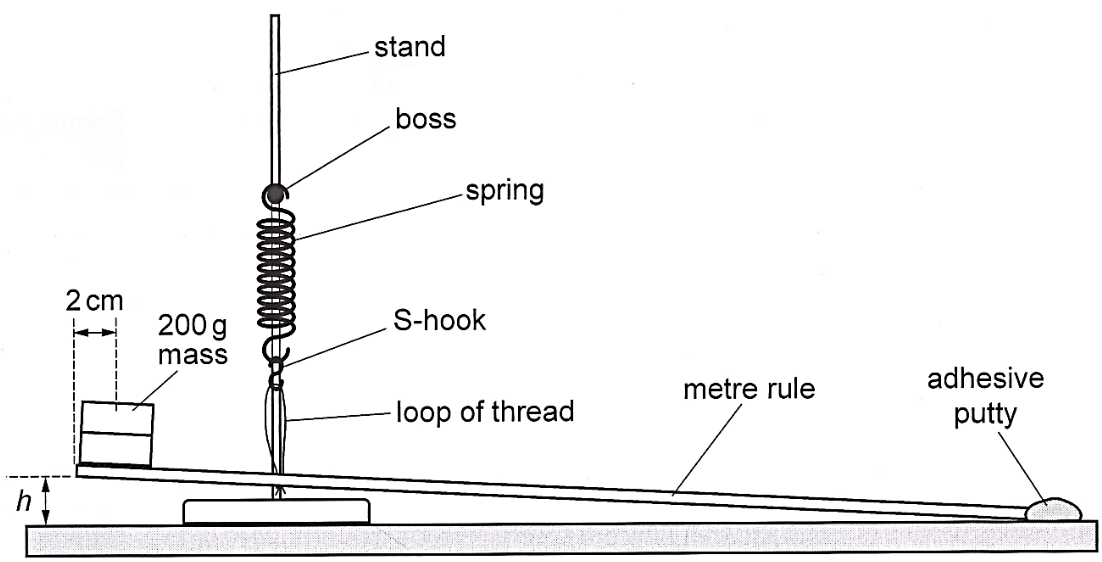

Fig. 2.1

(a) **(i)** Push the 0 cm end of the metre rule down until it almost touches the bench. Release the metre rule and observe the oscillation.

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

T = ……………………………….[2]

(ii) Calculate T^2.

T^2 = ……………………………….[2]

(b) A student claims that $T^2 = ax + b$, where a and b are constants and x is the extension of the spring.

Plan an experiment to investigate the student's claim.

In your plan, you should:

- explain briefly how to do the experiment
- describe how to determine x
- state **one** key variable to control
- draw a table, with column headings, to show how to display the range of readings
- explain how to determine a and b if the student's claim is correct.

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……[6]

[Total: 10]

Section B

3 *In this experiment, you will investigate the focal length of a combination of lenses.*

You have been provided with:

- a pair of converging lenses mounted on a block
- a torch
- a screen
- a stand, boss and clamp
- a 50 cm rule.

Assemble the apparatus as shown in Fig. 3.1.

There is a card with a triangular hole mounted on the front of the torch.

Use the stand, boss and clamp to hold the torch level with the centre of the lenses. Place the torch so that the triangle is at the 0.0 cm mark on the 50 cm rule. Switch on the torch.

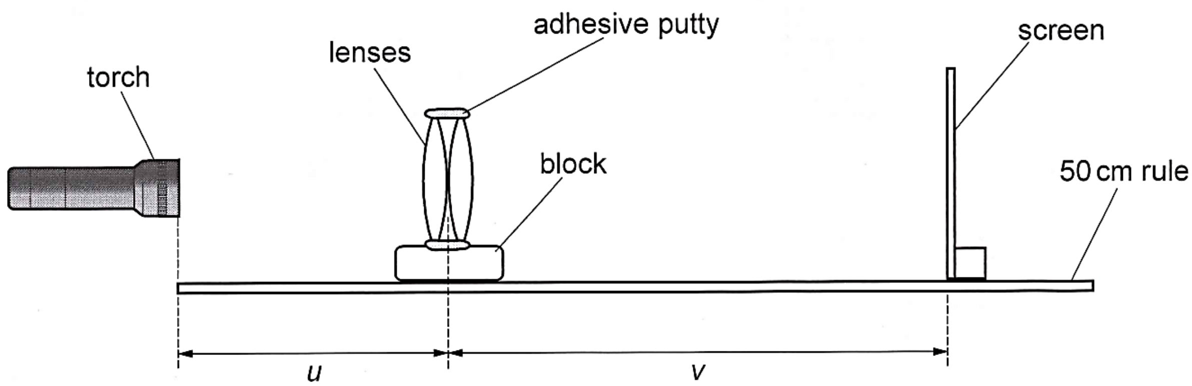

Fig. 3.1

Place the centre of the combination of lenses at u = 15.0 cm and move the screen until a focused image of the triangle is formed on the screen. The distance v is measured between the centre of the combination of lenses and the screen where the image is focused.

(a) Describe the process and techniques used to ensure a focused image of the triangle forms on the screen.

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....

....

....[4]

(b) Determine an accurate value for the distance *v*.

v = ……………………….. [2]

(c) Record your values of *u* and *v* in a table. Include a column for (*u* + *v*) and a column for *uv*.

For values of *u* from 15.0 cm to 25.0 cm, determine corresponding values of *v*, (*u* + *v*) and *uv*. Record all of your measurements and calculations in your table.

[5]

(d) Using the grid provided, plot a graph of *uv* against (*u* + *v*). [4]

(e) The gradient of your line of best fit is numerically equal to the focal length *f* of the combination of lenses.

Determine *f*.

f = ……………………….. [2]

(f) Describe **three** improvements to the experiment that reduce experimental error.

1 ……………………………………………………………………………………………….

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2 ……………………………………………………………………………………………….

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3 ……………………………………………………………………………………………….

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[3]

[Total: 20]

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