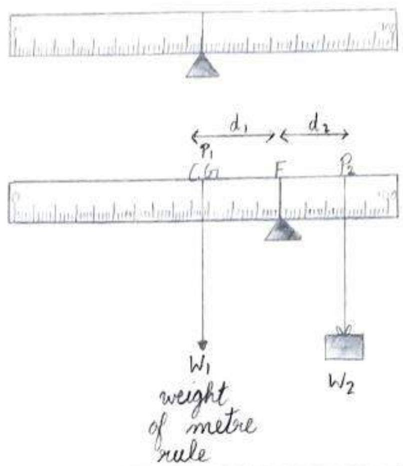
General Diagram



Calculations

1) $W_1 d_1 = W_2 d_2$

$W_1 \times 12.8 = 50 \times 16.2$

$W_1 = \frac{50 \times 16.2}{12.8}$

$= 63.3$ gf

2) $W_1 d_1 = W_2 d_2$

$W_1 \times 13.6 = 50 \times 17.2$

$W_1 = \frac{50 \times 17.2}{13.6}$

$= 63.2$ gf

Experiment No. 1

Aim — To find the weight of a given metre rule by using principle of moments.

Apparatus Used — A metre rule, a knife edge, a known weight of 50 gf.

Formula Used — $W_1 d_1 = W_2 d_2$, where

W_1 = weight of metre rule

W_2 = 50 gf

$d_1 = F - P_1$ or $F - CG$

$d_2 = P_2 - F$

Theory

Moment of Force

Moment of force is the turning of a body due to the force applied.

Moment of force is the product of the force applied and the perpendicular distance between the point of rotation and point of application of force.

S.I unit of moment of force is newton metre.

CGS unit of moment of force is dyne centimetre.

3) $W_1 d_1 = W_2 d_2$

$W_1 \times 14.5 = 50 \times 18.2$

$W_1 = \frac{50 \times 18.2}{14.5}$

$= 62.8$ gf

4) $W_1 d_1 = W_2 d_2$

$W_1 \times 15.4 = 50 \times 19.3$

$W_1 = \frac{50 \times 19.3}{15.4}$

$= 62.7$ gf

5) $W_1 d_1 = W_2 d_2$

$W_1 \times 16.2 = 50 \times 20.2$

$W_1 = \frac{50 \times 20.2}{16.2}$

$= 62.3$ gf

6) $W_1 d_1 = W_2 d_2$

$W_1 \times 17.2 = 50 \times 21.3$

$W_1 = \frac{50 \times 21.3}{17.2}$

$= 61.9$ gf

Experiment No./Name :

Moment of Force = F × ⊥ distance

τ (Torque) = F × ⊥ distance

PRINCIPLE OF MOMENTS

According to principle of moments, if a body is in rotational equilibrium, then the sum total of anti clockwise moments is equal to the sum total of clockwise moments.

A.C.W.M = C.W.M

The weight of a metre rule can be found by using principle of moments.

Average weight of metre rule $= \frac{\text{sum of weights}}{6}$

$= \frac{63.3 + 63.2 + 62.8 + 62.7 + 62.3 + 61.9}{6}$

$= \frac{376.2}{6}$

$= 62.7$ gf

Experiment No./Name :

OBSERVATION TABLE

OBSERVATION NUMBER	CENTRE OF GRAVITY C.G. (cm)	POSITION OF FULCRUM F (cm)	POSITION OF 50 gf P_2	$d_1 = F - CG$ (cm)	$d_2 = P_2 - F$ (cm)
1	50.3	63.8	80	12.8	16.2
2	50.3	64.8	82	13.6	17.2
3	50.3	65.8	84	14.5	18.2
4	50.3	66.7	86	15.4	19.3
5	50.3	67.8	88	16.2	20.2
6	50.3	68.7	90	17.2	21.3

3/5

RESULT The average weight of the given metre rule by using principle of moments = 62.7 gf

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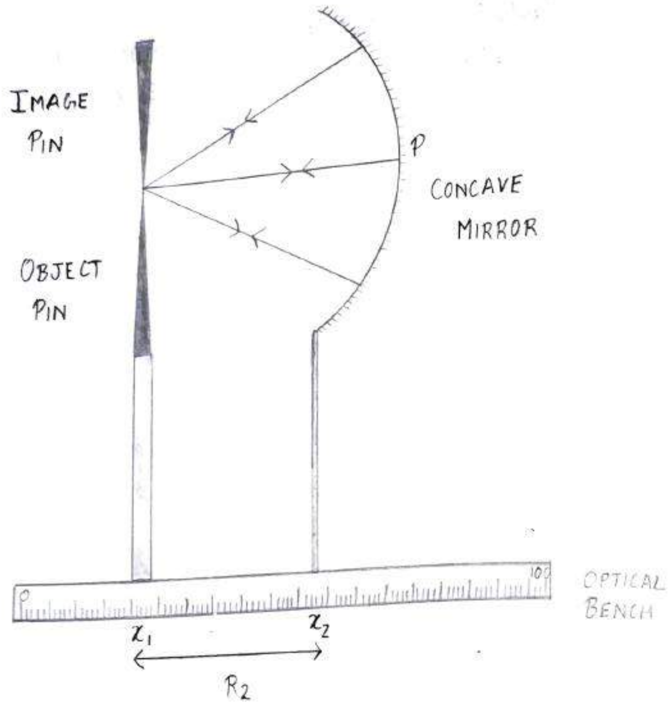
GENERAL DIAGRAM



CALCULATIONS

1) $f = \frac{x_2 - x_1}{2}$

$= \frac{20 - 5.8}{2}$

$= \frac{14.2}{2} = 7.1$ cm

EXPERIMENT No. - 2

AIM To find the focal length of a concave mirror by one pin method.

APPARATUS USED Optical bench, object pin and a concave mirror.

FORMULA USED $f = \frac{R}{2}$ or $f = \frac{x_2 - x_1}{2}$, where

f = focal length of the concave mirror

R = radius of curvature

x_1 = position of object pin

x_2 = position of concave mirror.

THEORY For a distant object, the image is formed by a concave mirror at the focus. The image is real, inverted and diminished. Therefore, the approximate focal length of a concave mirror can be obtained by focusing the real image on a screen or a wall, but for an object at the centre of curvature of a concave mirror, the image of the same size, real and inverted is formed

2) $f = \frac{x_2 - x_1}{2}$

$= \frac{25 - 10.3}{2}$

$= \frac{14.7}{2} = 7.35$ cm

3) $f = \frac{x_2 - x_1}{2}$

$= \frac{30 - 15.2}{2}$

$= \frac{14.8}{2} = 7.4$ cm

4) $f = \frac{x_2 - x_1}{2}$

$= \frac{35 - 20.5}{2}$

$= \frac{14.5}{2} = 7.25$ cm

5) $f = \frac{x_2 - x_1}{2}$

$= \frac{40 - 24.6}{2}$

$= \frac{15.4}{2} = 7.7$ cm

Experiment No./Name :

at the centre of curvature itself. Thus, by focusing the inverted image of a pin itself, the radius of curvature can be determined.

Half of radius of curvature = The focal length i.e $f = \frac{R}{2}$

OBSERVATION TABLE

OBSERVATION NUMBER	POSITION OF OBJECT PIN UPRIGHT x_1 (cm)	POSITION OF IMAGE PIN INVERTED x_1 (cm)	POSITION OF CONCAVE MIRROR x_2 (cm)	FOCAL LENGTH $F = \frac{x_2 - x_1}{2}$
1	5.8	5.8	20	7.1
2	10.3	10.3	25	7.35
3	15.2	15.2	30	7.4
4	20.5	20.5	35	7.25
5	24.6	24.6	40	7.7
6	27.2	29.2	45	7.9

Teacher's Signature ______

6) $f = \frac{x_2 - x_1}{2}$

$= \frac{45 - 29.2}{2}$

$= \frac{15.8}{2} = 7.9$ cm

Average focal length of the concave mirror = $\frac{\text{sum of readings}}{6}$

$= \frac{7.1 + 7.35 + 7.4 + 7.25 + 7.7 + 7.9}{6}$

$= \frac{44.7}{6}$ cm

$= 7.45$ cm

$= 7.5$ cm

Date ___/___/___

Experiment No./Name :

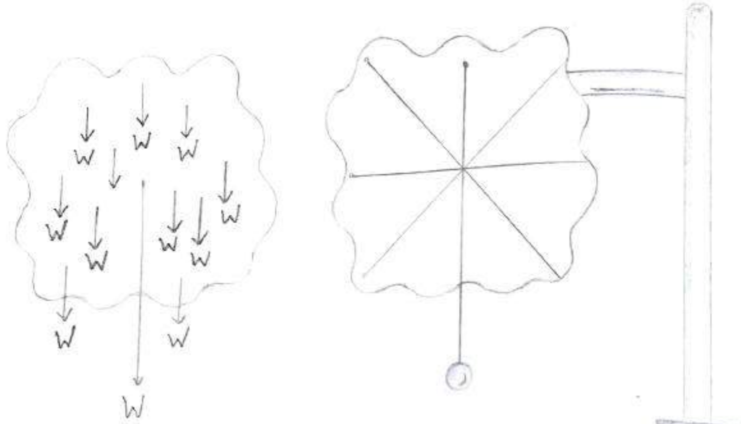
RESULT	The average focal length of the concave mirror by one pin method = 7.5 cm

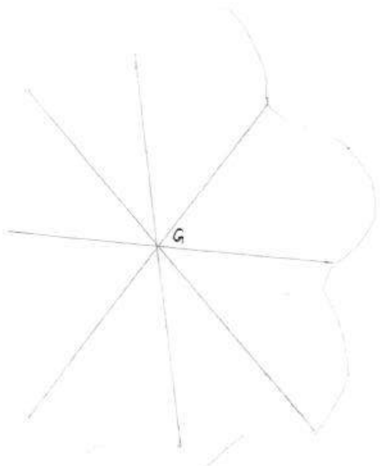
3/5

M

Teacher's Signature

GENERAL DIAGRAM





EXPERIMENT No. ..

AIM To find the centre of gravity of an irregular lamina by using plumbline method.

APPARATUS USED A stand, a plumbline and a ruler

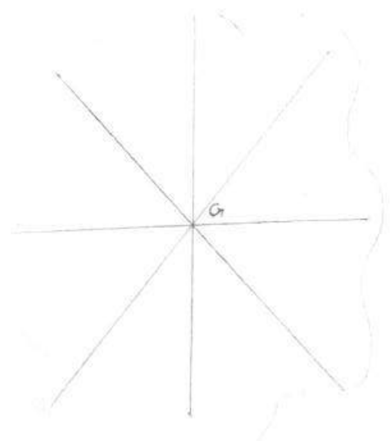
THEORY CENTRE OF GRAVITY

The point at which the whole of the weight of a body is supposed to be acting in the downward direction is known as its centre of gravity.

The centre of gravity of an object depends on the distribution of its mass

The centre of gravity of an irregular lamina can be found by the following methods

1) Plumbline method
2) Trial and error or Balancing method.



Experiment No./Name :

RESULT

The centre of gravity of the given irregular lamina has been indicated by letter 'G'.

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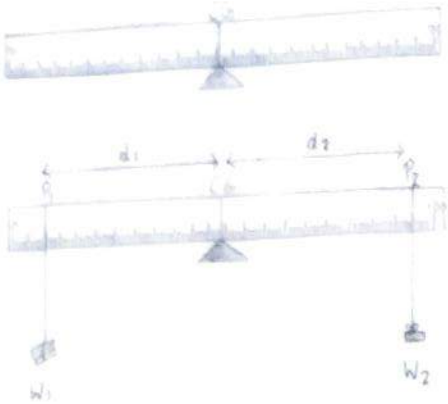
GENERAL DIAGRAM



CALCULATIONS

1) $W_1 d_1 = W_2 d_2$

$W_1 \times 21.8 = 20 \times 34.6$

$W_1 = \frac{20 \times 34.6}{21.8}$

$= 31.74$ gf

2) $W_1 d_1 = W_2 d_2$

$W_1 \times 23.8 = 20 \times 37.5$

$W_1 = \frac{20 \times 37.5}{23.8}$

$= 31.51$ gf

Experiment No./Name 4

EXPERIMENT No. 4

AIM To find the weight of the given irregular object by using principle of moments.

APPARATUS USED A metre rule, a knife edge, a stand, the irregular body and a given weight of 20gf.

FORMULA USED $W_1 d_1 = W_2 d_2$, where

W_1 = weight of the irregular object

d_1 = C.G - P_1

d_2 = P_2 - C.G

W_2 = 20gf

THEORY MOMENT OF FORCE

Moment of force is the turning of a body due to the force applied.
Moment of force is the product of the force applied and the perpendicular distance between the point of rotation and point of application of force.
SI unit of moment of force is newton metre. CGS unit of moment of force is dyne centimetre.
Moment of Force = F × ⊥ distance

Teacher's Signature

3) $W_1 d_1 = W_2 d_2$

$W_1 \times 25.8 = 20 \times 40.2$

$W_1 = \frac{20 \times 40.2}{25.8}$

$= 31.16$ gf

4) $W_1 d_1 = W_2 d_2$

$W_1 \times 27.8 = 20 \times 42.7$

$W_1 = \frac{20 \times 42.7}{27.8}$

$= 30.71$ gf

5) $W_1 d_1 = W_2 d_2$

$W_1 \times 29.8 = 20 \times 45.1$

$W_1 = \frac{20 \times 45.1}{29.8}$

$= 30.26$ gf

6) $W_1 d_1 = W_2 d_2$

$W_1 \times 31.8 = 20 \times 47.7$

$W_1 = \frac{20 \times 47.7}{31.8}$

$= 30$ gf

τ (Torque) = F × ⊥ distance.

PRINCIPLE OF MOMENTS.

According to principle of moments -
If a body is in rotational equilibrium, then the sum total of anti clockwise moments is equal to sum total of clockwise moments.

A.C.W.M = C.W.M

The weight of the irregular object can be found by using principle of moments.

Average weight of the irregular body = $\frac{\text{sum of weights}}{6}$

$$= \frac{31.74 + 31.51 + 31.16 + 30.71 + 30.76 + 30}{6}$$

$$= \frac{185.4}{6}$$

$$= 30.9 \text{ gf}$$

Date __/__/__

Experiment No./Name :

OBSERVATION TABLE

OBSERVATION NUMBER	POSITION OF CENTRE OF GRAVITY C.G (cm)	POSITION OF IRREGULAR BODY P_1 (cm)	POSITION OF 20 gf WEIGHT P_2 (cm)	$d_1 = C.G - P_1$	$d_2 = P_2 - C.G$
1	49.8	28	84.4	21.8	34.6
2	49.8	26	87.3	23.8	37.5
3	49.8	24	90	25.8	40.2
4	49.8	22	92.5	27.8	42.7
5	49.8	20	94.0	29.8	45.1
6	49.8	18	97.5	31.8	47.7

4/5

RESULT: The average weight of the given irregular object by using principle of moments = 30.9 gf.

[signature]

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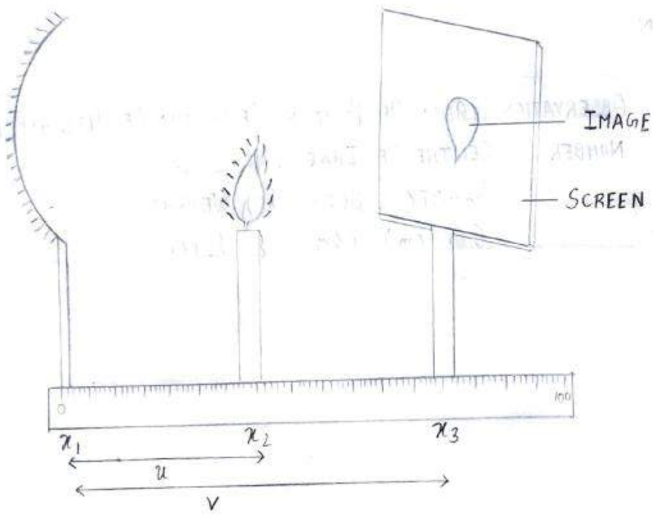
GENERAL DIAGRAM



CALCULATIONS

1) $f = \frac{uv}{u+v}$

$= \frac{18 \times 53}{18 + 53} = \frac{954}{71}$

$= 13.43$ cm.

2) $f = \frac{uv}{u+v}$

$= \frac{19 \times 48}{19 + 48} = \frac{912}{67}$

$= 13.61$ cm

EXPERIMENT No. 5

AIM: To find the focal length of a concave mirror by using an illuminated object (candle) and a screen.

APPARATUS USED: An optical bench, a concave mirror, a glowing candle and a screen.

FORMULA USED: $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ or $f = \frac{uv}{u+v}$

where,

f = focal length of the concave mirror

u = object distance

v = image distance.

THEORY: When the object is placed beyond the focus of a concave mirror, a real and inverted image is formed which can be obtained on the screen.

If u, v and f are respectively the object distance, the image distance and the focal length of the concave mirror. Then,

$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ or $f = \frac{uv}{u+v}$

3) $f = \frac{uv}{u+v}$

$= \frac{20 \times 45}{20 + 45} = \frac{900}{65}$

$= 13.84$ cm

4) $f = \frac{uv}{u+v}$

$= \frac{21 \times 40}{21 + 40} = \frac{840}{61}$

$= 13.77$ cm

5) $f = \frac{uv}{u+v}$

$= \frac{22 \times 36}{22 + 36} = \frac{792}{58}$

$= 13.65$ cm

6) $f = \frac{uv}{u+v}$

$= \frac{23 \times 32}{23 + 32} = \frac{736}{55}$

$= 13.38$ cm

Average focal length of the concave mirror $= \frac{\text{sum of focal length}}{6}$

$= \frac{13.43 + 13.61 + 13.84 + 13.77 + 13.65 + 13.38}{6}$

$= \frac{81.68}{6} = 13.61$ cm

Experiment No./Name : ____________ Date ___/___/___

The size, the position and the nature of the image formed can be changed by changing the position of the object.

OBSERVATION TABLE

OBSERVATION NUMBER	POSITION OF CONCAVE MIRROR x_1 (cm)	POSITION OF CANDLE x_2 (cm)	OBJECT DISTANCE $u = x_2 - x_1$ (cm)	POSITION OF SCREEN (IMAGE) x_3 (cm)	IMAGE DISTANCE $v = x_3 - x_1$ (cm)	f = FOCAL LENGTH $f = \frac{uv}{u+v}$ (cm)
1	0	18	18	53	53	13.43
2	0	19	19	48	48	13.61
3	0	20	20	45	45	13.84
4	0	21	21	40	40	13.77
5	0	22	22	36	36	13.65
6	0	23	23	32	32	13.38

4/5

RESULT The average focal length of the given concave mirror by using an illuminated object and a screen = 13.61 cm.

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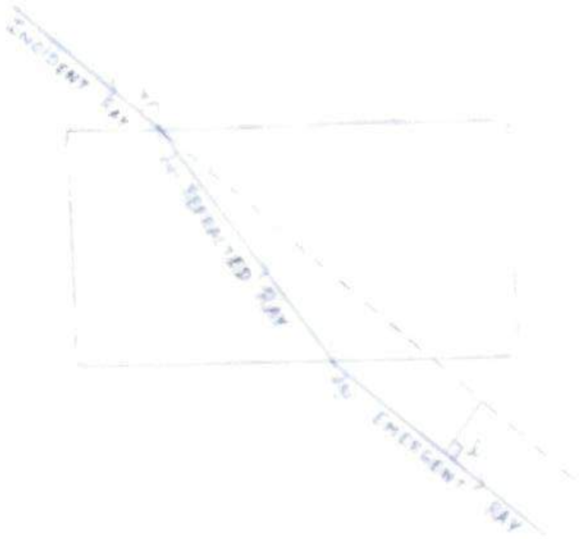
GENERAL DIAGRAM



∠i : ∠ of incidence . ∠r = ∠ of refraction
∠e = ∠ of emergence , l = lateral displacement

EXPERIMENT No.

AIM To study the relationship between the angle of incidence and lateral displacement.

APPARATUS USED A wooden board, a glass slab and pins.

FORMULA USED $_a\mu_g = \frac{\sin i}{\sin r}$

THEORY REFRACTION OF LIGHT

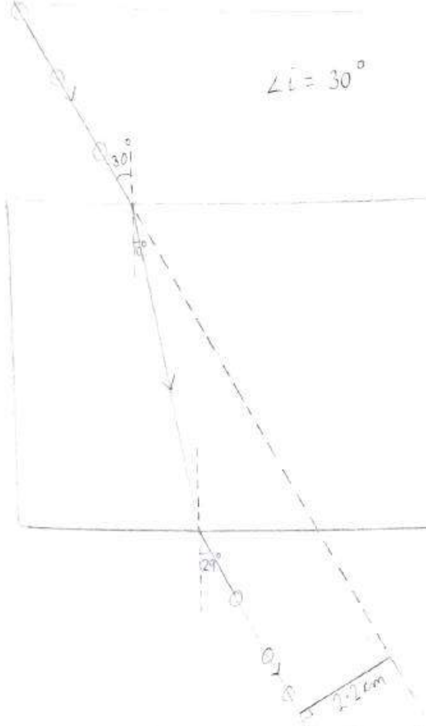
The bending of a ray of light when it moves from one transparent medium to another is known as refraction of light.

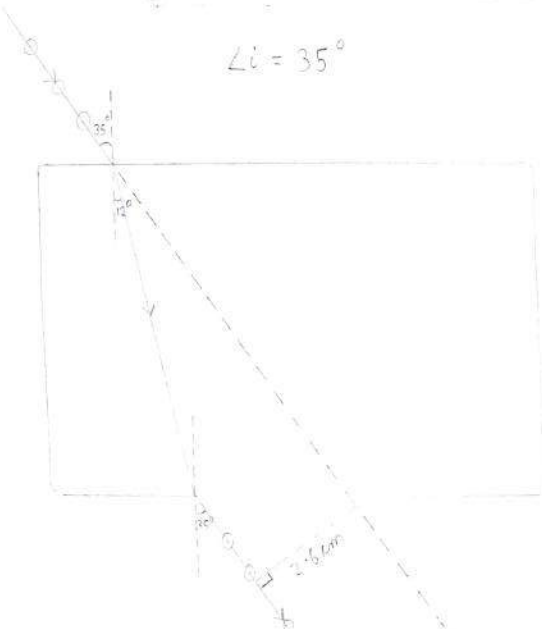
LAWS OF REFRACTION

There are two laws of refraction.

1) The incident ray, the normal at the point of incidence and the refracted ray, all lie on the same plane.

2) The ratio of sine of angle of incidence to the sine of angle of refraction





is a constant for the pair of media. This constant is known as refractive index of the second medium with reference to the first medium. Second law of refraction is also known as Snell's Law.

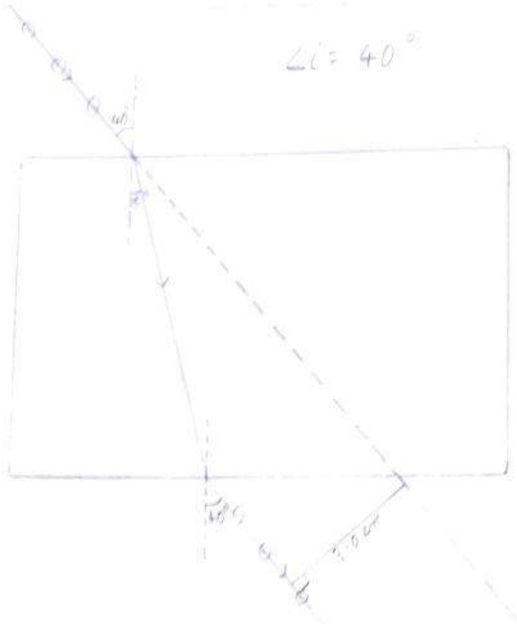
FACTORS AFFECTING THE LATERAL DISPLACEMENT

The following factors affect the lateral displacement in a glass slab.

1) Angle of incidence : More the angle of incidence, more will be the lateral displacement

2) Thickness of the glass slab : More the thickness of the glass slab, more will be the lateral displacement.

3) Refractive index of the glass slab : More the refractive index, more will be the lateral displacement.



OBSERVATION TABLE

OBSERVATION NUMBER	ANGLE OF INCIDENCE ∠i (DEGREE)	ANGLE OF REFRACTION ∠r (DEGREE)	ANGLE OF EMERGENCE ∠e (DEGREE)	LATERAL DISPLACEMENT l (cm)
1	30°	10°	29°	2.2
2	35°	12°	35°	2.6
3	40°	15°	40°	3.0
4	45°	17°	46°	3.4
5	50°	20°	49°	3.7
6	55°	22°	55°	4.2

RESULT

From the graph between angle of incidence and lateral displacement, we observe that the graph is a straight line which means more the angle of incidence, more will be the lateral displacement.

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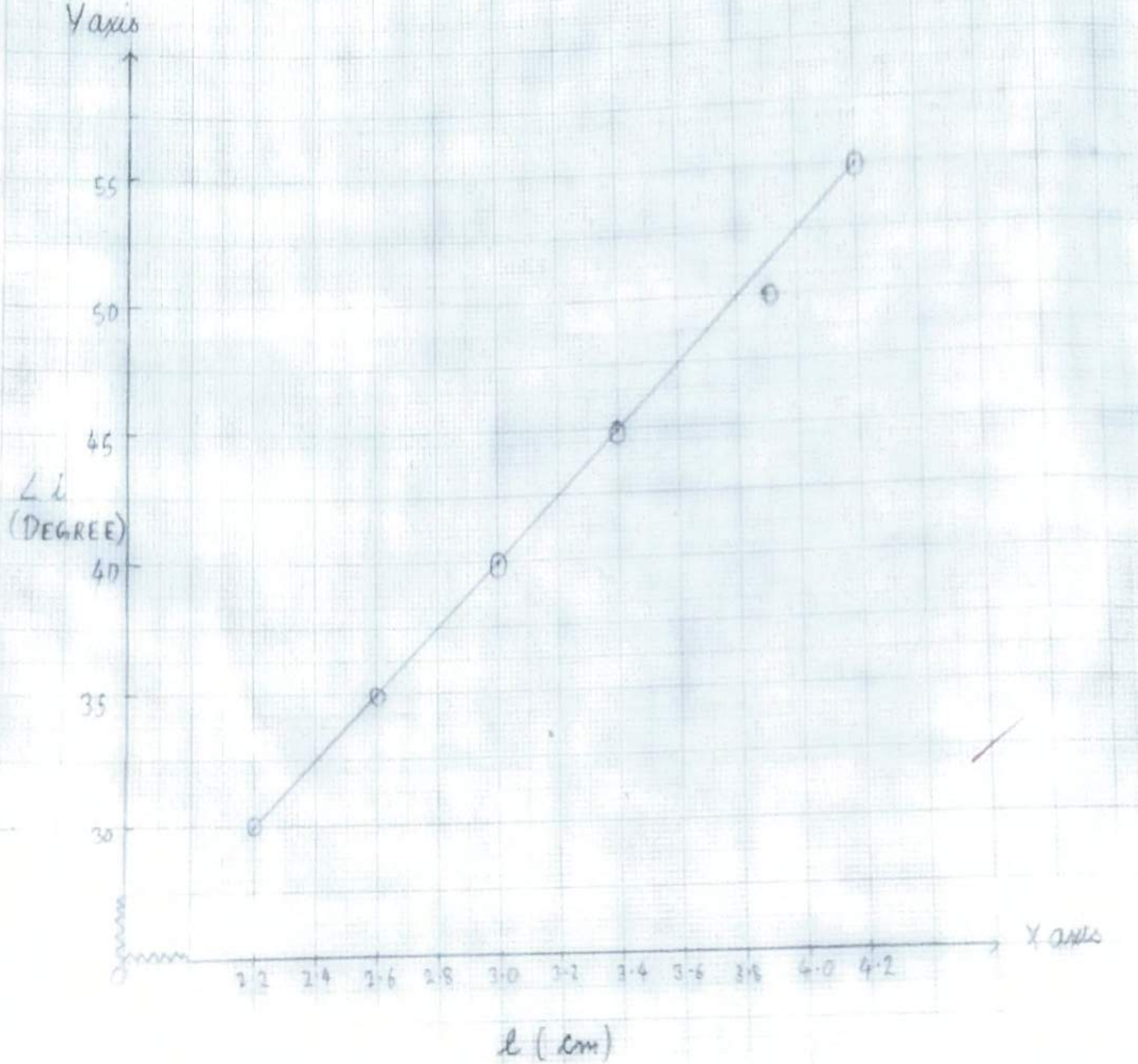
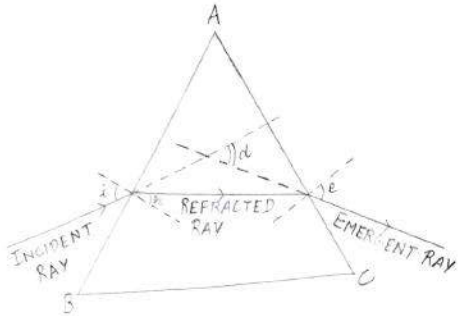
i vs l graph



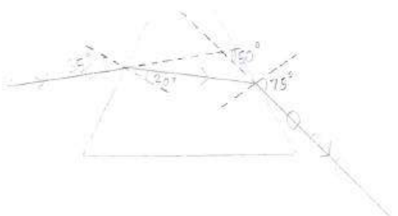
Y axis
55
50
45
40
35
30
∠i (DEGREE)
X axis
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
l (cm)

GENERAL DIAGRAM



$\angle i$ = $\angle$ of incidence
$\angle r$ = $\angle$ of refraction
$\angle e$ = $\angle$ of emergence
$\angle d$ = $\angle$ of deviation
$\angle A$ = $\angle$ of prism

$\angle i = 35^\circ$
$\angle r = 20^\circ$
$\angle d = 50^\circ$
$\angle e = 75^\circ$



EXPERIMENT -

AIM	To study the relationship between angle of incidence and angle of deviation in a glass prism
APPARATUS USED	A glass prism, a wooden block and pins.
FORMULA USED	Refractive index of glass ($_a\mu_g$) = $\frac{\sin i}{\sin r}$
THEORY	REFRACTION OF LIGHT

Bending of a ray of light when it moves from one transparent medium to another is known as refraction of light

LAWS OF REFRACTION

There are two laws of refraction

1) The incident ray, the normal at the point of incident and the refracted ray, all lie on the same plane.

2) The ratio of sine of angle of incidence to the sine of angle of refraction is a constant for the

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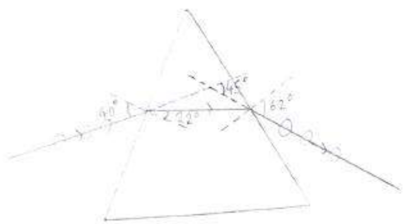
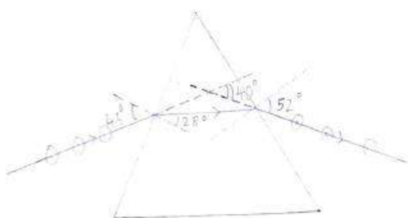
$\angle i = 40^\circ$
$\angle r = 22^\circ$
$\angle e = 62^\circ$
$\angle d = 45^\circ$



$\angle i = 45^\circ$
$\angle r = 28^\circ$
$\angle e = 52^\circ$
$\angle d = 40^\circ$



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Date ___/___/___

Experiment No./Name : ____________

pair of media. This constant is known as refractive index of the second medium with reference to the first medium.

The second law of refraction is also known as Snell's Law

Angle of deviation depends on the following factors.

1) Angle of incidence
2) Refractive index of glass
3) Angle of prism
4) colour of light

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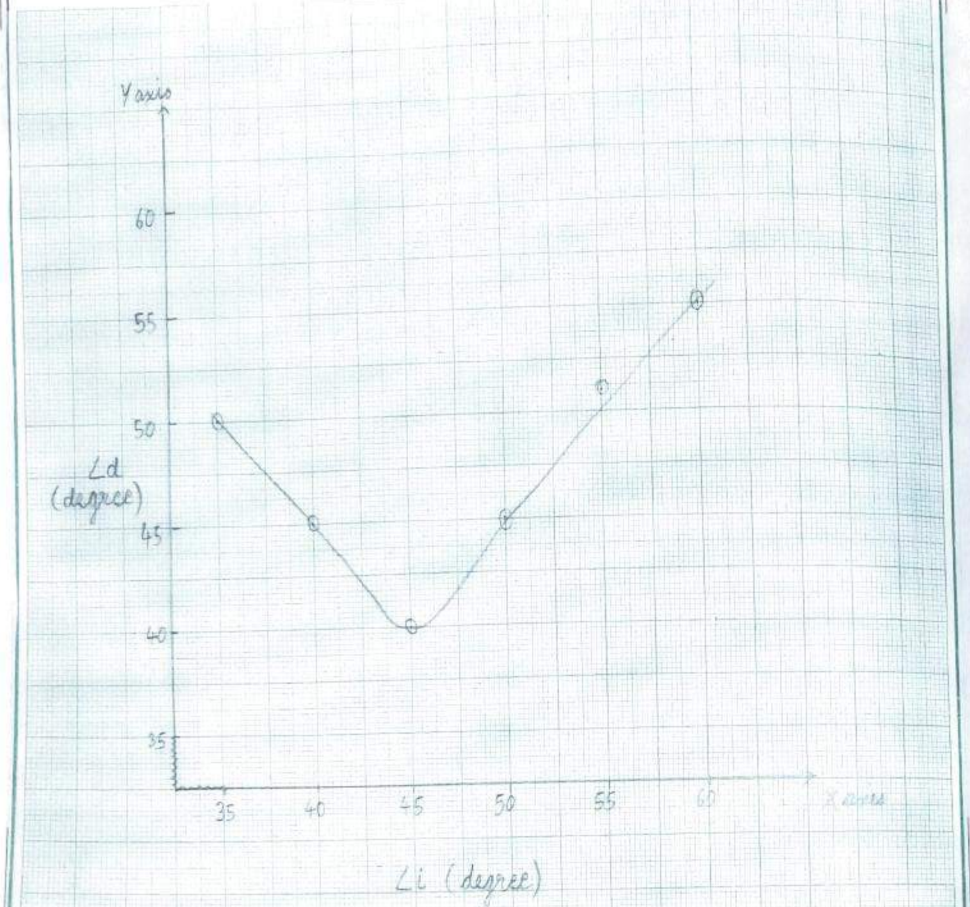

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Date ___/___/___

Experiment No./Name :

OBSERVATION TABLE

OBSERVATION NUMBER	ANGLE OF INCIDENCE ∠i (degree)	ANGLE OF REFRACTION ∠r (degree)	ANGLE OF EMERGENCE ∠e (degree)	ANGLE OF DEVIATION ∠d (degree)
1	35	20	74	[illegible]
2	40	22	62	[illegible]
3	45	[illegible]	52	40
4	50	[illegible]	[illegible]	45
5	55	[illegible]	44	51
6	60	42	47	55

RESULT The graph between angle of deviation and angle of incidence is a parabola

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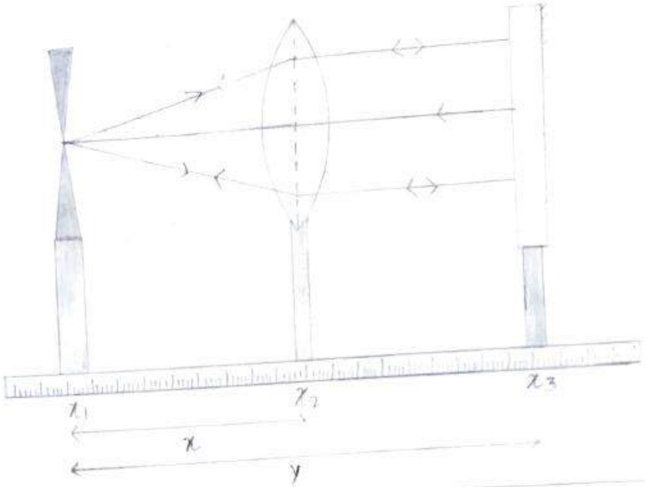
GENERAL DIAGRAM



CALCULATIONS

1) $f = x_2 - x_1$
$40 - 5$
$= 35\, cm$

2) $f = x_2 - x_1$
$= 44.2 - 10$
$= 34.2$

Experiment No./Name : ____

EXPERIMENT No- __

AIM

To find the focal length of a convex lens by using one pin method with the help of a plane mirror.

APPARATUS USED

An optical bench, a convex lens, a plane mirror and an object pin.

FORMULA USED

1) $f = x_2 - x_1$
2) $f = \frac{x+y}{2}$, where -

f = focal length of the convex lens
x_1 = position of the object pin.
x_2 = position of convex lens
x = distance between the pin and the lens
y = distance between the pin and the plane mirror

THEORY

Light rays from the object pin, kept at the focus of the convex lens are made incident on the convex lens and after refraction from the convex lens become parallel to the principle axis and are incident normally on the plane mirror. The get reflected

3) $f = x_2 - x_1$
$48 - 15$
33 cm

4) $f = x_2 - x_1$
$52.1 - 20$
32.1 cm

5) $f = x_2 - x_1$
$= 56 - 25$
$= 31$ cm

6) $f = x_2 - x_1$
$60 - 30$
$= 30$ cm

back from the plane mirror along the same path and get refracted through the lens again and retrace their path to form the inverted image of the object pin on the object pin itself. The distance of the object pin from the convex lens is approximately equal to the focal length of the convex lens. i.e $f = x_2 - x_1$

Average focal length = $\frac{\text{sum of focal length}}{6}$

$= \frac{35 + 34.2 + 33 + 32.1 + 31 + 30}{6}$

$= \frac{195.3}{6}$ cm

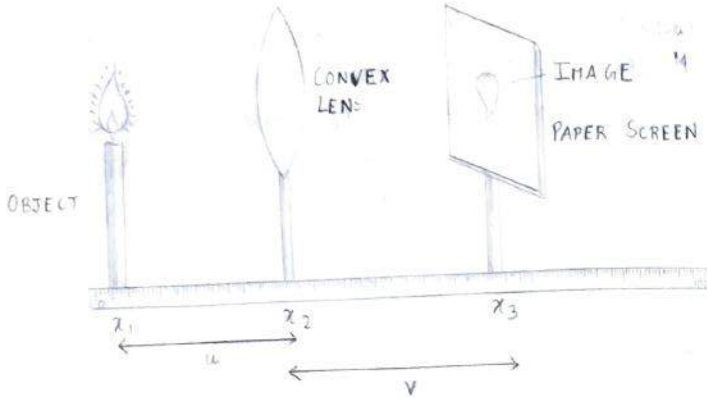
$= 32.55$ cm

OBSERVATION TABLE

OBSERVATION NUMBER	POSITION OF OBJECT PIN x_1 (cm)	POSITION OF CONVEX LENS x_2 (cm)	POSITION OF PLANE MIRROR x_3 (cm)	POSITION OF IMAGE PIN x_1 (cm)	FOCAL LENGTH $f = x_2 - x_1$
1	5	40	46.5	5	35
2	10	44.2	50.7	10	34.2
3	15	48	54.5	15	33
4	20	52.1	58.6	20	32.1
5	25	56	62.5	25	31
6	30	60	66.5	30	30

RESULT Average focal length of the given convex lens by one pin method by using a plane mirror = 32.6 cm

GENERAL DIAGRAM



EXPERIMENT No -

AIM To find the focal length of a convex lens by using an illuminated object (a glowing candle)

APPARATUS USED An optical bench, a convex lens, a glowing candle and a paper screen.

FORMULA USED

1) $p = y_1 + y_2$
2) $f = \frac{40}{2+p}$ where,

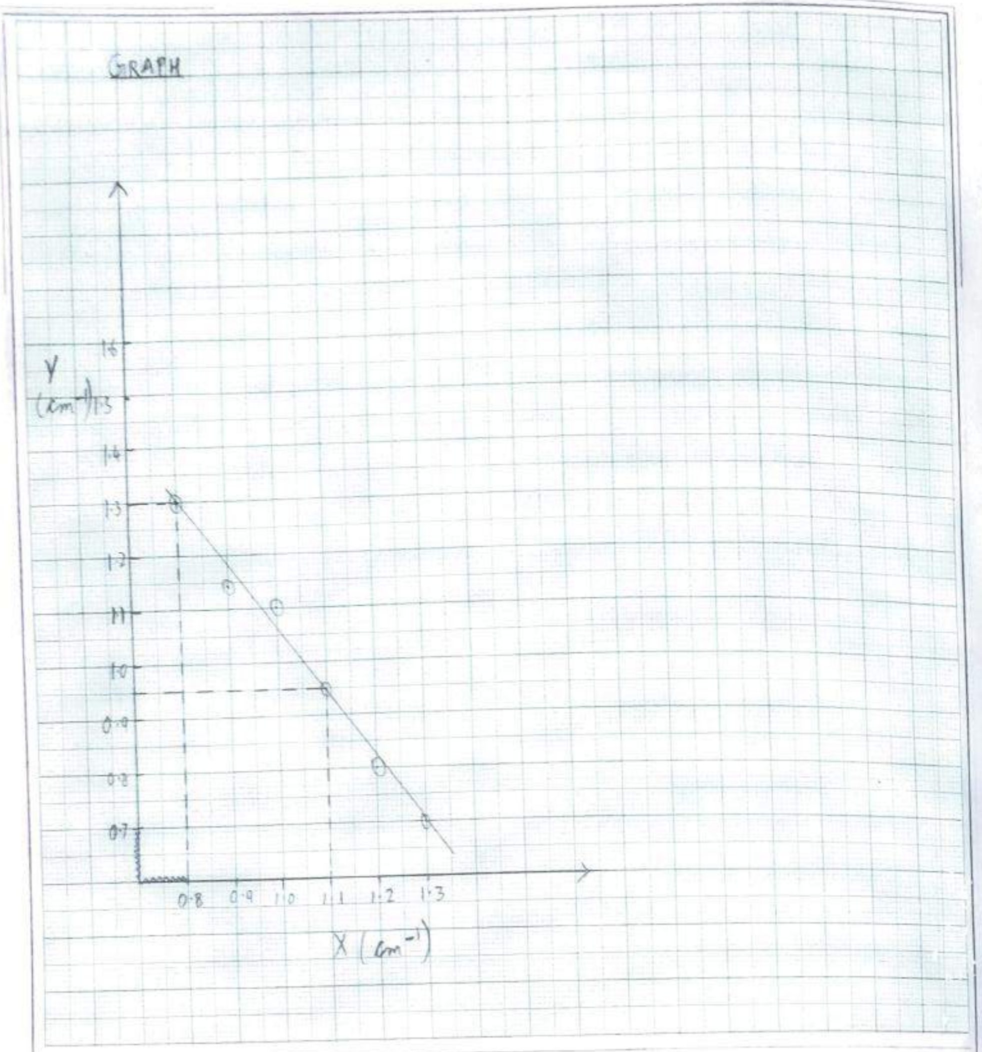
y_1 = value of y when $x = 0.8$
y_2 = value of y when $x = 1.1$

THEORY A convex lens is thicker in the middle and thinner in the edges. A light beam converges at the focal point on passing through the lens. A parallel beam of light converges at the focal point on passing through a lens. The distance from the optical centre upto the focal point of the lens is called its focal length.

Experiment No./Name :

The position, size and nature of the image formed of an object by the convex lens can be determined by drawing ray diagrams.
A ray incident on the convex lens coming from the object gets refracted by following the laws of refraction. The rays follow the following properties.
1) A ray incident at the optical centre passes undeviated through the convex lens.
2) A ray incident parallel to the principal axis after refraction passes through the second focal point (F_2) of the convex lens.
3) A ray incident and passing through the first focal point (F_1) of a convex lens emerges parallel to the principle axis after refraction.

Teacher's Signature

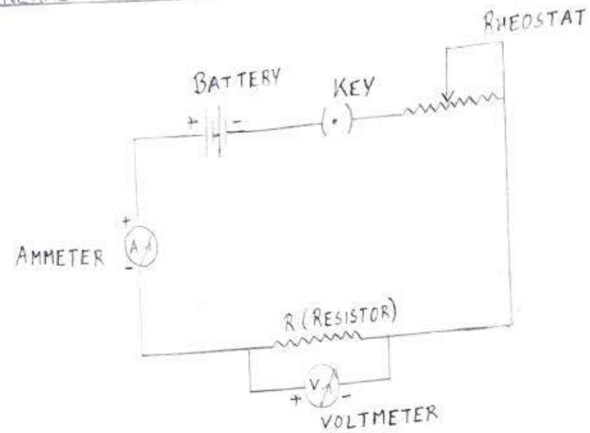


OBSERVATION TABLE

OBSERVATION NUMBER	POSITION OF OBJECT (CANDLE) x_1 (cm)	POSITION OF CONVEX LENS x_2 (cm)	POSITION OF SCREEN x_3 (cm)	OBJECT DISTANCE $u = x_2 - x_1$ (cm)	IMAGE DISTANCE $V = x_3 - x_2$ (cm)	$X = \frac{20}{u}$ (cm^{-1})	$Y = \frac{20}{v}$ (cm^{-1})
1	0	15	44	15	29	1·33	0·7
2	0	17	32	17	25	1·17	[illegible]
3	0	19	40	19	21	1·1	0·95
4	0	21	39	21	18	0·95	1·1
5	0	23	40·5	23	17·5	0·76	1·14
6	0	25	40·7	25	15·7	[illegible]	1·27

RESULT The focal length of the given convex lens by using an illuminated object = 9·41 cm

GENERAL DIAGRAM



CALCULATIONS

1) $R = \frac{V}{I}$

$= \frac{0.8}{0.4}$

$= 2\,\Omega$

2) $R = \frac{V}{I}$

$= \frac{0.6}{0.3}$

$= 2\,\Omega$

EXPERIMENT No.-

AIM: To verify ohm's law.

APPARATUS USED: A battery or a cell of two volt (2V), a key, a rheostat, connecting wires, a volt meter, an ammeter and a resistor.

FORMULA USED: $R = \frac{V}{I}$ or $V = IR$ where

V is the Potential difference
I is current
R is Resistance

THEORY: Ohm's Law

According to ohm's law, current flowing in a conductor is directly proportional to the potential difference across its ends provided the physical conditions and the temperature of the conductor remains constant.

$I \propto V$

or $\frac{V}{I}$ = constant = R.

The constant is equal to R, the resistance of the conductor

3) $R = \frac{V}{I}$

$= \frac{0.4}{0.2}$

$= 2\ \Omega$

4) $R = \frac{V}{I}$

$= \frac{0.3}{0.15}$

$= 2\ \Omega$

5) $R = \frac{V}{I}$

$= \frac{0.2}{0.1}$

$= 2\ \Omega$

6) $R = \frac{V}{I}$

$= \frac{0.1}{0.05}$

$= 2\ \Omega$

Average resistance $= \frac{\text{Sum of resistance}}{6}$

$= \frac{2 + 2 + 2 + 2 + 2 + 2}{6}$

$= \frac{12}{6} = 2\ \Omega$

Page No. #

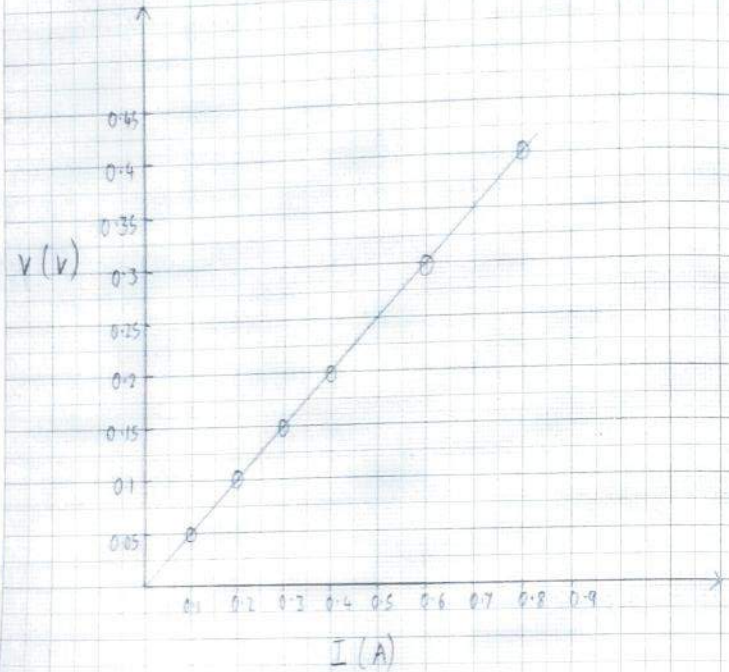
Date __/__/__

Experiment No./Name :

The S.I unit of resistance is ohm (Ω)
The slope of VI graph will always be a straight line for ohmic resistances and the slope of this graph will give the value of resistance.

Teacher's Signature

GRAPH



Experiment No./Name : ____________

OBSERVATION TABLE

OBSERVATION NUMBER	VOLT METER READING V (V)	AMMETER READING I (A)	RESISTANCE $R = \frac{V}{I}$ ohm (Ω)
1	0·8	0·4	2
2	0·6	0·3	2
3	0·4	0·2	2
4	0·3	0·15	2
5	0·2	0·1	2
6	0·1	0·05	2

RESULT The graph between potential difference V and current I is a straight line which means current is directly proportional to the potential difference across the conductor. Since the ratio between V and I (i.e $\frac{V}{I}$) is a constant, this verifies ohm's law