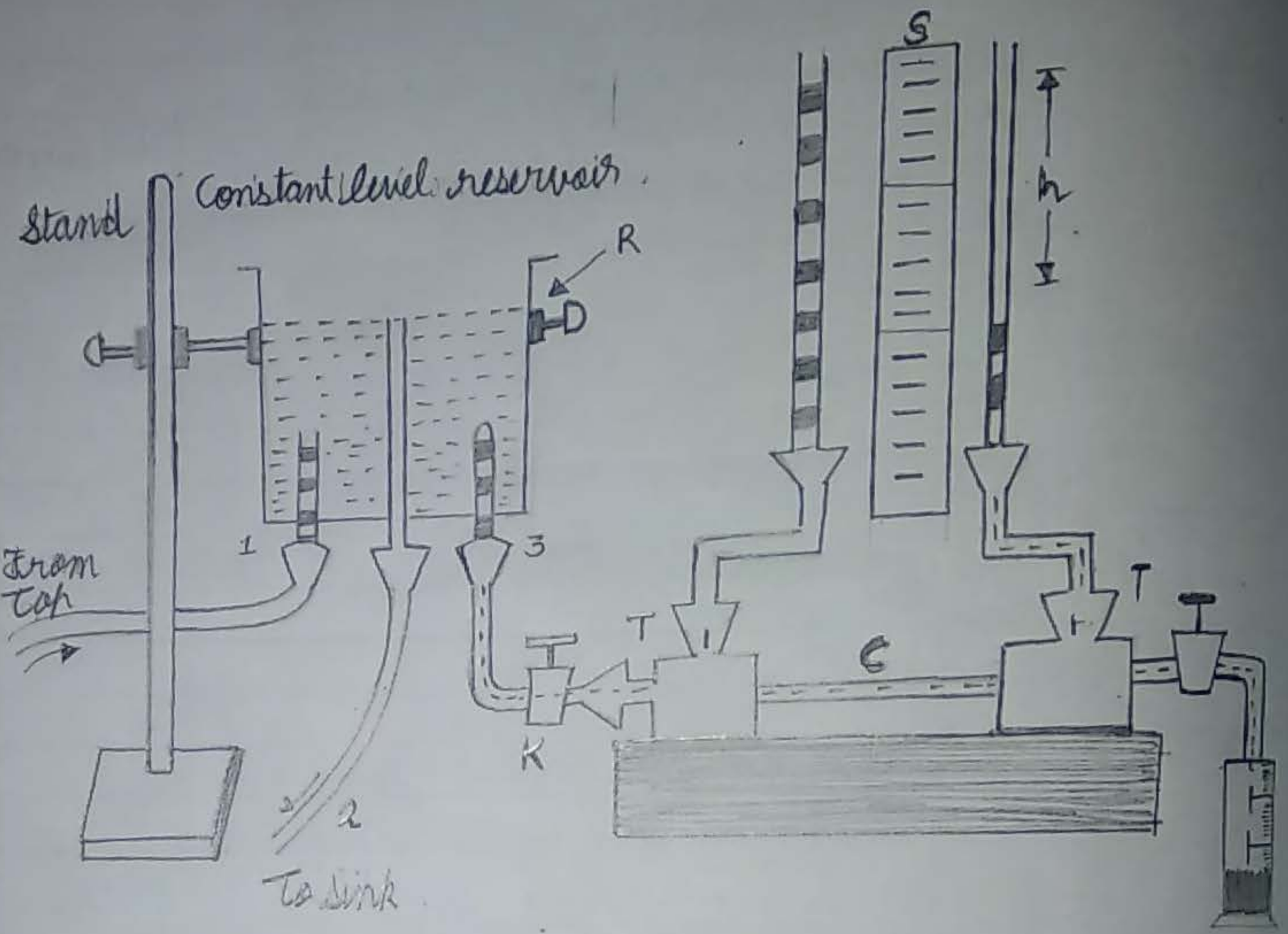
Stand
Constant level reservoir
R
D
1
3
From tap
2
To sink
S
h
T
T
T
C
K

Date _____

Expt. No. _____ Page No. _____

Experiment no. 1

Object: To determine the coefficient of viscosity of water, by Poiseuille's method.

Apparatus used: A capillary tube of uniform bore and a constant level reservoir fitted on a board, a manometer, stop watch and graduated jar.

Formula used: The coefficient of viscosity η of a liquid is given by the formula:

$$\eta = \frac{\pi P r^4}{8 V l} = \frac{\pi (h \rho g) r^4}{8 V l} \text{ kg/m-sec or Poise.}$$

where r = radius of capillary tube

V = volume of water collected per second

l = length of capillary tube

p = density of liquid

h = difference of levels in manometer.

Teacher's Signature : _____

Calculations

$h = 31 \times 10^{-2} m$ $\quad r = 0.048 \times 10^{-2} m$

$\rho = 1 \times 10^{3} kg/m^3$ $\quad l = 36 \times 10^{-2} m$

$g = 9.8 m/s$ $\quad V = 0.12667 \times 10^{-6} m^3/sec$

$$\eta = \frac{\pi \times h \times \rho \times g \times r^4}{8 V l}$$

$$\eta = \frac{3.14 \times 31 \times 10^{-2} \times 10^{3} \times 9.8 \times (0.048 \times 10^{-2})^4}{8 \times 0.12667 \times 10^{-6} \times 36 \times 10^{-2} m}$$

$$= \frac{3141 \times 31 \times 98 \times 5308416 \times 10^{-12} \times 10^{-8} \times 10^{-2}}{8 \times 12667 \times 36 \times 10^{-8} \times 10^{-5}}$$

$$= \frac{314 \times 31 \times 98 \times 5308416 \times 10^{-9}}{8 \times 12667 \times 36}$$

$$= 1388085 \times 10^{-9}$$

$$= 0.001388 \ kg\ m/sec$$

or

0.01388 Poise

Date _____

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Observation Table :

S.no.	Time (minutes)	h_1 (cm)	h_2 (cm)	h $(h_2 - h_1)$	Volume of water collected (meter)^3	V $\left(\frac{m^3}{sec}\right)$
1.	5	32	1	31	38×10^{-6}	0.12667×10^{-6}
2.	10	32	1	31	76×10^{-6}	0.12667×10^{-6}
3.	15	32	1	31	114×10^{-6}	0.12667×10^{-6}

Result : The coefficient of viscosity of water is 0.01388 Poise.

Standard Result : $\eta = 0.01000$ Poise

Percentage Error : $\frac{\Delta \eta}{\eta} = 38.8\%$

Teacher's Signature : _____

Date _____

Expt. No. _____ Page No. _____

Precautions:

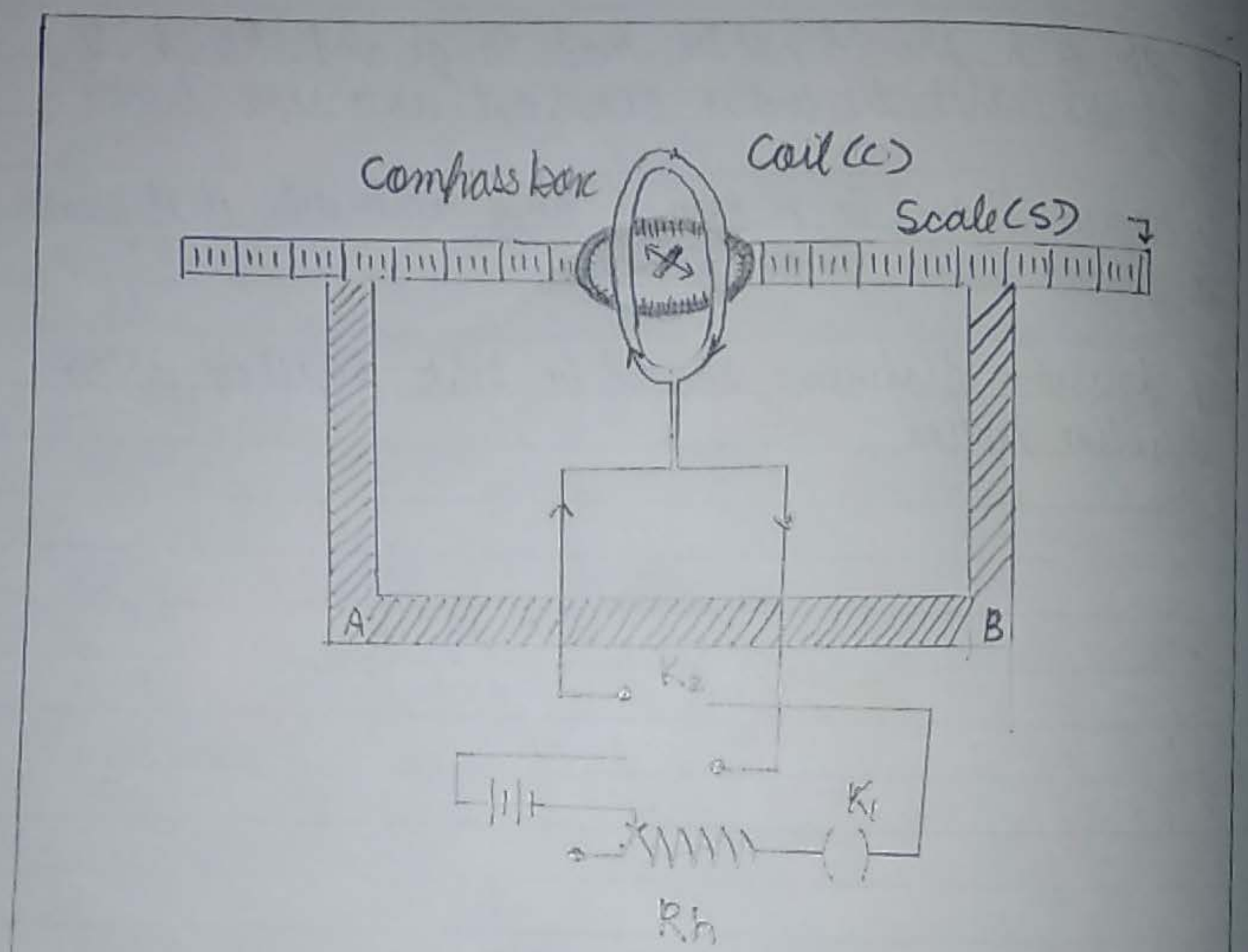
1. The tube should be held horizontally to avoid the effect of gravity.

2. The value of h should not be made large and should be so adjusted that the water comes out as a slow trickle.

3. The radius should be measured very accurately as it occurs in fourth power in the formula.

4. The pressure difference should be kept small to obtain streamline motion.

Teacher's Signature : _____


Compass box
Coil (C)
Scale (S)
A
B
K2
K1
Rh

Date 20/3/23

Expt. No. 2 Page No. 4

Experiment - 2

Object : To plot graph showing the variation of magnetic field with distance along the axis of a circular coil carrying current.

Apparatus required: Tangent galvanometer of Stewart and Gee type, a strong battery, a rheostat, a commutator, plug key and connecting wires.

Formula used : The field F along the axis of a coil is given by.

$$F = \frac{2\pi n r^2 i}{10(x^2 + r^2)^{\frac{3}{2}}}$$

where n = number of turns in the coil
r = radius of the coil
i = current in ampere flowing in the coil
x = distance of the point from the centre of the coil.

If F is made $\perp$ to H, earth's horizontal field, the deflection θ of the needle is given by.

$$F = \frac{2\pi n r^2 i}{10(x^2 + r^2)^{\frac{3}{2}}} = H \tan\theta.$$

Teacher's Signature : _____

Scale:

x axis ⇒ 1km = 1cm

Y axis ⇒ 1cm = 0.25

tan θ

2.25

1.75

1.50

1.25

1.00

0.75

0.25

12 10 8 6 4 2

X

Distance from hill

Date

Expt. No. Page No.

Observation Table

LHS

S.no	X	θ_1	θ_2	θ_3	θ_4	Mean θ	Tan θ
1	0	76	76	54	54	65	2.144
2	2	70	70	50	50	60	1.732
3	4	65	65	45	45	55	1.428
4	6	58	58	40	40	49	1.150
5	8	48	48	35	35	41.5	0.884
6	10	40	40	30	30	35	0.700

RHS

S.No	X	θ_1	θ_2	θ_3	θ_4	Mean θ	Tan θ
1	0	76	76	54	54	65	2.144
2	2	71	71	49	49	60	1.732
3	4	64	64	46	46	55	1.428
4	6	59	59	39	39	49	1.150
5	8	47	47	36	36	41.5	0.884
6	10	41	41	29	29	35	0.700

Teacher's Signature :

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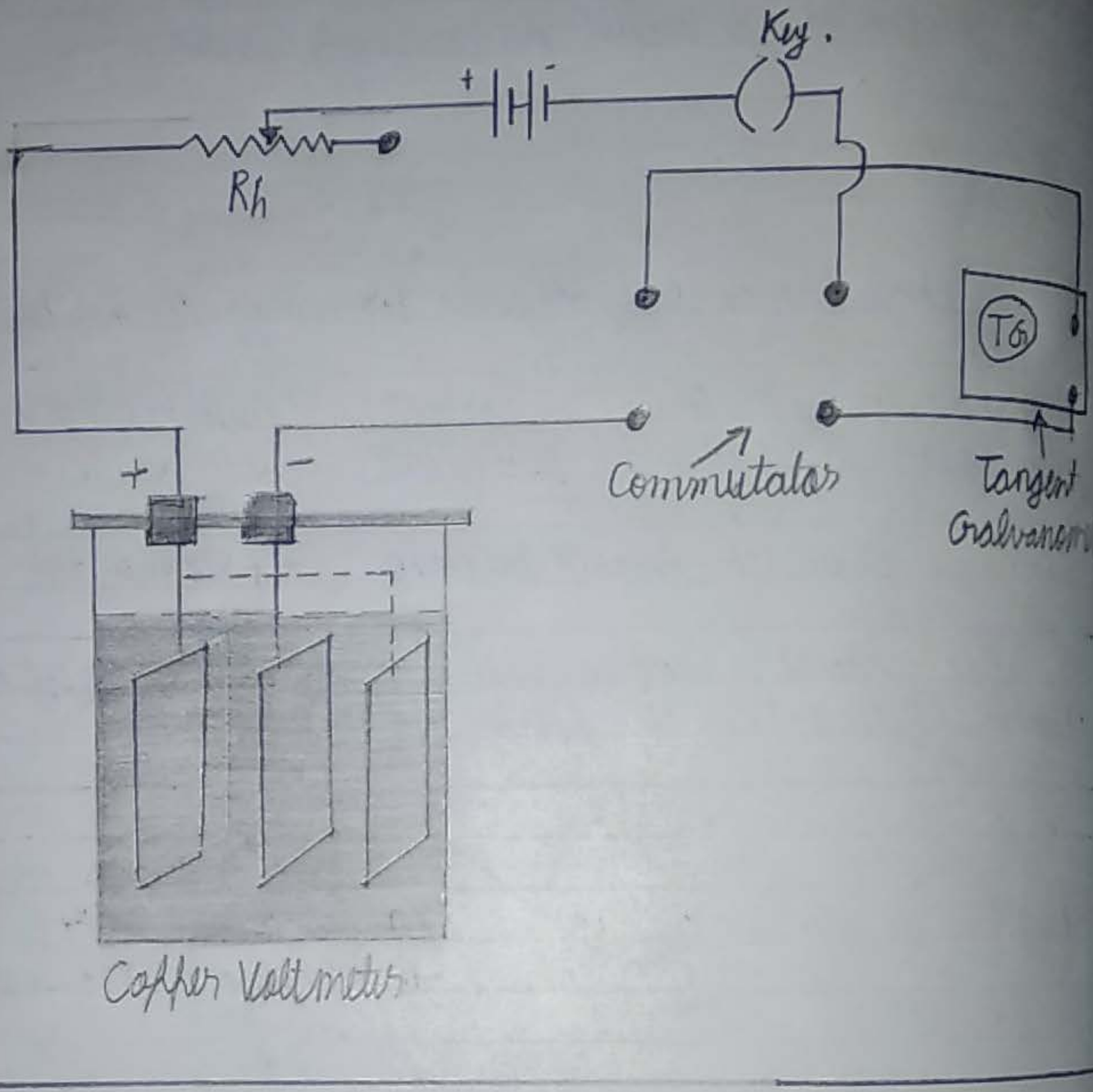
Result: The graph shows the variation of magnetic field along the axis of a circular coil carrying current.

Precautions:

1. The coil should be carefully adjusted in the magnetic meridian.
2. The current passed in the coil should be of such magnitude as to produce a deflection of nearly 75°.
3. The curve should be drawn smoothly.
4. Parallax should be removed while reading the position of the pointer. Both ends of the pointer should be read.

Teacher's Signature : _____


Key.
+
-
R_h
T6
+
-
Commutator
Tangent
Galvanometer
Copper Voltmeter

Date 27/3/23

Expt. No. 3 Page No. 7

Experiment no. 3

Object: To determine the Electro-chemical equivalent of copper using tangent galvanometer.

Apparatus Required: Chemical balance, weight box, copper voltameter, test peste, tangent galvanometer, accumulator, commutator and connection wires.

Formula used: If current of strength i ampere is allowed to flow in tangent galvanometer then

$$i = \frac{10 r H \tan\theta}{2\pi n}$$

where, r = radius of the coil
n = number of turns of tangent galvanometer
H = Horizontal component of earth's magnetic field.

If some current is allowed to flow through a copper voltmeter connected in series with galvanometer, then from faraday's law of electrolysis, we have

$$Z = \frac{m}{it}$$

where, m = mass of copper deposited on cathode plate.
i = strength of the current
Z = E.C.E of copper on t = time in second for which current flows.

Teacher's Signature : _____

Calculations

$$i = \frac{10mH \tan\theta}{2\pi n}$$

$$= \frac{10 \times 7.9 \times 0.3389 \times 1}{2\pi \times 50} = 0.085266\ A$$

$$z = \frac{m}{i \times t} = \frac{0.104}{0.08526 \times 1200} = \frac{4}{852.6 \times 12}$$

$$= 0.0003909\ gm/coulomb.$$

Date _____

Expt. No. _____ Page No. 8

Observations:

Number of turns in each coil (n) = 500
Radius of the coil = 7.9cm
Value of the field H = 0.339 oersted.

S.No	Quantities measured	Amount	Calculated quantities from observations
1	Mass of copper plate before deposition of copper.	36.67gm	Mass of copper deposited m=0.04 gm.
2	Mass of the copper plate after deposition of copper	36.71 gm	
3.	Initial Reading of Stopwatch	0 sec	Total time t taken = 1200sec
4.	Final Reading of Stopwatch	1200 sec	

Result: The electro-chemical equivalent of copper

= 0.0003909 gm/coulomb.

Teacher's Signature : _____

Standard Result: $Z = 0.00003294$ gm/coulomb.

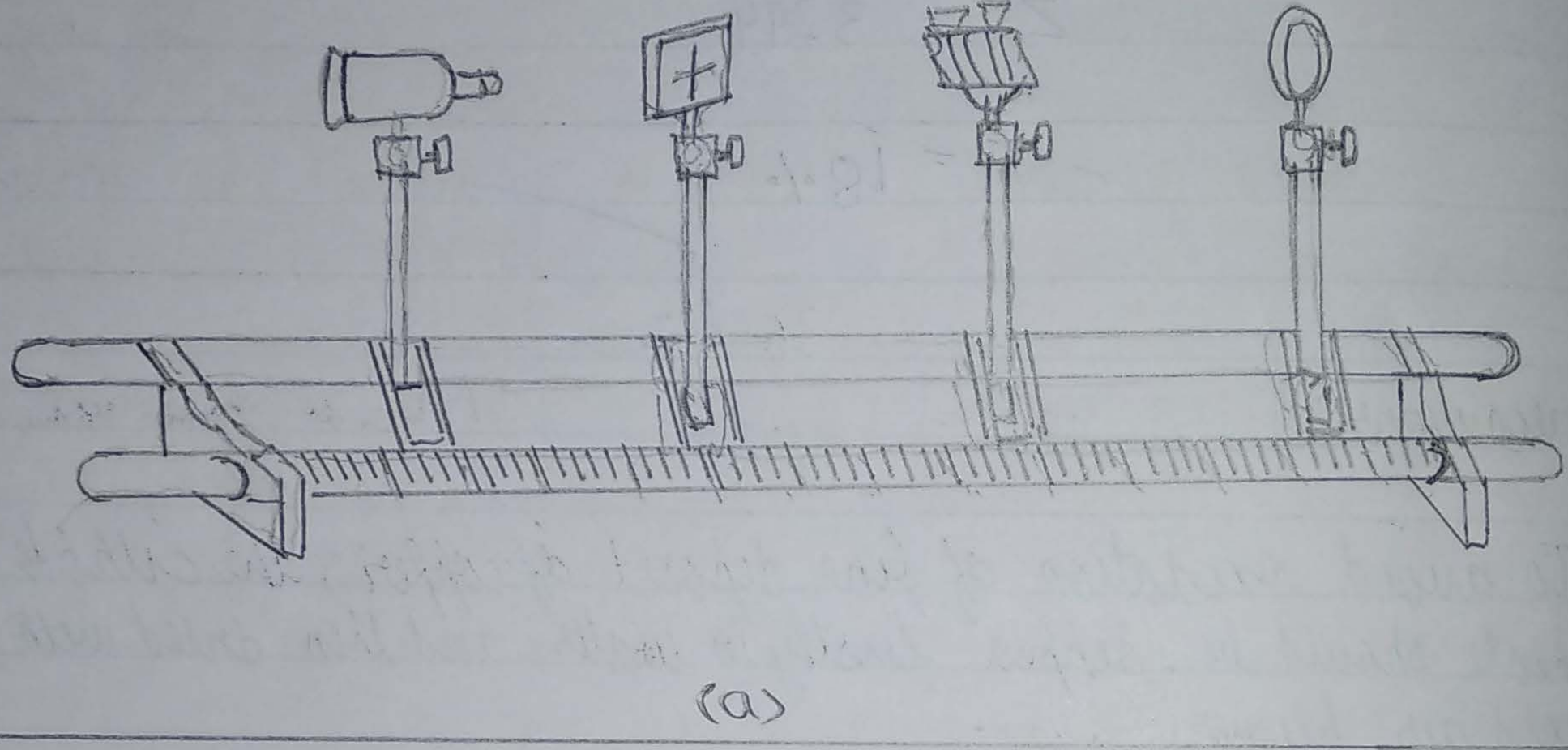
Percentage error: $\frac{\Delta Z}{Z} \times 100 = \frac{615}{3294} \times 100$

$= 18\%$

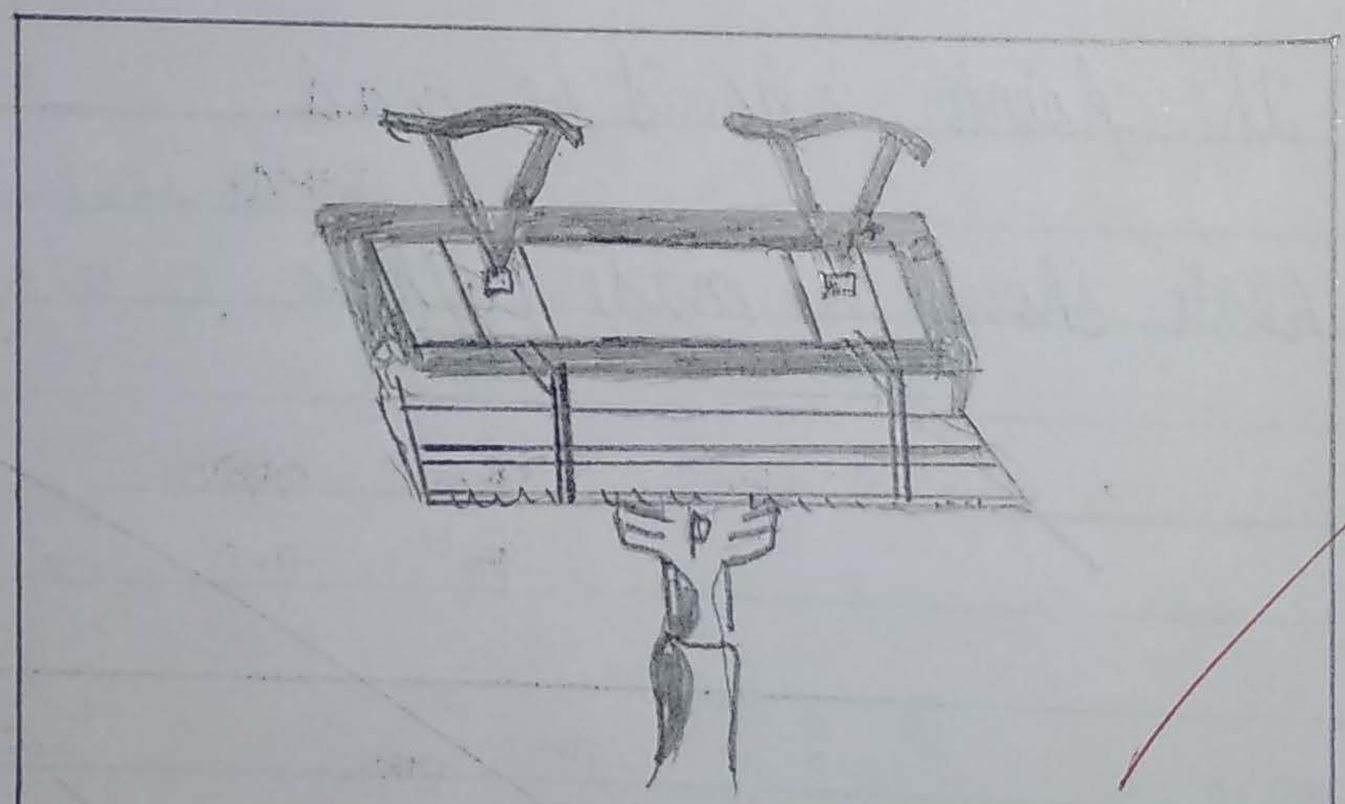
Precautions:

1. To avoid oxidation of fine deposit of copper, the cathode plate should be dipped firstly in water and then dried with cold air blower
2. Both ends of the pointer should be read.
3. The middle plate should be made cathode.

Teacher's Signature : _____



(a)



(b)

Date 10/4/23

Expt. No. 4 Page No. 10

Experiment: 4.

Object: To determine the focal length of the combination of two lenses separated by a distance with the help of a nodal slide.

Apparatus required: Nodal slide arrangement (optical bench, plane mirror, cross slit and a lamp) and two convex lenses.

Formula used:

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{x}{f_1 f_2}$$

where F = focal length of the combination,

f_1, f_2 = focal lengths of the given lenses,

x = separation between two lenses.

Teacher's Signature : _____

Calculations.

$f_1 = 31.0$ cm $f_2 = 26.0$ cm $x = 1.2$

Using formula.

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{1.2}{31 \times 26}$$

$$\frac{1}{F} = 0.0322 + 0.0357 - 0.001$$

$$\frac{1}{F} = 0.0669$$

$$F = 14.947$$

Date

Expt. No. Page No. 11

Observations:

Lens	Position of Nodal point (a)	Position of Cross slit (b)	Total focal length (a-b)
L_1	36.3	5.3	$f_1 = 31.0$
L_2	33.3	5.3	$f_2 = 28.0$
L_1+L_2	20.2	5.3	$F = 14.9$

Result: The calculated and experimentally observed values of the focal length of the combination are very nearly equal and hence the formula is verified.

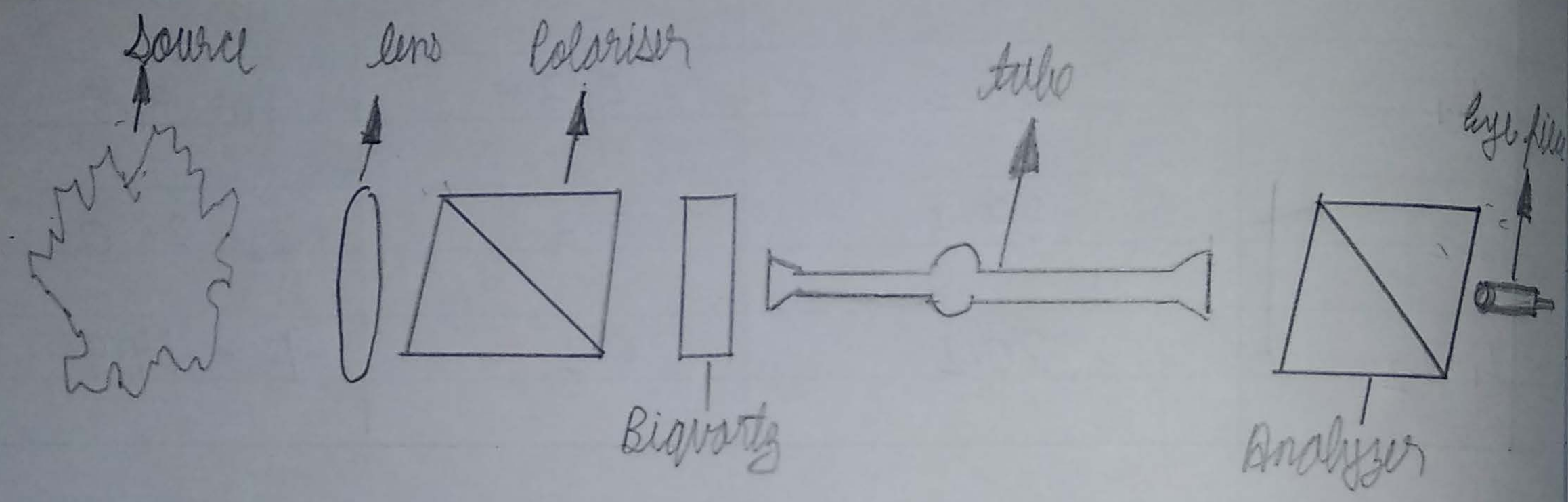
Precautions:

(i) Source, slit, nodal slide arrangement and plane mirror should be adjusted to the same height.

(ii) Slit should be well illuminated.

(iii) "No image shift position" should be obtained accurately.

Teacher's Signature :


Source
lens
Colsriser
tube
eye piece
Biprism
Analyzer

Date 17/4/23

Expt. No. 5

Page No.

Experiment -5.

Object: To determine the specific rotation of cane sugar solution using polarimeter.

Apparatus Required: Source of light (sodium lamp), half-shade polaraimeter, sugar measuring cylinder or 100 c.c. flask, beaker, funnel, physical balance with weight box, redding lens and reading box.

Formula used: The specific rotation of the plane of polarisation of sugar dissolved in water can be determined by the formula,

$$S = \frac{\theta}{l \times c} = \frac{\theta \times V}{l \times m}$$

where θ = rotation produced in degrees
l = length of the tube in decimeter
m = mass of sugar in gm dissolved in water
V = volume of sugar solution.
c = concentration of sugar solution.

Teacher's Signature : _____

Calculations

Length of tube $l = 2\,dm$

$C = 0.2\,gm/cc$

$$S = \frac{\theta}{l \times C}$$

$$S = \frac{24.8}{2 \times 0.2}$$

$S = 62.0$ degree/dm/gm/cc.

Date

Expt. No. Page No.

Observation Table.

S.no		Clockwise (x)			Anticlockwise (y)			Mean $\frac{x+y}{2}$
		M.S	V.S	M.S+V.S×L.C	M.S	V.S	M.S+V.S×L.C	
1	Water	82	4	82.4	269	3	269.3	A=175.85
2.	Sugar solution	109	2	109.2	292	2	292.2	B=200.7
								AB=24.8

Result: The specific rotation of cane sugar solution is 62.0 degree/dm/gm/cc.

Precautions:

1. The polarimeter tube should be well cleaned.
2. Water used should be dust free.
3. There should be no air bubble inside the tube.
4. The position of analyser should be set accurately.

Teacher's Signature :