KCSE PREDICTIONS 2020

PHYSICS PAPER 3

Question 1

You are provided with the following:-

- Vernier callipers
- Micrometer screw gauge
- Masses; 10g, 20g, 50g and 100g
- A helical spring
- Metre rule or half metre rule

Proceed as follows

(a) Determine the number of complete turns of the helical spring.
N = _____ (1 Mark)

(b) Measure the external diameter of the spring using the vernier callipers
D = _____ m (1 Mark)

(c) Use the micrometer screw gauge to determine the diameter of the wire of the spring.
d = _____ m (1 Mark)

(d) Determine the value of m (2 Marks)
N = $\frac{0.4D}{dm}$

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(e) Suspend the helical spring vertically alongside the clamped half metre rule as shown in figure 1 below.

Determine the length L_0, of the spring before loading it.

L_0 = _____ cm

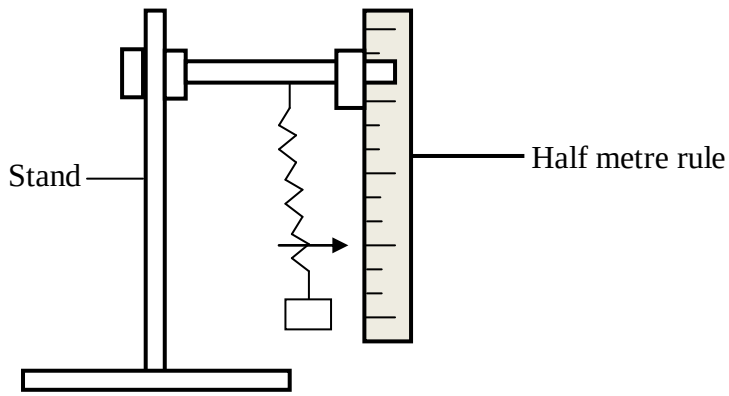

Figure 1

(f) Load the spring with a mass of 20g and determine the new reading on the metre rule. (L) Record this in the table below.
Calculate the extension e = L – L_0 due to the mass of 20g and record the value in the table given below.
Repeat step f for other masses and complete the table.

Mass (g)	0	10	20	30	40	50	60	70	80	90	100
Weight (N)											
Reading (L) (cm)											
Extension e (cm)											

$\frac{1}{e}$ (cm^{-1})											

(6 Marks)

(g) Plot a graph of weight (N) against $\frac{1}{e}$ (cm^{-1}) (4 Marks)

(h) Determine the slope (s) of the graph at a mass of 45g (2 Marks)

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(i) Given that m = $\frac{-255T}{(S+60)^2}$

Determine the value of T where (S) is the slope at 45g (3 Marks)

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2. This question consists of two parts A and B attempt both parts.

PART A

You are provided with the following:

- 5 optical pins
- A glass block
- A plain paper
- A soft board
- 4 thumb pins

Proceed as follows:

(a) Fix the white piece of paper on softboard using the thumb pins provided. Place the glass slab on the white paper and draw the outline of the block on the paper. Remove the block and indicate the sides ABC and D as shown. On side BC determine the centres of side BC using your ruler and fix pin P_0 as shown. Looking from one side at the opposite end of the slab fix pin P_1, P_2 so that they are in with the image I of P_0. On the other side locate the same image using pins P_3 and P_4 as shown in figure 2. Remove the glass block and produce lines P_1, P_2 and P_3, P_4 to their points of intersection which is the position of the image I.

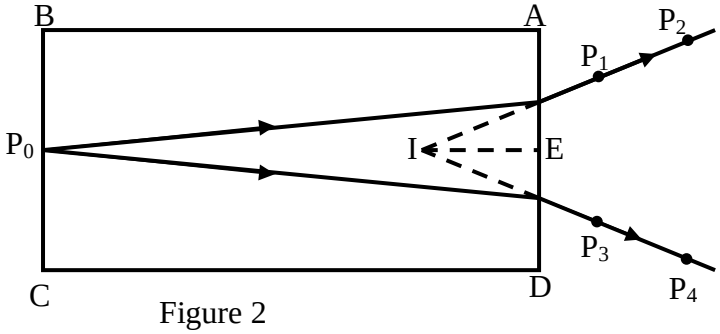

Figure 2

(b) (i) Using the half metre rule measure the lengths

EP0 = _____ cm (1 Mark)

EI = _____ cm (1 Mark)

(ii) Work out the ratio n = $\frac{EP_O}{EI}$ (2 d.p) (1 Mark)

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(iii) What does n represent? (1 Mark)

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Part B

You are provided with the following.

- A plain sheet of paper
- A soft board
- 4 optical pins
- 4 thumb pins
- A triangular prism

Proceed as follows

(c) (i) Firmly fix the plain sheet of paper on the softboard using the thumb pins and place the prism near the centre of the paper. Trace the outline of the prism using a pencil.

(ii) Remove the prism from the outline and label the vertices of the outline PQ and R.

On the side QR mark a point and draw a normal OZ at this point. Measure an angle of 200 from the normal and draw a line along this angle as shown in figure 3.

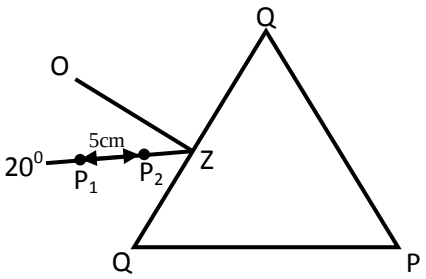


Figure 3

(d) Replace the prism on the outline and fix pins P_1 and P_2 on the 20^0 line at a distance of 3cm from each other.

View the images of the pins P_1 and P_2 through side PR and fix other pins P_3 and P_4 so that all the pins appear on one line. Remove the prism and draw a line to pass through the holes made by pins P_3 and P_4 extend the line into the outline as shown in figure 3. Also extend the 20^0 line so that the two lines cross each other. Determine angle θ and record in the table below.

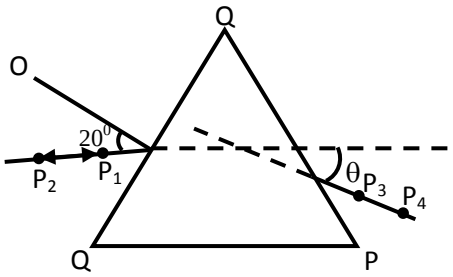
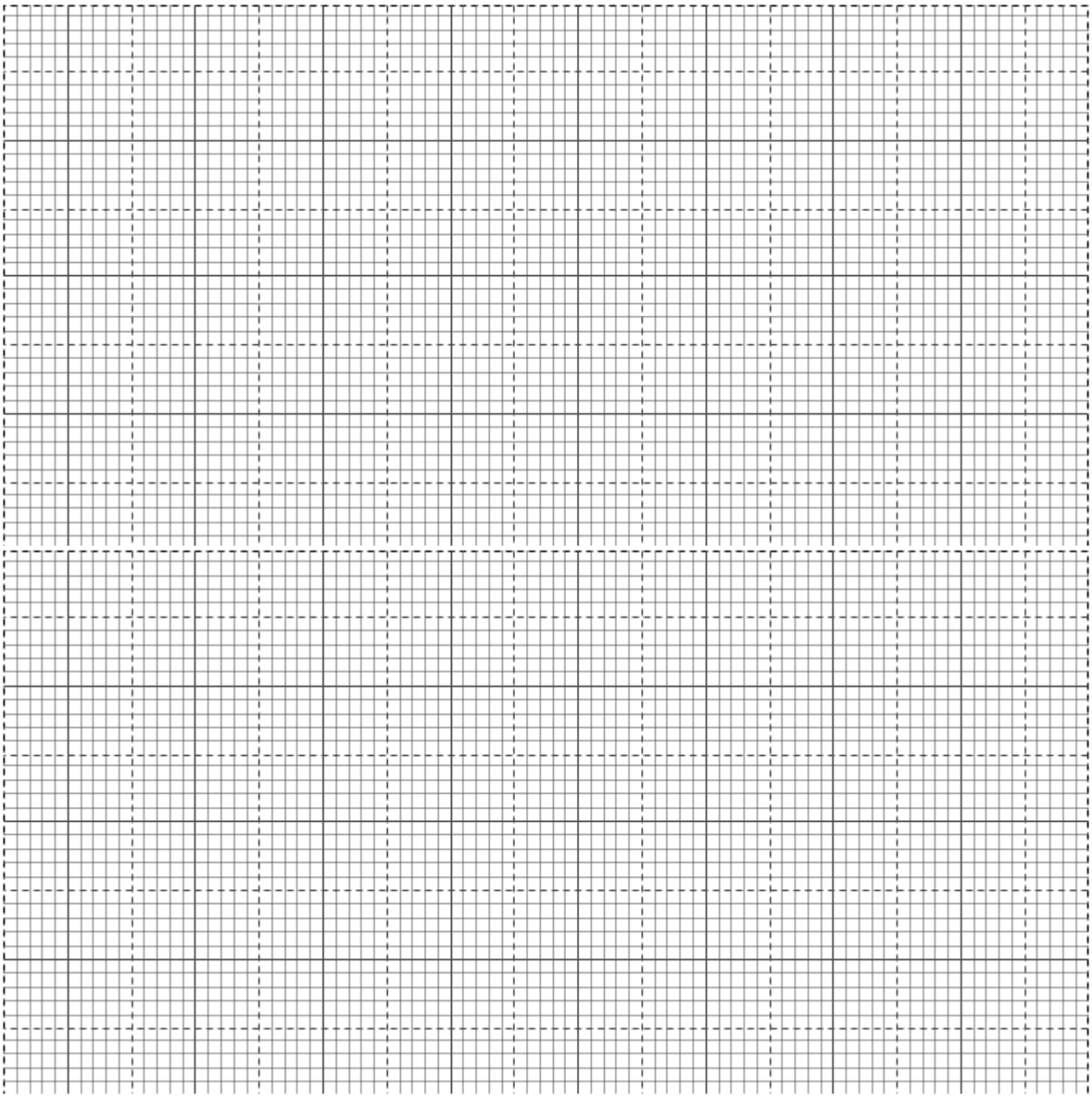


Figure 4

(e) Repeat the procedure and complete the table below.

Angle I ($^{0)}$	20	30	40	50	60	70
Angle θ						

(f) On the grid provided plot a graph of angle θ against angle i (5 Marks)



(g) Use your graph to determine the highest value H_{max} of angle θ H_{max} = (2 Marks)

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(h) Determine the constant R for the glass prism from the formula. (3 Marks)

$R = \frac{Cos\ 40}{Sin^2\ (16+\frac{H_{max}}{3})}$

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