Instructions to Candidates

- Write your name and index number in the spaces provided above
- Answer **ALL QUESTIONS** in the spaces provided in the question paper
- You are supposed to spend the first 15 minutes of the 2\(\frac{1}{4}\) hours allowed for this paper reading the whole paper carefully before commencing your work.
- Marks are awarded for clear record of the observations actually made, their suitability, accuracy and the use made of them.
- Candidates are advised to record their observations as soon as they are made.
- Mathematical tables and electronic calculators may be used.

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**Question 1**

For Examiner’s Use Only

<table>
<thead>
<tr>
<th></th>
<th>b(v)</th>
<th>c(i)</th>
<th>c(ii)</th>
<th>c(iii)</th>
<th>d(i)</th>
<th>d(ii)</th>
<th>d(iii)</th>
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**Question 2**

<table>
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<th>a(iv)</th>
<th>a(v)</th>
<th>a(vi)</th>
<th>b(iii)</th>
<th>b(iv)</th>
<th>b(v)</th>
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</table>
Question 1
You are provided with the following apparatus
- Two complete retort stands.
- A metre rule
- Two pieces of thread (120cm and 20cm)
- A stop watch or stop clock
- A piece of masking tape
- A peddling bob – (31.3g)
- A half metre rule
- A piece of masking tape

a) (i)
- Attach one end of string to the metre rule at the 10cm mark by fastening a loop of string tightly round the metre rule.
- Fix the string at this point with a piece of masking tape
- Tie the string in the second loop at 90cm mark. Fix this loop with another piece of masking tape.
ii) Attach the pendulum bob at the centre of the string – so that the centre of gravity of the bob is 15cm below the point of suspension (see figure 1 below.)

Figure 1

b) (i) Measure the angle $2\theta$
ii) Pull the pendulum bob towards you through a small distance release it and measure time “t” for 10 oscillations.
iii) Remove the masking tape; slide the loops to the 12cm and 88cm marks. Refix the masking tape. Measure the angle $2\theta$ and time “t” as before
iv) Report (iii) above with the loops at 15cm and 85cm, 20cm and 80cm, 25cm, and 75cm. 30 and 70cm, 35cm and 65cm marks.
v) Enter all your results in the table below. (8mrks)

<table>
<thead>
<tr>
<th></th>
<th>10 and 90</th>
<th>12 and 88</th>
<th>15 and 85</th>
<th>20 and 80</th>
<th>25 and 75</th>
<th>30 and 70</th>
<th>35 and 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2\theta$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\theta$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\cos \theta$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t(s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T = \frac{t}{10}(s)$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T^2(S^2)$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
c) i) Plot a graph of $T^2$ (y-axis) against $\cos \theta$ (5 marks)
ii) Find the intercept on the $T^2$ axis.  

(1 mark)

iii) Find the slope of your graph.  

(2 marks)

d) i) Measure the length $L$ of the pendulum bob when $2\theta = 0$ in metres.  

(1 mark)

ii) Using your graph, determine the period $T$ of the pendulum when $2\theta = 0$.  

(1 mark)

iii) Using the formula

$$T^2 = \frac{KL}{g}$$  

where $K = 39.48$  

Determine the value of $g$.  

(2 marks)

**Question 2**

You are provided with the following:

- Two dry cells
- A nichrome wire, 1m long labelled AB
- Eight connecting wire, one of the length 70cm having a Jockey
- A Carbon resistor $5\Omega$
- An ammeter (0 – 1.0A)
- A voltmeter (0 – 3V)
- A switch
- Two one cell holders

Proceed as follows...
a)  
   i) Set up the circuit below.

   ![Circuit Diagram]

   ii) With the jockey at A i.e. L = 100 cm, record the voltmeter reading V and the ammeter reading I. Repeat the reading for L = 80, 60, 40, 20, and 0 cm and enter your results in the table below. (6 marks)

<table>
<thead>
<tr>
<th>L (cm)</th>
<th>100</th>
<th>80</th>
<th>60</th>
<th>40</th>
<th>20</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.d V (volts)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current I (A)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

   iii) Plot a graph of P.d(V) (y-axis) against the ammeter reading I. (5 marks)
iv) Determine the slope of your graph when $V = 0.5$ volts. (2 marks)

v) What physical quantity does the slope in (iv) represent. (1 mark)

vi) What happens to this physical quantity named in (v) above as the current increases. (1 mark)

b) You are provided with the following apparatus.
- A lit candle
- White screen
- 250ml flat bottomed flask
- Metre rule
- Access to water.

Procedure;

i) Fill the flat bottomed flask with tap water. Fit the round flat flask in the clamp and follow the procedure.

ii) Starting with distance $U = 50$ cm adjust the screen until you get a sharp image of the flame. Measure the distance $V$ when the image is sharpest.
iii) Repeat the procedure for other values of U as shown in the table below.

<table>
<thead>
<tr>
<th>U(cm)</th>
<th>50</th>
<th>40</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>V(cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V/U</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(3 marks)

iv) Determine the average values of $\frac{V}{U}$ and V

\[ V = \]  

(½ mark)

\[ \frac{V}{U} = \]  

(½ mark)

v) Find the mean value of f from the equation.

\[ M = \frac{V}{f} - I \]  

(1 mark)