Anglican High School
Secondary Four
Preliminary Examination 2025

S4

CANDIDATE NAME

CLASS 4

CLASS INDEX

PHYSICS

6091/03

Paper 3 Practical Test

12 August 2025

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.
DO **NOT** WRITE IN ANY BARCODES.

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.

For Examiner's Use	
1	
2	
3	
Total	

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

Section A

1 *In this experiment, you will determine the volume of a straw by two different methods.*

You are provided with:

- two round straws
- two set squares
- a 30 cm ruler
- a 50 cm^3 measuring cylinder
- a container of water
- scissors
- paper towels

(a) Method 1

Take one straw.

Immerse the straw fully in the container of water as shown in Fig. 1.1.

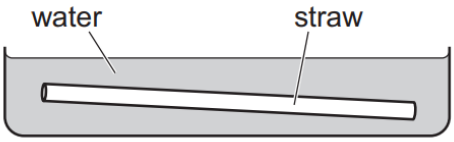


Fig. 1.1

Move the straw backwards and forwards in the water several times so that the water enters the straw.

Put a finger firmly over one end of the straw and remove the straw from the water.

Put the straw above the open end of the measuring cylinder and remove the finger so that the water is transferred into the measuring cylinder.

Repeat this process 5 more times for a total of 6 transfers.

(i) Measure and record the volume of water V_T in the measuring cylinder.

V_T = ... [1]

(ii) Calculate the average volume of water V_1 in one straw.

V_1 = ... [1]

(b) Method 2

(i) Measure and record the length l of the other straw.

l = ... [1]

(ii) Cut the straw into 4 pieces that are approximately equal in length.

Line up the pieces of straw as shown in Fig. 1.2.

Ensure the pieces of straw are touching.

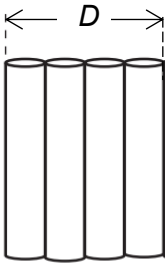


Fig. 1.2

Length D is the width of the 4 pieces of straw placed side by side.
Measure and record the length D for your 4 pieces of straw.

D = ... [1]

(iii) Use your answer to **(b)(ii)** to determine the diameter d of one straw.

d = ... [1]

(iv) Some of the apparatus on your bench are used to ensure that your measurement of D is as accurate as possible.

Draw a diagram to show how you use the apparatus to make sure your measurement of D is as accurate as possible. Label all the apparatus used. [1]

(v) The volume V_2 of the straw is given by the equation:

$$V_2 = \frac{3.14 d^2 l}{4}$$

Use your answers from **(a)(i)** and **(a)(iii)** to calculate V_2.

V_2 = ... [2]

(c) Suggest two reasons why the values of V_1 and V_2 are different.

1 .....

.....

2 .....

.....
[2]

[Total: 10]

2 *In this experiment you will investigate the oscillation of a mass on a spring.*

You are provided with:

- two stands, bosses and weights
- a stopwatch
- a rule

You are also provided with a spring, a wooden rod and two pieces of adhesive putty assembled as shown in Fig. 2.1.

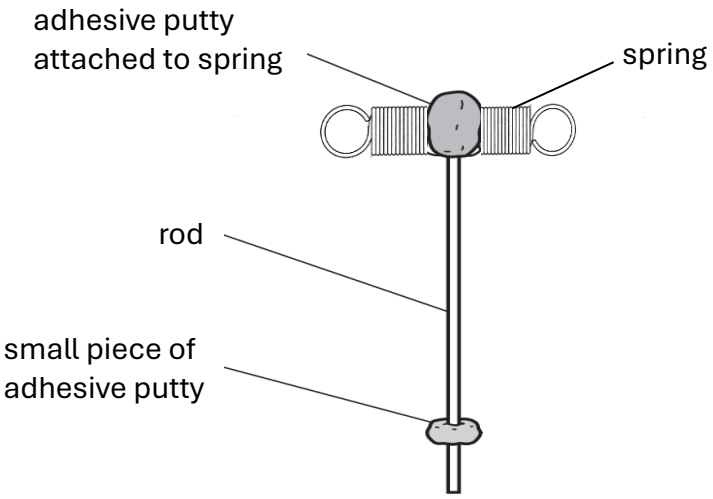


Fig. 2.1

(a) Set up the apparatus as shown in Fig. 2.2.

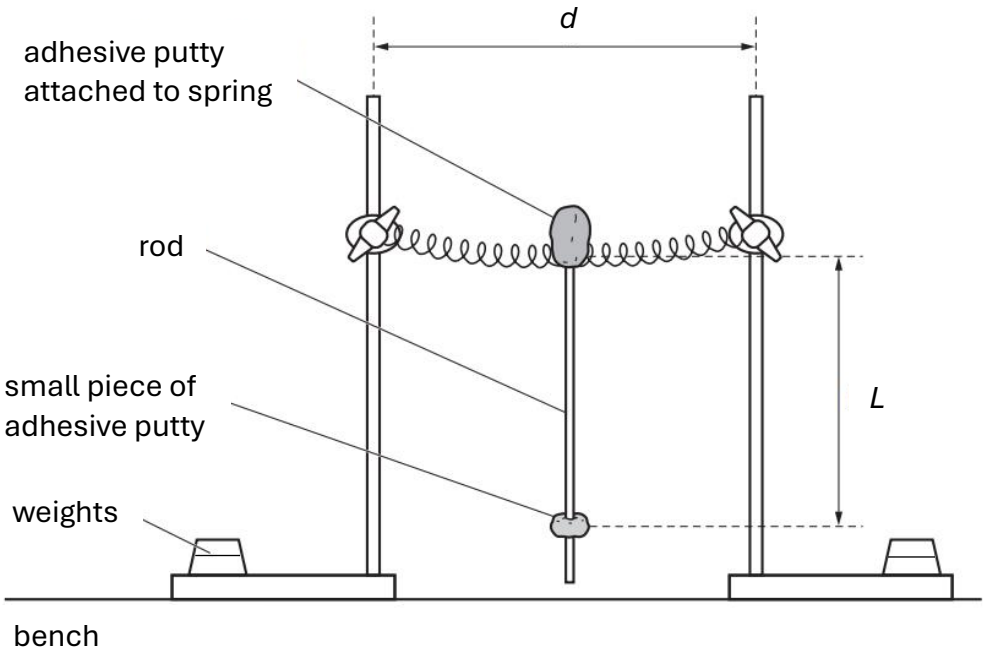


Fig. 2.2

Adjust the position of the stands so that d is approximately 26 cm.
Adjust the position of the small piece of adhesive putty so that it is approximately 3 cm from the lower end of the rod.
Press it firmly to the rod to ensure that it does not slip off.

Measure and record the distance L from the centre of the spring to the centre of the small piece of adhesive putty.

L = ... [1]

(b) Explain one difficulty in obtaining an accurate value of L

……

……..…… [1]

(c) Describe one way that the apparatus is arranged to reduce the risk of the stands toppling over.

……

……..…… [1]

(d) Pull the bottom tip of the rod towards you.
Release the rod so that it oscillates freely.
Determine accurately the period T of the oscillating rod.

T = …….. [2]

(e) A student claims that $T^2 = a\,\frac{L}{d}$

where *a* is a constant.

Using the same apparatus as in Fig. 2.2, plan experiments to find out if the student's claim is correct.

In your plan, you should

- identify the quantities that you should keep constant,
- describe how you would perform the experiments,
- sketch the graphs that you would obtain if the suggested relationship is correct,
- explain how you would obtain the value for *a* from your graphs,
- explain one precaution that you should take to ensure the accuracy of the experiments.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[5]

[Total: 10]

Section B

3 *In this experiment, you will investigate the resistance of a thermistor.*

You are provided with:

- a power supply
- a switch
- a voltmeter
- connecting leads
- a resistor (in a plastic container)
- a beaker with a thermistor attached to an ice cream stick
- a thermometer
- a dropping pipette
- a plastic jug with handle
- a supply of cold water
- a glove
- a supply of very hot water (metal container at the side bench)

(a) Set up the circuit as shown in Fig. 3.1.

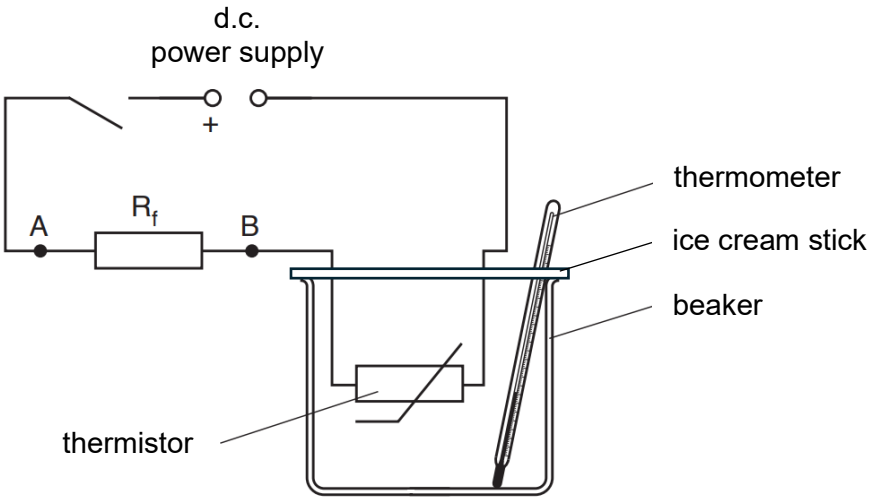


Fig. 3.1

(b) Connect the voltmeter across the terminals of the power supply. Switch on the circuit.

Record the voltmeter reading *Vs*.

Vs = ... [1]

(c) Connect the voltmeter across the fixed resistor R_f between points A and B.
Make sure the crocodile clips do not touch each other.

Collect about 200 cm^3 of very hot water using the plastic jug.
You may wear a glove to protect your hand.
Pour very hot water into the beaker until it reaches the 140 cm^3 mark.

Put the thermometer in the beaker.

(i) Observe the temperature rise.
When the temperature reading on the thermometer stops rising, record

1. the temperature reading θ on the thermometer

θ = ... [1]

2. the voltage V_{AB} across the fixed resistor R_f in the second column.

V_{AB} = ... [1]

(ii) Allow the water to cool and continue to observe the thermometer.

Take readings of the temperature θ and the corresponding readings of the voltage V_{AB} as the temperature decreases. You should take one voltage reading for every 3°C or 4°C decrease in temperature until the temperature reaches about 50°C.

For each value of θ and V_{AB},

1. use the equation $V_t = V_s - V_{AB}$ to calculate the potential difference V_t across the thermistor.

2. use the equation $I = V_{AB} / 47$ to calculate the current I in the circuit.

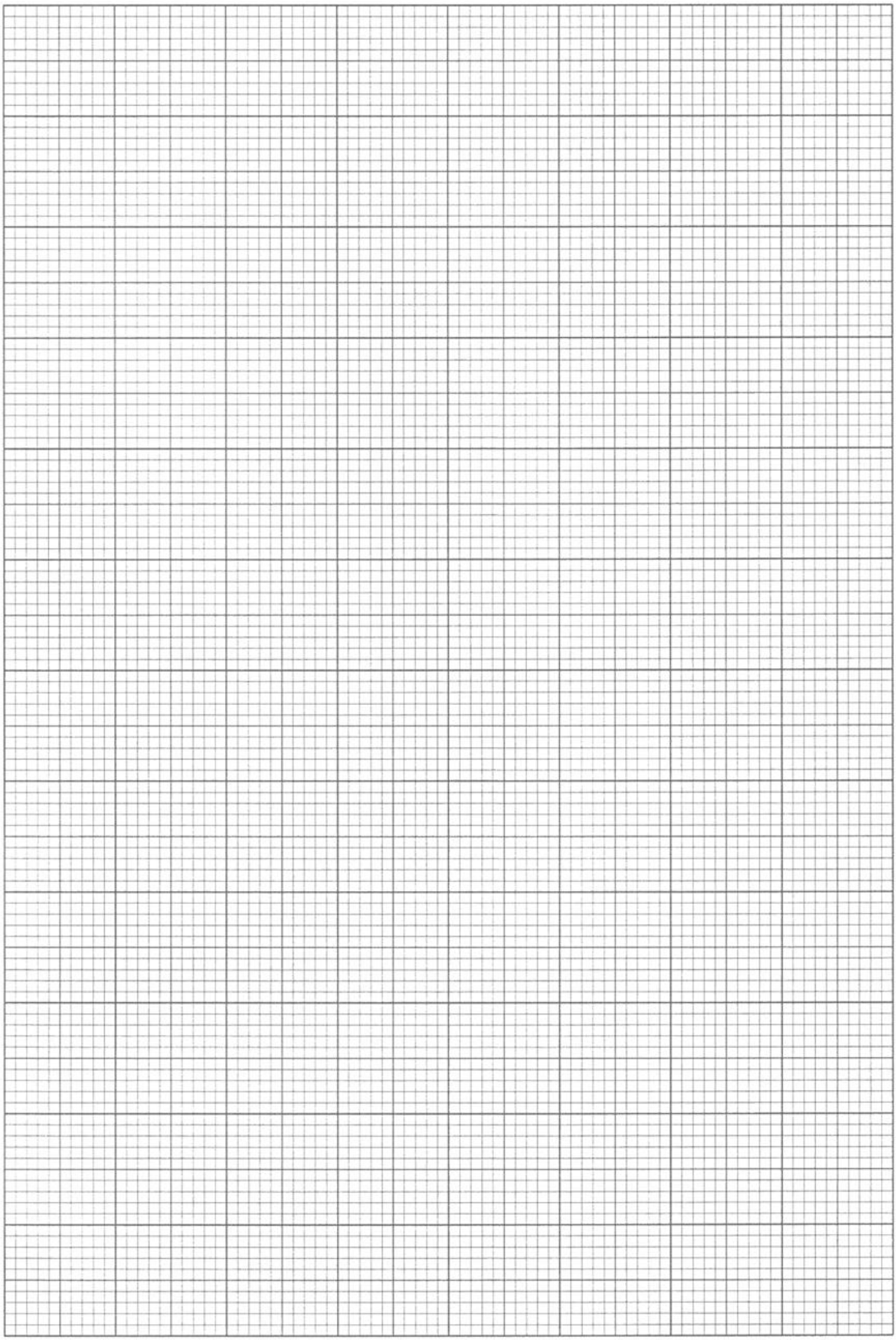
3. use the equation $R_t = V_t / I$ to calculate the resistance R_t of the thermistor.

The water cools slowly. To speed up the cooling of the water, use the dropping pipette to remove some of the hot water and replace it with a similar volume of the cold water provided.

Switch off the circuit when you have finished.

Record all measurements and calculations in a suitable table.

[7]



(d) (i) On the grid provided, plot a graph of R_t against θ.

Draw the line of best fit. [4]

(ii) Draw a tangent to the curve at a temperature of 65°C. Determine the gradient of your graph at this point.

gradient = ... [3]

(e) Explain **one** precaution to ensure that the values measured are as accurate as possible.

…...……..

…...……..

……..…….. [1]

(f) Explain **two** sources of error in the experimental procedure.

1. ……...

……..……

……..……

2. ……..

..……

……..……

[2]

[Total: 20]