THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education
Physics Paper 2
2006

QUESTION ONE

You are provided with the following:

- a glass marble
- a stop watch
- a 105 cm plastic tube split open with a mark near one end
- vernier callipers (to be shared)
- a metre rule or half-metre rule
- a balance (to be shared)
- retort stand, one boss and one clamp.

Proceed as follows:

(a) Use the vernier callipers provided to measure the diameter of the marble and hence determine the radius.

Diameter of the marble   = ...cm

Radius of the marble r = ...cm

(b) (i) Using the balance provided obtain the mass M of the marble.

M = ...g

(ii) Determine the constant P given that $P = 0.4 \, Mr^2$.

The experiment involves timing a marble as it runs down the split tube as a runway.

(c) Clamp the marked end of the split tube with the inside uppermost. Ensure the end with the mark is on the greater slope. Raise this end such that the mark is at a height h = 8 cm above the bench level. The other end should rest on the bench as shown in figure 1.
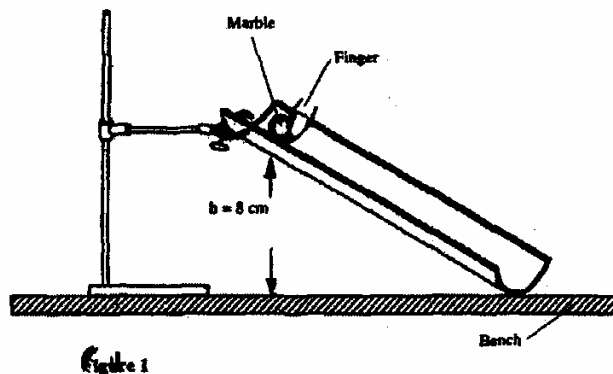
Figure 1

Place the marble at the mark on the runway and hold it in place gently with the finger as shown in the figure 1. By simultaneously releasing the ball and starting the stop watch measure and record in table 1, the time, t, taken by the marble to reach the lower end of the runway. (It is advisable to measure the time twice and record the average value).

Vary the height h, to other values shown in table 1. Measure and record in the table the corresponding average values of t. Complete the table.

Table

height, h (cm)	8	9	10	11	12	13	14	15
Average time, t (s)								
t^2 (s^2)								
$\frac{1}{h}$ (cm^{-1})								

(d) (i) On the grid provided plot the graph of t^2 (y-axis) against $\frac{1}{h}$.

(ii) Determine the slope S of the graph.

(iii) Determine the constant G for the marble given that

$$G = Mr^2\left(\frac{S}{20} - 1\right)$$

QUESTION TWO

You are provided with the following:

- a voltmeter
- two dry cells and a cell holder
- a switch
- a resistor labelled R (4Ω)
- a wire mounted on a mm scale and labelled G
- a micrometer screw gauge (to be shared)
- six connecting wires with six crocodile clips.

Proceed as follows:

(a) Record the length L_0 of the wire labelled G.

$L_0 =$ ....

Use the micrometer screw gauge provided to measure the diameter of the wire labelled G at two different points and determine the average diameter, d.

The diameter $d_1 =$ .... mm, $d_2 =$ .... .mm

Average diameter d = ... mm

Determine the radius r of the wire in metres.

Radius r = ... m

(b)   Set up the apparatus as shown in the circuit diagram in figure 2.

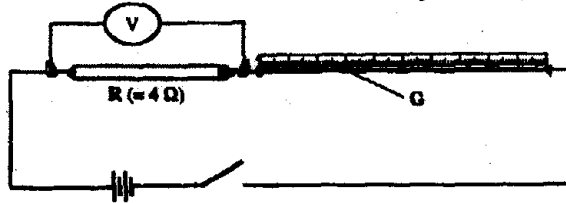**Figure 2**

(i)   Use the voltmeter provided to measure the p.d, V_R across R and the p.d, V_G across G when the switch is closed.

V_R = ... Volts

V_G = ... Volts

Open the switch.

(ii)   Use the value of R provided and the value of V_R in b (i) above to calculate the current I flowing through R when the switch was closed.

I   = ... Amperes

(iii)   Determine the constant H given that

$$H = \frac{100 V_G}{I \times L_o}$$

H = ... Ωm^{-1}

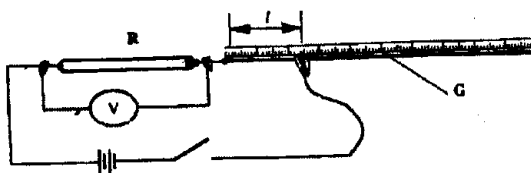(c)   Connect the volmeter across R as shown in figure 3.

Figure 3

Adjust the position of one crocodile clip on the wire G to a point such that the length l of the wire in the circuit is 5 cm. (see figure 3).   Close the switch.

Read and record in table 2, the value of the p.d. across R.   Open the switch.

(d)   Repeat the procedure in (c) above for the other values of l shown in table 2.

Table 2

Distance l (cm)	0	5	10	20	30	40	60	70
p.d. V across R(V)								

(e)   (i)   On the grid provided plot the graph of V (y-axis) against l.

(ii)   From the graph, determine l_1, the value of l when $V = \dfrac{V_o}{2}$ where V_o is the p.d. where $l = 0$.

(f)   Determine the constant D for the wire given that

$$D = \frac{R}{l_1} x \frac{300}{v_o}$$

(g)   Determine the constant ρ given that

$$\rho = \frac{\pi r}{2}(D+H), \text{ where r is the radius of the wire in metres.}$$