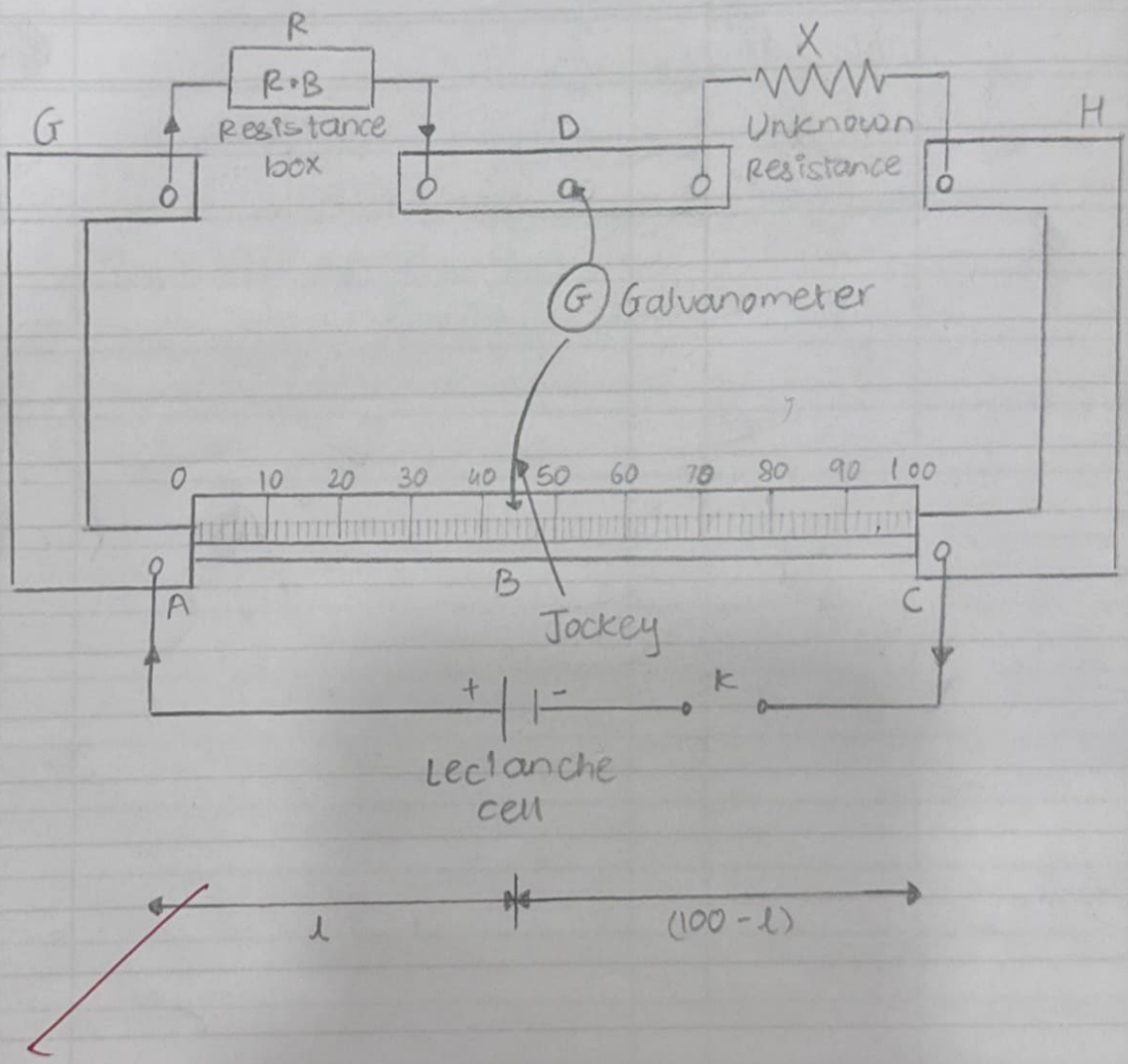
Diagram:


R
R.B
Resistance box
X
Unknown Resistance
G
D
H
G Galvanometer
0 10 20 30 40 50 60 70 80 90 100
A
B
C
Jockey
+
-
K
Leclanche cell

l
(100 - l)

OBSERVATIONS:

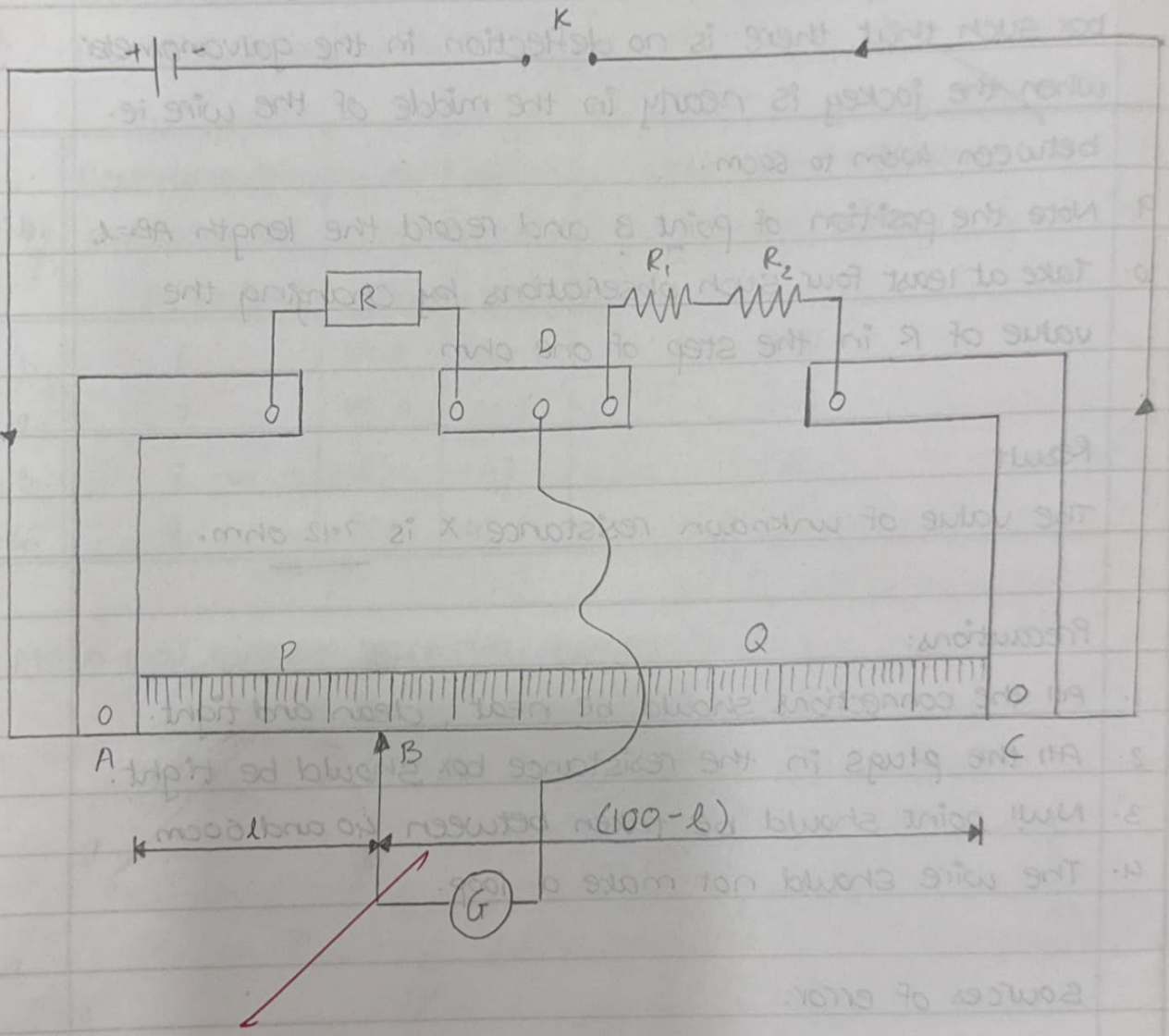
1. Length of the wire $l = \underline{1.2m}$

S. No.	Resistance from resistance box R (ohm)	Length AB = l (cm)	Length BC = 100 - l (cm)	Unknown Resistance $X = \left(\frac{100-l}{l}\right) R$ (ohm)
1.	6	44.5	55.5	7.26
2.	7	49.4	50.6	7.17
3.	8	53	47	7.09
4.	9	56.4	43.6	6.95

Mean Resistance = $\frac{7.26 + 7.17 + 7.09 + 6.95}{4}$

$= 7.12\ \Omega$

Diagram:



OBSERVATIONS:

Resistance coil	S. No	Resistance from Resistance box R (ohm)	Length AB = ℓ (cm)	Length BC = (100-ℓ) (cm)	Resistance $r = \left(\frac{100-\ell}{\ell}\right)R$ (ohm)	Mean Resistance (ohm)
R_1	1.	5	46.2	53.8	$R_1 = 5.82$	$R_1 = 5.54$
	2.	6	52.4	47.6	$R_1 = 5.45$	
	3.	7	56.6	43.4	$R_1 = 5.36$	
R_2	1.	5	49	51	$R_2 = 5.20$	$R_2 = 5.12$
	2.	6	54.4	45.6	$R_2 = 5.02$	
	3.	7	57.7	42.3	$R_2 = 5.13$	
R_1 and R_2 in series	1.	8	45.2	42.3	$R_S = 9.69$	$R_S = 9.47$
	2.	9	48.5	51.5	$R_S = 9.55$	
	3.	10	50.8	49.2	$R_S = 9.68$	

Calculations:

1. $R_1 = \left(\frac{100-\ell}{\ell}\right)R = \left(\frac{53.8}{46.2}\right)5$

$= 5.82\,\Omega$

2. $R_1 = \left(\frac{100-\ell}{\ell}\right)R = \left(\frac{47.6}{52.4}\right)6$

$= 5.45\,\Omega$

3. $R_1 = \left(\frac{100-\ell}{\ell}\right)R = \left(\frac{43.4}{56.6}\right)7$

$= 5.36\,\Omega$

Mean $R_1 = \frac{5.82+5.45+5.36}{3}$

$= 5.54\,\Omega$

1. $R_2 = \left(\frac{100-\ell}{\ell}\right)R = \left(\frac{51}{49}\right)5$

$= 5.20\,\Omega$

2. $R_2 = \left(\frac{100-\ell}{\ell}\right)R = \left(\frac{45.6}{54.4}\right)6$

$= 5.02\,\Omega$

3. $R_2 = \left(\frac{100-\ell}{\ell}\right)R = \left(\frac{42.3}{57.7}\right)7$

$= 5.13\,\Omega$

Mean $R_2 = \frac{5.20+5.02+5.13}{3}$

$= 5.12\,\Omega$

1. $R_S = \left(\frac{100-\ell}{\ell}\right)R = \left(\frac{42.3}{45.2}\right)8$

$= 9.69\,\Omega$

2. $R_S = \left(\frac{100-\ell}{\ell}\right)R = \left(\frac{51.5}{48.5}\right)9$

$= 9.55\,\Omega$

3. $R_S = \left(\frac{100-\ell}{\ell}\right)R = \left(\frac{49.2}{50.8}\right)10$

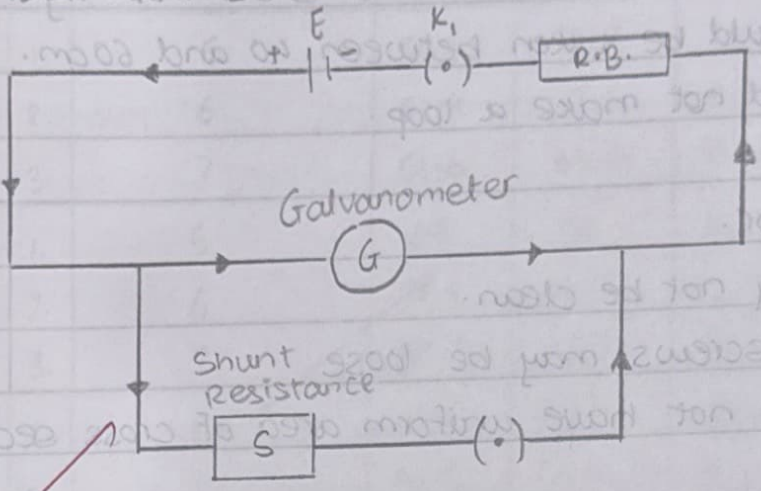
$= 9.68\,\Omega$

Mean $R_S = \frac{9.69+9.55+9.68}{3}$

$= 9.47\,\Omega$

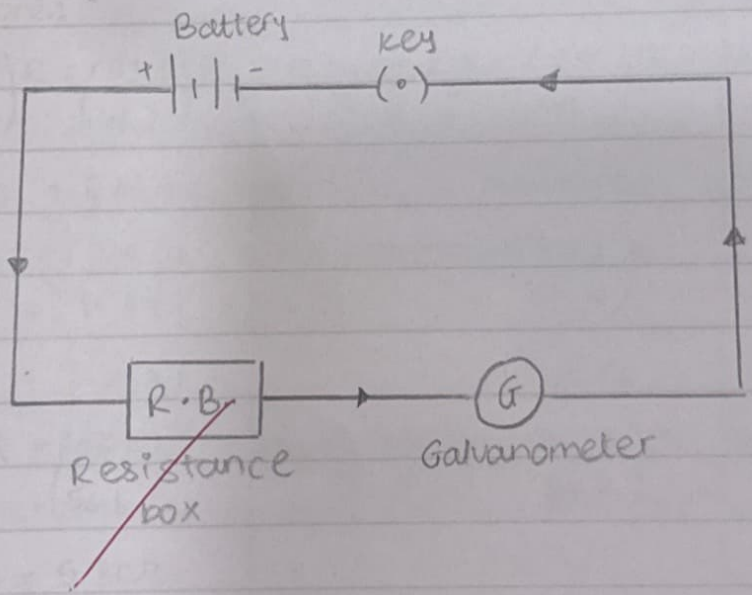
CIRCUIT DIAGRAMS:

A]



Determination of Resistance of galvanometer by half deflection method

B]



Determination of figure of merit of the galvanometer

OBSERVATIONS:

1) Resistance of galvanometer by half-deflection method:

S. No	Resistance R(ohm)	Deflection in galvanometer (θ) (divisions)	Shunt Resistance S(ohm)	Half deflection θ/2 (divisions)	Galvanometer Resistance $G = \frac{R \cdot S}{R - S}$ (ohm)
1.	7000	18	100	9	101
2.	8000	16	100	8	101
3.	9000	14	100	7	
4.	10000	12	100	6	

2) Table for figure of merit

S. No.	e.m.f. of the cell (E)	Resistance from resistance box (R)	Deflection in Galvanometer (θ)	Figure of Merit
1.		5000	12	3.26×10^{-5}
2.		6000	18	3.64×10^{-5}
3.		8000	22	3.36×10^{-5}
4.		10000	23	3.44×10^{-5}

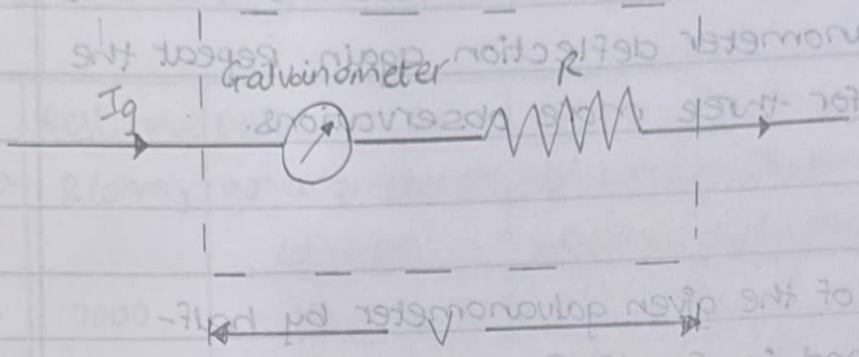
Calculations:

1. Calculate resistance of galvanometer G by using formula:

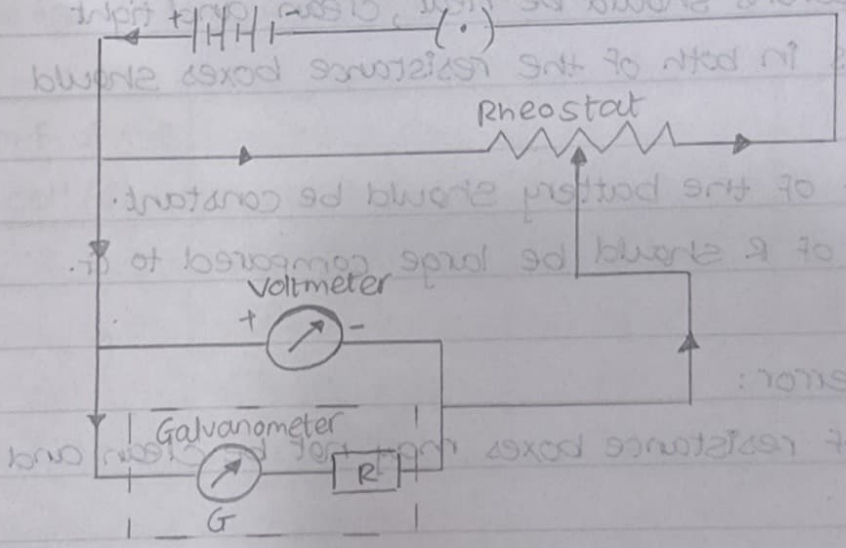
$$G = \frac{R \cdot S}{R - S}$$

2. Calculate figure of merit by formula

$$\frac{E}{(R+G)\theta}$$



Conversion of Galvanometer into voltmeter



Converted Galvanometer

Verification of converted Galvanometer by comparing it with standard voltmeter

OBSERVATION TABLE

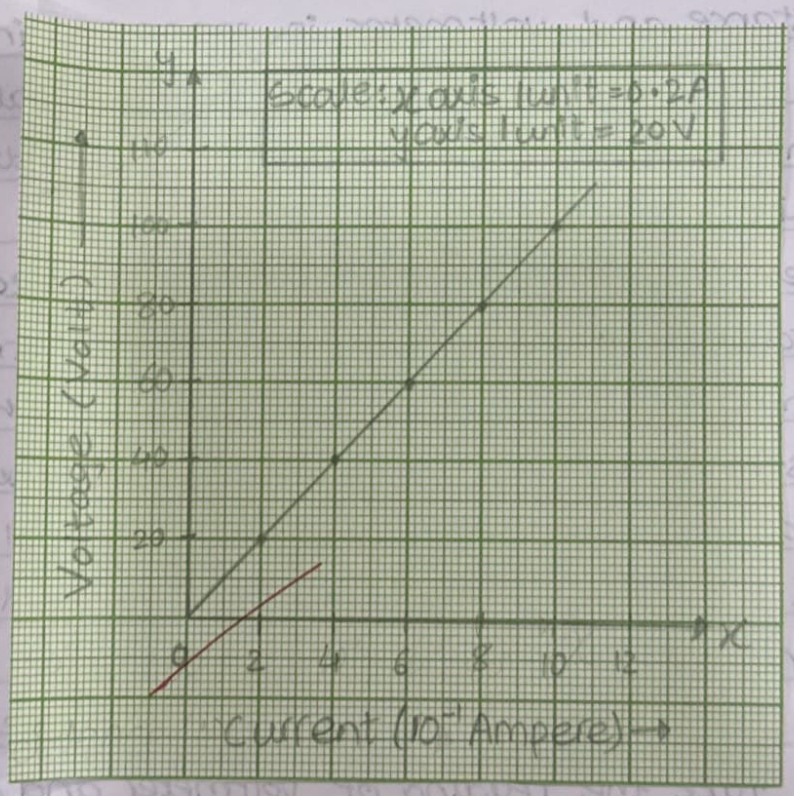
S. No.	Reading of converted voltmeter		Standard voltmeter reading V_2 (volt)	Error $V_2 - V_1$ (volt)
	Deflection θ (division)	Potential Difference $V_1 = \theta \times L.C.$ (volt)		
1.				
2.	4			
3.	5			
4.	6	1.8	2	

CALCULATIONS:

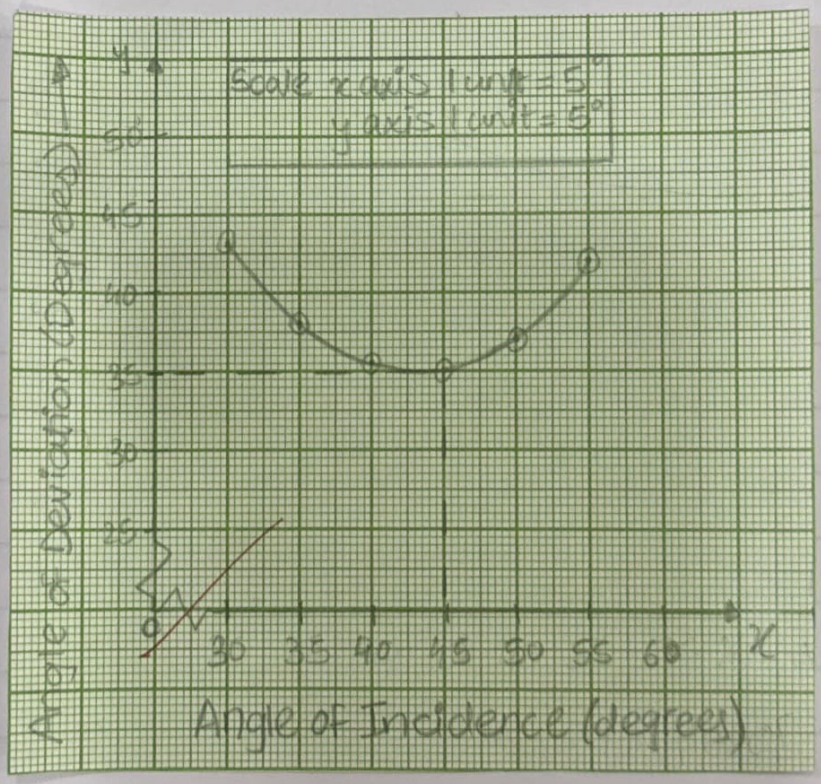
Compute the value of required series resistance by the relation, $R = \frac{V}{I_g} - G$.

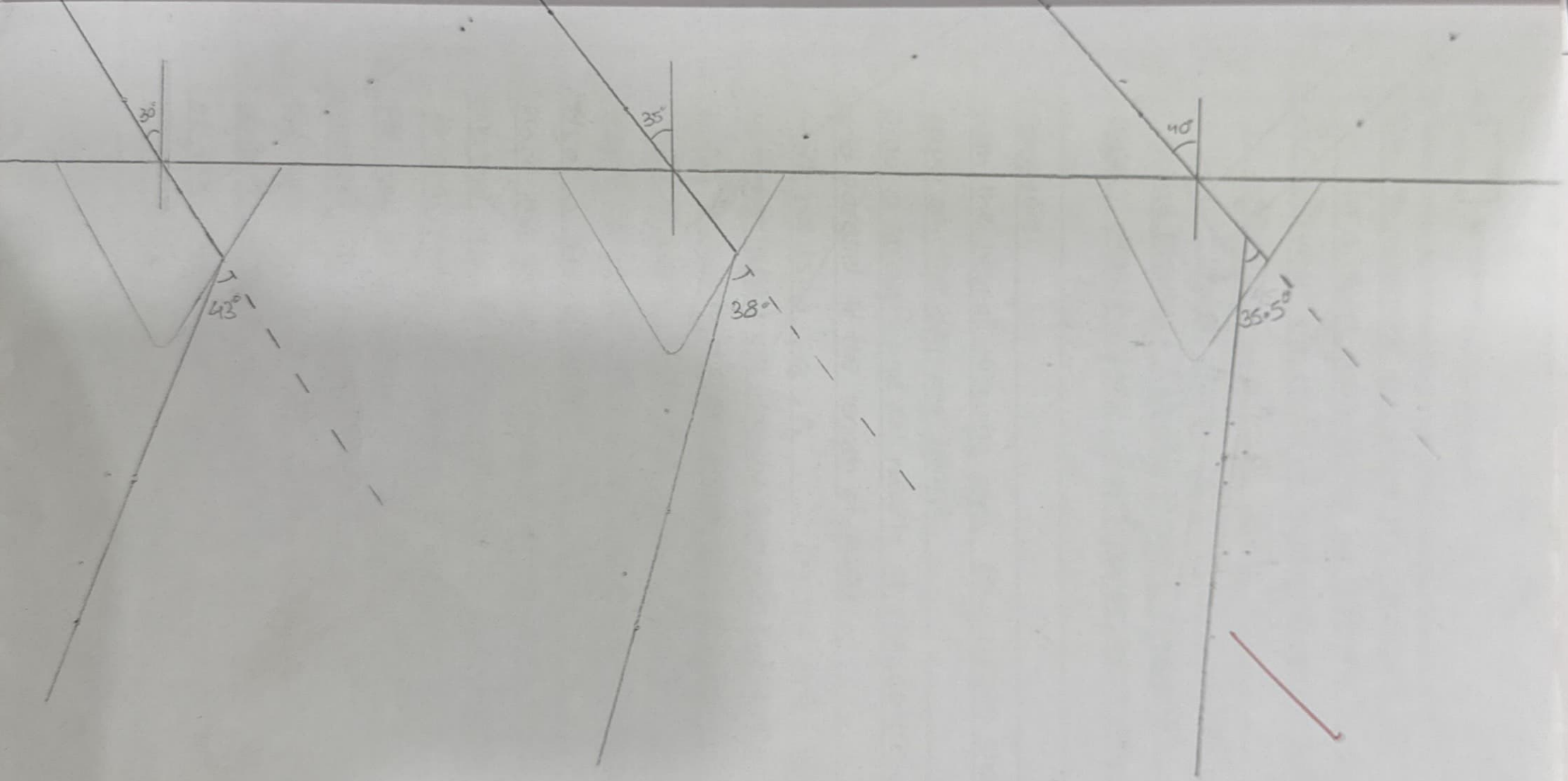
OBSERVATION TABLE

Voltmeter reading (V) volt		Ammeter reading (I) Ampere	
Observed V	Corrected V	Observed I	Corrected I
0	0	0	0
0·2	0·2	20	20
0·4	0·4	40	40
0·6	0·6	60	60
0·8	0·8	80	80
1	1	100	100



	Angle of Incidence (Degrees)	Angle of Deviation (Degrees)
1	30°	43°
2.	35°	38°
3.	40°	35.5°
4.	45°	35°
5.	50°	37°
6.	55°	42°

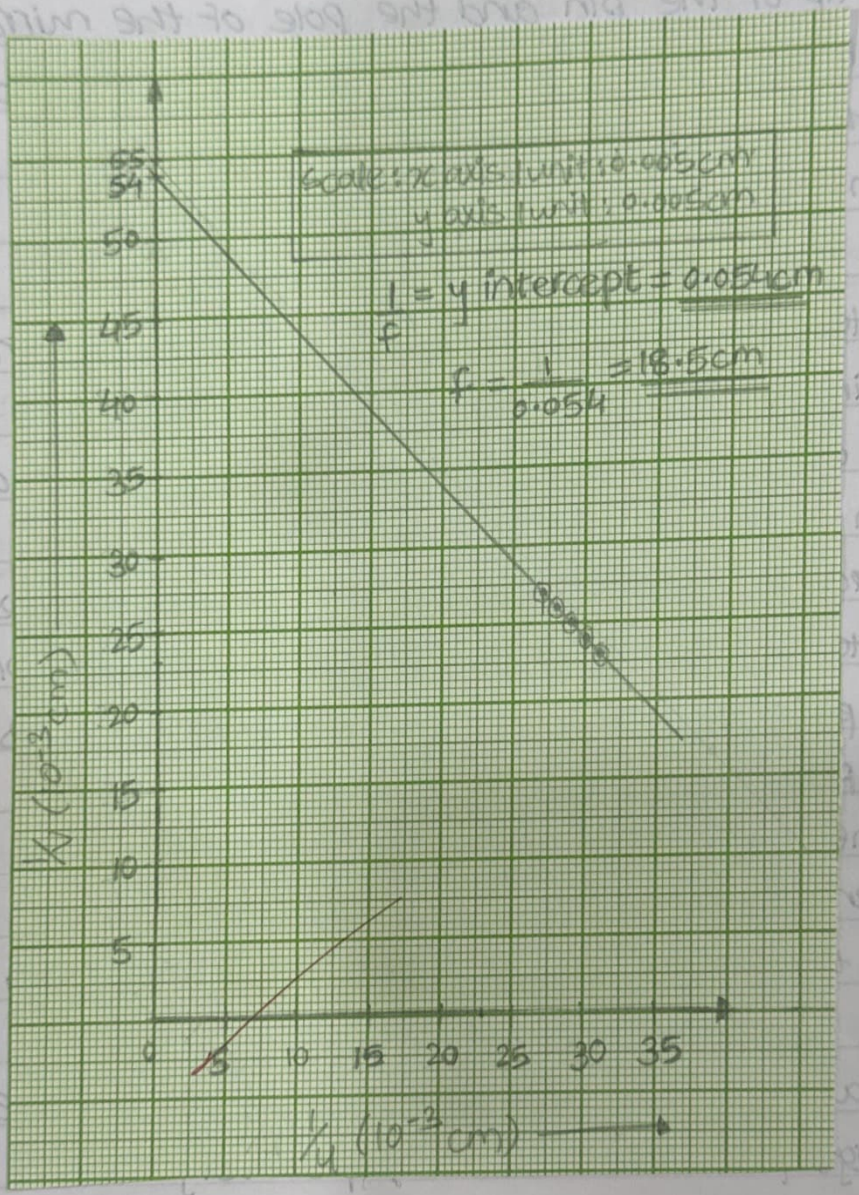



30°
43°1
35°
38°1
40°
35°5'

	Position of (cm)			observed distance (cm)		corrected Distance (cm)		$\frac{1}{u}$	$\frac{1}{v}$	$f = \frac{uv}{u+v}$
	Concave Mirror P	object needle	Image needle	u=PQ	V=PI	u	V	(cm)	(cm)	(cm)
1	2·3	34.6	44·4	32·3	42·1	32·3	42·1	0·031	0·023	18·5
2	2·3	35·6	43·5	33·3	41·2	33·3	41·2	0·03	0·024	18·5
3	2·3	36·6	42·3	34·3	40·0	34·3	40·0	0·029	0·025	18·5
4	2·3	37·6	40·8	35·3	38·5	35·3	38·5	0·028	0·026	18·5
5	2·3	38·6	39·3	36·3	37	36·3	37	0·027	0·027	18·5

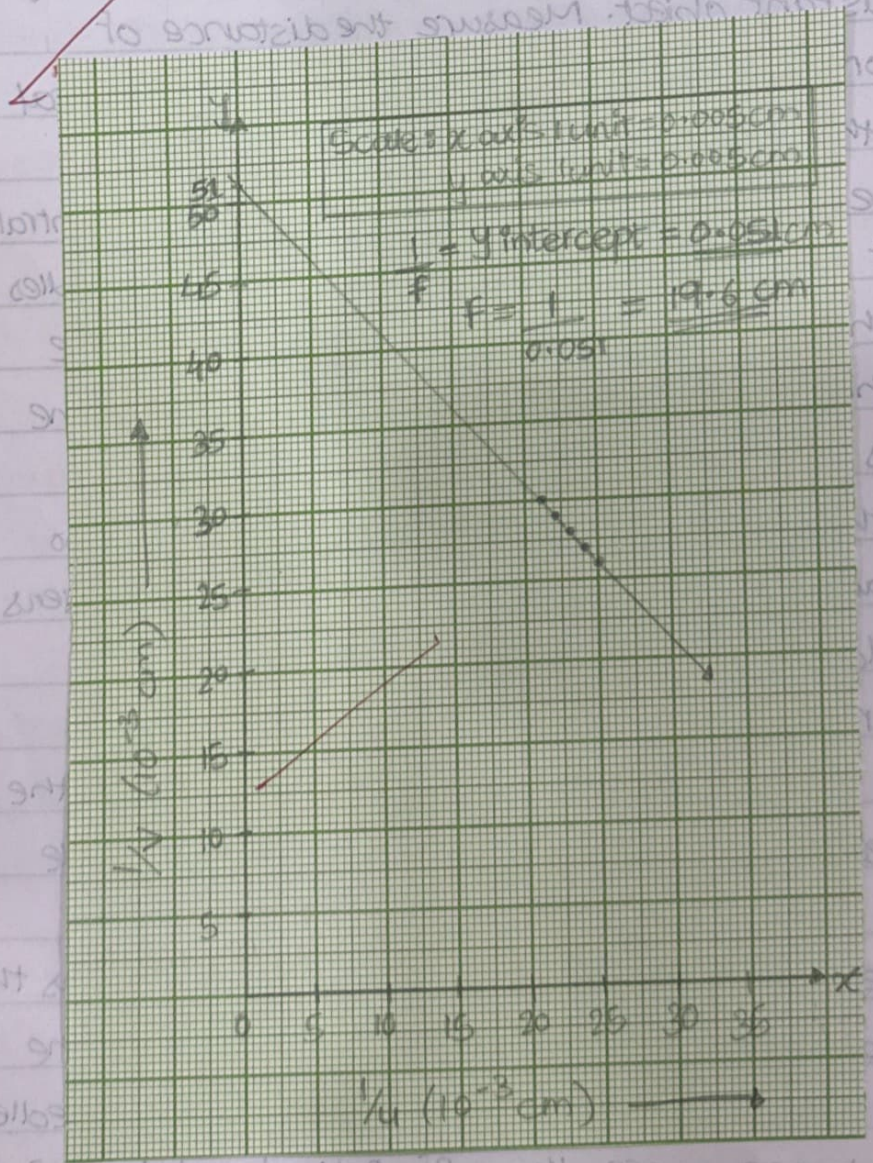
Mean focal length = $\frac{18.5 + 18.5 + 18.5 + 18.5 + 18.5}{5}$

= 18·5cm


Scale: x axis: 1 unit = 0.005cm
y axis: 1 unit = 0.005cm
1/f = y intercept = 0.054cm
f = 1/0.054 = 18.5cm
55
50
45
40
35
30
25
20
15
10
5
0
5
10
15
20
25
30
35
1/v (10⁻² cm⁻¹)
1/u (10⁻² cm⁻¹)

OBSERVATION TABLE:

	Position of (cm)			observed distance (cm)		corrected distance (cm)		$\frac{1}{u}$	$\frac{1}{v}$	$f = \frac{uv}{u+v}$
	Object needle A	Lens O	Image needle C	OA	AV = OC	u	v	(cm)	(cm)	(cm)
1.	10	50	88.5	40	38.5	40	38.5	0.025	0.026	19.6
2.	8	50	87	41	37	41	37	0.024	0.027	19.6
3.	7	50	86	42	36	42	36	0.023	0.028	19.6
4.	2.5	50	83.4	47.5	33.4	47.5	33.4	0.021	0.030	19.6
5.	6	50	84	44	34	44	34	0.022	0.029	19.6



OBSERVATION TABLES:

Focal length of convex lens (f_1)

	Distance of tip of needle from		Focal Length of convex lens $f_1 = \frac{a+b}{2}$ (cm)
	Upper surface of convex lens (a) (cm)	Upper surface of plane mirror (b) (cm)	
1.	19.3	19.6	19.45
2.	19.2	19.6	19.4
3.	19.1	19.5	19.3

Mean focal length $f_1 = \frac{19.45+19.4+19.3}{3} = 19.4$

Focal length of combination of convex lens and plane mirror (F):

	Distance of tip of needle from		Focal length of combination $F = \frac{a'+b'}{2}$ (cm)
	Upper surface of convex lens a' (cm)	Upper surface of plane mirror b' (cm)	
1.	28.6	29	28.8
2.	28.8	29	28.95
3.	28.8	29	28.8

Mean focal length $F = \frac{28.8+28.95+28.8}{3} = 28.85$

Table for (b):

	Initial circular scale reading on convex lens (a)	No. of complete rotations made by circular scale (n)	Final reading of circular scale on the glass slab (b)	Additional division moved $m = (a-100) - b$ if $b < a$	$t = n \times pitch + m \times L.C$
1.	68	0	0	68	0.168
2.	67	0	0	67	0.167
3.	68	0	0	68	0.168

Mean $t = \frac{0.168+0.167+0.168}{3} = 0.167$ cm

CALCULATIONS:

$F_1 = 19.46$

$F = 28.85$

$\frac{1}{F} = \frac{1}{F_{water}} - \frac{1}{F_{plano-convex}}$

$f = 59.22\,cm$

Radius of curvature of convex surface of lens is:

$R = \frac{d^2}{6h} + \frac{h}{2}$

$R = 18.46\,cm$

$u = d + R$

$u = 21.32$

	Cross mark without slab			Cross mark with slab			Powder on Slab		
	M.S.R. a (cm)	Vernier division coinciding n	$R_1 = a + n \times L.C$ (cm)	M.S.R. b (cm)	Vernier division coinciding n	$R_2 = b + n \times L.C$	M.S.R. c (cm)	Vernier division coinciding n	$R_3 = c + n \times L.C$ (cm)
1.	8.3	12	8.3012	8.7	10	8.71	9.8	9	9.809
2.	8.3	10	8.301	8.7	10	8.71	9.8	9	9.809
3.	8.3	11	8.3011	8.7	9	8.709	9.8	10	9.81

Mean $R_1 = 8.3011$ cm, Mean $R_2 = 8.708$ cm, Mean $R_3 = 9.808$ cm

Calculations:

Real thickness of glass slab $R_3 - R_1 = 1.5069$ cm

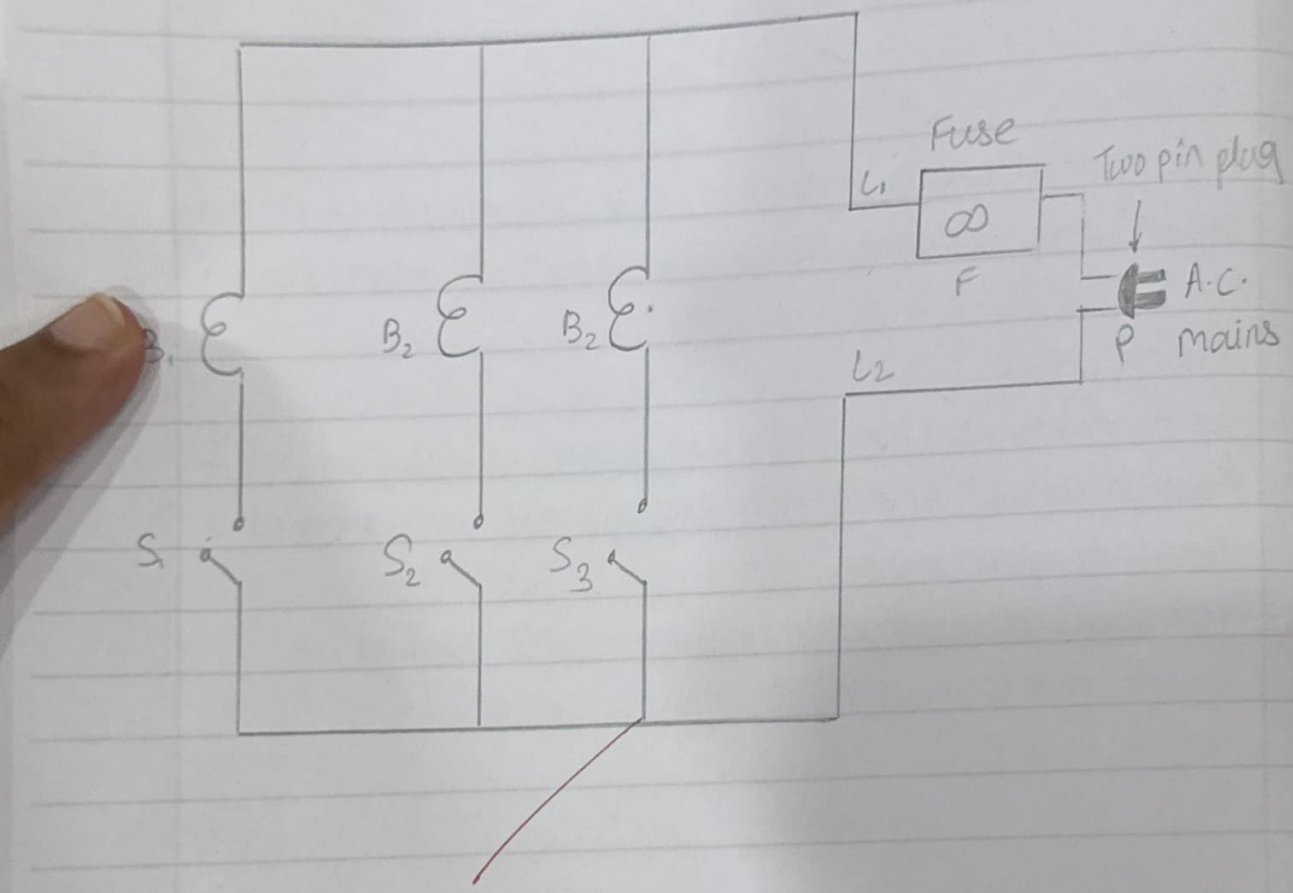
Apparent thickness of glass slab $R_3 - R_2 = 1.105$ cm

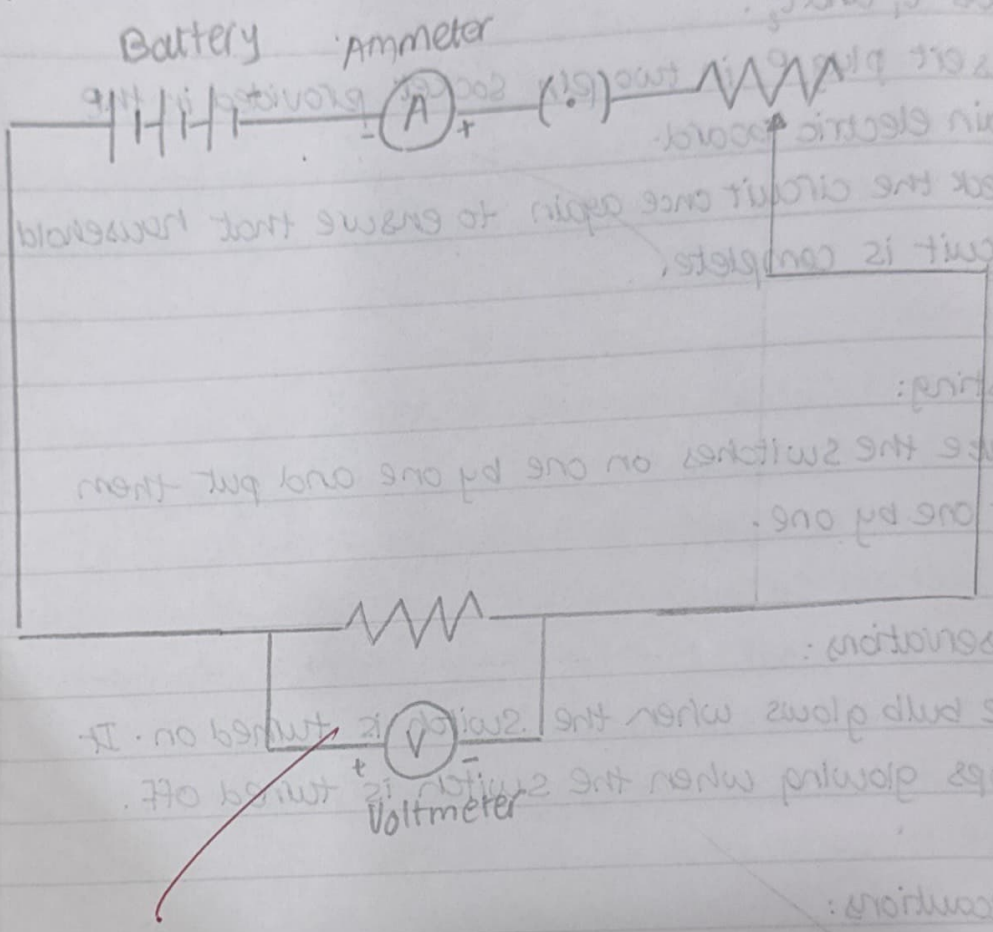
Refractive index $(\mu) = \frac{\text{Real thickness of slab}}{\text{Apparent thickness of slab}}$

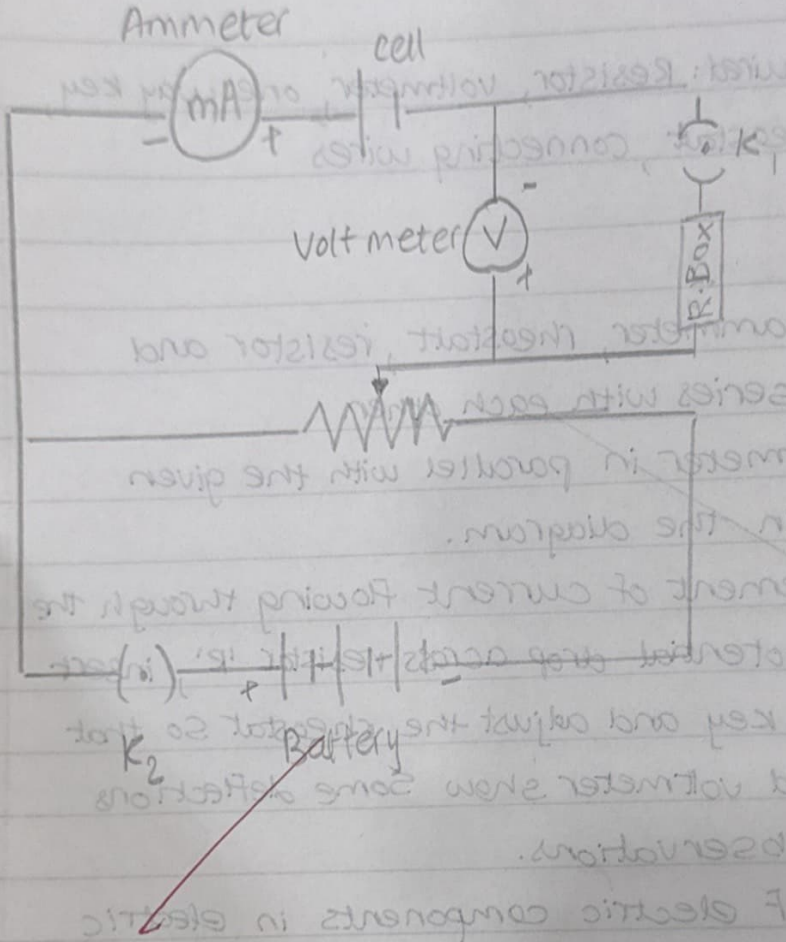
$= \frac{R_3 - R_1}{R_3 - R_2}$

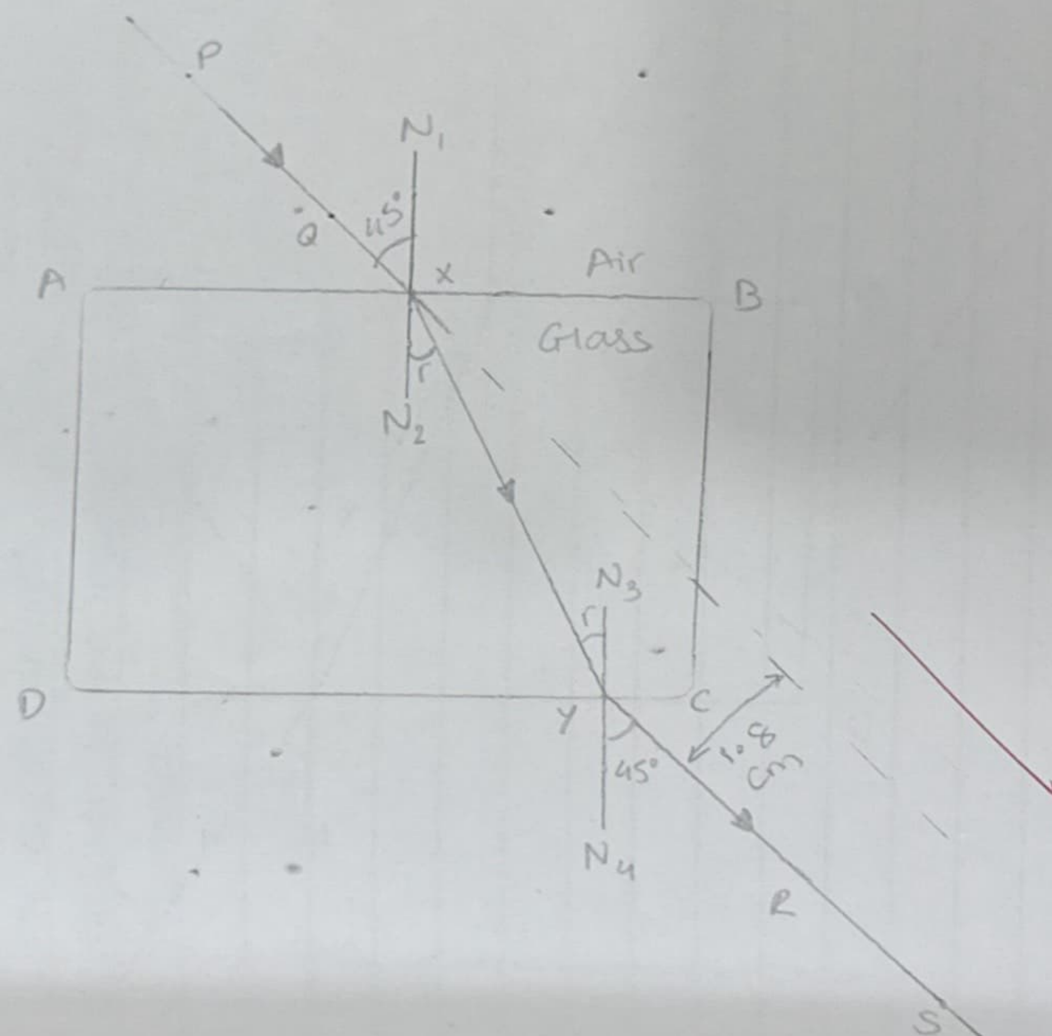
$= 1.36$

Sr. No.	For forward biasing		For reverse biasing	
	Forward bias Voltage V_f (V)	Forward bias current I_F (mA)	Reverse bias Voltage V_R (V)	Reverse bias current I_R (μA)
1.	0	0	0	0
2.	0.1	0	1	2
3.	0.2	0.2	2	4
4.	0.3	0.4	3	6
5.	0.4	0.6	4	8
6.	0.5	0.8	5	10
7.	0.6	1.2	6	12
8.	0.7	1.4	7	14
9.	0.8	1.8	8	16
10.	0.9	2	9	18
11.	1	2.4	10	20
12.	1.1	2.8	11	22
13.	1.2	3	12	24
14.	1.3	3.4	13	26
15.	1.4	3.8	14	28
16.	1.5	4	15	30
17.	1.6	4.4	16	32
18.	1.7	4.8	17	34
19.	1.8	5.2	18	36
20.	1.9	5.6	19	38


Fuse
Two pin plug
L_1
F
A.C.
P
mains
L_2
B_2
B_2
S_1
S_2
S_3


Battery
Ammeter
A
V
Voltmeter


Ammeter
cell
mA
+
−
K1
−
Volt meter
V
+
R.Box
K2
Battery


P
Q
N1
45°
x
Air
A
B
Glass
r
N2
N3
r
D
Y
C
45°
1.8 cm
N4
R
S