TERM 2 - 2023

PHYSICS - PRACTICAL

FORM FOUR (4)

MARKING SCHEME

QUESTION ONE

You are provided with the following apparatus:

- An ammeter (0-1 A)
- Voltmeter (0-3 V)
- Two dry cells
- Cell-holder
- Variable resistor (0-100 Ω)
- Connecting wires
- Switch

Proceed as follows:

a) Connect the apparatus as shown in figure 1 below:

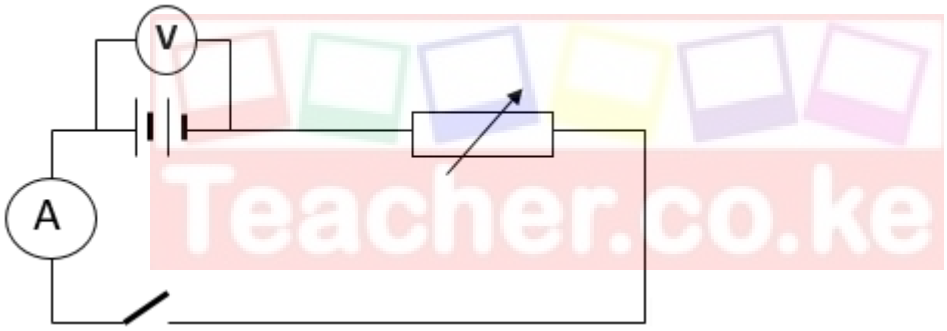


Figure 1

b) With the switch open, measure and record the voltmeter reading, V_0

V_0 = **3.5V** **; range: ∓0. 1** (1 mark)

c) Now, remove the voltmeter and connect it across the variable resistor (as shown in figure 2).

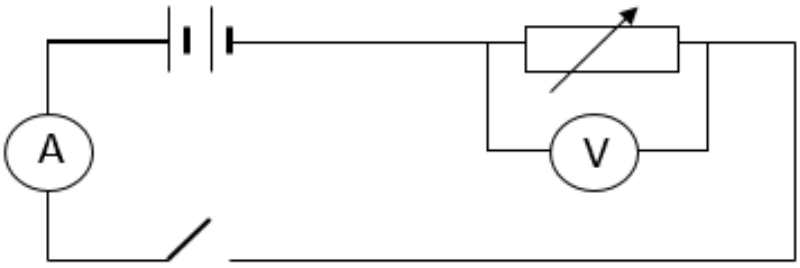


Figure 2

d) Adjust the variable resistor until you obtain a reading of 1.0 V on the voltmeter. Record the corresponding ammeter reading. Continue to adjust the variable resistor to obtain the voltmeter readings shown in table 1, each time recording the corresponding current value.

Table 1:

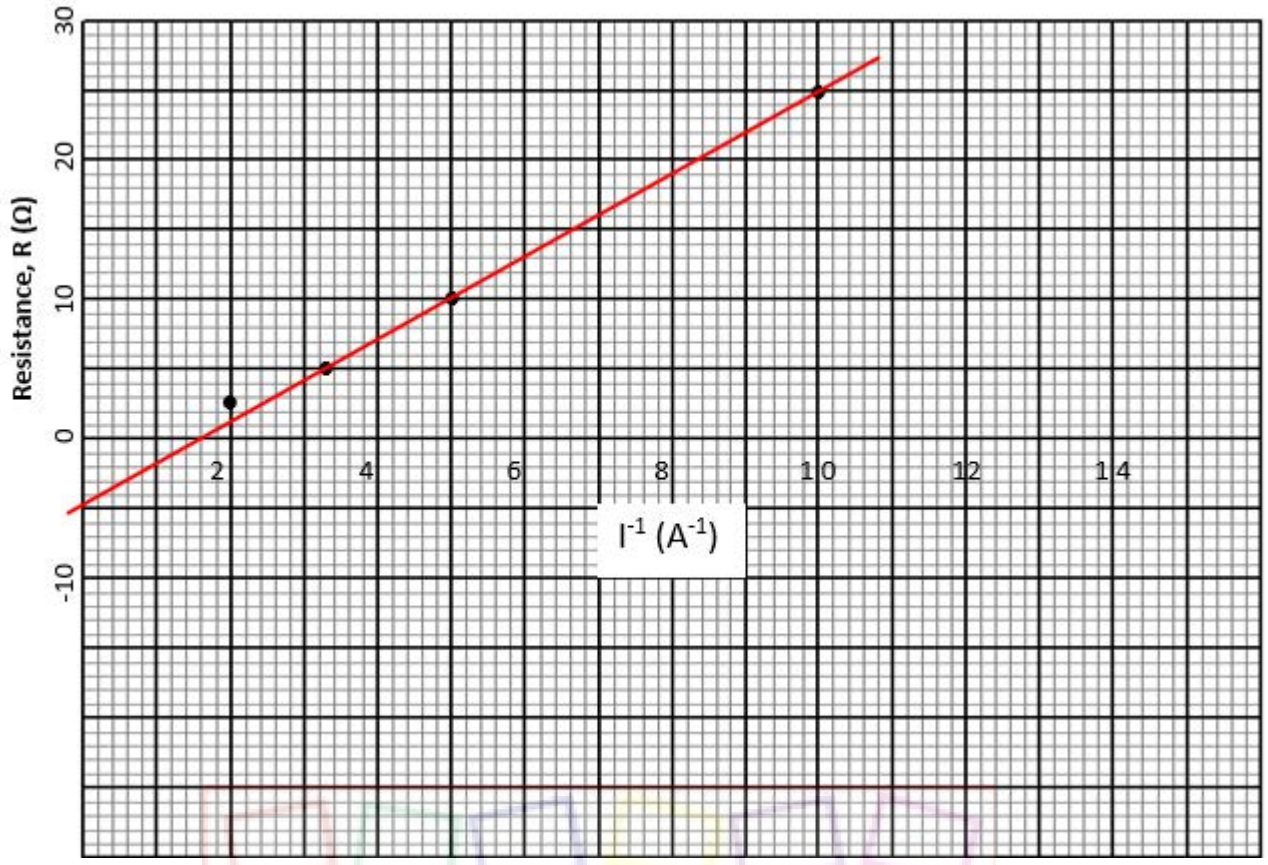
Voltage, V	1.0	1.5	2.0	2.5
Current, A **Range: ∓0.01**	**0.40 ;**	**0.30 ;**	**0.20 ;**	**0.10 ;**
$R = \frac{V}{I}\ (\Omega)$	**2.5**	**5**	**10**	**25**
$\frac{1}{I}\ (A^{-1})$	**2.5**	**3.333**	**5**	**10**

e) complete the table 1 above: (6 marks)

notes:

- 2 dp a must for all values of current
- Resistance and 1/I must be to 4 SF or exact
- Award 1 mark for all values of R correctly done
- Award 1 mark for all values of 1/I correctly done

f) Plot a graph of resistance, R against $\frac{1}{I}$ (5 marks)



g) Determine the slope of your graph (3 marks)

Slope $= \frac{\Delta resistance}{\Delta \frac{1}{I}} = \frac{25-10;}{10-5;} = 3.0\ V;$

h) Given that: $\frac{V}{I} = \frac{P}{I} - K$, where P and K are constants. From the graph determine the values of P and K.

i. P (2 marks)

P = slope ;

= 3.0 V;

ii. K (2 marks)

K = Y-intercept;

= 10Ω;

i) State the significance of K (1 mark)

Internal resistance;

QUESTION TWO

PART A

You are provided with the following apparatus:

- Complete retort stand
- Cork
- Optical pin (for suspending the cardboard)
- Stop-watch
- Half-metre rule
- Knife-edge
- Rectangular Cardboard (40cm by 5 cm by 0.5cm)

PROCEED AS FOLLOWS:

a) Using the knife-edge, determine the centre of gravity of the cardboard. Mark it as G.
b) From G, cut holes 1, 2, 3, 4, 5 and 6 at intervals of 3 cm. measure and record the distance, L of each of the holes from G.
c) Now set-up the apparatus as shown in figure 3, below:

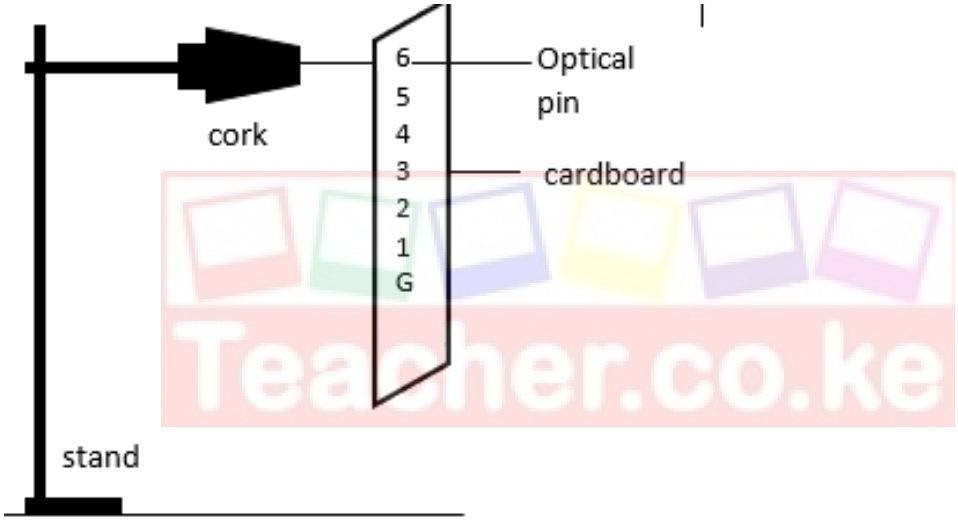


Figure 3

d) Displace the strip through a small angle, θ and release it to oscillate. Determine time, t for 10 oscillations and fill in your results in table 2 below: (8 marks)

Notes:
For all values of: L,T, T^2, T^2L and L^2- award 1 mark for each row correctly done
Award ½ mark for each correct value of time, t up to a maximum of 3

Table 2

hole	1	2	3	4	5	6

Distance, L (cm)	**3**	**6**	**9**	**12**	**15**	**18**
Time, t for 10 oscillations (s)	**14.16**	**10.65**	**9.85**	**9.75**	**10.01**	**10.20**
Periodic time, T (s)	**1.416**	**1.065**	**0.9850**	**0.9750**	**1.001**	**1.020**
T^2 (s^2)	**2.005**	**1.134**	**0.9702**	**0.9506**	**1.002**	**1.040**
T^2L (ms^2)	**0.06015**	**0.06804**	**0.08732**	**0.1141**	**0.1503**	**0.1872**
L^2(m^2)	**0.0009**	**0.0036**	**0.0081**	**0.0144**	**0.0225**	**0.0324**

e) Determine Z, given that: $Z = \frac{A}{B}$, where A, is the average value of T^2L and B is the average value of T^2 (2 marks)

$$B = \frac{2.005+1.134+0.9702+0.9506+1.002+1.040}{6}; = 1.184 s^2 \text{ ignore unit}$$

$$A = \frac{0.06015+0.06804+0.08732+0.1141+0.1503+0.1872}{6} = 0.111185$$

$$= 0.1112 ms^2$$

$$\text{Therefore, } Z = \frac{0.1112}{1.184} = 0.09392m \quad ;$$

Notes:

Award ½ mark for the principle of averaging (1 max) while ignoring units

Award 1 mark for correct evaluation while ignoring units

PART B

You are provided with the following apparatus:

- A thermometer (range: -10^0c- 110^0c)

- A 250 ml beaker
- Measuring cylinder
- Retort stand, clamp and boss
- Stop watch
- Source of boiling water or Bunsen burner
- Some tissue paper

Proceed as follows:

f) Record the temperature reading, T_0 of the thermometer provided

$T_0 = \mathbf{25^0C}$; (1 mark)

g) State the significance of the temperature, T_0 above. (1 mark)

Room temperature ;

h) Now pour 200ml of hot (boiling) water from the source into the beaker and immediately insert the thermometer as shown in figure 1 below. Ensure it is at a temperature above 85^0C.

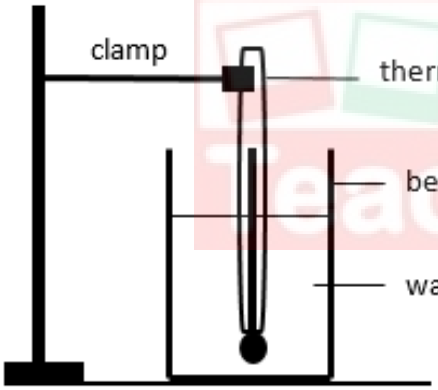


Figure 4

i) Start the stop watch when the temperature falls to 80^0c. Record the temperature of the water as it cools down after every two minutes for about ten minutes. Record your results in the table below:

(5 marks)

Notes:

1 mark for each correct value up to a maximum of 5 marks

Table 3:

Time, t (minutes)	0	2	4	6	8	10
Temperature, T (^{0}C) **Range: $\mp 5^0$C**	**80**	**74**	**69**	**65**	**62**	**59**

j) Given that the specific heat capacity of water is 4J/g^{0}C. determine the heat lost when the water cools from 80^{0}c to the temperature in (a) above. (assume: 1ml = 1g) (3 marks)

$Q = mc\Delta\theta$;

$Q = 0.2 \times 4000 \times (80 - 25)$;

$= 44000J$;

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