

Name: _____ Index Number: _____ Class: _____



TEMASEK SECONDARY SCHOOL
O Level Preliminary Examination 2024
Secondary 4 Express

PHYSICS

6091 / 03

Paper 3 Practical

1 hour 50 minutes

Additional Material: NIL

READ THESE INSTRUCTIONS FIRST

Do not open the booklet until you are told to do so.

You are required to submit this booklet at the end of the paper.

Write your name, index number and class on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

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 [] as the end of each question or part question.

Shift
Laboratory

For Official Use	
1	
2	
3	
Total	40

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

Section A

- 1 In this experiment, you will investigate an electrical circuit containing a light-emitting diode (LED).

You are provided with

- a power supply (consists of two 1.5 V batteries with battery holders),
- a switch,
- a light-emitting diode (LED),
- 1500 Ω and 6200 Ω resistors,
- a voltmeter,
- 6 connecting leads,
- a digital micrometer.

- (a) The LED has two legs, one labelled positive, and the other labelled negative. Measure and record the diameter of any one leg.

diameter = [1]

Assemble the circuit shown in Fig. 1.1, where $R = 1500 \Omega$.

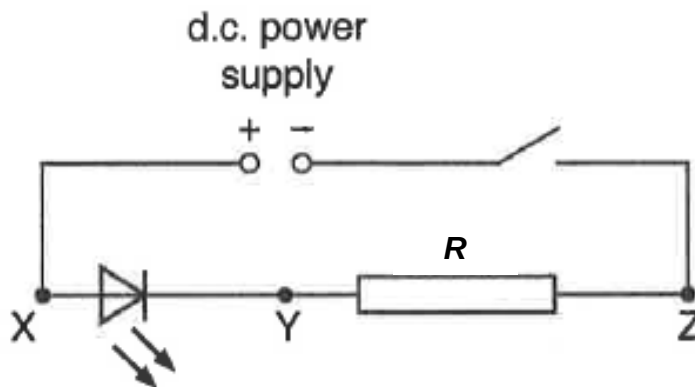


Fig. 1.1

- (b) (i) Connect the voltmeter across junctions Y and Z to measure the potential difference (p.d.) V_R across R .

Close the switch and record V_R .

$V_R =$ [1]

- (ii) Open the switch and disconnect the voltmeter.

Calculate the current I in the circuit using the relationship

$$I = \frac{V_R}{R}$$

where R is the resistance of the resistor that is in the circuit.

$$I = \dots\dots\dots [1]$$

- (iii) Connect the voltmeter across junctions X and Y to measure the p.d. V across the LED.

Close the switch and record V .

$$V = \dots\dots\dots [1]$$

- (iv) Calculate the power P dissipated in the LED using the relationship

$$P = I V$$

$$P = \dots\dots\dots [1]$$

- (c) Disconnect the $1500\ \Omega$ resistor and replace it with the $6200\ \Omega$ resistor.

- (i) Repeat (b) and record the new values of V_R and V .

$$V_R = \dots\dots\dots$$

$$V = \dots\dots\dots [1]$$

- (ii) Calculate new values of I and P .

$$I = \dots\dots\dots$$

$$P = \dots\dots\dots [1]$$

- (iii) R is increased from $1500\ \Omega$ to $6200\ \Omega$.

Compare the increase in R with the change in I and with the change in P .

.....
 [1]

- (d) Describe how modifications can be made to the circuit in Fig. 1.1 to measure I directly and for a range of values of R .

.....

 [2]

[Total: 10]

- 2 *In this experiment, you will investigate how the speed of a water wave changes as the depth of the water is altered.*

You are provided with

- a tray,
- a beaker
- a marked stick,
- a stopwatch,
- a half-metre rule.

Set up the apparatus shown in Fig. 2.1.

With the tray flat on the bench, carefully pour water into it so that the depth, d , is 10 mm. Use the marked stick provided to help you measure this depth.

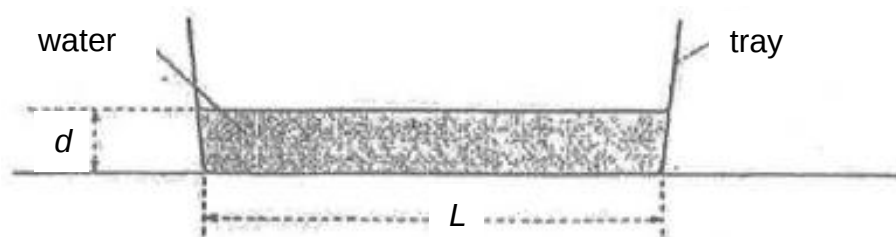


Fig. 2.1

- (a) Measure and record the length L of the tray.

$L =$ [1]

Raise one side of the tray, A, by about 15 to 20 mm, as shown in Fig. 2.2 and then let it drop back to the bench.

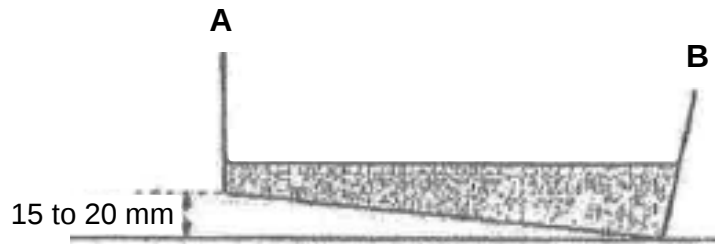


Fig. 2.2

You should see a wave move forward and backward across the surface of the water several times, as shown in Fig. 2.3.

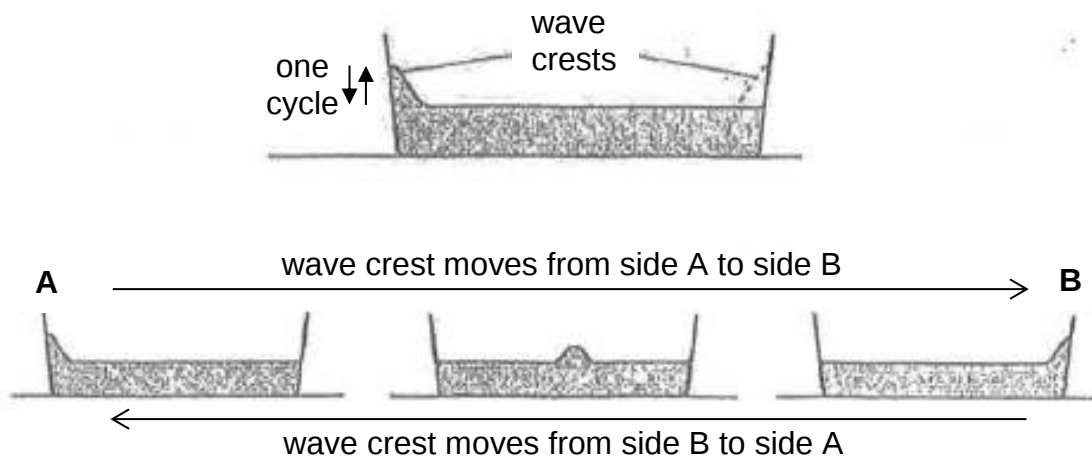


Fig. 2.3

One cycle consists of a wave crest traveling from side **A** of the tray to side **B** and back again to side **A**.

(b) Determine an accurate time t taken for a wave crest to complete 3 cycles.

$t = \dots\dots\dots$ [2]

(c) Calculate the average speed of the wave, c , using the formula

$$c = \frac{6L}{t}$$

$c = \dots\dots\dots$ [1]

(d) Plan

It is suggested that the average speed c and depth d are related by the expression:

$$c = A\sqrt{d} + B$$

where A and B are constants.

Using the same apparatus given in this experiment, plan an experiment to investigate this relationship.

In your plan, you should:

- state **one** key variable to control.
- explain briefly how to do the experiment.
- describe how to vary d .
- draw a table, with column headings, to show how to display the range of readings.
- write a statement of the graph to plot to test this relationship.
- explain how to determine A and B if the relationship is valid.

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Section B

- 3** *In this experiment, you will investigate how the energy transferred to the surroundings from a beaker of hot water depends on the insulation of the beaker.*

You have been provided with

- a thermometer,
- two 250 ml beakers,
- a folded sheet of newspaper,
- two rubber bands,
- a square piece of card,
- a stopwatch.

- (a)** Measure room temperature θ_0 .

$\theta_0 = \dots\dots\dots$ [1]

- (b)** Pour hot water into one of the beakers until it reaches the 200 ml mark.

- (c) (i)** Place the thermometer in the water.

- (ii)** When the thermometer reads 65.0 °C, start the stopwatch.

Measure and record the temperature θ_1 and the time t at appropriate intervals for six minutes.

- (iii)** Describe the process and techniques used to ensure the temperature is measured accurately with time.

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..... [2]

- (d) (i) Insulate the empty beaker by wrapping the folded newspaper around the **sides** of the beaker. Secure the newspaper to the beaker using one or two rubber bands as shown in Fig. 3.1.

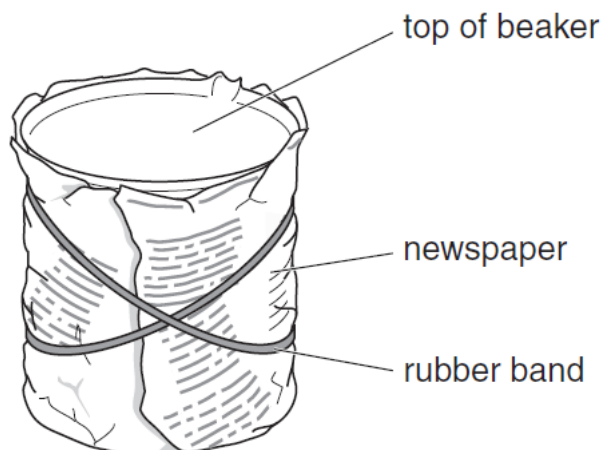


Fig. 3.1

- (ii) Pour the hot water into the beaker until it reaches the 200 ml mark.
- Place the cardboard lid on the beaker and gently insert the thermometer through the hole in the lid so that the thermometer is in the water.
- (iii) Repeat (c)(ii), recording the temperature θ_2 at the same time intervals for six minutes.
- (e) Record all values of θ_1 and θ_2 for the corresponding times in a table.
- Include a column for $(\theta_2 - \theta_1)$.

- (f) It is suggested that θ_1 and θ_2 are related by the expression

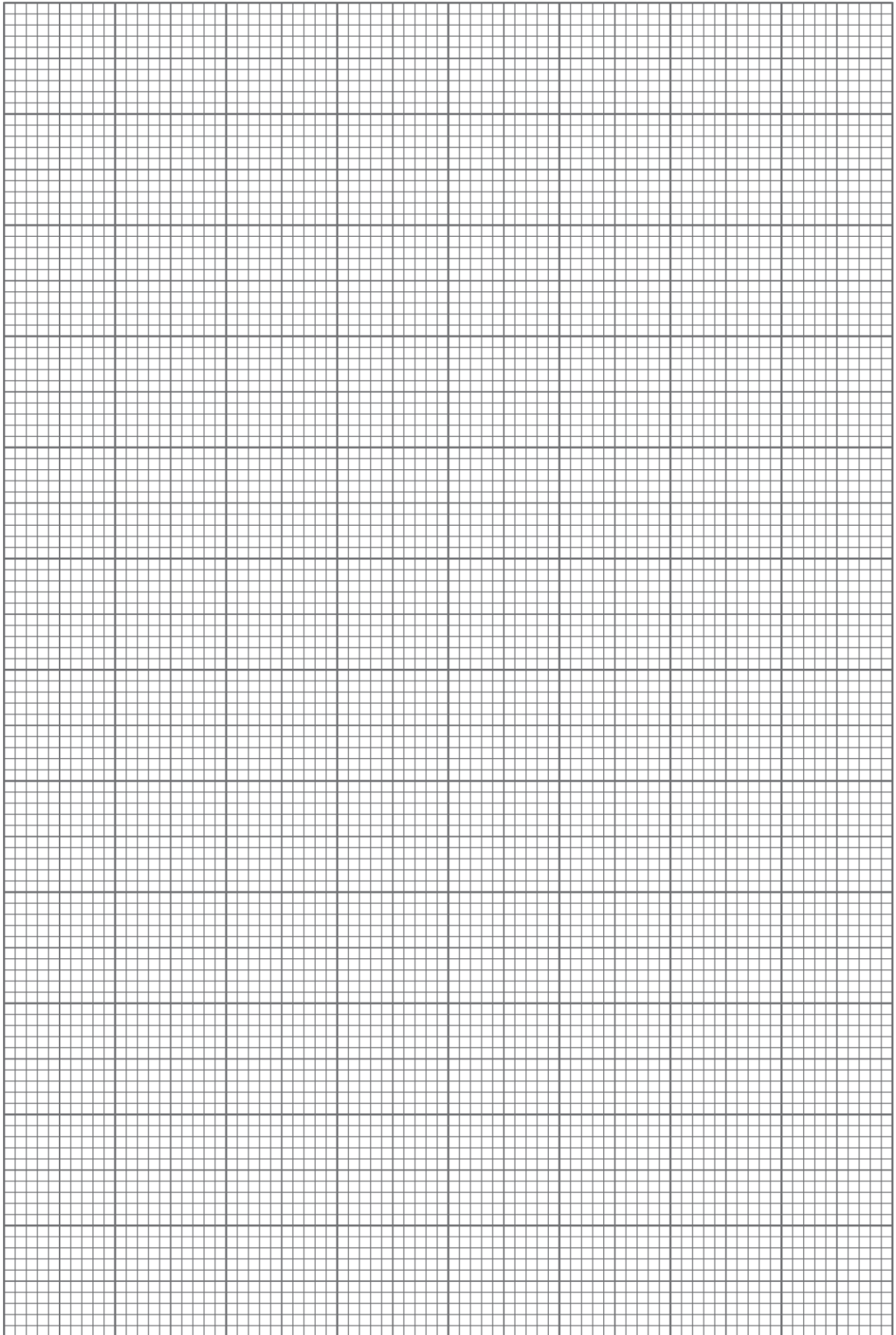
$$(\theta_2 - \theta_1) = k\theta_1 + c$$

where k and c are constants.

Using the grid provided, plot a graph of $(\theta_2 - \theta_1)$ against θ_1 .

Draw the line of best fit.

[4]



- (g) From your graph, determine the values of k and c .

$k = \dots\dots\dots$

$c = \dots\dots\dots$ [3]

- (h) Use your values from (a) and (g) to determine the value of θ_2 when θ_1 reaches room temperature.

$\theta_2 = \dots\dots\dots$ [1]

- (i) State **two** significant sources of error.

1.

.....

2.

..... [2]

- (j) Suggest **two** improvements that could be made to the experiment to address the errors identified in (i). You may suggest the use of other apparatus or different procedures.

1.

.....

2.

..... [2]

[Total: 20]

END OF PAPER