232/3
PHYSICS
PRACTICAL
TIME: 2 ½ HRS

Kenya Certificate to Secondary Education

PHYSICS PAPER 3

PRACTICAL

1. You are provided with the following;

- a galvanometer
- a dry cell and a cell holder
- a switch
- a wire labelled Y mounted on a piece of wood.
- light connecting wires each with a crocodile clip at one end.
- a resistance wire labelled AB mounted on a millimeter scale.
- Six 10 ohm carbon resistors
- a jockey or crocodile clip
- micrometer screw gauge to be shared

Proceed as follows:

(a) Set up the circuit as shown in figure 1. Z is one of the 10 ohms carbon resistors.

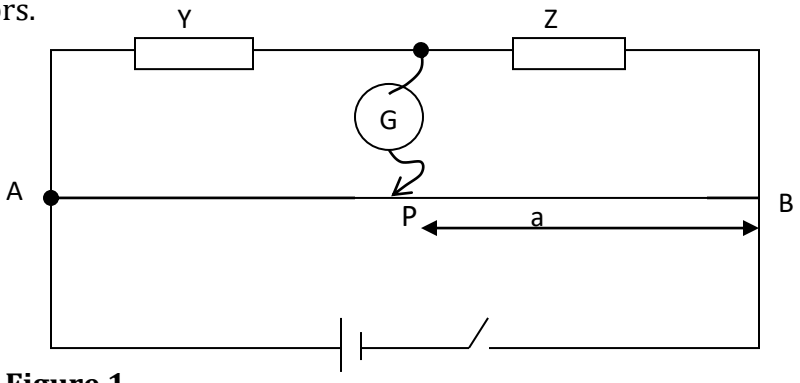


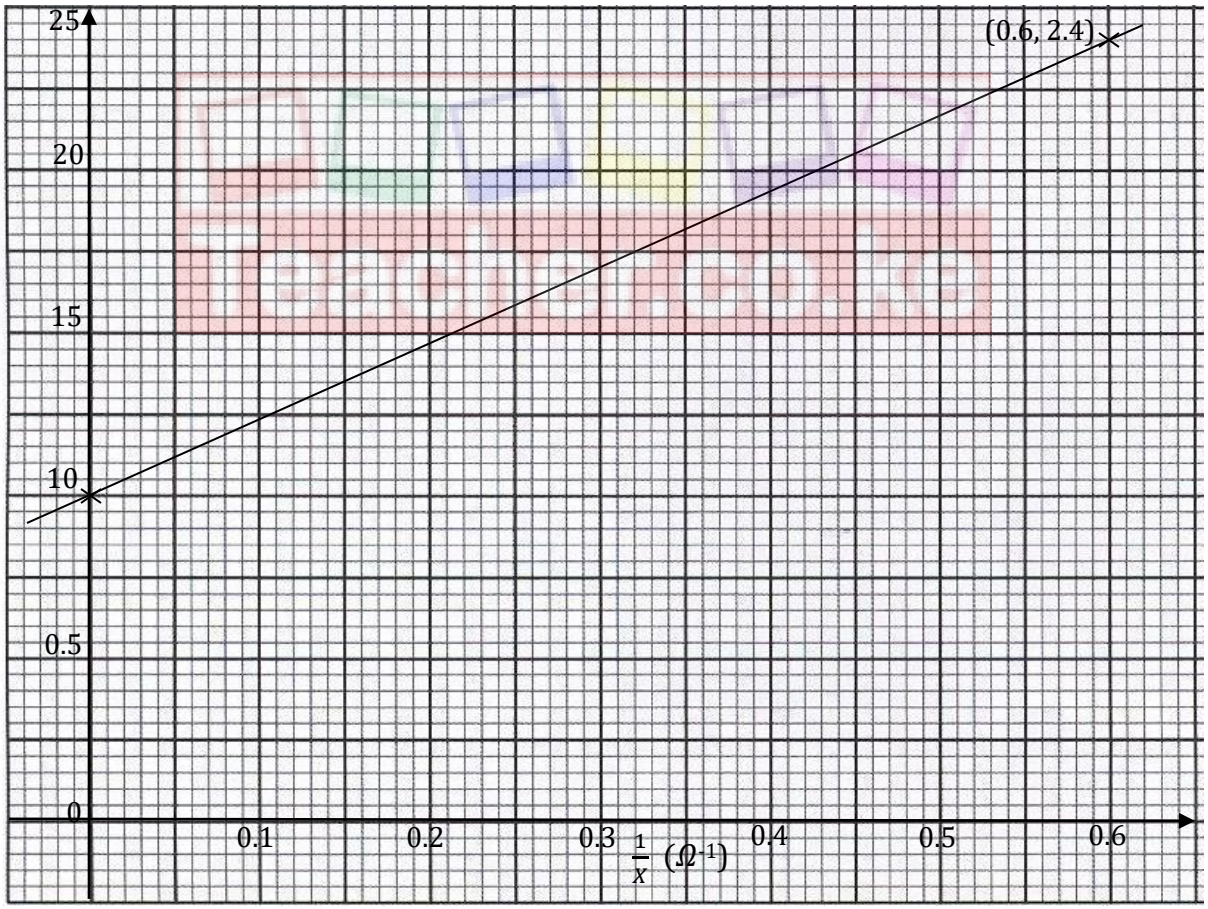
Figure 1

(b) Close the switch. Tap the jockey at various points on the wire AB and locate a point P at which the galvanometer shows zero deflection, measure and record in table 1 the length a, where a = PB.

(c) Repeat the procedure in (b) using two 10Ω resistors in parallel, three resistors in parallel four resistors in parallel, five resistors in parallel and six resistors in parallel. Record your readings in table 1. Complete the table. X is the effective resistance for the parallel combination i.e. $X = \frac{10}{n}$ where n is the number of resistors in parallel. **(6 marks)**

Number of 10Ω Carbon resistor	One	Two	Three	Four	Five	Six
X (Ω)	10.0	5.0	3.33	2.50	2.00	1.67
a (cm)	81.0	71.4	59.0	52.0	45.0	41.7
$\frac{1}{x}$ (Ω^{-1})	0.1	0.2	0.3	0.4	0.5	0.6
$\frac{1}{a}$ (cm^{-1}) $x\ 10^{-2}$	1.23	1.40	1.69	1.92	2.22	2.40

(d) Plot a graph of $\frac{1}{a}$ (y-axis) against $\frac{1}{X}$ **(5 marks)**



(e) Determine the slope m of the graph. **(2 marks)**

$\frac{(1.5-1.0)\ x\ 10^{-2}}{0.2-0}$

$\frac{0.5}{0.2}\ x\ 10^{-2} = 2.5\ x\ 10^{-2}\ \Omega cm^{-1}$

(f) Given that $\frac{1}{a} = \frac{R}{K}.\frac{1}{X} + \frac{1}{K}$ where K = 100cm. Use the graph to determine X. **(2 marks)**

$\frac{x}{K} = m$

$x = 2.5\ x\ 10^{-2}\ x\ 100$

$= 2.5\Omega$

(g) Measure the diameter d and length L of wire Y and hence determine its cross-sectional area A. **(2 marks)**

L = 0.30m

$d = 0.32\ x\ 10^{-3}\ m$

$A = \frac{22}{7}\ x\ (0.16\ x\ 10^{-3})^2\ m^2$

$= 8.0425\ x\ 10^{-8} m^2$

(h) Determine the resistivity of the wire given that its resistance

$R = \rho\frac{L}{A}$ where ρ is the resistivity of wire Y.

L - the length of the wire Y
R – resistance of wire Y
A – cross section area of wire Y **(3 marks)**

$\rho = \frac{RA}{L}$

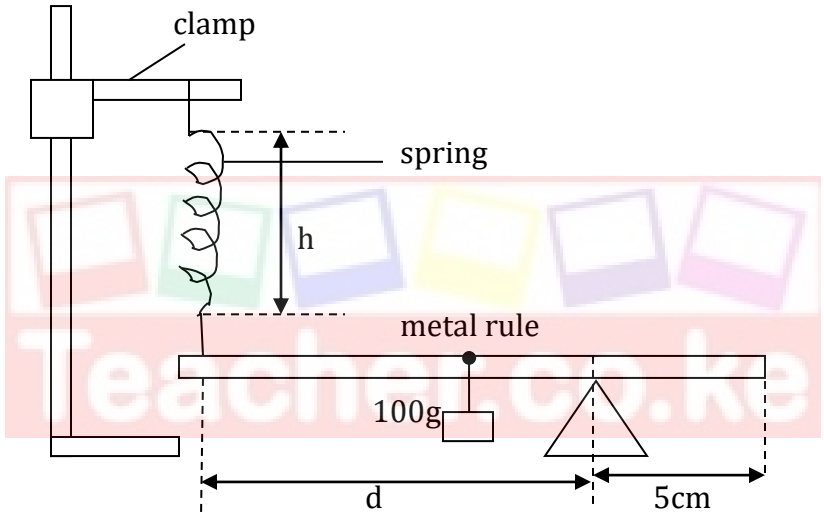
$= \frac{2.5\ x\ 8.0425\ x\ 10^{-8}}{0.3}$

$= 6.70206\ x\ 10^{-7}\Omega m$

2. You are provided with the following:
   - A spiral spring
   - A complete stand
   - A metre rule
   - A 100g mass
   - A wedge
   - A half metre rule.

Proceed as follows:

(a) Set up the apparatus as shown.



(b) Adjust the position of the pivot so that it is approximately 5cm from the free end of the metre rule.

(c) Adjust the clamp so that the metre rule is horizontal and the spring is vertical at 2cm mark.

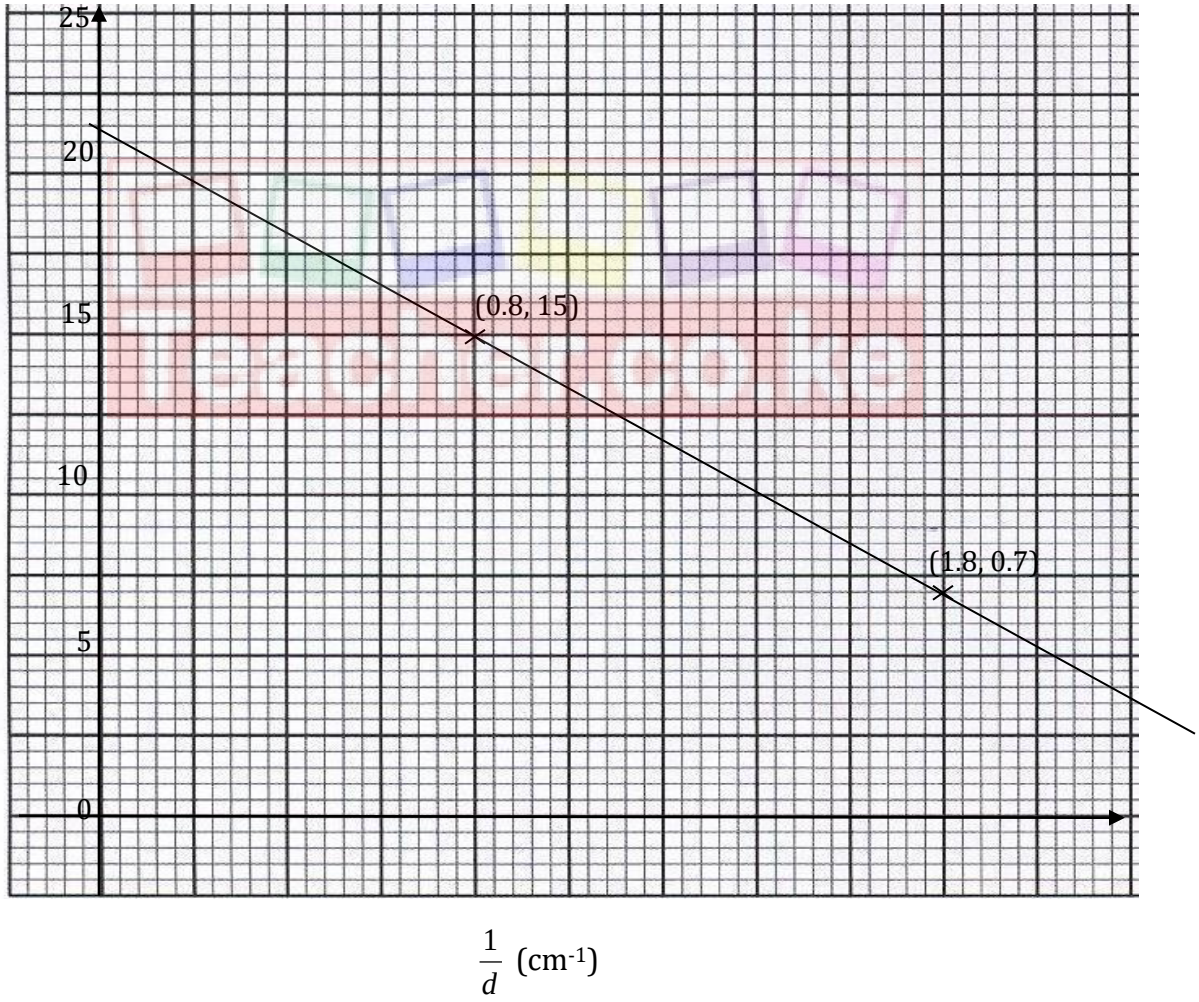
(d) Measure and record the length *h* of the coiled part of the spring and distance *d* from the pivot to the point where the springs is attached to the metre rule.

(e) Repeat (c) and (d) for different positions of the pivot along the metre rule as shown in the table.

Position of pivot from free end	5	15	25	35	45	
Length h (cm)	*13.0*	*11.5*	*10.0*	*8.5*	*6.5*	
d(cm)	*93.0*	*83.0*	*73.0*	*63.0*	*53.0*	
$\frac{1}{d}(cm^{-1})$	*1.075*	*1.205*	*1.370*	*1.587*	*1.887*	

(5 marks)

(f) Plot a graph of h (y-axis) against $\frac{1}{d}$. (5 marks)



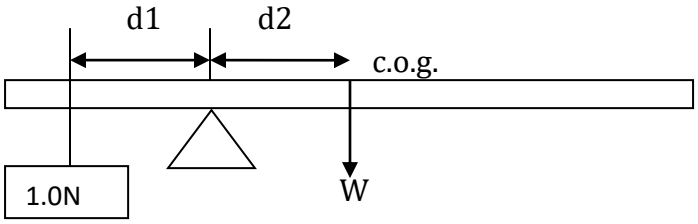
(g) Determine the gradient m and y – intercept c of the line.

m = $\frac{18.5-10}{1.4-0.44}$ = 9.854 (2 marks)

c = 22.4cm (1 mark)

(h) Determine

(i) the weight of the metre rule using the 100g mass. (3 marks)



Use your measurements to determine the weight W of the metre rule.

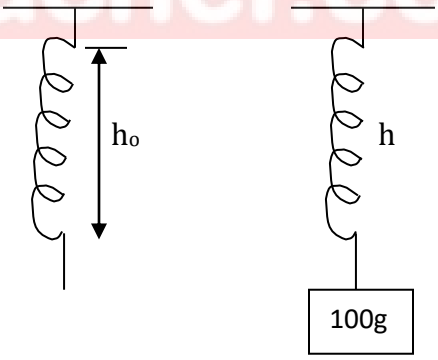
d_1 = 23cm

d_2 = 20cm

23 x 1 = 20W

W = 1.15N

(ii) the spring constant K using the 100g mass.



h_o = *5cm* *(½ mark)*

h = *12.5cm* *(½ mark)*

Hence determine the spring constant K in S.I units. *(1 mark)*

$K = \frac{F}{e} = \frac{F}{h-h_o} = \frac{1}{12.5-5}$ $= 0.1333\frac{N}{cm}$

$= 13.33 Nm^{-1}$

(i) The relationship between *d* and *h* is given by the equation.

$h = \frac{A}{d} + B$ where A and B are constants.

The value of A = $\frac{(W+1)Z}{K}$ where

W = weight of the metre rule

K = spring constant of the spring

Z = is a constant

B = $\frac{W+1}{K} + L_0$ where L_o is a constant.

Use your answer of W and K to determine;

(a) Z (1 mark)

$Z = \frac{885.4 \times 0.1333}{2.15} = 54.89cm$

(b) ho (1 mark)

$\frac{W+1}{K} + L_o = 21.25$

$L_o = 21.25 - \frac{2.15}{0.1333}$

$= 21.25 - 16.13$

$= 5.12cm$