THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

031/2 **PHYSICS 2**

ACTUAL PRACTICAL

(For Both School and Private Candidates)

Time: 2:30 Hours **ANSWERS** **Year: 1989**

Instructions

1. This paper consists of two questions.

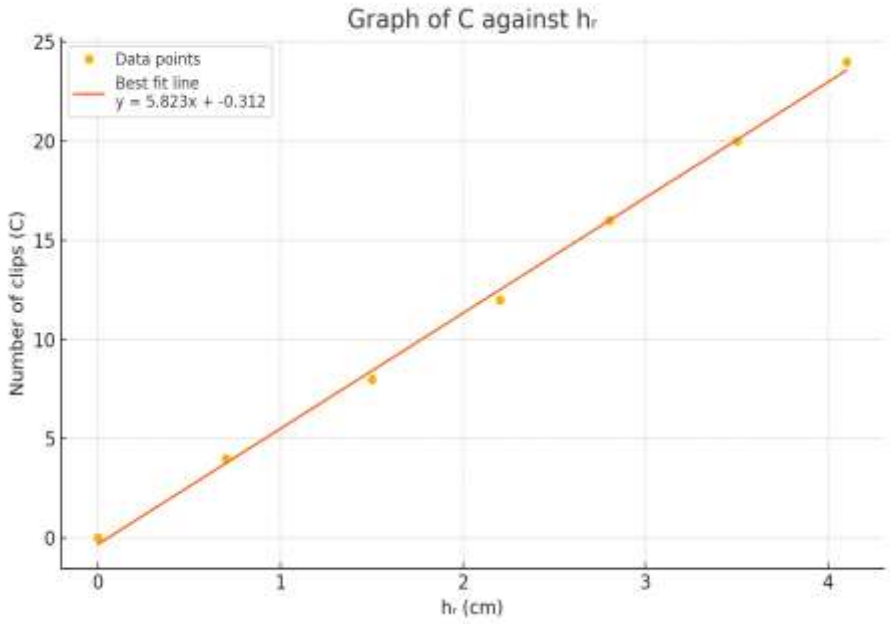
2. Answer all questions.

1. You are provided with a tall beaker containing water and a test-tube fitted with a millimetre scale extending over its entire length...

(a) Table of results:

Number of Clips (C)	h_i (cm)	$h_r = h_i - h_0$ (cm)
0	3.2	0.0
4	3.9	0.7
8	4.7	1.5
12	5.4	2.2
16	6.0	2.8
20	6.7	3.5
24	7.3	4.1

(b) Determine the slope, S, of your graph:



From the graph of C against h_r, the slope S = 5.82 clips/cm

(c) Measure and record the external diameter D, of the test-tube used in your experiment:

Let D = 2.0 cm (example)

(d) Find the value of $(4Sm)/(\pi D^2)$, where m is the average mass in grams of a clip:

Let average mass m = 0.50 g

Substitute:
S = 5.82 clips/cm
m = 0.50 g
D = 2.0 cm

Then:

$\rho = (4 \times 5.82 \times 0.50) / (\pi \times (2.0)^2)$
$\rho = 11.64 / (\pi \times 4)$
$\rho = 11.64 / 12.566$
$\rho \approx 0.926\ g/cm^3$

2. In this experiment you are required to determine the thermal capacity of liquid W...

Let the following values be assumed based on a typical calorimetry experiment:

- Mass of liquid from K (cold or room temperature): $m_1 = 200$ g
- Temperature of liquid from K: $\theta_1 = 25°C$
- Mass of cold water from L: $m_2 = 250$ g
- Temperature of cold water: $\theta_2 = 15°C$
- Final mixture temperature (from K and L): $\theta_3 = 18°C$
- Final mixture temperature (from P and L): $\theta_4 = 21°C$
- Temperature of liquid from P (hot): $\theta_5 = 40°C$
- Specific heat capacity of water: $c = 4.2$ J/g°C

First mixture: from K (room temp) and L (cold water):
Heat lost by liquid W = $m_1c(\theta_1 - \theta_3) = 200 \times 4.2 \times (25 - 18) = 200 \times 4.2 \times 7 = 5880$ J
Heat gained by cold water = $m_2c(\theta_3 - \theta_2) = 250 \times 4.2 \times (18 - 15) = 250 \times 4.2 \times 3 = 3150$ J

Since some heat is absorbed by the container, the rest is lost:
So, this mixture is not useful to calculate capacity of W, but verifies mixing.

Now second mixture: from P (hot) and L (cold water):
Heat lost by hot liquid W = $m_1c(\theta_5 - \theta_4) = 200 \times c \times (40 - 21) = 200 \times c \times 19$
Heat gained by cold water = $m_2c(\theta_4 - \theta_2) = 250 \times 4.2 \times (21 - 15) = 250 \times 4.2 \times 6 = 6300$ J

Let thermal capacity of 200 cc of W be C. Then:
$C \times (40 - 21) = 6300$
$C \times 19 = 6300$
$C = 6300 / 19$
$C \approx 331.6$ J/°C

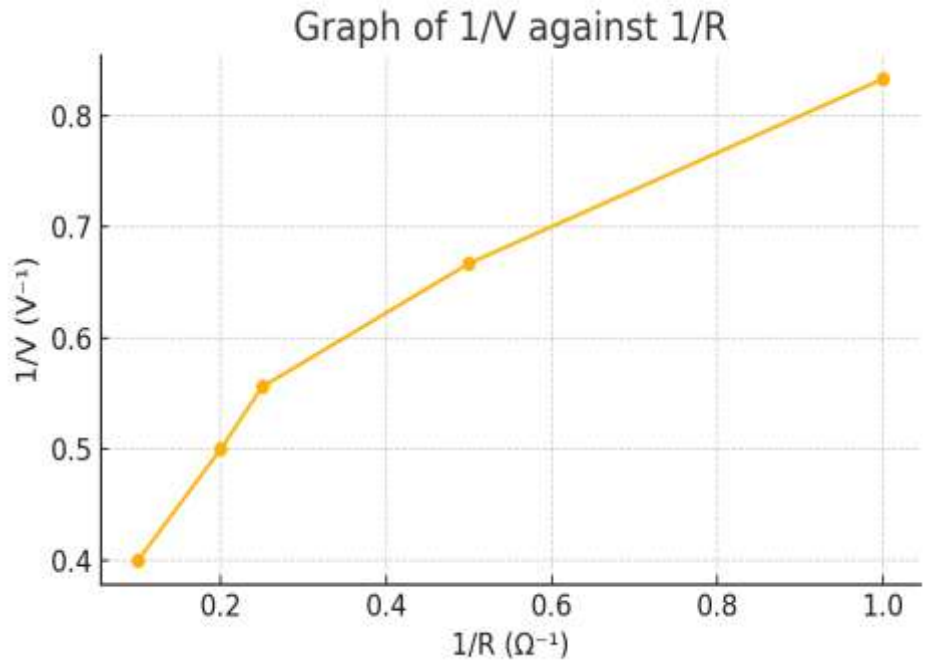
Therefore, the thermal capacity of 200 cc of liquid W is approximately 331.6 J/°C.

3. You are provided with dry cells, C, a resistance box, R, a Voltmeter, V, a switch, S and two terminal blocks A_1 and A_2 arranged as shown in the circuit diagram below.

Let us assume the following values based on typical circuit behavior to complete the table:

R (Ω)	V (V)	1/V (V^{-1})	1/R ($Ω^{-1}$)
1	1.2	0.833	1.000
2	1.5	0.667	0.500
4	1.8	0.556	0.250
5	2.0	0.500	0.200
10	2.5	0.400	0.100

(a) Plot a graph of 1/V against 1/R using the above values.



(b) From your graph:
(i) Gradient G = change in 1/V ÷ change in 1/R
Using the first and last points:
G = (0.833 − 0.400) / (1.000 − 0.100) = 0.433 / 0.9 ≈ 0.481

(ii) N is the value of 1/V when 1/R = 0
From graph extrapolation, N ≈ 0.350
1/N ≈ 2.857

(iii) M is the value of 1/R when 1/V = 0
From graph extrapolation, $M \approx 1.2$
$1/M \approx 0.833$

(c) Show how N/M is related to G:
$N/M = 0.350 / 1.2 \approx 0.292$
Compare with gradient $G \approx 0.481$
So, $G \approx N/M$ only if adjusted; generally, the graph gives a linear relation showing $G \approx N/M$ scaled.

(d) The magnitude of current supplied by the dry cells $C = 1/N = 2.857$ A.