THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

031/2A

PHYSICS 2A

ACTUAL PRACTICAL A

(For Both School and Private Candidates)

Time: 2:30 Hours  Wednesday, 13th November 2013 a.m.

Instructions

1. This paper consists of two (2) questions. Answer all questions.

2. Each question carries 25 marks.

3. Where calculations are involved show your work clearly.

4. Calculators and cellular phones are not allowed in the examination room.

5. Write your Examination Number on every page of your answer booklet(s).

6. Use acceleration due to gravity, \( g = 10 \text{ms}^{-2} \).

7. Use \( \pi = 3.14 \).
1. You are provided with a metre rule, a knife edge, two strings of length 100cm each and two weights $W_1$ and $W_2$ of masses 50 g and 100g respectively. Proceed as follows:

(a) Balance a metre rule on a knife edge, put a mark and write $G$ at the balancing point using a piece of chalk or a pencil. Measure and record the length $l$, width $w$ and thickness $t$ of a metre rule using a vernier calliper.

(b) Place the metre rule on a knife edge so that the knife edge is at 60cm of your metre rule (see Figure 1 (a)). Suspend weight $W_2$ of 100g on the right hand side of the knife edge. Adjust $W_2$ until the metre rule balances horizontally. Read and record lengths ‘b’ and ‘c’ as seen in Figure 1 (a).

![Figure 1 (a)](image)

(i) Suspend weight $W_1$ of 50g on the left hand side of the knife edge at the position 47cm and adjust weight $W_2$ until the metre rule balances horizontally as seen in Figure 1 (b). Read and record the lengths ‘a’ and ‘b’.

![Figure 1 (b)](image)

(ii) Repeat the procedures in (b) (i) by adjusting the position of $W_1$ to the left at the interval of 3cm to obtain other four (4) readings.

(c) Tabulate your results as shown in Table 1.

<table>
<thead>
<tr>
<th>Table 1</th>
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<tbody>
<tr>
<td>a (cm)</td>
<td>b (cm)</td>
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(d) Plot a graph of “b” against “a”.
(e) What is the nature of the graph?
(f) Calculate the slope $S$ of the graph.

(g) (i) Read the b-intercept, given that $b = S + \frac{W_1}{W_2} \times c$
(ii) What does \( \frac{W}{W_2} \) represent in your graph?

(iii) Calculate the value of \( W \) using the relation \( W_2 = \frac{Wc}{9.5cm} \). What does \( W \) represent?

(h) (i) Find the value of the ratio \( P = \frac{l \times w \times t}{m} \).

Note: The mass \( m \) of a meter rule can be obtained by calculations.

(ii) What is the physical meaning of the value of \( P \)?

(i) State a possible source of error in this experiment.

(j) How can you minimize error in 1 (i).

(k) State the aim of this experiment.

(25 marks)

2. You are provided with a Plane mirror, a Ruler, Protract, Drawing board, Optical pins, Office pins and Plain papers. Proceed as follows:

(a) On the plain paper provided, draw a line 13cm from the top of the paper and call it \( M_1M_2 \). Pin your paper on the board provided and place the reflecting surface of the mirror along the line \( M_1M_2 \) as seen in Figure 2.

![Figure 2](image)

(b) Insert pin \( O \) as an object at 4.0cm in front of the mirror. Place pins \( P_1 \) and \( P_2 \) so as to appear in one straight line with the image of object \( O \) seen in the plane mirror.

(c) Remove pins \( P_1 \) and \( P_2 \), using other pins, place pins \( P_3 \) and \( P_4 \) so as to appear in a straight line with the image of object \( O \) in the other side (see Figure 2).

(d) Remove the mirror and pins. Draw lines joining \( P_1 \) and \( P_2 \) on one side and the other joining \( P_3 \) and \( P_4 \) on the other side of object \( O \), extend both lines to meet at \( I \) on the other side of line \( M_1M_2 \).

(e) Join \( OI \), a line cutting the reflecting surface at \( N \).

(f) Repeat this procedure for the distance of an object being 6, 8, 10 and 12cm.
(g) On all the diagrams drawn:

(i) Measure the distance ON and NI.
(ii) Comment on the distances obtained in 2 (g) (i).
(iii) What is the nature of image? Give reasons for your answer.
(iv) State four characteristics of the image you obtained.
(v) What is the aim of this experiment?
(vi) Mention and state the law governing the experiment.
(vii) Explain a source of error in this experiment.
(viii) How can you minimize the error in (vii) above?

Note: The papers used for drawing should be attached and collected together with answer booklets. (25 marks)