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 **ANSWERS** **Year: 2011**

Instructions

1. This paper consists of two questions.

2. Answer all questions.

1. The aim of this experiment is to determine the mass of a given dry cell size “AA”.

1 (a) Locate and note the centre of gravity C of the metre rule by balancing it on the knife edge.
Balance the metre rule on a knife edge until it rests horizontally. The point at which it balances is the centre of gravity, denoted as point C. Mark and record this position.

1 (b) Suspend the 50g mass at length ‘a’ cm on one side of the metre rule and the 20g mass together with the dry cell at length ‘b’ cm on the other side of the metre rule. Fix the 50g mass at length 30cm from the fulcrum and adjust the position of 20g mass together with the dry cell until the meter rule balances horizontally. Read and record the values of a and b as a_0 and b_0 respectively.
Using a = 30 cm, and total mass on the other side as 20 g + 23 g = 43 g:
$50 \times 30 = 43 \times b$
$b = 1500 / 43 = 34.88$ cm
Thus, $a_0 = 30$ cm, $b_0 = 34.88$ cm

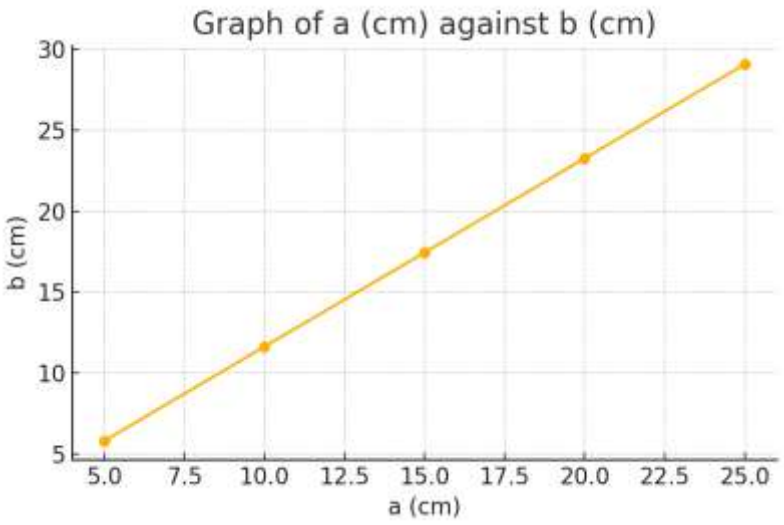
1 (c) Draw the diagram for this experiment.
A horizontal metre rule is shown resting on a knife edge at its centre of gravity C. On the left side, a 50 g mass is suspended 30 cm from the fulcrum. On the right side, a 20 g mass and a dry cell (total 43 g) are suspended at b cm such that the rule balances. Each side is clearly labeled with distances a and b, masses, and the fulcrum.

1 (d) By fixing a = 5cm from fulcrum C, find its corresponding length b.
$50 \times 5 = 43 \times b$
$b = 250 / 43 = 5.81$ cm

1 (e) Repeat the procedure in (d) above for a = 10cm, 15cm, 20cm and 25cm. Tabulate your results.

a (cm)	b (cm)
5	5.81
10	11.63
15	17.44
20	23.26
25	29.07

1 (f) Draw a graph of ‘a’ against ‘b’ and calculate its slope G.



Slope G = (29.07 - 5.81) / (25 - 5) = 23.26 / 20 = 1.163

1 (g) Calculate X from the equation $50 = (b_o / a_o)(20 + X)$.
$a_o = 30$ cm, $b_o = 34.88$ cm
$b_o / a_o = 34.88 / 30 = 1.163$
$50 = 1.163(20 + X)$
$20 + X = 50 / 1.163 = 42.98$
$X = 42.98 - 20 = 22.98$ g

1 (h) Comment on the value of b_o / a_o.
The value $b_o / a_o = 1.163$ shows the ratio of the balancing distances. Since the mass on the side of the dry cell is less than the 50 g mass, its distance from the fulcrum must be greater. This ratio allows for equilibrium based on the principle of moments.

1 (i) State the principle governing this experiment.
The principle of moments: For a body in equilibrium, the sum of clockwise moments about the fulcrum is equal to the sum of anticlockwise moments.

2. You are provided with an ammeter, A, resistance box, R, dry cell, D, a key, K and connecting wires.

2 (a) Connect the circuit in series.
Connect the dry cell in series with the resistance box, the ammeter, and the key using connecting wires to form a complete loop.

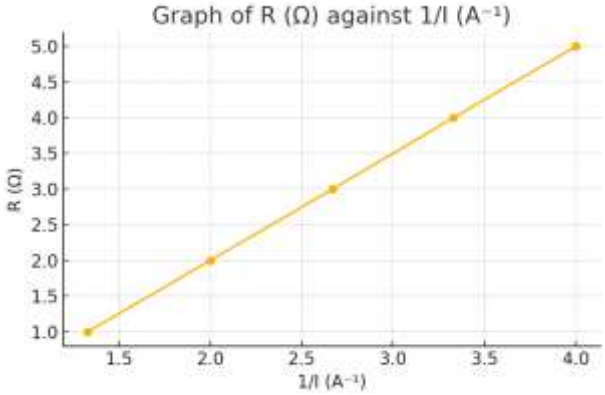
2 (b) Put R = 1Ω and quickly read the value of current I on the ammeter.
Use E = 1.5 V and internal resistance r = 1 Ω
Total resistance = R + r = 1 + 1 = 2 Ω
I = E / (R + r) = 1.5 / 2 = 0.75 A

2 (c) Repeat procedure (b) above for R = 2Ω, 3Ω, 4Ω and 5Ω. Record your results in a tabular form.

R (Ω)	I (A)	1/I (A^{-1})
1	0.75	1.33
2	0.50	2.00
3	0.375	2.67
4	0.30	3.33
5	0.25	4.00

2 (d) Draw the circuit diagram for this experiment.
The diagram consists of a dry cell D connected in series with a key K, resistance box R, and ammeter A forming a complete loop. All components are connected in one continuous wire.

2 (e) Plot the graph of R against 1/I.



Determine the slope of the graph.
Use two points: (1.33, 1) and (4.00, 5)
Slope = (5 - 1) / (4.00 - 1.33) = 4 / 2.67 = 1.498

2 (g) If the graph obeys the equation R = E/I - r, then
(i) Suggest how E and r may be evaluated from your graph.
E is the slope of the graph
r is the negative of the y-intercept

(ii) Compute E.
E = slope = 1.5 V

(iii) Compute r.
Using equation R = E(1/I) - r
Let's use point (2.00, 2):
2 = 1.5(2.00) - r
2 = 3.00 - r
r = 3.00 - 2 = 1.00 Ω

2 (h) State one source of error and suggest one way of minimizing it.
Source of error: Heating of resistor or internal resistance drift may alter current reading.
Minimization: Take readings quickly after closing the key to avoid voltage drop due to cell heating.

2 (i) Suggest the aim of this experiment.
To determine the electromotive force (E) and internal resistance (r) of a dry cell using the relation between resistance and the reciprocal of current.