Certificate

Certified that this is the bonafide work of ASMITA MANGIPUDI

(Student's Name)

of Class XII of SRI CHAITANYA SCHOOL

(Class/Section) *(School's Name)*

He/She has performed these experiments during the academic year 2023 - 2024

Number of practicals certified 8 out of 8

in PHYSICS .

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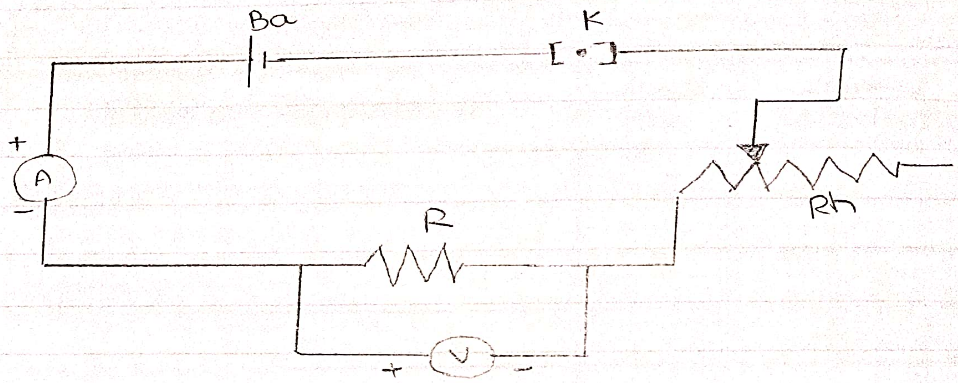
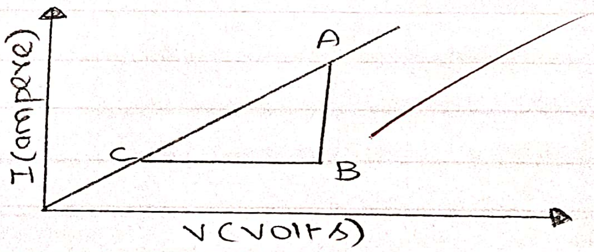
Circuit Diagram:



where :

Ba - Battery , K - Plug key , A - Ammeter , V - Voltmeter , Rh - Rheostat , R - Resistance of given wire .

Nature of graph:



RESISTIVITY OF WIRES

AIM: To determine resistivity of a given wire by plotting a graph of potential difference versus current.

APPARATUS: Two wires of unknown resistance, battery eliminator (0 to 3V), voltmeter (0-5V), ammeter (0-5A), rheostat, plug key, connecting wires.

PRINCIPLE:
Ohm's law states that the electric current flowing through a conductor is directly proportional to the potential difference across its end, provided the physical state of the conductors remains unchanged.

FORMULA:

$$R = \frac{1}{\text{slope}} \ \Omega$$

$$\text{Resistivity} \quad \rho = \frac{RA}{L}$$

PROCEDURE:

(1) Connect various components - resistance wire, rheostat, battery, key, voltmeter and ammeter as shown in circuit diagram.

(2) Note whether pointers in ammeter and voltmeter coincide with zero mark on the measuring scale. If it is not so, adjust the pointer.

Observations:

Radius of given wire (r) = 1.33×10^{-3} m

Length of the given wire (l) = 40×10^{-2} m

S.No	Applied potential difference (V in volts)	Current through the wire (I in ampere)
1.	0.1	0.15
2.	0.2	0.2
3.	0.3	0.25
4.	0.4	0.3
5.	0.5	0.35
6.	0.6	0.4

Radius of given wire (r) = 1.33×10^{-3} m

Length of the given wire (l) = 40×10^{-2} m

S.No	Applied potential difference (V in volts)	Current through the wire (I in ampere)
1	0.1	0.7
2.	0.2	1.15
3.	0.3	1.65
4.	0.4	2.00

(3) Insert the key K and slide the rheostat contact to one of its extreme ends, so that current passing through the resistance wire is minimum.

(4) Note the ammeter and voltmeter readings.

(5) Remove the key K and allow the wire to cool, if heated. Again insert the key. Shift the rheostat contact slightly to increase the applied voltage. Note the ammeter and voltmeter reading.

(6) Repeat step 5 for five to six different settings of the rheostat. Record your observation in a tabular coloumn.

(7) Plot a graph between the potential difference across the wire (V) v/s current (I).

(8) The resistance of the given wire is equal to the reciprocal of the slope.

(9) Resistivity can be calculated by given formulae.

(10) We will repeat the procedure with one/two more wires.

RESULT: Resistivity of the given wires

First wire = ~~0.75Ω~~ 1.04×10^{-5} Ω-m

Second wire = ~~0.66Ω~~ 0.92×10^{-5} Ω-m

PRECAUTIONS:

(1) The connections should be neat, clean and tight.

(2) The rheostat should be moved smoothly.

(3) Reading should be taken without any parallax error.

Calculation:

First wire

From graph, slope $= \frac{AB}{BC} = \frac{0.4 \times 0.6}{0.6 \times 0.3} = \frac{0.24}{0.18}$

The Resistance of the given wire is $R = \frac{1}{Slope} = \frac{1}{1.33} = 0.75\Omega$

Second wire

From graph, slope $= \frac{AB}{BC} = \frac{1.5 \times 0.3}{0.3 \times 1} = \frac{0.45}{0.3}$

The Resistance of the given wire is $R = \frac{1}{Slope} = \frac{1}{1.5} = 0.66\Omega$

Date

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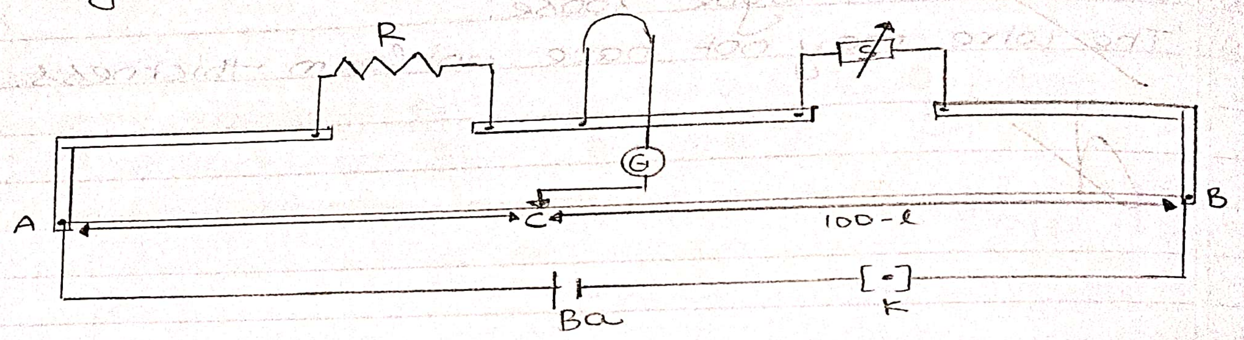
Source of error:

(1) Connections maybe loose.

(2) The wire may not have uniform thickness.

Circuit Diagram:



Where: AB - Meter bridge wire, Ba - Battery, K - Plug key, S - standard resistance box, R - Resistance of given wire, C - Balancing point, G - Pointer galvanometer, AC - Balancing length

Date 21.9.23

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METER - BRIDGE - RESISTANCE OF GIVEN WIRE

AIM: To determine the resistance of the given wire using meter bridge and hence determine the resistivity of the material of the wire.

APPARATUS: Meter Bridge, experimental wire, battery, plug key, resistance box, jockey and pointer galvanometer.

PRINCIPLE:

A meter bridge works on the principle of balanced wheatstone's bridge. The wheatstone bridge is said to be balanced when the current through the galvanometer is zero.

FORMULA:

Resistance of the wire

$$R = \frac{Sl}{100-l} \ \Omega$$

where:

S - standard resistance
l - Balancing length
L - Length of the experimental wire
r - Radius of the experimental wire.

Procedure:

(1) The connections are made as shown in the circuit diagram.

Observations:

Length of the given wire (L) = 50 cm

Radius of the given wire (r) = 0.133 cm

To measure the resistance of the given wire:

S.No	Resistance S in Ω	Balancing length l in cm	$R = \frac{Sl}{100-l}$ in Ω
1.	0.1	90.3	0.93
2.	0.3	84.7	1.66
3.	0.5	79.9	1.987

Mean R = 1.525 Ω

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(2) A suitable resistance S is unplugged in the standard resistance box.

(3) The circuit is checked for opposite deflections by placing jockey at the two ends of the wire AB alternatively.

(4) The jockey is moved on the wire from the end A towards B till the galvanometer shows zero deflection.

(5) The balancing length l is measured. The resistance of the wire is calculated using the formula

$$R = \frac{Sl}{100 - l}$$

(6) The experiment is repeated for different values of S and average value of R is found.

(7) The length and radius of the experimental wire is measured using meter scale and screw guage.

RESULT:

The resistance of the given wire is $1.525\,\Omega$

PRECAUTIONS:

(1) The connections should be neat, clean and tight.

(2) All the plugs in the resistance box should be tight.

(3) Move the jockey gently over the bridge wire and do not rub it.

(4) The plug in key K should be inserted only when the observation is to be taken.

Date

Expt. No.

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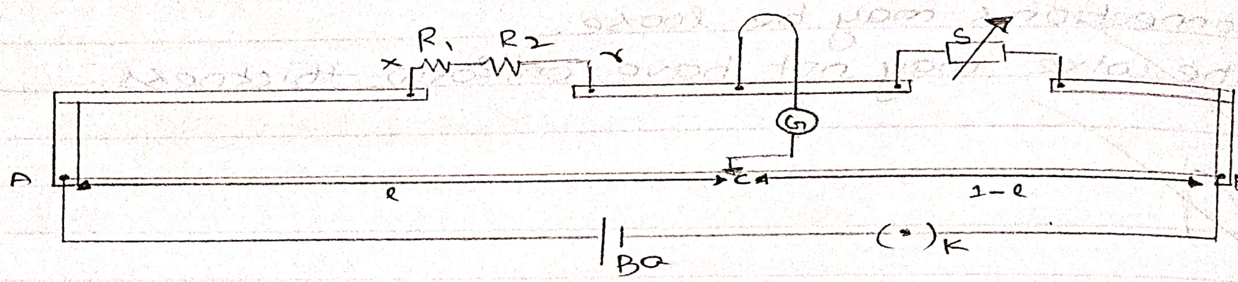
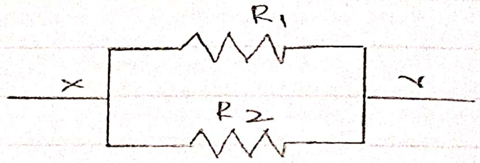
Source of error:

(1) Connections may be loose.

(2) The wire may not have uniform thickness.

CIRCUIT DIAGRAM:





Where:

R_1 and R_2 - given resistors, S - standard resistance box,
G - Galvanometer, Ba - Battery, K - plug key
AB - Meter Bridge wire
AC - Balancing length.

Date 5.10.23

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METER BRIDGE - COMBINATION OF RESISTANCE

AIM: To verify the laws of combination of resistance in series and using meter bridge

APPARATUS: Meter bridge, battery, two resistors, plug key, resistance box, galvanometer and jockey.

PRINCIPLE:

The series or parallel combinations of two resistors are connected in the left gap of meter bridge R. A standard resistance S is connected in the right gap of the meter bridge. When the bridge is balanced the current through the galvanometer is zero, (the jockey is at the point C). The balancing condition is,

$$\frac{\text{Effective Resistance of combination } (R_S \text{ or } R_P)}{S} = \frac{\text{Resistance of the wire AC}}{\text{Resistance of the wire BC}}$$

$$= \frac{l}{100-l}, \quad (\because R \propto l)$$

The effective resistance of combination is given by

$$R_S \text{ or } R_P = S\left(\frac{l}{100-l}\right)$$

Observations:

(1) Resistance of given resistor, $R_1 = 2\,\Omega$

(2) Resistance of given resistor, $R_2 = 1\,\Omega$

To verify the laws of combination of resistance in series:

S.No	Resistance S in Ω	Balancing length l in m	$R_S = \frac{Sl}{100-l}$ in Ω
1.	1	69	2.22
2.	2	59	2.87
3.	3	49	2.88

Mean $R_S = 2.65\,\Omega$

Calculations:

Theoretical, $R_S = R_1 + R_2$

$R_S = 2 + 1$

$= 3\,\Omega$

FORMULA :

Resistance, $R = \frac{Sl}{100 - l}\ \Omega$

Equivalent resistance in series, $R_S = R_1 + R_2\ \Omega$

where :

S - Standard resistance

l - Balancing length

R_1 and R_2 - individual resistances

PROCEDURE :

(1) The connections are made as shown in the circuit diagram i.e., the two resistors are connected in series.

(2) A suitable resistance S is unplugged in the standard resistance box.

(3) The circuit is checked for opposite deflections by jockey at the two ends of the meter bridge wire AB alternately.

(4) the jockey is moved on the wire from the end A towards B till the galvanometer shows zero deflection.

(5) The balancing length, is measured. The equivalent resistance of the series combination is calculated using the formula $R_S = \frac{Sl}{100 - l}$

(6) The experiment is repeated for different value of S and average value of R_S is found. The theoretical value of equivalent resistance is calculated using the formula $R_S = R_1 + R_2$

Date

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(7) Now the two resistors are connected in parallel on the left gap of meter bridge.

(8) The jockey is moved on the wire and hence balancing length l is measured. The equivalent resistance of the parallel combination is calculated using the formula $R_S = \frac{Sl}{100-l}$

RESULT:

Theoretical value of resistances in series, $R_S = 3\,\Omega$

Experimental value of resistances in series, $R_S = 2.65\,\Omega$

Experimental values are in good agreement with theoretical values, thus the laws of combination of resistances in series are verified.

PRECAUTIONS:

(1) The connections should be neat, clean and tight

(2) All the plugs in the resistance box should be tight.

(3) Move the jockey gently over the bridge wire and do not rub it.

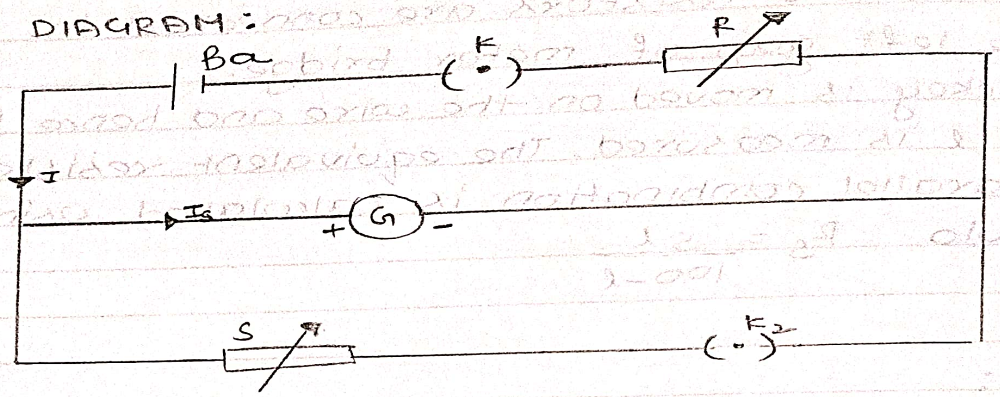
(4) The plug in key K should be inserted only when the observation is to be taken.

Source of error:

(1) Connections maybe loose.

(2) The wire may not have uniform thickness.

CIRCUIT DIAGRAM:



where:

Ba - Battery, G - Galvanometer, R and S - Resistance boxes,
K_1 and K_2 - plug keys

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Date 15.10.23

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FIGURE OF MERIT

AIM: To determine resistance of galvanometer by half deflection method and to find its figure of merit.

APPARATUS: Galvanometer, battery, two resistance boxes one way key (two numbers) and connecting wires.

THEORY: A galvanometer is a device used to detect small current in a circuit. It has a coil pivoted in a radical magnetic field. When electric circuit is passed through the coil, it gets deflected. Its deflection is noted by attaching a pointer to the coil. The deflection is proportional to current passed. A galvanometer has a moderate resistance and has a small current carrying capacity. The resistance of a galvanometer can be found by half deflection method. The circuit is shown for this method. Key K is inserted and deflection θ is determined with a suitable value of R. If E is the emf of cell and I be the current in circuit, the galvanometer resistance

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

Figure of merit of galvanometer: It is defined as current required for producing deflection of 1 division. It is measured in ampere/div. When a high resistance R is taken out from resistance box, a current I flow in the circuit and it produces

Observation:

S.NO	Resistance Ω	Deflection in galvanometer(θ)	$\theta/2$ (divisions)	Shunt S Ω	Galvanometer Resistance G Ω	Figure of merit $K = \frac{E}{(R+G)\theta}$
1.	5000	15	120	8	121.82	1.53×10^{-5}
2.	5000	20	120	10	122.6	1.75×10^{-5}
3.	4650	30	120	15	123.17	1.39×10^{-5}
4.	5400	18	120	9	122.58	1.71×10^{-5}

Mean (K) = 1.512×10^{-5} A/division a deflection θ.

Therefore, $I = \frac{E}{R+G} = k\theta$

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

By varying R and noting corresponding value of θ, we can find a set of values of figure of merit. The mean of these values gives the figure of merit.

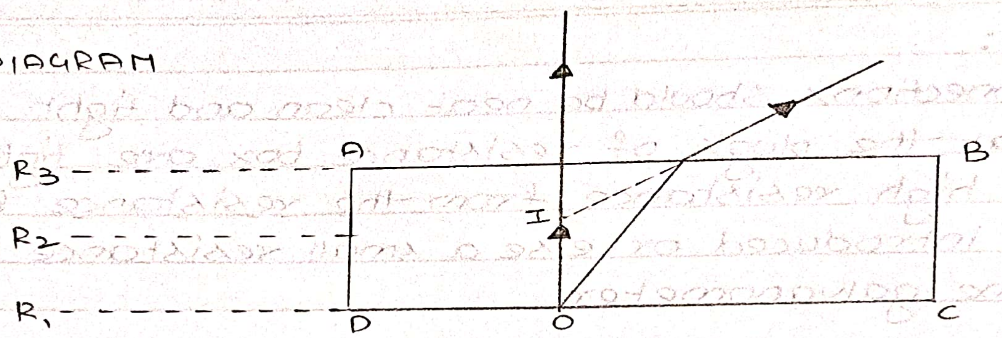
PROCEDURE:

(a) Make the connections as shown.
(b) See that the plug of resistance box are tight.
(c) Introduce a resistance of 5000 from the resistance box R and then insert the K1 only.
(d) Adjust the value of R so that the deflection in the galvanometer is maximum (say 30 div)
(e) Note the deflection. Let it be θ i.e., θ = 30 div
(f) Now, insert the key K_2 without changing the value of R, adjust the value of K, such that deflection in galvanometer reduces exactly to half the value obtained i.e., θ/2.
(g) Note the value of R.
(h) Repeat the above steps for various values of R.

RESULT:

(1) The resistance of galvanometer is found to be
(2) Figure of merit of galvanometer is 1.512×10^{-5} A/division

DIAGRAM



where :

ABCD - Rectangular glass slab, O - Object, I - image

R_3 - position of particles on glass slab,

R_2 - position of image (object seen through glass slab)

R_1 - position of object.

Date 8.11.23

Expt. No. 5

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REFRACTIVE INDEX OF GLASS

AIM: To determine the refractive index of glass using travelling microscope.

APPARATUS: Travelling microscope, a glass slab, chalk dust and paper.

PRINCIPLE: If a glass slab is placed in air or horizontal surface and its bottom surface is viewed from top, it appears to be elevated due to the refraction. The distance between the apparent bottom and the top surface of the slab gives the apparent thickness of the slab. In case of normal observation, the refractive index of the glass with respect to air is the ratio of real thickness of glass slab to the apparent thickness.

FORMULA:

(1) Total reading $TR = MSR + (CVD \times LC)$ cm

(2) Refractive index of glass slab $n_g = \frac{R_3 - R_1}{R_3 - R_2}$

where: MSR - Main scale reading

CVD - coincide vernier scale division.

LC - Least count

R_1 - travelling microscope reading when focussed on object (ink mark) through air.

R_2 - travelling microscope reading when focussed

Observations:

The value of 1MSD of travelling Microscope (S) = 0.05 cm
Total number of VSD (N) =

Least count (LC) = $\frac{\text{The value of 1MSD}}{\text{Total no. of VSD}} = \frac{0.05}{50} = 0.001$ cm

S.No	Travelling microscope Reading for								
	Mark made on paper			Mark made on paper through glass slab			Particles on the top of glass surface		
	MSR in cm	CVD in div	TR in cm (R_1)	MSR in cm	CVD in div	TR in cm (R_2)	MSR in cm	CVD in div	TR in cm (R_3)
1.	3.2	4.5	3.6	4.2	37	4.5	5.7	44	6.1

Calculation:

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

$$n_g = \frac{R_3 - R_1}{R_3 - R_2} = \frac{b}{c}$$

$$= \frac{6.1 - 3.6}{6.1 - 4.5} = \frac{2.5}{1.6} = 1.5$$

on image when glass slab is kept on object
R_3 - travelling microscope reading when focussed on the particles on the surface of glass slab.

PROCEDURE:

(1) The least count of travelling microscope is calculated.
(2) A sheet of white paper with ink mark is placed on the base of travelling microscope.
(3) The microscope is adjusted to focus on the ink mark on the paper and readings are noted in vertical scale and total reading (R_1) is found using relevant formula.
(4) Now glass slab is placed on the paper and the microscope is focussed on the ink mark through glass slab and corresponding reading R_2 is found.
(5) Some chalk dust is sprinkled on the upper surface of the glass slab the microscope is focussed on chalk dust and corresponding reading R_3 is found.
(6) Refractive index of glass slab is calculated using the formula $n_g = \frac{R_3 - R_1}{R_3 - R_2}$
(7) The experiment is repeated for one more trial to raise the position of glass slab and hence calculated the refractive index. Then mean refractive index is found.

RESULT: The refractive index of glass in (n_g) = 1.5

PRECAUTIONS:

(1) In microscope, the parallax should be properly removed.

(2) The microscope should be moved in upper direction only to avoid back lash error.

Sources of error:

(1) The microscope scale may not be properly calibrated.

DIAGRAM:

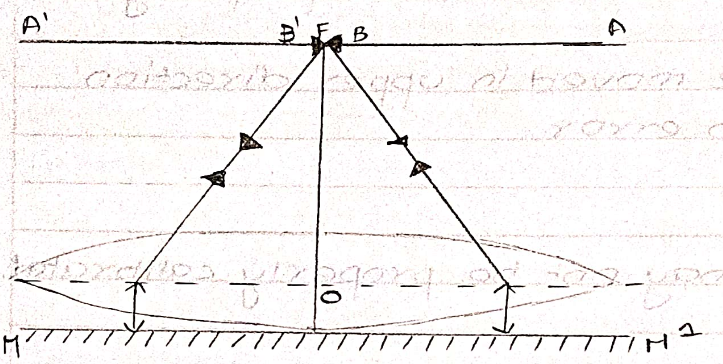

Figure - 1

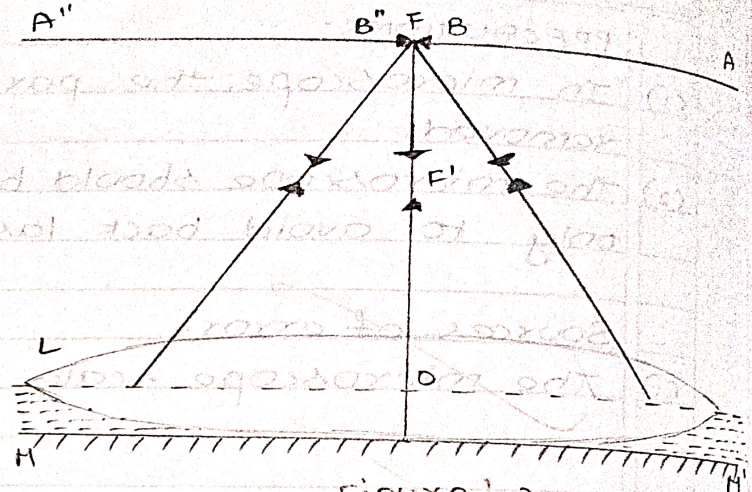

Figure - 2

Where:

L- convex lens, MM'-plane mirror, AB - object pin, A'B' image by convex lens, O-optic centre, A"B" - image by combination of water lens end convex lens.

Date 22.11.23

Expt. No. 6

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REFRACTIVE INDEX OF WATER BY CONVEX LENS.

AIM: To determine the refractive index of water using convex lens and plane mirror.

APPARATUS: Plane mirror, convex lens, laboratory stand with rigid base and clamp arrangement, water, a pin, a plumb line, spherometer and a meter scale.

PRINCIPLE: The reciprocal of the equivalent focal length of the combination of the lens is the equal to the sum of the reciprocal of focal lengths of individual lenses.

In Figure-1, OF-F is the focal length of the convex lens. In Figure-2, OF'-F' is the equivalent focal length of combination of convex lens and the plano-concave lens of water. If Fw is the focal length of the plano-concave lens of water.

$$\frac{1}{F'} = \frac{1}{F} + \frac{1}{f_w}$$

$$\frac{1}{F_w} = \frac{1}{F'} - \frac{1}{F}$$

$$\therefore \quad F_w = \frac{FF'}{F-F'}$$

From lens maker formula the focal length of plano-concave water lens.

$\frac{1}{F_w} = (n_w - 1)\left(\frac{1}{R}\right)$ where F_w - magnitude of the

OBSERVATIONS:

(i) The radius of curvature of the given convex lens (R) =

To measure the focal length of water lens:

S. No	Position of pin with respect to the optical center O						$F_w = \frac{FF'}{F-F'}$ in cm
	Distance of the pin without water			Distance of pin with water from			
	upper surface of lens (d_1 cm)	Plane mirror (d_2 cm)	$F = \frac{d_1+d_2}{2}$ in cm	upper surface of the lens (d_1' cm)	Plane mirror (d_2' cm)	$F' = \frac{d_1'+d_2'}{2}$ in cm	
1.	20.8	21.1	21.1	30.6	31.2	36.9	66.5

Mean F_w = 6.65 cm

Calculation:

Focal length of the plano-concave lens of water

$$F_w = \frac{FF'}{F-F'}$$

Refractive index of water $\mu_w = 1 + \frac{R}{F_w}$

$$= 1 + \frac{20 \times 100}{665}$$

$$= 1.32$$

Focal length of ~~plano-convex~~ concave water lens

$n_w = 1 + \frac{R}{|F_w|}$

FORMULA:

(1) Focal length of plano-concave water lens $F_w = \frac{FF'}{F-F'}$

(2) Refractive index of water, $n_w = 1 + \frac{R}{F_w}$

where: F - Focal length of convex lens

F' - Equivalent focal length of combination of convex lens and plano-concave water lens.

PROCEDURE:

(1) A plane mirror is placed on the base of laboratory stand keeping its reflecting surface upward.

(2) A convex lens is placed on the plane mirror as shown in figure.

(3) A sharp edged bright pin AB is placed horizontally just above the optic center (O) of the convex lens and clamped.

(4) The position of the pin AB is adjusted such that it coincides with its image A'B' without parallax.

(5) The vertical distance between the optic center (O) of convex lens and pin is measured using plumb line. It's equal to the focal length F of convex lens.

(6) A few drops of water are put under the lens with the help of syringe so that the space between the mirror and lens is filled with water.

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(7) The position of the pin AB is raised such that it coincides with its image A "B" without parallax.

(8) Then vertical distance between the optic center (O) of convex lens and pin AB is measured by plumb line, which is equal to the effective focal length F' of the combination lens and water lens.

(9) The focal length of water lens is calculated using the relevant formula.

(10) The radius of curvature of the spherical surface of the convex lens in contact with water is found by using spherometer.

(11) Refractive index of water is calculated using the formula.

PRECAUTIONS:

(1) The parallax should not be there

(2) Meter scale should be straight while taking reading.

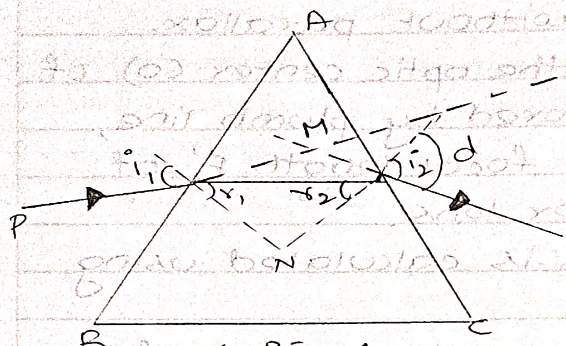
(3) Air bubbles should not be there in water.

Sources of error:

(1) Formation of air bubbles in water.

(2) Impurities in water.

DIAGRAM:



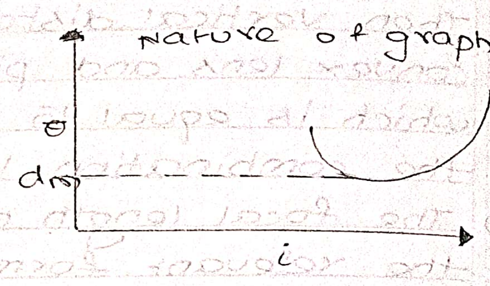


FIGURE - I

Where:

ABC - Prism,

$P_1, Q_1, R_1, S_1, P_2, Q_2, R_2, S_2, \ldots$ - pins.

$i_1\ i_2\ i_3$ - difference angle of incidence

$d_1, d_2\ d_3$ - angle of deviation

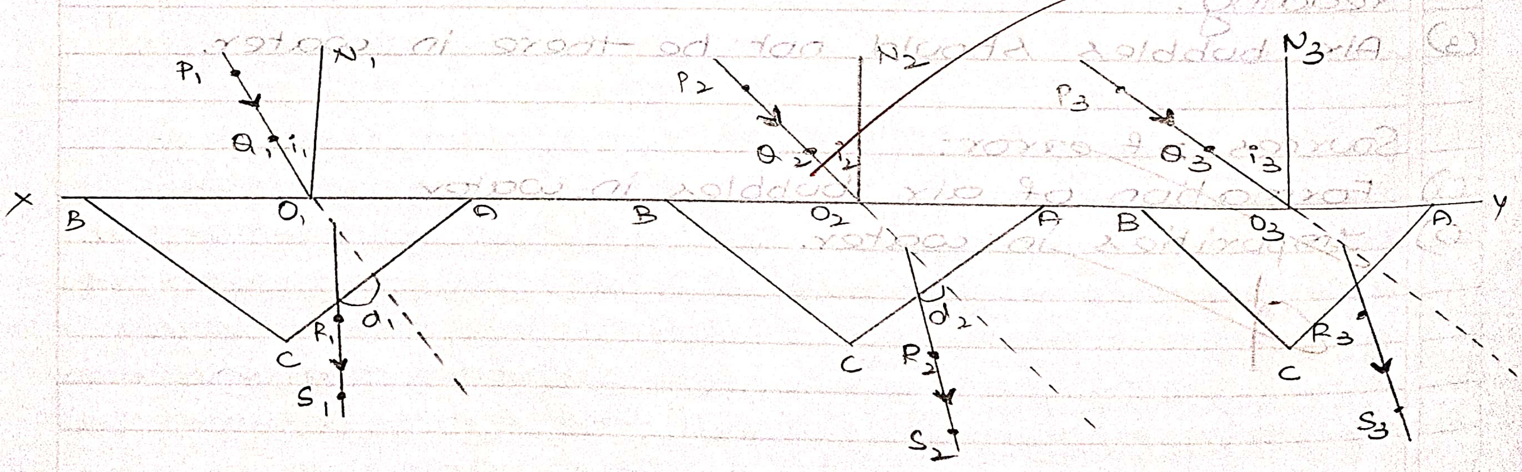


FIGURE-2

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ANGLE OF MINIMUM DEVIATION

AIM:- To determine the angle of minimum deviation for a given glass prism by plotting graph between angle of incidence and the angle of deviation.

APPARATUS:- Drawing board, prism, drawing pins and white paper.

PRINCIPLE:

A ray of light incident on one of the refracting surface of prism of angle A and refractive index n, it will deviate while passing through prism as shown in figure-1. The deviation is given by $d = (i_1 + i_2) - A$ where i_1 and i_2 are angle of incidence and angle of emergence.

As the angle of incidence is gradually increased, the angle of deviation first decreases reaches a minimum value (d_m) and then increases as shown in graph. When the angle of incidence is equal to the angle of emergence, the deviation is minimum.

PROCEDURE:

(1) A straight line XY is drawn on the sheet of white paper fixed on the drawing board.

(2) The points $O_1, O_2, O_3, \ldots$ are marked on line XY.

(3) The normal N_1O_1 is drawn to XY at O_1 and straight line QO_1 is drawn to represent ray of incidence

Observations:

S. NO	Angle of incidence i	Angle of deviation d
1	30°	45°
2	35°	41°
3	40°	40°
4	45°	40°
5	48°	40°
6	55°	43°
7	60°	45°

$$\mu = \frac{\sin\left(\frac{A+D_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

Calculation:

From graph

Angle of minimum deviation $d_m = 40°$

which makes an angle 45° with N_1O_1.

(4) The prism ABC is placed on the paper as shown in the figure and its boundary is drawn.

(5) Two pins P_1 and Q_1 are vertically fixed about 5cm apart on the ray of incidence D_1O_1.

(6) While seeing the images of the pins P_1 and Q_1 through the other refracting surface BC of the prism, two more pins R_1 and S_1 are fixed on the side of AC so that R_1S_1 and the images of the pins P_1 and Q_1 will be collinear.

(7) Pins are removed and their pricks are marked. A straight line is drawn through the pin pricks of R_1 and S_1 to obtain the ray of emergence.

(8) The ray of incidence and emergence are extended as shown in the figure-2 to find the angle of deviation (d)

(9) The experiment is repeated for different value of angle of incidence and to find the corresponding angle of deviation.

(10) A graph of angle of incidence (i) versus angle of deviation (d) is drawn and angle of minimum deviation d_m is ~~equ~~ found from the graph.

RESULT: The angle of minimum deviation, $d_m = 40^\circ$

PRECAUTIONS:

(1) The angle of incidence should lie between $35^\circ - 60^\circ$

(2) The pins should be fixed vertically.

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(3) The distance between the two pins should not be less than 10mm.

(4) Arrow heads should be marked to represent incident and emergent rays.

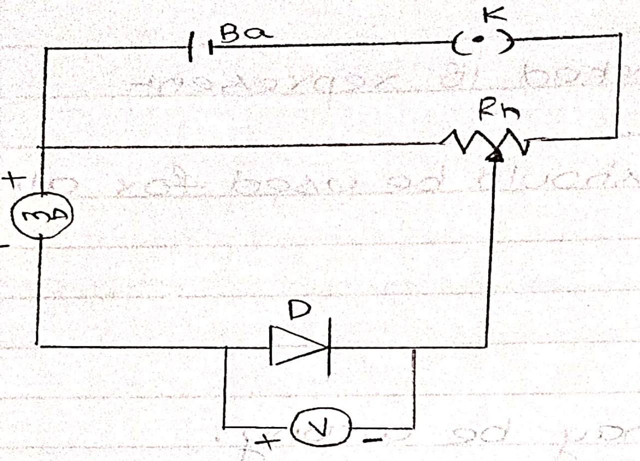
(5) The same angle of prism should be used for all observations.

Sources of error:

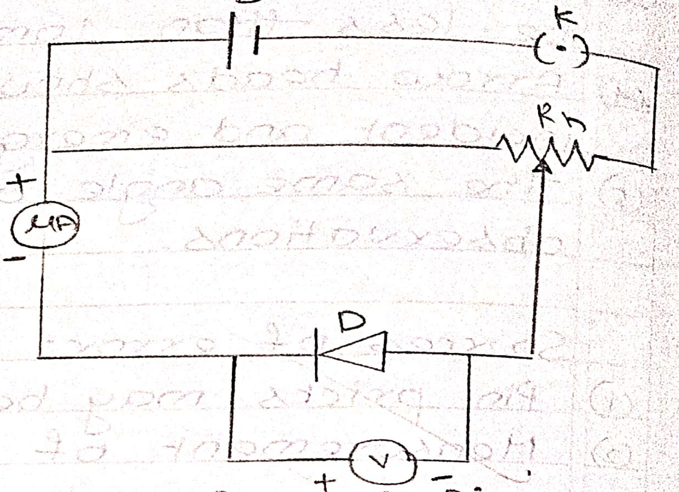
(1) Pin pricks may be thick.

(2) Measurement of angles may be wrong.

CIRCUIT DIAGRAM:



Forward Bias

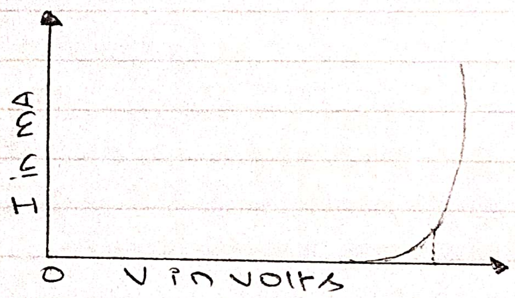


Reverse Bias

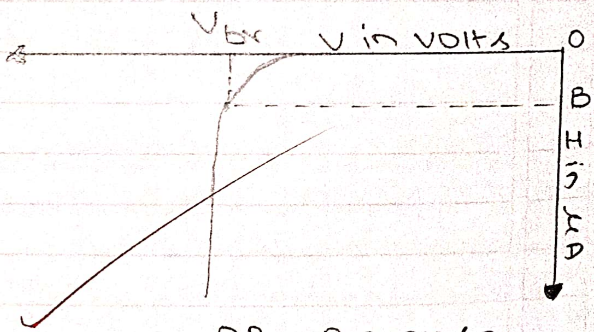
Where:

Ba - Battery, V - Voltmeter, μA - Micro ammeter, mA - Milli ammeter, Rh - Rheostat, D - Diode, K - plug key

Nature of Graph:



FORWARD BIAS



OB - Reverse saturation current

REVERSE BIAS

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SEMI-CONDUCTOR DIODE

AIM:- To draw the I-V characteristic curve of a p-n junction in forward bias and reverse bias.

APPARATUS:- A p-n junction diode, milli ammeter, micro ammeter, voltmeter, rheostat and battery.

PRINCIPLE:- When p-side of the semi-conductor diode is connected to the positive terminal of the battery, then p-n junction is said to be forward biased. The junction offers low resistance and initially a negligibly small current flows through circuit till the applied voltage crosses a certain value the diode current increases exponentially.

When p-side of the semi-conductor diode is connected to the negative terminal of the battery, then p-n junction is said to be reverse biased. As the applied voltage is increased in the reverse biased condition starting from zero, the current increases, but soon becomes constant. It is called reverse saturation current.

PROCEDURE:

(a) For forward bias:

(i) The connections are made as shown in the circuit diagram.

OBSERVATIONS:

Forward bias characteristics

S.NO	voltage (V) in volts	current I in mA
1	0.06	0
2	0.02	0
3	0.04	0
4	0.60	0.5
5	0.66	2
6	0.72	7
7	0.68	4
8	0.62	1

Reverse bias characteristics

S NO	voltage (V) in volts	current I in mA
1	0	0
2	5	2
3	10	4
4	15	10
5	20	16
6	25	22
7	30	27
8	35	44
9	40	64

(2) Using rheostat, the voltage is adjusted for a value V. The voltage V and corresponding current I are noted.

(3) The voltage is increased in small steps value of V and I are noted in each case and readings are tabulated.

(4) A graph is plotted for the current I versus voltage V.

(5) Cut in voltage is located in the graph.

(b) For reverse bias:

(1) The connections are shown in the circuit diagram.

(2) Using rheostat, the voltage is adjusted for a value V. The voltage V and I are noted.

(3) The voltage is increased in small steps. Value of V and I are noted in each case and readings are tabulated.

(4) A graph is plotted for the current I versus voltage V.

(5) Reverse saturation current is found.

RESULT:

I-V characteristics of p-n junction diode are drawn.

From graph: cut in voltage = OP = 15V

cut out voltage = 0.6V

PRECAUTIONS:

(1) The connections should be neat, clean and tight.

(2) Forward-bias voltage beyond breakdown should

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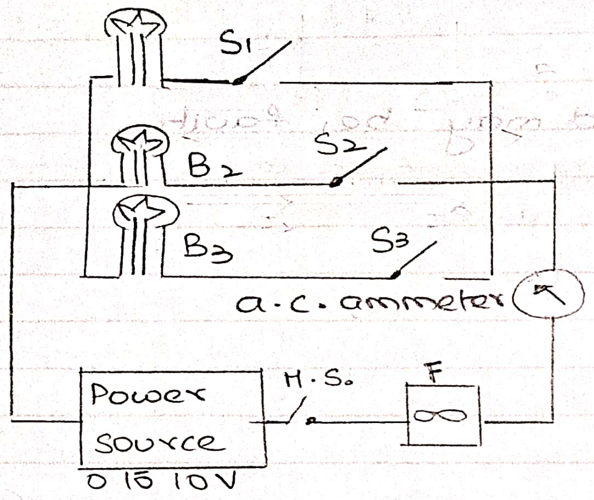
not be applied.

(3) Reverse - bias voltage beyond breakdown should not be applied.

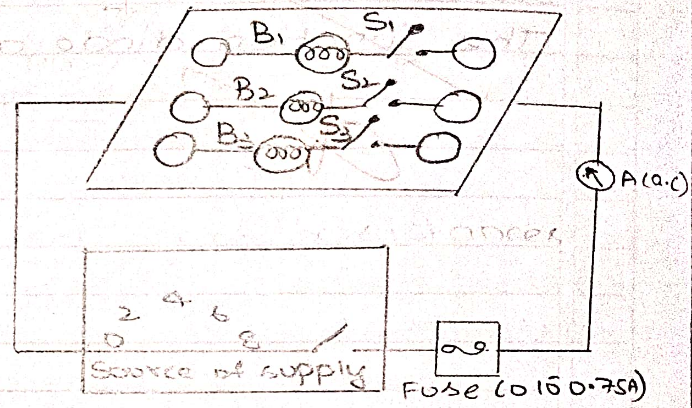
Source of error:

The junction diode applied may be faulty.

CIRCUIT DIAGRAM:



(a) Circuit diagram



(b) Actual layout

SECTION-A
ACTIVITY-1

AIM: To assemble a household circuit, comprising three bulbs, three (on/off) switches, a fuse and a power source.

APPARATUS: No apparatus required in assembling a circuit.

MATERIAL: Three bulbs (6V, 1W) each, a fuse of 0.6A, main switch a power supply (battery eliminator), three (on/off) switches flexible connecting wire with red and black plastic covering, a fuse wire.

SUPPLEMENTARY: Main electric board with a two-pin socket and main switch.

THEORY:
Electricity supplied to us for domestic purposes is 220V a.c and 50Hz. The household circuit, all appliances are connected in "parallel" with mains. The switches are connected in series with each appliances in live wire. 5A switches are required for normal appliances like bulbs, flourescent tubes fans etc, 15A sockets and switches are required for heavy load appliances like, refrigerator, air conditioner, geyser, hot plates etc. All appliances must have three wires called live, neutral and the earth. Total power consumption 'P' at a time

$$P = P_1 + P_2 + P_3 - - -$$

where P_1, P_2, P_3 are the powers drawn by appliances. To protect the appliances from damage when unduly high currents are drawn fuse of little higher rating, 10 to 20% higher than the current normally drawn by all appliances. For further safety, a suitable value MAINS FUSE like rating 32A is connected in series with supply source.

PROCEDURE:

(1) Connect the bulbs B_1, B_2 and B_3 in series with switches S_1, S_2 and S_3 respectively and connect each set ~~p~~. Connect main supply to a step-down transformer (battery eliminator) to get required voltage from 0 to 10V (0, 2, 4, 6, 8 and 10V)

(2) Connect the mains fuse M.S. in series with the power supply (battery eliminator).

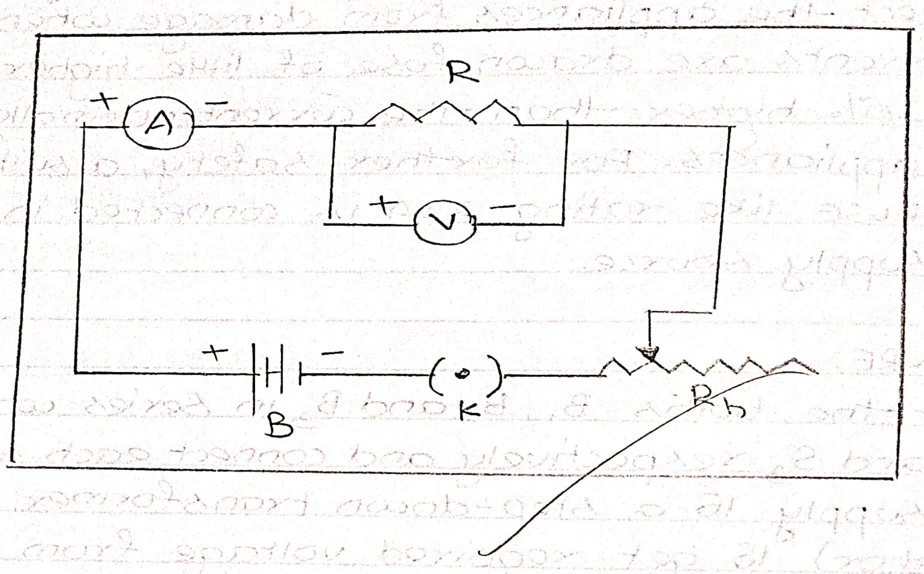
(3) Connect an a.c. ammeter in series with the B-S set.

(4) Connect one end of power supply to one end of B-S set.

(5) Check the circuit once again to ensure that household circuit is complete.

(6) Gradually increase the current to 0.75A, the fuse must burn off at about 0.6A.

CIRCUIT DIAGRAM:



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ACTIVITY- 2

AIM: To assemble the components of a given electrical circuit (Say Ohm's law circuit)

APPARATUS: A voltmeter and an ammeter of appropriate range, a battery, a rheostat, one way key.

MATERIAL: An unknown resistance or resistance coil, connecting wires, a piece of sand paper.

PROCEDURE:

(1) Connect the rheostat in series with the battery with a key.

(2) Connect the ammeter in series with the circuit, to measure the current.

(3) Connect the voltmeter in parallel to the resistor, to measure the potential difference.

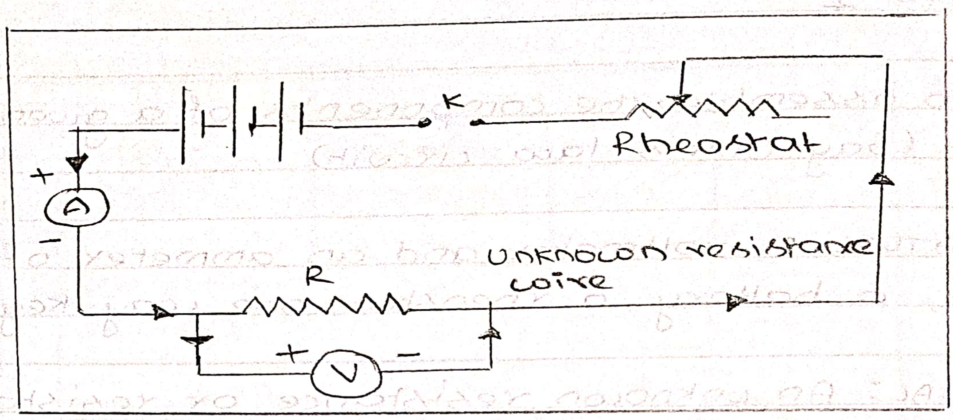
(4) Connect the switch in series with the battery.

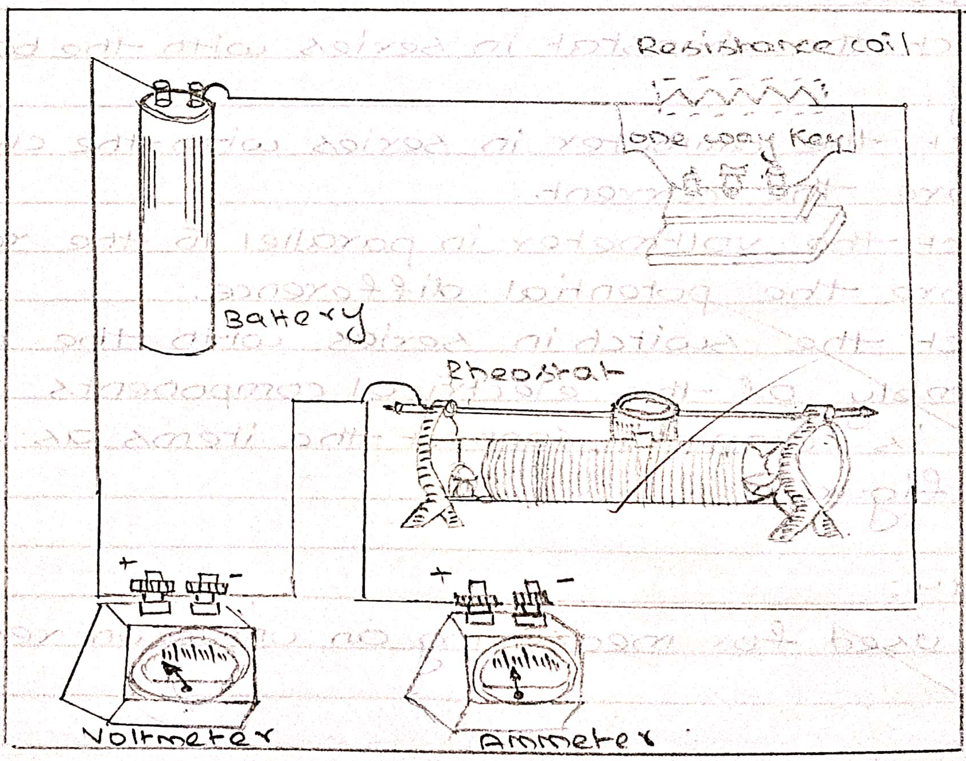
(5) Assembly of the electrical components in electric circuit is complete. Connect the items as shown in the figure.

UTILITY:

It is used for measuring an unknown resistance.

CIRCUIT DIAGRAM:





ACTIVITY-3

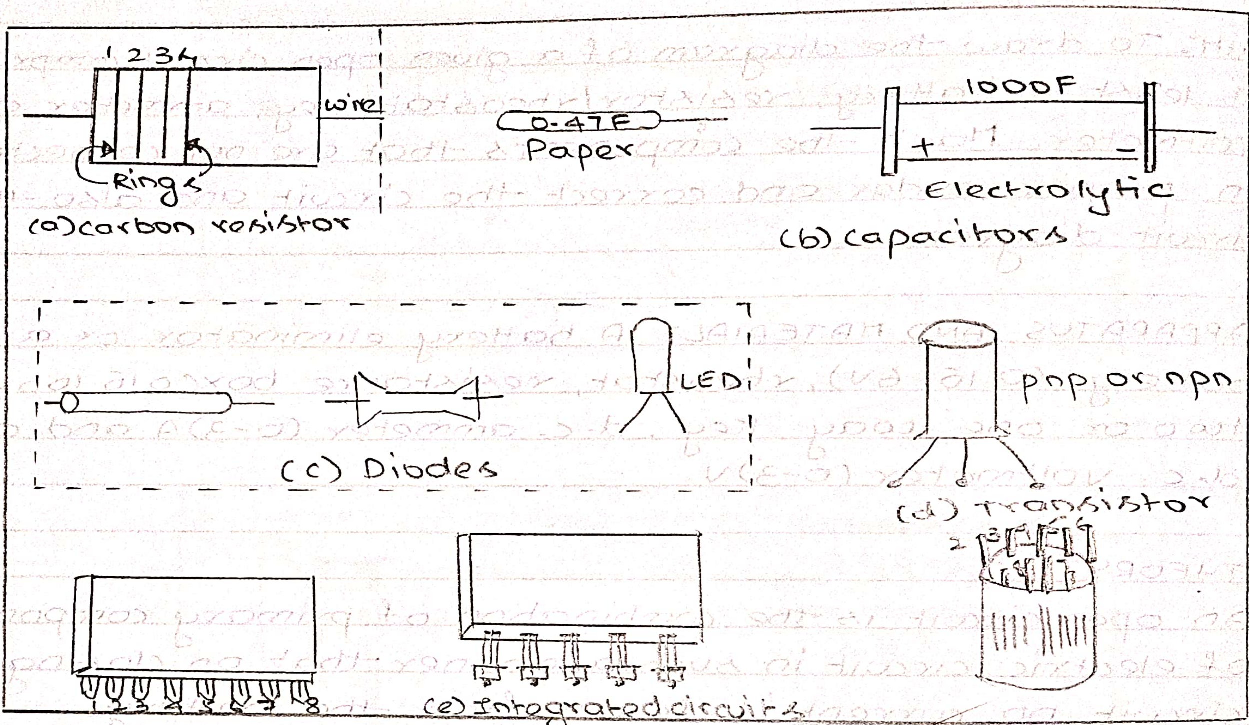
AIM:- To draw the diagram of a given open circuit comprising at least a battery, resistor/rheostat, key, ammeter and voltmeter. Mark the components that are not connected in proper order and correct the circuit and also the circuit diagram.

APPARATUS AND MATERIAL: A battery eliminator or a battery (0 to 6V), rheostat, resistance box(0 to 100 Ω), two or one way key, d.c. ammeter (0-3)A and a d.c. voltmeter (0-3)V.

THEORY:
An open circuit is the combination of primary components of electric circuit in such a manner that on closing the circuit no current is drawn from the battery.

PROCEDURE:
Ammeter. It should be connected in series with the battery eliminator.
Voltmeter. It should be connected in parallel to resistor.
Rheostat. It should be connected in series (in place of resistance coil) with the battery eliminator.
Resistance coil. It should be connected in parallel (in place of rheostat).
One way key. It should be connected in series to the battery eliminator.

Correct circuit diagram (components connected in proper order).



Some of the commonly available circuits

SECTION - B

ACTIVITY - 4

AIM: To identify a diode, an LED, a transistor, an IC, a resistor and a capacitor from a mixed collection of such items.

APPARATUS: Multimeter
MATERIAL: Above mixed collection of items.

THEORY:
For identification, appearance and working of each item will have to be considered.

(1) A diode is a two terminal device. It conducts when forward biased and does not conduct when reverse biased. It does not emit light while conducting. Hence, it does not glow.

(2) A LED (light emitting diode) is also a two terminal device. It also conducts when forward biased and does not conduct when reverse biased. It emits light while conducting. Hence, it glows.

(3) A transistor is a three terminal device. The terminals represent emitter (E), base (B) and collector (C).

(4) An IC (integrated circuit) is a multi-terminal device in form of a chip.

(5) A resistor is a two terminal device. It conducts when either forward biased or reverse biased. (Infact there is no forward or reverse bias for a resistor). It conducts even when operated with A.C

OBSERVATIONS:

No. of obs	Number of legs	Name of device	No. of obs	Possible current flow	Name of device
1.	More than 3	IC	4.	Undirectional emit no light	Diode
2.	Three	Transistor	5.	Undirectional emit light	LED
3.	Two	capacitor, diode LED or resistor	6.	Both direction (steady)	Resistor
			7.	Initial high but decays to zero	capacitor

or D.C. voltage.

(6) A capacitor is also a two terminal device. It does not conduct when either forward biased or reverse biased. When a capacitor is connected to a d.c. source, then multi-meter shows some current initially but it decays to zero quickly. It is because that initially a capacitor draws a charge.

The components to be identified are shown in figure.

PROCEDURE:

(1) If the item has four or more terminals and has form of a chip, it is an IC (integrated circuit).

(2) If the item has three terminals, it is a transistor.

(3) If the item has two terminals, it may be a diode, a LED, a resistor or a capacitor. To differentiate proceed as ahead.

(4) Put the selector on resistance R of multimeter for checking continuity. The probe metal ends are inserted in terminal marked on the multimeter as common and P (or +ve). If such that ~~the~~ black one is in common and red probe is in P (or +ve). On touching the two ends of the device to the two other metal ends of probes.

(1) If pointer moves when voltage is applied in one way and does not move when reversed and there is no light emission, then item is a diode.

(2) If pointer moves when voltage is applied in one way and does not move when reversed and there is light emission, the item is a LED.

(3) If pointer moves when voltage is applied in one way and also when reversed, the item is a resistor.

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(4) If pointer does not move when voltage is applied in one way and also when reversed, the item is a capacitor.

ACTIVITY-5

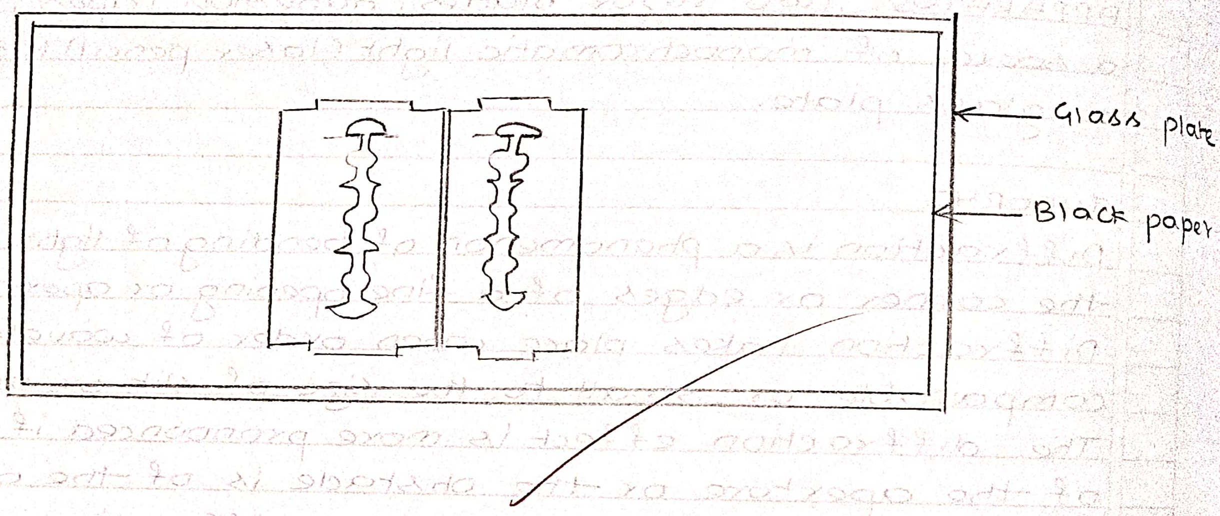
AIM: To observe diffraction of light due to a thin slit between sharp edges of razor blades.

APPARATUS: Two razor blades, adhesive tapes, a screen a source of monochromatic light (laser pencil) black and a glass plate.

THEORY:
Diffraction is a phenomenon of bending of light around the corner or edges of a fine opening or aperture. Diffraction takes place when order of wavelength is comparable or small to the size of slit or aperture. The diffraction effect is more pronounced if the size of the aperture or the obstacle is of the order of wavelength of the waves. The diffraction pattern arises due to interference of light waves from different symmetrical point of the same wavefront. The diffraction pattern due to a single slit consists of a central bright band having alternate dark and weak bands of decreasing intensity on both sides

For diffraction, $d \sin\theta = n\lambda$

Here d = size of aperture or slit
θ = angle of diffraction
n = order of diffraction.
λ = wavelength of light


Glass plate
Black paper

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PROCEDURE:

(1) Fix the black paper on the glass plate by using adhesive.
(2) Place two razor blades so that their sharp edges are parallel and extremely close to each other to form a narrow slit in between, as shown in figure.
(3) Cut the small slit inbetween the edges of blades and place at a suitable distance from a wall or screen of a dark room.
(4) Throw a beam of light on the slit by the laser pencil.
(5) A diffraction pattern of alternate bright and dark bands is seen on the wall.

CONCLUSION:

When light waves are incident on a slit or aperture then it bends away (spread) at the corners of slit showing the phenomena of diffraction of light.

PRECAUTIONS:

(1) Air gaps should not be left between glass plates and black paper.
(2) The razor blades should be placed extremely closed as possible.
(3) Diffraction pattern should be seen on a wall of a dark room.
(4) A point source of monochromatic light like laser torch should be used.

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Date 26.11.23

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ACTIVITY 6

AIM: To study the nature and size of the image formed by a concave mirror on a screen by using a candle and a screen (for different distances of the candle from the mirror).

APPARATUS: An optical bench with three uprights, a concave mirror with holder, a burning candle, a card-board screen.

THEORY:

From mirror formula $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

When $u = \infty$ (infinite), $v = -f$

When $u = -2f$, $v = -2f$

When $u = -f$, $v = \infty$ (infinite)

When $u < (-f)$, u becomes positive, image is virtual

Hence as the object (burning candle) is moved from infinity towards the concave mirror, its image (position of screen) moves from mirror focus towards infinity. The two cross each other at distance $2f$ i.e., at the centre of curvature of the mirror.

For candle distance less than focal length, image becomes virtual and does not come on screen.

PROCEDURE:

Find rough focal length of the concave mirror by usual method.

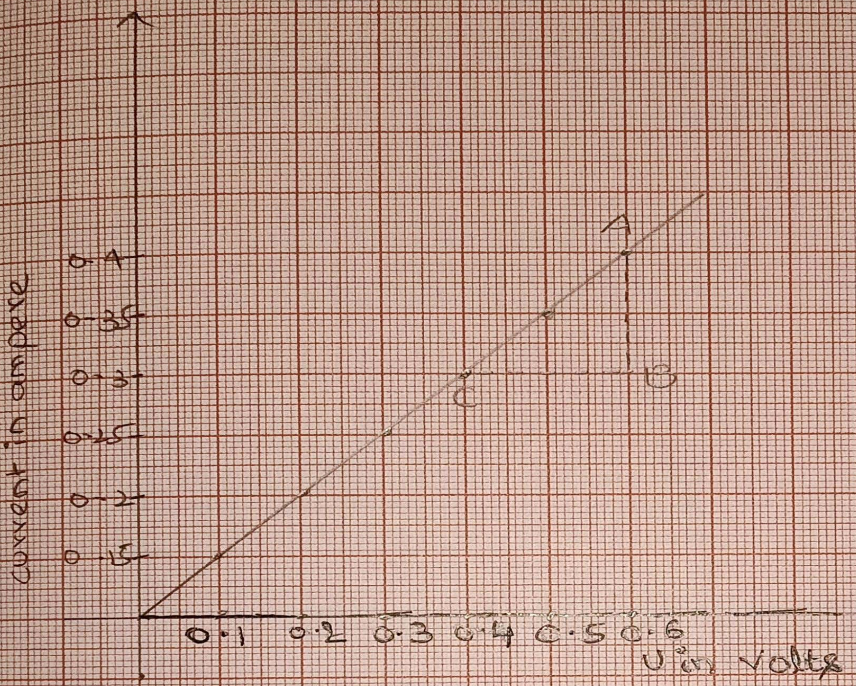
Mount the concave mirror in holder in first upright and keep it near one end of the optical bench, keeping mirror face inward.
Mount the card-board screen on a second upright and keep it at a distance equal to length of mirror, from first upright.
Mount the burning candle in third upright and keep it near other end of the optical bench.
Adjust heights so that the inverted image of erect flame of burning candle is formed on screen. Move the screen to make the image sharp. The screen will be nearly at the focus of the concave mirror.
The image will be real, inverted and much more diminished.
As the burning candle is moved towards the mirror, the screen has to be moved away from it for getting a sharp flame image. The inverted image size increases.
When the position of the candle approaches centre of curvature of the mirror, the screen also approaches the same position. The image size will be equal to the actual flame size.
Now interchange the uprights. Bring candle upright nearer to mirror than the screen upright.
Move the candle further nearer. The screen has to be moved away for getting an enlarged inverted real image on screen.
As the candle reaches the focus of the mirror, the screen may not be able to get its image

which will be formed at infinity i.e. beyond the length of the optical bench.

CONCLUSION:

This change in position, nature and size of the image is according to theoretical predictions.

Experiment No. : RESISTIVITY OF WIRES **Date :**



Scale

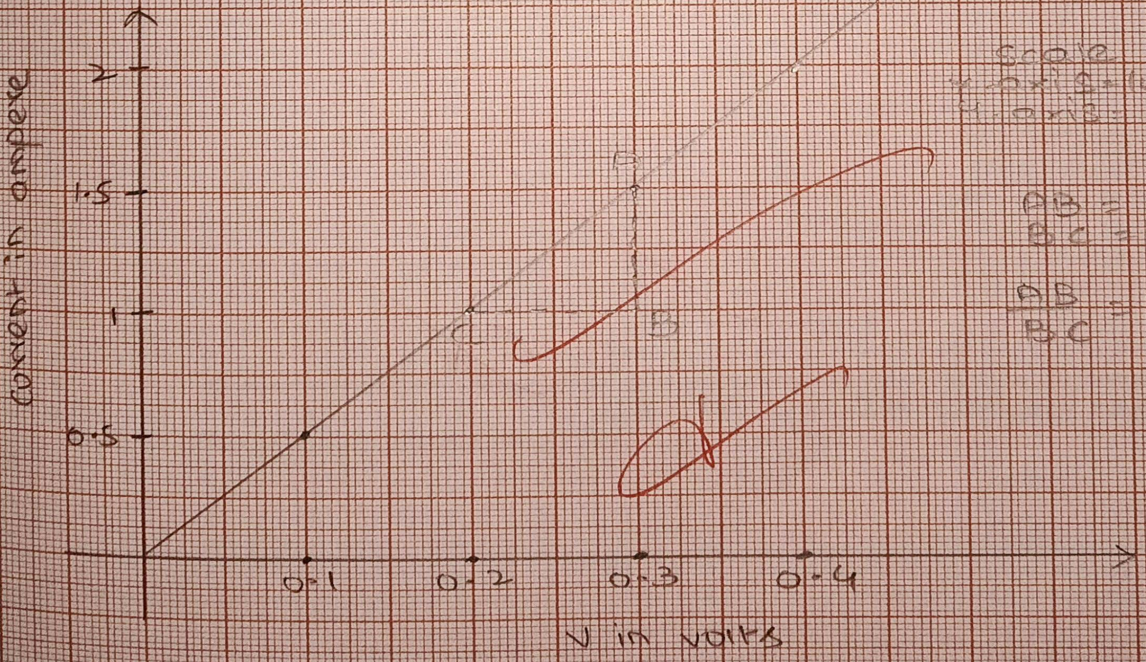
X-axis = 1 unit = 1V

Y-axis = 1 unit = 0.05A

AB = 0.24

BC = 0.18

$\frac{AB}{BC} = \frac{0.24}{0.18} = 0.75\Omega$



Scale

X-axis = 1 unit = 0.05V

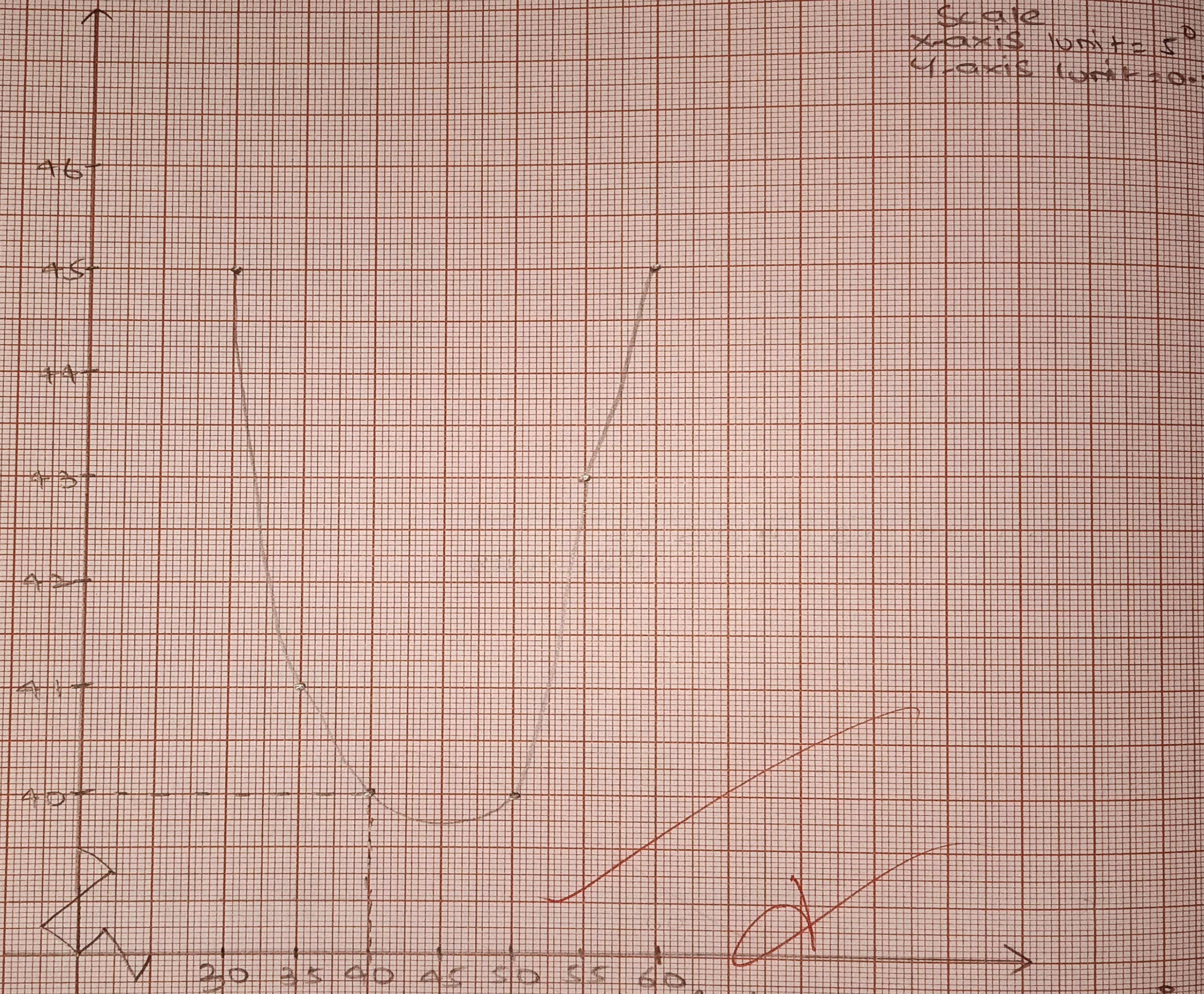
Y-axis = 1 unit = 0.25V

AB = 0.45

BC = 0.3

$\frac{AB}{BC} = \frac{0.45}{0.3} = 0.666\Omega$

Experiment No. : ANGLE OF MINIMUM DEVIATION FOR PRISM Date :



angle of minimum deviation = 40°

Experiment No. : P-N JUNCTION

Date :