PC5123
WASSCE 2017
PHYSICS 3
Test of Practical Work
2¾ hours

3

Name.....

Index Number.....

THE WEST AFRICAN EXAMINATIONS COUNCIL

West African Senior School Certificate Examination
for Private Candidates

PC 2017 PHYSICS 3 2¾ hours

[50 marks]

TEST OF PRACTICAL WORK

Answer **two** *questions* **only**.

Do **not** *open this booklet until you are told to do so. While you are waiting, read the following instructions. Write your* **name** *and* **index number** *in the spaces provided above.*

You are required to record your measurements as soon as they are read. The measurements, arithmetical calculations and answers to questions should be written in your answer booklet. Scrap paper must **not** *be used. Write your* **name** *and* **index number** *on every graph sheet and attach each one to your answer booklet.*

All questions carry equal marks.

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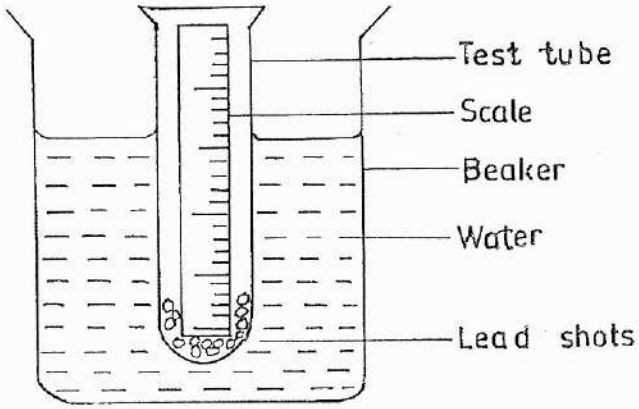
1. (*a*)



A test tube is weighed and its mass m_o = 20 g is recorded. It is then loaded with sufficient lead shots so that it floats vertically in a beaker of water as shown in the diagram above. The depth, *d*, of immersion of the test tube and content is measured and recorded.

The test tube and content are taken out of the water, weighed and the mass m_s read and recorded. The mass m_l of the lead shot is determined and recorded.

The quantity $l = \frac{m_l}{d}$ is then evaluated and recorded.

The test tube and its contents are returned into the water. The test tube is slightly depressed vertically in the water and released so that it performs vertical oscillations. The time *t* for ten (10) complete oscillations is noted and recorded.

The procedure is repeated **four** other times by increasing the mass m_l of the lead shot in the test tube.

Fig. **1**(a) shows the masses m_{si} of the test tube and its contents.

Fig. **1**(b) shows the corresponding depths d_i of immersion.

Fig. **1**(c) shows the coresponding time t_i for ten (10) complete vertical oscillations of the test tube in the water, where i = 1, 2, 3, 4 and 5.

(i) Read and record the masses m_{si} of the loaded test tube and the depth d_i of immersion.

(ii) Read and record the corresponding time t_i for ten (10) complete oscillations.

(iii) Evaluate in **each** case, the mass m_l of the the lead shot and the period *T* of oscillations.
Also evaluate T_i^2 and $l_i = \frac{m_{li}}{d_i}$

(iv) Tabulate your readings.

(v) Determine the mean value Q of l_i

(vi) Plot a graph m_l on the vertical axis and T^2 on the horizontal axis

(vii) Determine the slope, *s*, of the graph and the intercept *c*, on the vertical axis

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(viii) Evaluate $k = \frac{4\pi^2 s}{Q}$. [Taking $\pi = \frac{22}{7}$]

(ix) State **two** precautions that are necessary to ensure accurate results when performing this experiment.

[21 marks]

(*b*) (i) List the forces acting on the loaded test tube as it performs vertical oscillations in the water. [2 marks]

(ii) Explain why the amplitude of oscillation of a loaded test tube decreases with time? [2 marks]

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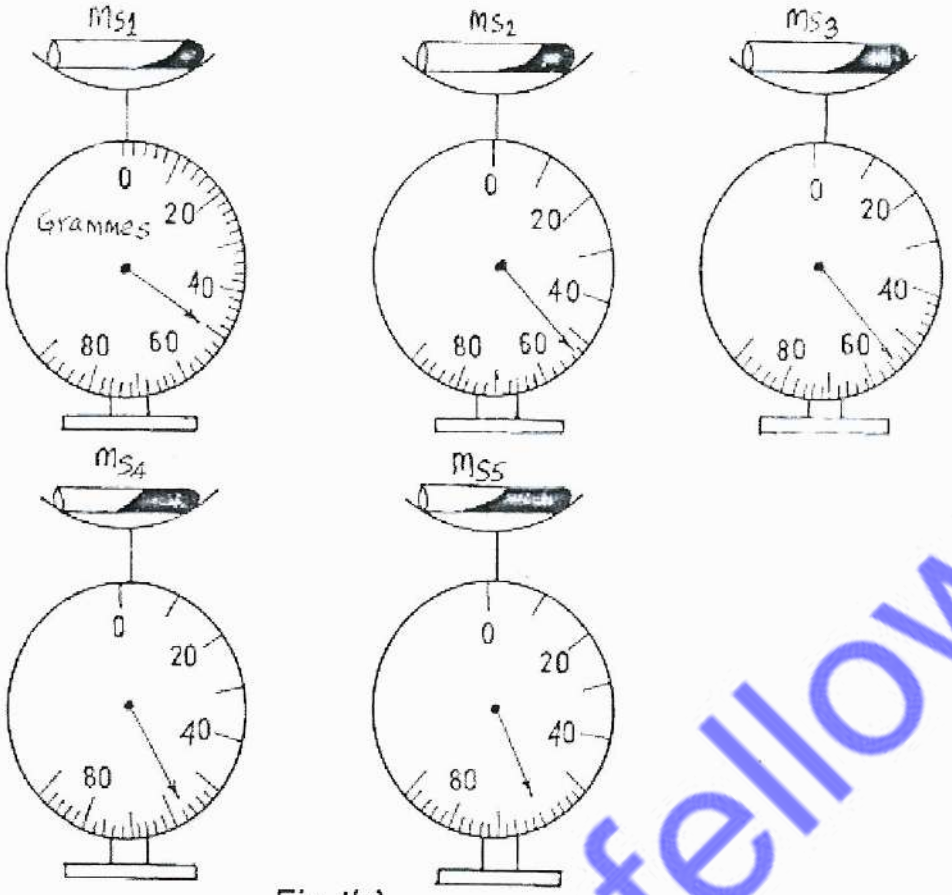

Fig. 1(a)

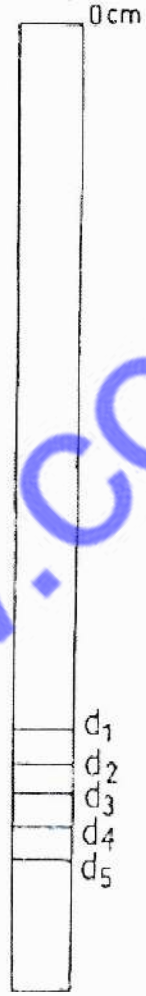

Fig. 1(b)

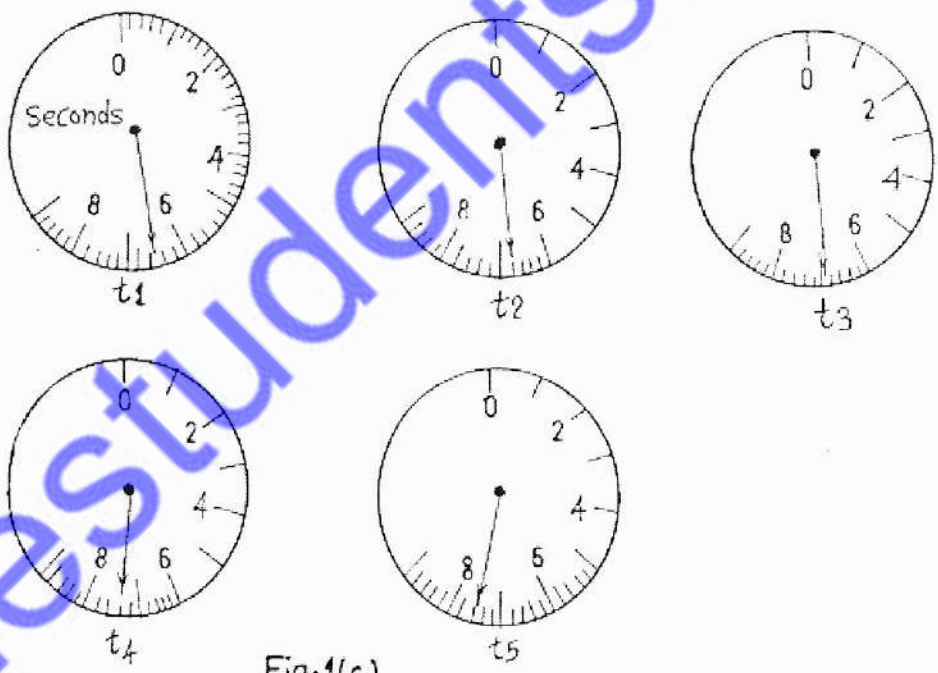

Fig. 1(c)

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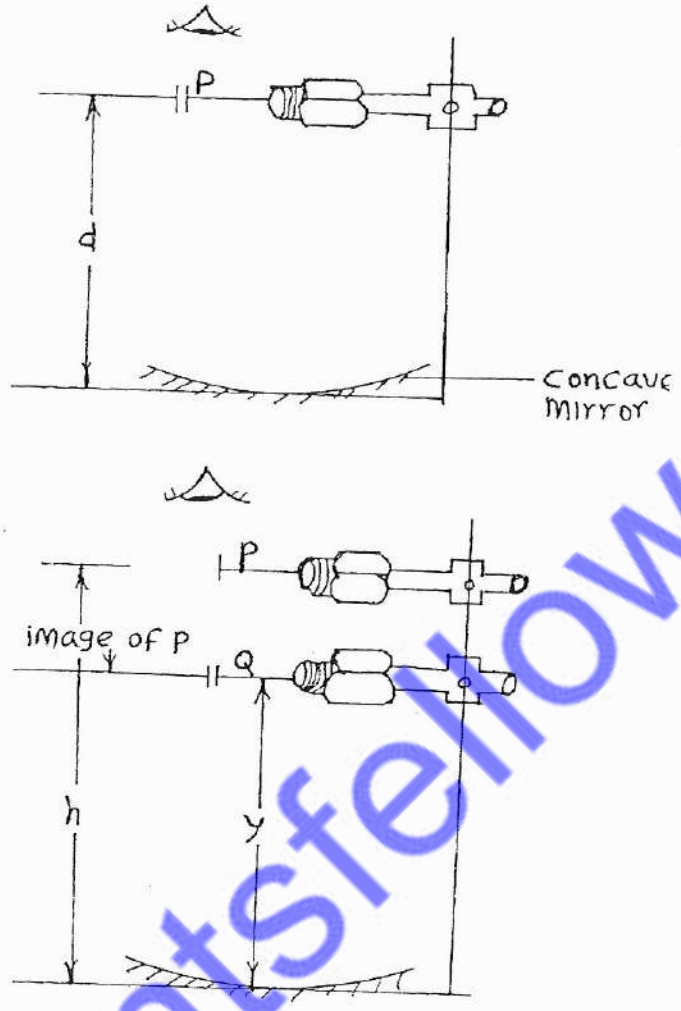
2. (*a*)



A concave mirror is placed on the base of a retort stand and a pin, P, is held horizontally above the mirror as shown in the diagram above. The position of P is varied until its image in the mirror, when viewed vertically downwards, coincides with it. The distance, d, between the image and the base of the retort stand is measured and recorded.

The position of P is adjusted so that it is at a height, h, (> 15 cm) from the base of the retort stand. A second pin, Q, is used to locate the position of the image of P, using the method of no parallax. The distance, y, between the position of Q and the base of the retort stand is measured and recorded.

This procedure is repeated for **four** other positions of P.

Fig. 2(a) shows the position of P when its image formed by the concave mirror coincides with it.
Fig. 2(b) shows the positions of P relative to the base of the retort stand.
Fig. 2(c) shows the corresponding positions of Q above the base of the retort stand

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(i) Measure and record PO = d.

(ii) Measure and record the values of h_i = OP and the corresponding values of y_i = OQ where i = 1, 2, 3, 4 and 5.

(iii) In **each** case evaluate h^{-1} and y^{-1}.

(iv) Tabulate your readings.

(v) Plot a graph h^{-1} on the vertical axis against y^{-1} on the horizontal axis.

(vi) Determine the slope s, of the graph and the intercepts, c_1 and c_2 on the vertical and horizontal axes respectively. Evaluate c_1^{-1} and c_2^{-1}.

(vii) Evaluate:

(α) $k_1 = \frac{1}{2}\left(\frac{c_1^{-1} + c_2^{-1}}{s}\right)$

(β) $k_2 = \frac{d}{k_1}$

(viii) State **two** precautions that are necessary to ensure accurate results when performing this experiment.

[21 marks]

(*b*) (i) Explain with the aid of a well labelled diagram, how a concave mirror can be used to produce an enlarged, upright image of an object. [2 marks]

(ii) A concave mirror of focal length 10 cm forms an image of an object placed 20 cm from its pole. Calculate the magnification produced. [2 marks]

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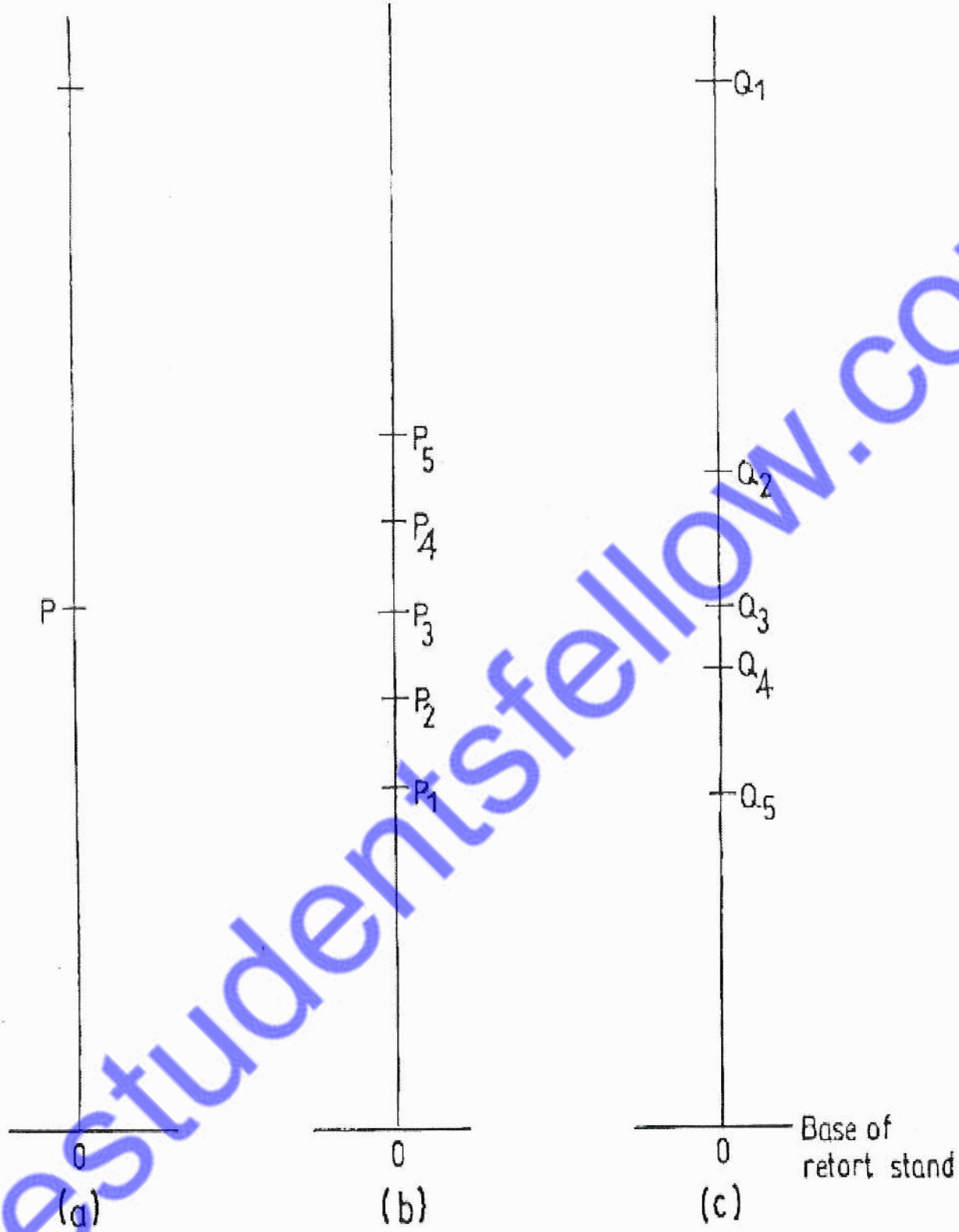

Scale: 1cm ≡5cm

Fig·2

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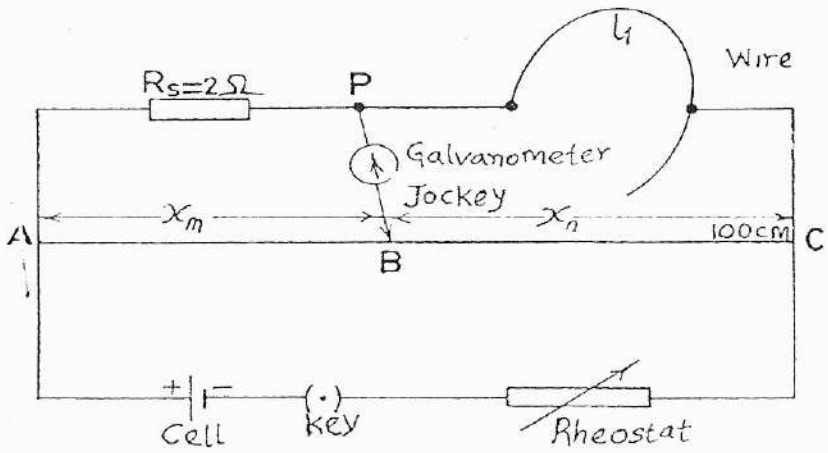
3. (*a*)



A standard resistor of resistance 2 Ω is connected in the left gap of the metre bridge and a length, l_1, of wire $\mathbf{W}_1$ is connected across the right gap of the bridge as shown in the diagram above. The balance point, **B**, is determined by torching the metre wire with the jockey. The balanced lengths $\mathbf{x}_m$ and $\mathbf{x}_n$ are measured and recorded.
The procedure is repeated for **five** other values of length l.
The entire procedure is repeated using a second wire $\mathbf{W}_2$.
The diameters $\mathbf{d}_1$ of $\mathbf{W}_1$ and $\mathbf{d}_2$ of $\mathbf{W}_2$ are measured and recorded.

Fig. (3a) and Fig. (3b) represent sections of a micrometer screw gauge indicating the readings of the diameters $\mathbf{d}_1$ and $\mathbf{d}_2$ respectively.

Fig. (3c) and Fig. (3d) show the positions $\mathbf{B}_i$ of the jockey on the metre wire for $\mathbf{W}_1$ and $\mathbf{W}_2$ respectively, where i = 1, 2, 3, 4, 5 and 6.

(i) Read and record the diameters $\mathbf{d}_1$ and $\mathbf{d}_2$.
(ii) Measure and record $\mathbf{x}_{mi}$ and the corresponding $\mathbf{x}_{ni}$ for $\mathbf{W}_1$.
(iii) Evaluate $\mathbf{R}_1 = \frac{\mathbf{x}_n}{\mathbf{x}_m} \times \mathbf{R}$ in **each** case.
(iv) Measure and record $\mathbf{x}_{mi}$ and the corresponding $\mathbf{x}_{ni}$ for $\mathbf{W}_2$.
(v) Evaluate $\mathbf{R}_2 = \frac{\mathbf{x}_n}{\mathbf{x}_m} \times \mathbf{R}$ in **each** case.
(vi) Tabulate your readings.
(vii) Plot a graph with $\mathbf{R}_2$ on the vertical axis and $\mathbf{R}_1$ on the horizontal axis.
(viii) Determine the slope s, of the graph.
(ix) Evaluate $\mathbf{k} = \frac{\mathbf{d}_2}{\mathbf{d}_1}\sqrt{s}$.
(x) State **two** precautions that are necessary to ensure accurate results when performing this experiment.

[21 marks]

(*b*) (i) Explain why the resistance of a metallic conductor increases with increase in temperature. [2 marks]
(ii) The rating of an electrical heater is 1000 W, 200 V. Calculate its resistance. [2 marks]

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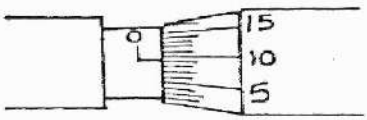


Fig.(3a)

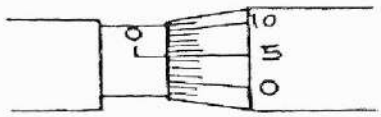
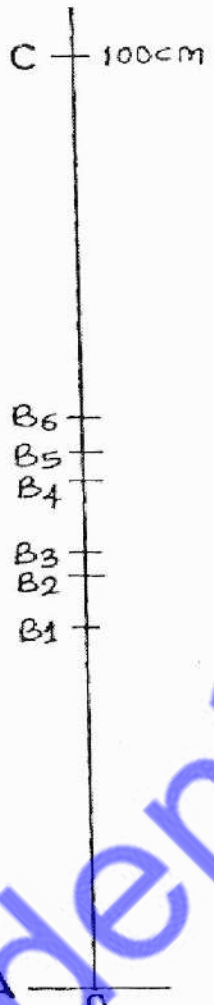


Fig.(3b)



Scale: 1cm represents 5cm

Fig.(3c)

Scale: 1cm represents 5cm

Fig.(3d)

END OF PAPER

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