QUESTION 1.

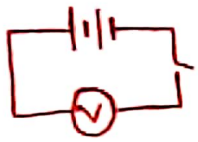
You are provided with the following apparatus

- Two dry cells
- Nichrome wire mounted on the meter rule
- An ammeter
- Cell holder
- Voltmeter
- 8 connecting wires
- Switch
- A jockey

Proceed as follows.

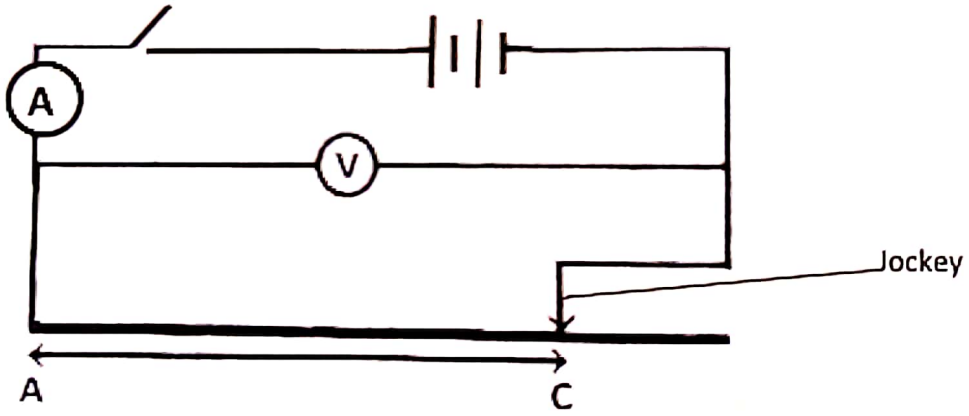
a. Determine the electromotive force of the dry cells.
E = 3.0 V ± 0.1 ✓1 (1 mark)

b. Draw a diagram to show how the electromotive force of the dry cells is measured. (1 mark)



✓1

c. Connect the circuit as shown below



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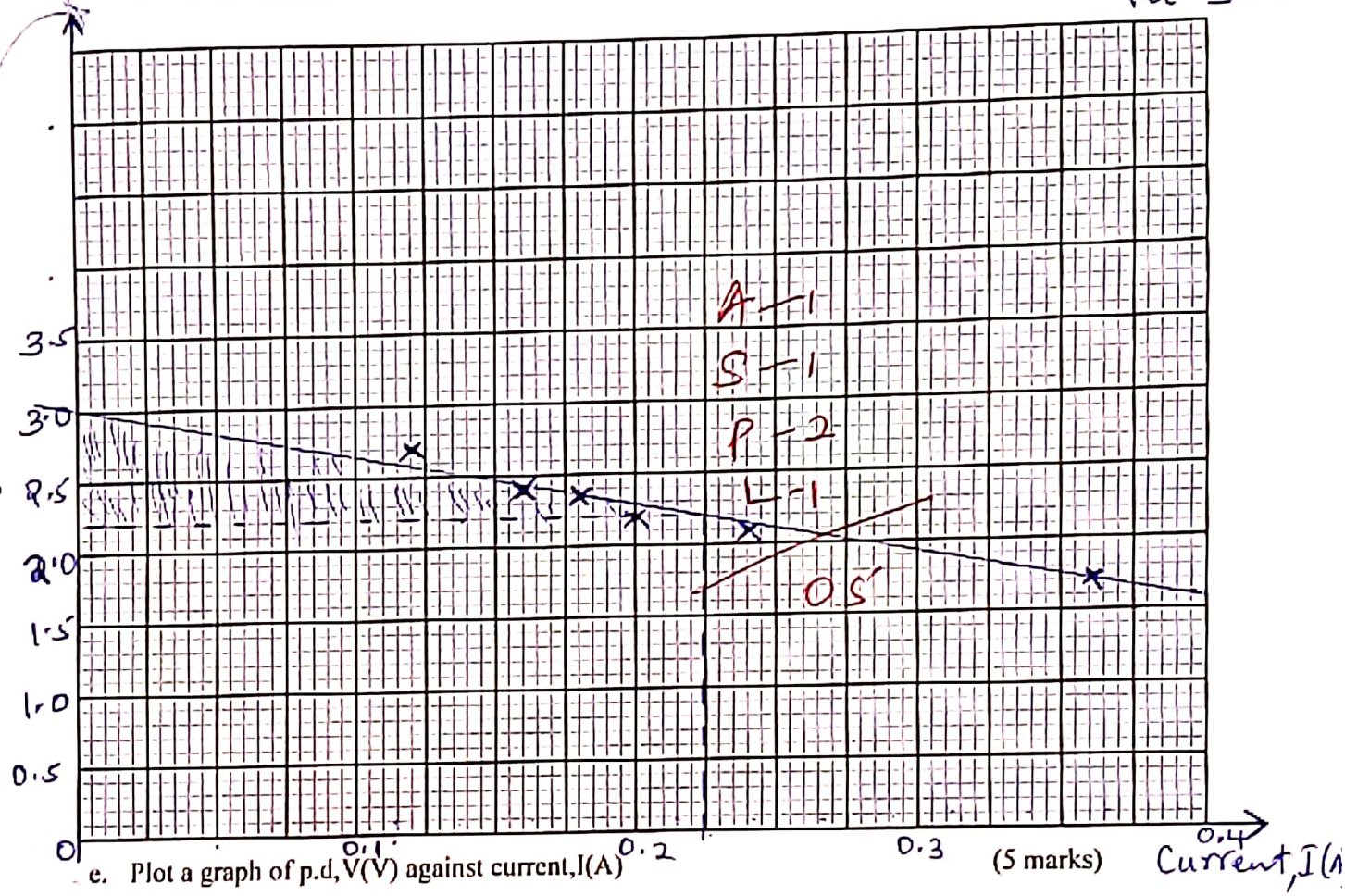
c. Connect the ends of A and C where AC is 100 cm across the terminals as shown above. Close the switch and record both ammeter reading and the voltmeter reading.

Current I = 0.12 A ± 0.05 ✓1 (1 mark)
P.d (V) = 2.60 V ± 0.10 ✓1 (1 mark)

d. Proceed for the lengths shown in the table and record the corresponding values of current,I and voltage,V (6marks)

Length L(cm)	100	70	60	50	40	20
I(A)	0.12	0.16	0.18	0.20	0.24	0.36
P.d(V)	2.60	2.45	2.40	2.20	2.10	1.75

½ x 12 – 6 marks
± 0.05
p.d ± 0.1



e. Plot a graph of p.d,V(V) against current,I(A) (5 marks)

f. Determine the slope of the graph. (3 marks)

Slope = $\frac{\Delta V(v)}{\Delta I(A)}$ ✓ Slope = $-\frac{0.8}{0.225}$

$= \frac{3.0 - 2.2}{0 - 0.225}$ ✓ 1 $= -3.5556$ Ohms ✓ 1

9 x 5 = 45
45 x 0.005
0.225

g. Given that $E = V + Ir$, determine the following using the graph above.

i) Internal resistance r (1mk)

$V = -ri + E$ | $M = -r$ but gradient $= -3.5556$

$y = mx + c$ | $\therefore r = 3.5556\ \Omega$

ii) The e.m.f E of the dry cells (1mk)

e.m.f, $E = 3.0\ V$ ✓1 - Accept students -1- intercept value. - Confirm from the graph.

Question 2

PART A

You are provided with the following:

- A metre rule
- A knife edge
- One 50g mass and a 100 g mass
- Two pieces of threads each 30 cm long
- Some water in a beaker
- Liquid L in a beaker
- Tissue paper

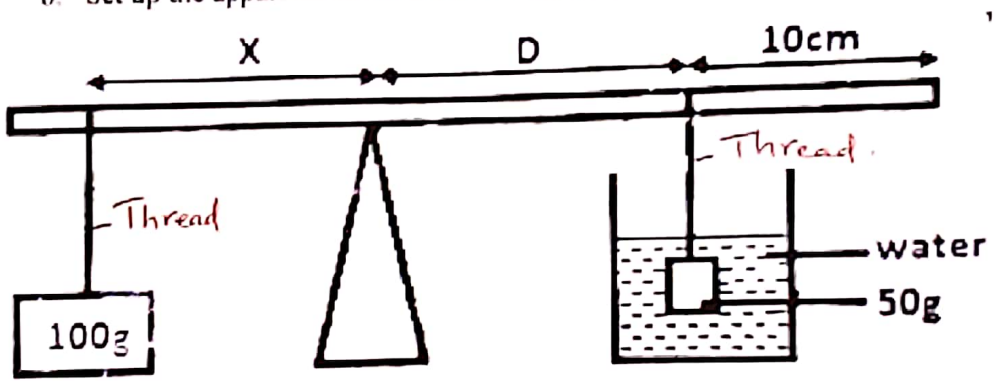
Proceed as follows

a. Balance the metre rule on the knife edge and record the reading at this point

Balance point =.....50.0 ± 0.5.....cm mark (1 mark)

For the rest of this experiment the knife edge must be maintained at this position.

b. Set up the apparatus as shown in the figure below



The balance is obtained by adjusting the position of 100g mass when 50 g mass is fully immersed in water. Record the values of X and D.

X=.....17.5 ± 0.5 cm.....(1 mark)

D=.....39.8 ± 0.5 cm.....(1 mark)

c. Using the principle of moments;

i. determine the weight W_1 of the 50g mass in water (2 marks)

$F_1 d_1 = F_2 d_2$ ✓1

$W_1 \times \frac{39.8}{100} = 0.1 \times \frac{17.5}{100}$

$W_1 = \frac{0.0175}{0.398}$

$W_1 = 0.04396\,N$ ✓1

ii. determine the Upthrust U_W in water (1 mark)

$U_W = W_A - W_1$

$= 0.5 - 0.04396$

$= 0.456N$ ✓1

d. Remove the 50 g mass from the water and dry it using a tissue paper.

Keeping D constant, adjust the position of 100g mass until the metre rule is balanced and record the value of distance X.

X = 17.0 ± 0.5 cm ✓1 (1 mark)

i. Determine the weight W_2 of the 50g mass in liquid L. (2 marks)

$F_1 d_1 = F_2 d_2$ ✓1

$W_2 \times \frac{39.8}{100} = 0.1 \times \frac{17.0}{100}$

$W_2 = 0.04271N$ ✓1

ii. Determine the Uphtrust U_L in the liquid. (1 mark)

$U_L = W_A - W_L = 0.5 - 0.04271$

$= 0.45729N$ ✓1

e. Determine the relative density R.D of the liquid L, given that

$R.D = \frac{U_L}{U_W}$ (2marks)

$R.D = \frac{0.45729}{0.456}$ ✓1 $= 1.002829$ ✓1

f. Find the density of liquid L in S.I unit (2marks)

PART B

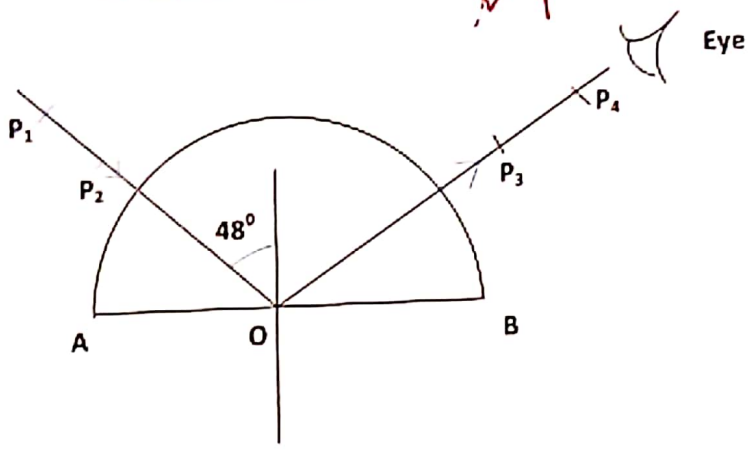
You are provided with the following:

- A semi-circular glass block
- Soft board
- White paper
- Four Optical pins
- Two Thumb pins
- Vernier calipers

Procedure

a) Measure the thickness of the glass block using the Vernier calipers provided (1mk)

t = 1.50 cm 0.015 m ✓1



b) Fix the plain paper to the soft board using drawing/thumb pins

c) Place the semi-circular glass block on the paper and trace its outline. Remove the block and label A and B as shown in figure above.

d) Identify the centre O of the plane and draw the normal at that point as shown in the figure above.

e) Measure incident angle *i* as 48^0 then draw the incident ray

d) Place two pins P_1 and P_2 on the incident ray as shown.

e) Move your eyes at curved face and locate the images of pins P_1 and P_2, place pins P_3 and P_4 such that the four pins are aligned in a straight line.

f) Remove the glass block and join points P_3 and P_4 to meet the interface AB.

g) Measure the angle Y between incident ray and the reflected ray.

Y= 96° ± 2° ✓1 Confirm the angle between the drawing measured from ✓1 (2 marks)

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.....

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(3marks)

i. Find the value of M given that

$$M = \left(\frac{tY}{2}\right)^{-1}$$

$M = \left(\frac{0.015 \times 96}{2}\right)^{-1} = 1.388 \simeq 1.4$

(1mark)

ii. Hand in the white paper used

Check the Plain Paper ✓1 to confirm What the student has drawn.