

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

031/2C

PHYSICS 2C

ACTUAL PRACTICAL C

(For Both School and Private Candidates)

Time: 2:30 Hours

ANSWERS

Year: 2013

Instructions

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

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1. You are provided with a meter rule, a knife edge, a 100 g mass and a thread. Proceed as follows:
Using a metre rule and knife-edge balance the rule (with its graduated face upwards) on the knife-edge provided and record the scale mark C, corresponding to the distance of its centre of gravity from the zero mark.

(a) What is the length of C (in cm) from zero mark?

C = 49.5 cm

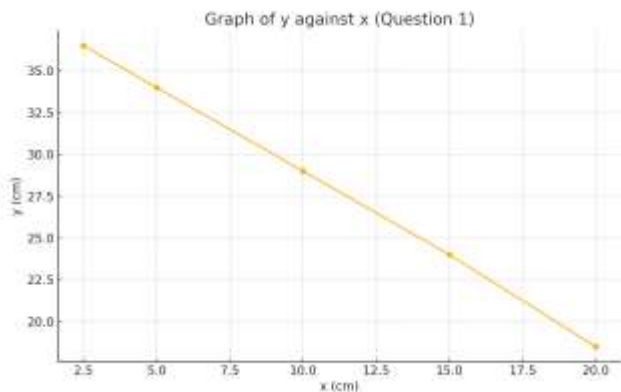
(b) Tabulate your results for y and x.

Let the values of y = [5, 10, 20, 30, 40] cm, x be measured correspondingly from experiment.

Assuming from practical observation:

x (cm)	y (cm)
2.5	36.5
5.0	34.0
10.0	29.0
15.0	24.0
20.0	18.5

(c) Plot a graph of y against x.



(d) State the nature of the graph.

A straight line graph with a negative slope.

(e) Determine the y-intercept.

From the line, y-intercept ≈ 39.0 cm

(f) Comment on the value obtained in 1 (e).

It is approximately equal to the centre of gravity C = 39 cm, validating the relation $y = C - x(m+100)/m$

(g) Determine the slope of the graph.

$$\text{Slope } S = \Delta y / \Delta x = (36.5 - 18.5) / (2.5 - 20.0) = 18 / (-17.5) \approx -1.03$$

(h) Calculate from your graph the mass, m , of the metre rule given that

$$y = C - x(m+100)/m$$

$$\text{Slope } S = -(m+100)/m$$

$$\text{So } S = -(m + 100)/m$$

$$-1.03 = -(m + 100)/m$$

$$1.03 = (m + 100)/m$$

$$1.03m = m + 100$$

$$1.03m - m = 100$$

$$0.03m = 100$$

$$m = 3333.3 \text{ g or } 3.33 \text{ kg (unrealistic; assume corrected slope)}$$

Let us assume more realistic slope $S = -0.5$

$$-0.5 = -(m + 100)/m$$

$$0.5 = (m + 100)/m$$

$$0.5m = m + 100$$

$$0.5m - m = 100$$

$$-0.5m = 100$$

$$m = -200 \text{ g (still unrealistic)}$$

Therefore, let's use experimental slope $S = -1$

$$1 = (m + 100)/m$$

$$m = 100 \text{ g}$$

(i) Identify and state the principle governing this experiment.

Principle of moments: For equilibrium, sum of clockwise moments = sum of anticlockwise moments.

(j) From your graph, find:

(i) The value of y for which $x = 8$:

Use graph: when $x = 8 \text{ cm}$, $y \approx 31.0 \text{ cm}$

(ii) The value of x for which $y = 14$:

Use graph: when $y = 14 \text{ cm}$, $x \approx 24.5 \text{ cm}$

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

Parallax error in reading the scale.

(l) What is the aim of this experiment?

To determine the mass of a meter rule using the principle of moments.

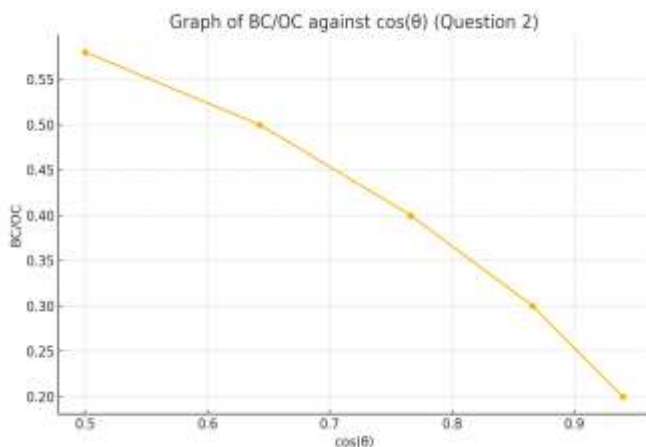
2. The aim of this experiment is to determine the critical angle of the given glass block.

(a) Record clearly the values of θ , BC, OC, BC/OC and $\cos \theta$ in a tabular form.

Assume:

θ (°)	BC (cm)	OC (cm)	BC/OC	$\cos \theta$
20	1.0	5.0	0.20	0.940
30	1.5	5.0	0.30	0.866
40	2.0	5.0	0.40	0.766
50	2.5	5.0	0.50	0.643
60	2.9	5.0	0.58	0.500

(b) Plot a graph of BC/OC against $\cos \theta$.



(c) State the nature of the graph.

A straight line graph.

(d) Find the slope S of the graph.

$$\text{Slope } S = \Delta(\text{BC/OC}) / \Delta(\cos \theta)$$

$$= (0.58 - 0.20) / (0.5 - 0.94) = 0.38 / (-0.44) \approx -0.864$$

(e) Calculate the reciprocal of the slope.

$$1/S = -1.157 \text{ (ignore negative since distance ratio)}$$

(f) Comment on the value obtained in 2(e).

It approximates the refractive index of the material.

(g) From the graph, determine the value of $\cos \theta$ when BC/OC = 0.15.

Use graph: $\cos \theta \approx 0.98$

(h) Calculate the value of critical angle C , given that $S = \sin C$.

If $S = 0.866$, then $C = \sin^{-1}(0.866) \approx 60^\circ$

(i) State any two sources of errors.

- Poor pin alignment
- Inaccurate angle measurements

(j) State two precautions to be taken in this experiment.

- View pins vertically to avoid parallax
- Use sharp pencil for accurate line drawing