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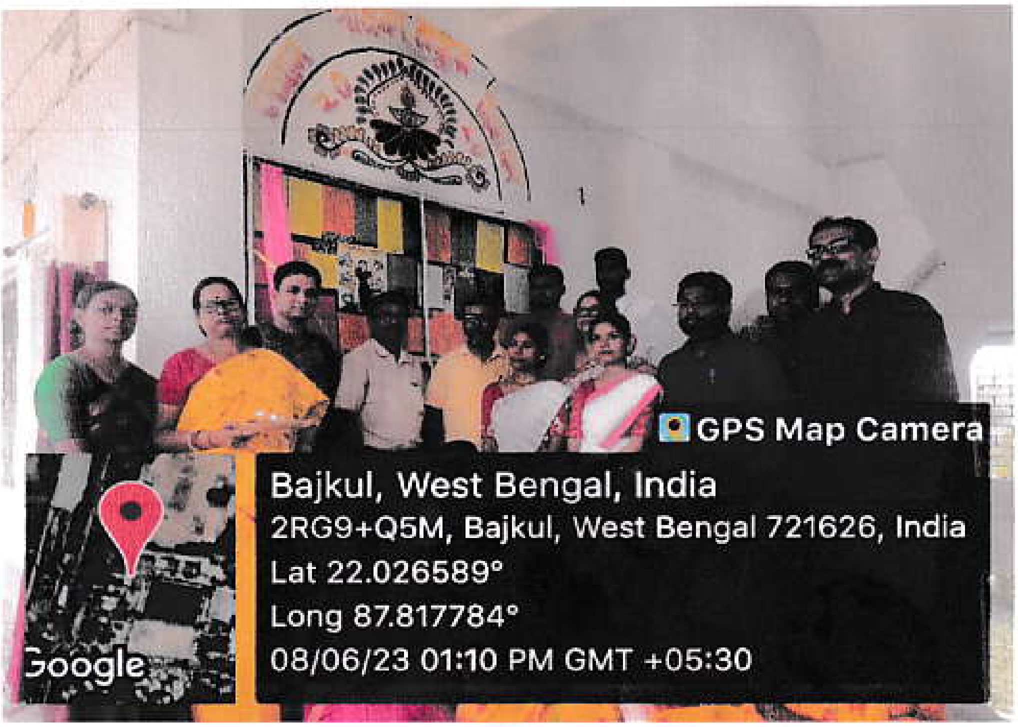

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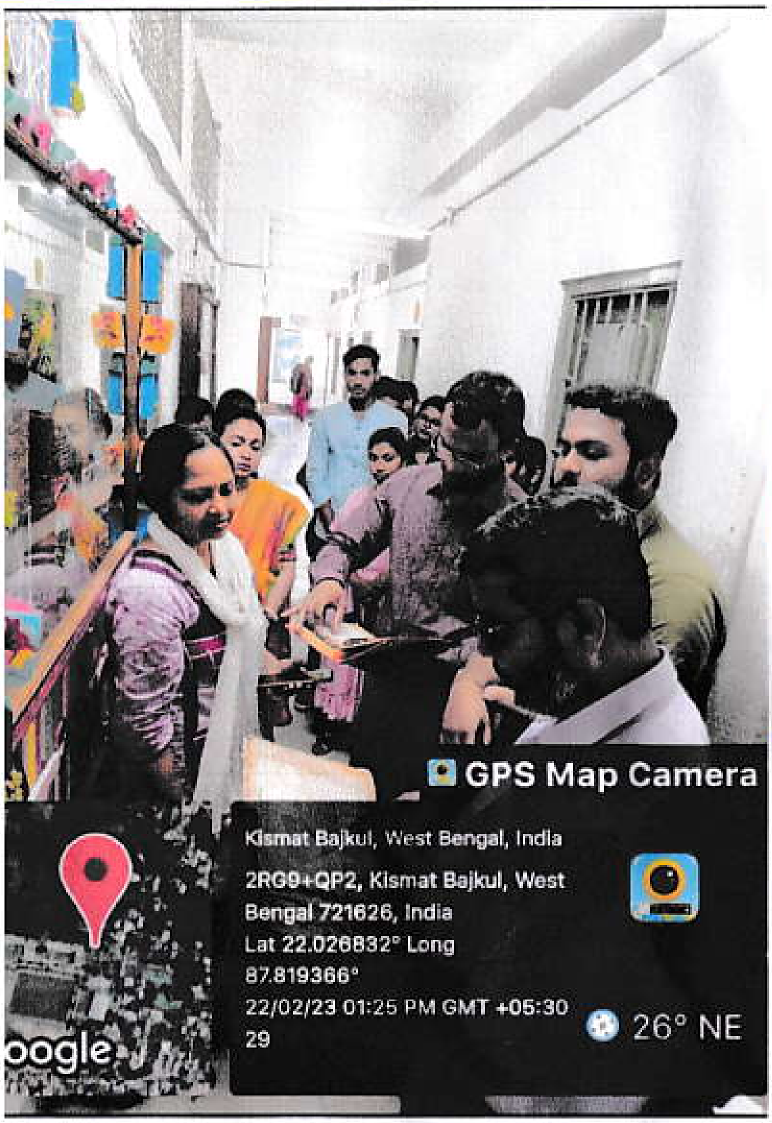

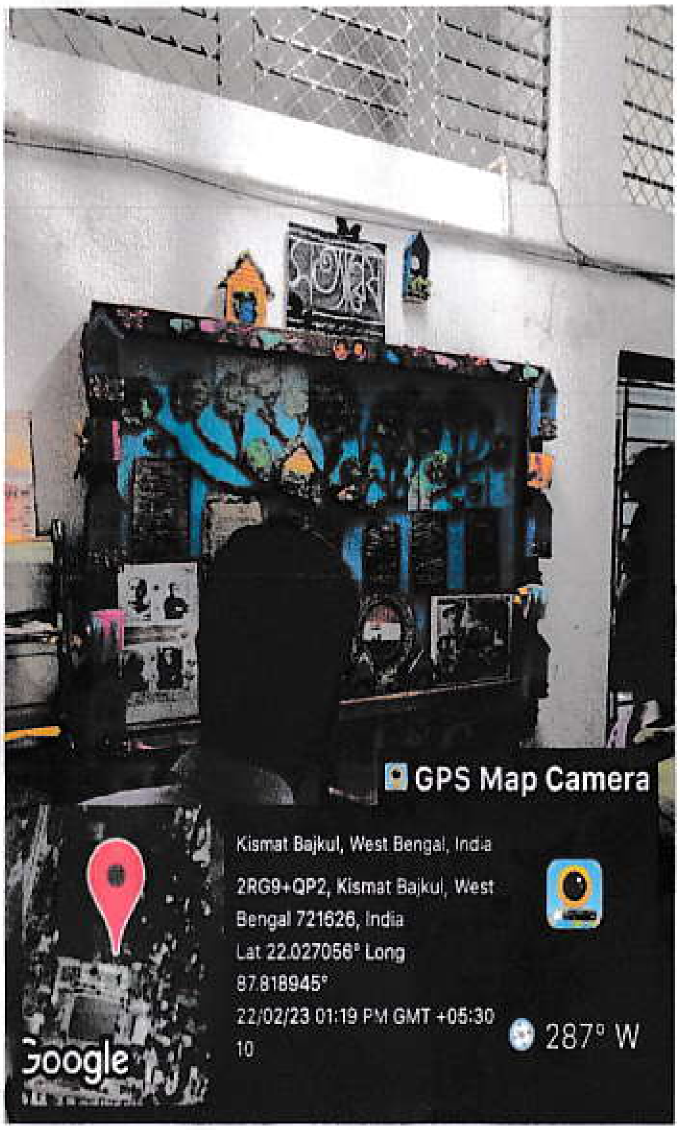

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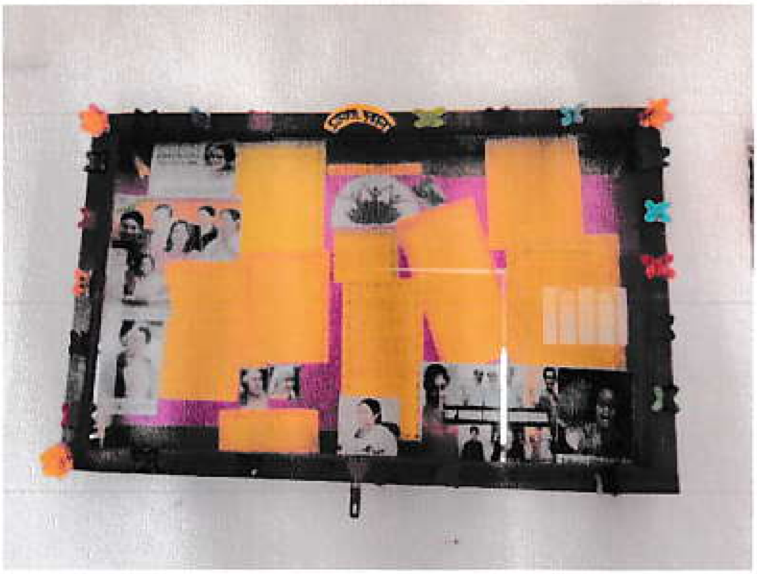

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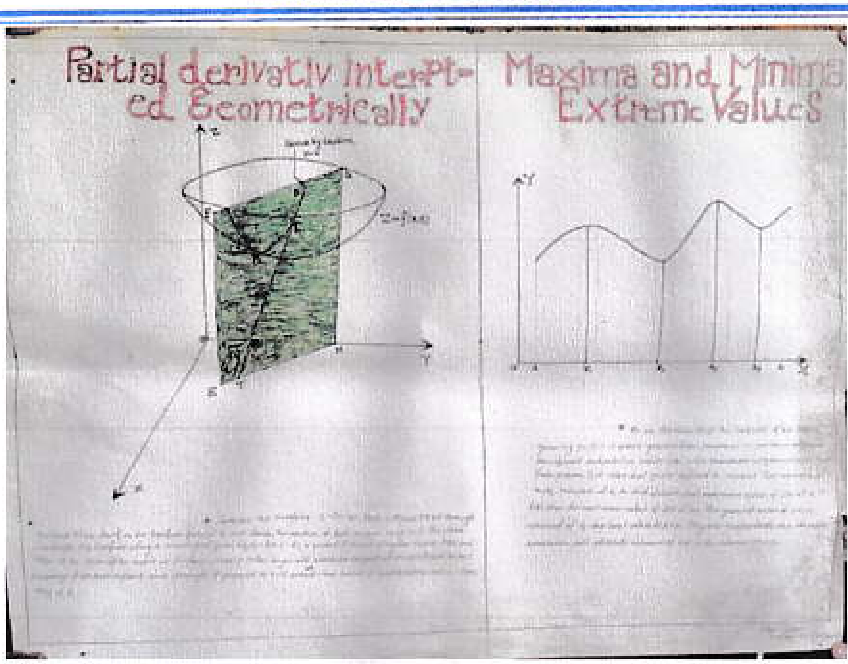

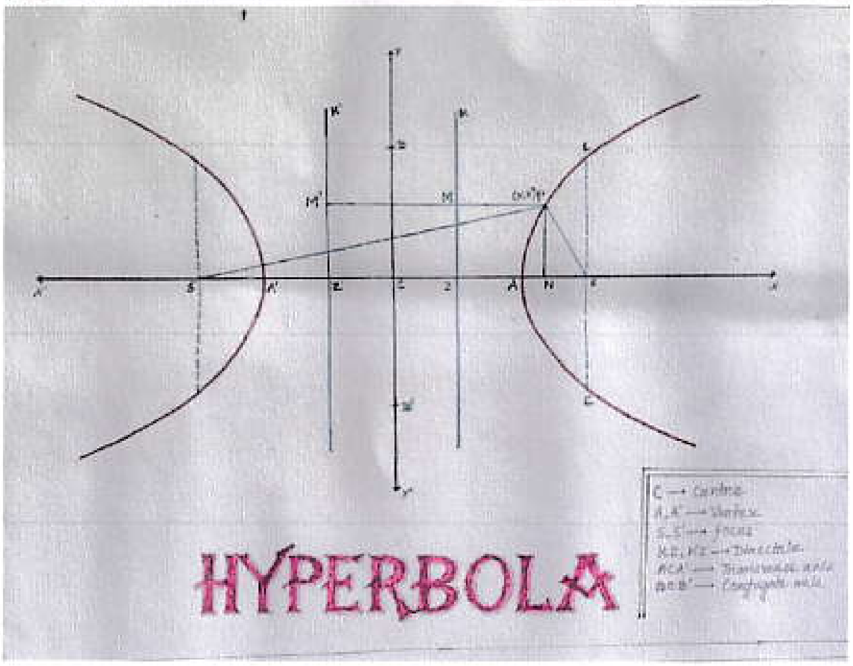

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"STUDY OF REFRACTIVE INDEX OF SUGAR SOLUTION AT DIFFERENT CONCENTRATION".

A project work performed & submitted according to the syllabus of B.Sc. part-III Physics (honours) examination-2019

Of

VIDYASAGAR UNIVERSITY

BY

BAPPA MANNA

ROLL-31215101 NO-0151

REG.NO-011179

UNDER THE GUIDENCE OF

ISMAIL SK

Asst. Prof. of Physics

DEPT. OF PHYSICS

BAJKUL MILANI MAHAVIDYALAYA

FOWARD

Bappa Manna is a student of B.Sc. Physics Honours, Part-III of Bajkul Milani Mahavidyalaya. He has performed the project work on **"Study of refractive index of sugar solution at different concentration".** With great effort under the guidance and super vision of Prof. Ismail Sk, Assistant professor of physics Department.

…………………………………

Prof. Biswanath Dolai

Date …………..

Assistant Prof. & H.O.D

Department of Physics

Bajkul Milani Mahavidyalaya

CERTIFICATE

This is to certify that Bappa Manna, Roll.-31215101 No.-0151, Registration No-011179; Session-2014-2015 is a student of the B.sc (Hons in physics) 3rd year of Bajkul Milani Mahavidyalaya under Vidyasagar University. He is performed the project work entitled, “”**Study of refractive index of sugar solution at different concentration** under my supervision and is in partial fulfillment of the requirements for the award of the degree of **Bachelor of Science** under Vidyasagar University.

He has done experimental work very sincerely with limited facility of our laboratory and consulted me as and when required.

I wish his success in life.

Ismail SK.

Prof. Ismail SK

Department of Physics

Bajkul Milani Mahavidyalaya

Date 30/03/19.

ACKNOELEDGEMENT

At first, I would like to express my heartfelt gratitude Prof. Ismail Sk, Department of Physics, Bajkul Milani Mahavidyalaya, who provided his invaluable guidance throughout to complete this work. For his encouragement, support and kind attention have enabled me to prepare this project report. I also offer my best regard to my respected teacher Prof. Biswanath Dolai, Head of the Department of physics, and all teacher's of our department. I also acknowledge our lab assistants, also grateful to my friends for their all around cooperation and encouragement.

Bappa Manna

Date. 30/03/019

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CONTENTS

ABSTRACT

Refractive indexes of sugar solution at different concentrations are determined using the image formation in plane mirror and convex lens. Specific rotations of polarized light in sugar solution are determined at different concentration. A discussion and comparison of the result have been present.

INTRODUCTION

Light goes slower in water than air, and slower slightly in air than vacuum. This effect is described by the refractive index of the medium. All materials are consisted of atoms, which contain electrons. When radiation from source falls on the atoms it drives the electrons up and down. Now any moving electron generates a field. Thus the total field is not just the field of the source, but it is modified by the addition contribution from the other moving charges. This modification occurs in such a way that the field inside the material appears to be moving at a different speed.

It is very complicated to find the exact equation of motion of a moving charge inside a material under the external field. For simplicity we consider a material in which the field is not modified very much by the motion of the other charges. That corresponds to a material in which the index of refraction is very close to unity. This type of situation arises when the density of the material is very low.

The standard expression for refractive index is

$$\mu = 1 + Nq_e^2/2\epsilon_0 m(\omega_0^2 - \omega^2)$$

Here, q_e = charge of an electron.

m = mass of electron.

ω = is the angular frequency of incident radiation.

ω_0 = is the angular frequency of natural oscillation of electron.

In case of vacuum N=0, i.e. $\mu = 1$

The above expression demands that the refractive index depends on density of atom.

In the present project work we study the variation of refractive index of sugar solution with variation in concentration.

Sugar molecules have property of optical activity, i.e. they can rotate the plane of polarized light. In this project work we have compared the variation of specific rotation of polarized light in sugar solution with varying concentration.

WORKING FORMULA OF THE EXPERIMENT

The focal length f of a lens is given by formula,

$1/f = (\mu - 1)(1/r_1 - 1/r_2)$ ....(1)

Here μ is the refractive index of the material of the lens and r_1 and r_2 are the radii of curvature of its first and second surfaces. Considering proper signs and using values of f, r_1 and r_2 we get,

$1/f = (\mu - 1)(1/r_1 + 1/r_2)$

Or, $\mu = 1 + r_1 r_2/f(r_1 + r_2)$.............................. (2)

The convex lens C is placed on a plane mirror M so that its particular surface, whose radius of curvature was measured, may touch the mirror. A horizontal pointer is moved vertically up and down along the axis of the lens until there is no parallax between the tip of the pin and its own real image. Thus the focal length f can be determined using the relation

$f = (x_1 + x_2)/2$.......................... (3)

Where x_1 is the distance between convex lens to the index rod, x_2 is the distance between mirror to the index rod.

If a double convex lens C of focal length f_1 is placed over a few drops of liquid placed on a plane mirror, then a Plano-concave lens of focal length f_2 is formed between the lower surface of the convex lens and the plane mirror. If F be the focal length of the combination, then we have

$1/F = 1/f_1 + 1/f_2$

Or, $f_2 = -F f_1/F - f_1$ .... (4)

Finding f_1 and F experimentally by coincidence method, and putting their values in the relation (4) we can calculate f_2. Again, the focal length f_2 of the Plano- concave liquid lens is given by

$1/f_2 = (\mu - 1)(1/r - 1/r') = (\mu - 1)1/r \quad [\because r' = \alpha]$

Or, $\mu = 1 + r/f_2$ ....(5)

Where r is the radius of curvature of the lower surface of the convex lens. The value of r can be measured by a spherometer, using the formula

$r = d^2/6h + h/2$ .... (6)

Where d is the mean distance between any two consecutive legs of the spherometer and h is the displacement of the screw tip when it touches consecutively the lower surface of the lens and a plane surface.

The knowing f_2 and r and putting their numerical value in equation (4) we can calculate μ, the refractive index of the liquid.

The rotation Θ of the plane of polarisation of polarised light by an active solution of length *l* cm (or, l/10 dm) containing m g of active substance per c.c. of the solution is given by,

$\Theta = s\,l\,m/10$ .... (7)

Here s is the specific rotation of the substance, which is the rotation produced by a solution of active substance in a non-active solvent of one decimetre in length containing 1 gm of active substance per c.c. of the solution.

Using the formula $\Theta = s\,l\,m/10$, we can determine the specific rotation of polarised light.

APPARATUS

1) A vertical stand with pin.
2) A convex lens.
3) Plane mirror.
4) 20% sugar solution.
5) The arrangement of a bi-quartz polarimeter.
6) Tube and biker.

PROCEDURE

1) The radius of curvature of one surface of the convex lens is determined by spherometer. Thus we get r.
2) The convex lens C is placed on a plane mirror M so that its particular surface, whose radius of curvature was measured, may touch the mirror. A horizontal pointer is moved vertically up and down along the axis of the lens until there is no parallax between the tip of the pin and its own real image. This is repeated three times and the mean of these three values give f.
3) A few drops of liquid are now placed on the plane mirror and the surface of the lens, which was originally in contact with the mirror, is now placed over liquid. The mean of the three values of the focal length f_2 can be determined.
4) Varying the concentration of liquid (sugar) we get many focal length f_2.
5) By putting the mean numerical values of f_2 and r we can calculate μ.
6) To find Θ for solution of c_1% strength: the water in the tube T is thrown away and after washing the tube T for two or three times by a little of the solution of c_1% strength, the whole tube is now completely filled with the solution of c_1% strength and it is placed in its proper position . As in term (ii), the tube T_2 is rotated to make the two halves of the field equally bright or equally greyish violet and the mean of the three readings of vernier V_1 and V_2 are noted. If R_1 and R'_1 are respectively the mean readings of verniers

V_1 and V_2 then we get $\Theta_1 = (R_1 \sim R_0)$ and $\Theta_2 = (R'_1 \sim R'_0)$. Hence mean rotation for solution of c_1% strength is $\Theta = (\Theta_1 + \Theta_2)/2$.

7) To dilute the solution of c_1% strength to other lower strengths and then to find rotations for those strengths: the x c.c. of stock solution of c_1% strength is mixed with y c.c. of distilled water to have c_2% strength.

   By washing the tube T with a little of this new solution of c_2% strength for two or three times, the whole tube T is filled c_2% strength solution by avoiding any air bubble. By placing the tube T in its proper place the mean rotation of the plane of polarisation by this solution is determined in the manner as mentioned in term (iii).

8) By adopting the process mentioned in term (iv) solutions of other lower strengths are prepared and the mean rotations of the plane of polarisation for those solution are determined.

9) A graph is then drawn by plotting the strength of the solution c along x axis and its corresponding rotation Θ along y axis. The graph would be a straight line.

EXPERIMENTAL DATA

A)Determination of h:-

Value of each division of linear scale = s=1mm.

No of division of the circular scale=N=100.

Pitch of the screw=P=1mm.

Least count of the instrument= l.c =P/N=1/100=0.01mm.

Distance between two outside legs=d= (4.1+4.2+4.2)/3 c.m =4.167 c.m

TABLE-1

Surface position	No of obs.	Initial c.s reading when the screw touches the convex spherical surface(R_1)	When the screw touch the plane			Total no. of C.S.D rotated =x	h = x .l.c in mm.	Mean h in cm.
			No of full rotation of circular disc(m)	Final circular scale reading(R_2)	Add. No of C.S div. rotated n			
1st surface	1	69	2	90	79	279	2.79	0.2684
1st surface	2	65	2	9	56	256	2.56	
1st surface	3	74	2	90	84	284	2.84	

1^{st} surface	4	76	2	28	48	248	2.48	
1^{st} surface	5	69	2	94	75	275	2.75	
2^{nd} surface	1	94	2	96	98	298	2.98	
2^{nd} surface	2	68	2	97	71	271	2.71	
2^{nd} surface	3	66	2	93	73	273	2.73	0.2762
2^{nd} surface	4	55	2	89	66	266	2.66	
2^{nd} surface	5	63	2	90	73	273	2.73	

B) **Find the radius r_1 and r_2:-**

$r_1 = d^2/6\ h_1 + h_1/2$

$= 17.36/6\times0.2762 + 0.2762/2$

$= 10.48+0.138=10.618$ c.m.

$R_2 = d^2/6\ h_2 + h_2/2$

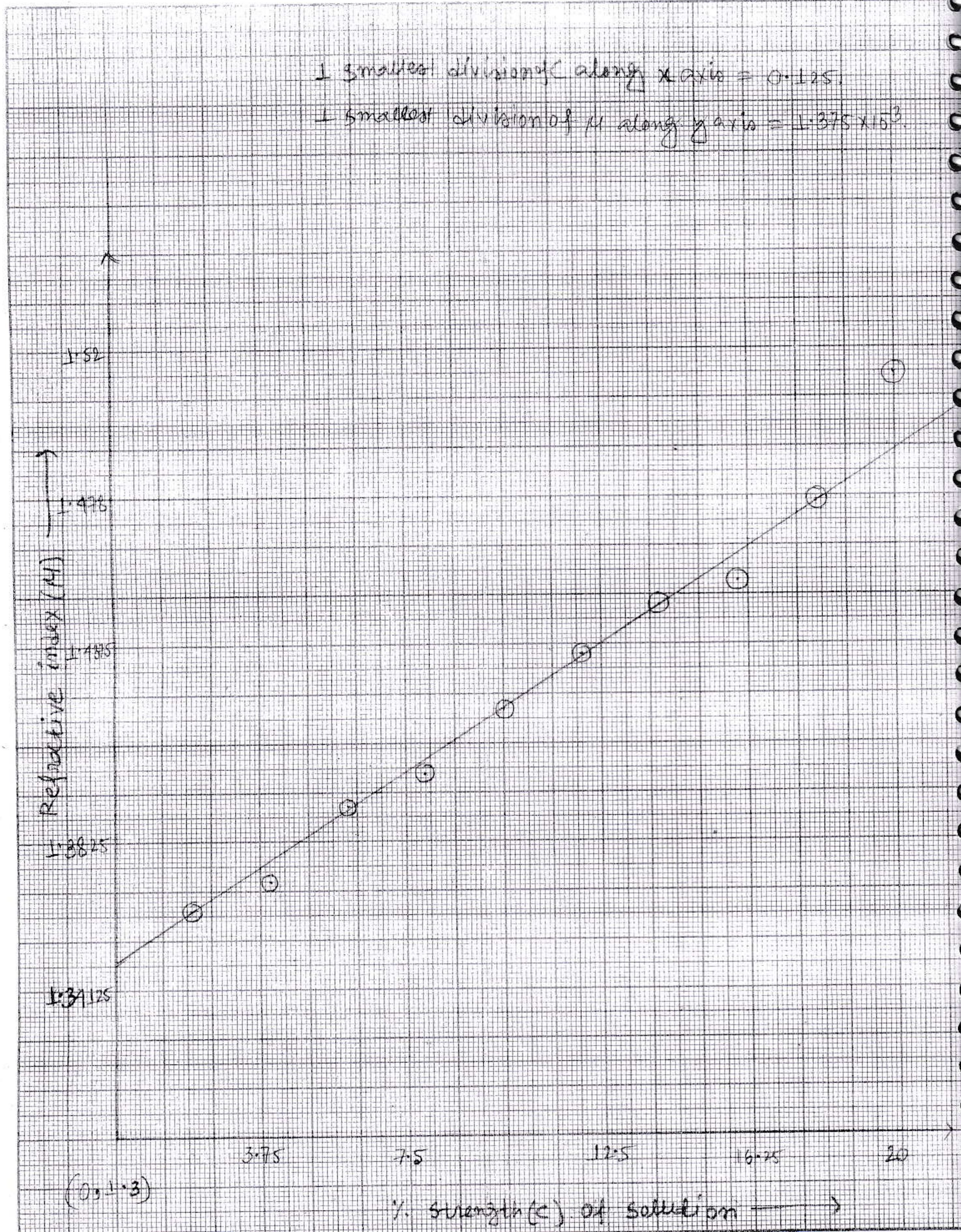
$= 17.36/6\times0.2684 + 0.2684/2$

$= 10.78+0.134=10.914$c.m.

C) DETERMINE FOCAL LENGTH AND REFRACTIVE INDEX, WITHOUT WATER AND WITH WATER:-

	Distance between convex and index rod x_1 in c.m.	Distance between mirror and index rod x_2 in c.m.	Focal length $f=(x_1+x_2)/2$ in c.m.	Refractive index μ
Without water	19.5	20.5	20	1.5309
With water	29.1	30.1	29.6	1.3587

Graph C Vs μ



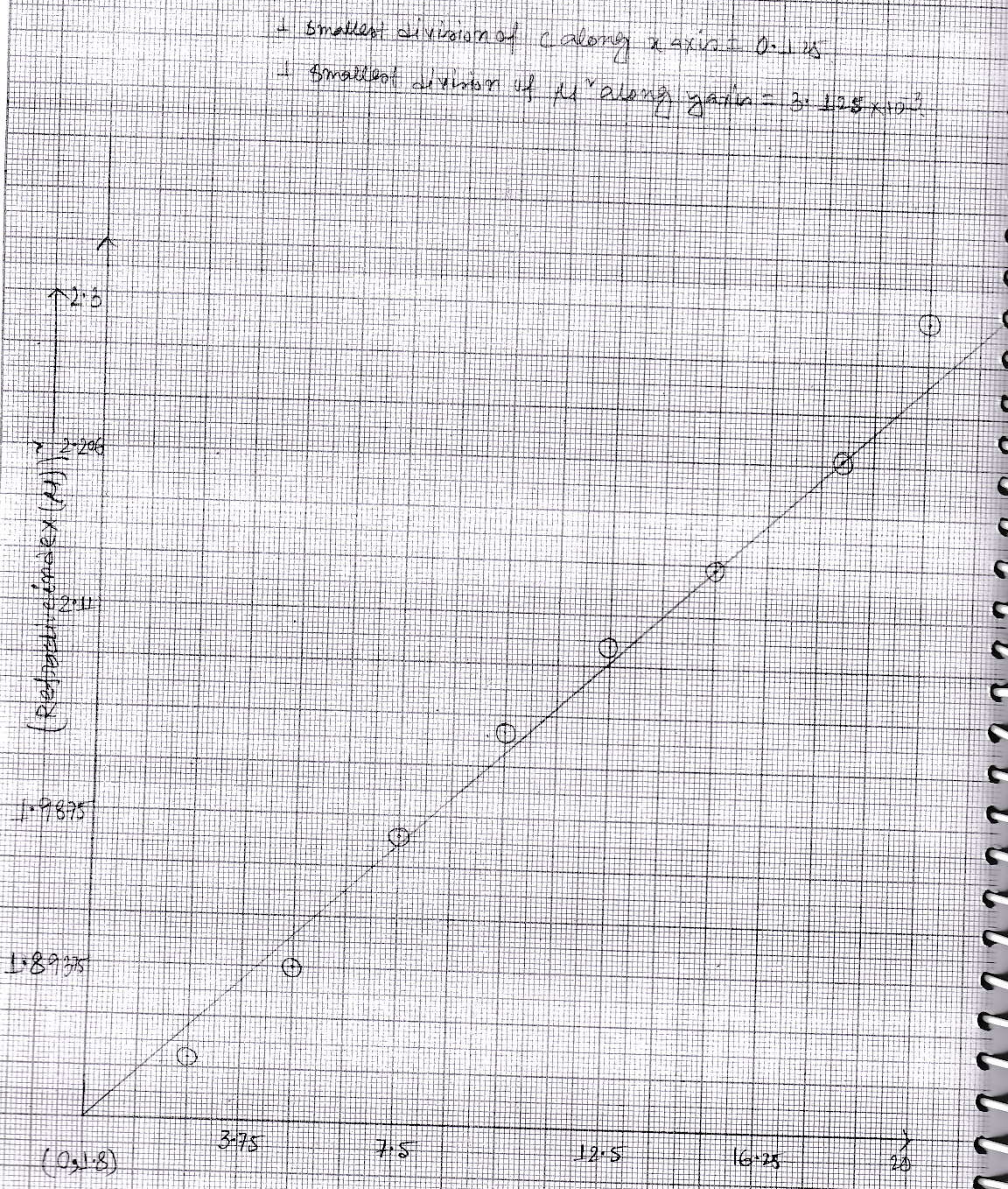
1 smallest division of C along x axis = 0.125
1 smallest division of μ along y axis = 1.375 x 10⁻³
1.52
1.478
1.4835
1.3825
1.34125
3.75
7.5
12.5
16.25
20
(0, 1.3)
Refractive index (μ)
% strength (c) of solution

D)DATA FOR CONCENTRATION VS REFRACTIVE INDEX:-

TABLE-3

% Concentration	Distance between convex and index rod x_1 in c.m.	Distance between mirror and index rod x_2 in c.m.	Focal length $f=(x_1+x_2)/2$ in c.m.	Refractive index μ
2%	28.7	29.7	29.2	1.363
4%	28.1	29.1	28.6	1.371
6%	26.6	27.6	27.1	1.392
8%	25.9	26.9	26.4	1.402
10%	24.8	25.8	25.3	1.420
12%	24	25	24.5	1.433
14%	23.2	24.2	23.7	1.448
16%	22.8	23.8	23.3	1.456
18%	21.7	22.7	22.2	1.478
20%	20.2	21.2	20.7	1.513

Graph C vs μ^2



DATA FOR C VS. μ^2

% STRENGTH (C) OF SOLUTION	REFRACTIVE INDEX^2(μ^2)
2%	1.857769
4%	1.879641
6%	1.937664
8%	1.965604
10%	2.0164
12%	2.053489
14%	2.096704
16%	2.119936
18%	2.184484
20%	2.289169

E) To find V.C. of verniers V_1 and V_2:

Smallest value in main scale in degree	Value of vernier division	Vernier constants of V_1 and V_2 in degree
1	10/9	(1-9/10)*1 $=0.1^0$

F) To find the length of the tube T between the inner surfaces of its two ends plates:-

$$l = (20.3 + 20.4 + 20.5)/3 = 20.4 \text{ cm}$$

G) Vernier readings when pure water fills the tube T:-

TABLE - 1

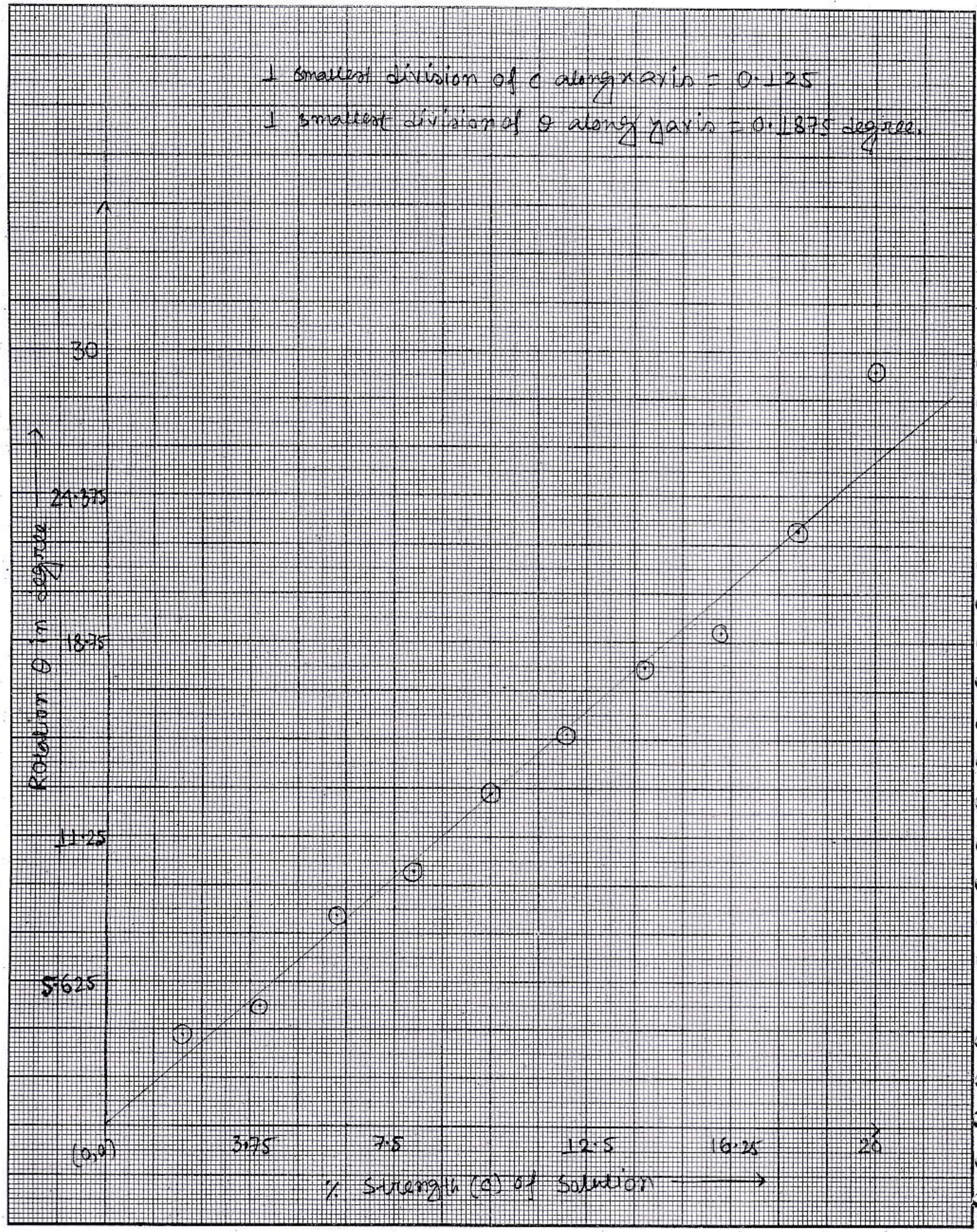
N of os	Readings for 1^{st} vernier V_1				Readings for second vernier V_2			
	Circular scale readings(s) in degree	Vernier readings (V.r)	Total R_0 in degree	Mean R_0 in degree	Circular scale readings(s) in degree	Vernier readings (V.r)	Total R_0 in degree	Mean R_0 in degree
1	259	1	259.1		79	6	79.6	
2	260	1	260.1	259.47	80	1	80.1	80.77
3	259	2	259.2		79	6	79.6	

H) To find the rotation of the plane of polarisation when the tube T contains of different known strengths:-

TABLE- 2

No of obs.	% strength of solution (c)	vernier	Circular scale (s) in degree	Vernier readings (v.r)	Total in degree	Mean readings in degree	Rotation of the vernier in degree	Mean Rotation =Θ in degree
1	20%	V_1	230 231 230	2 4 8	230.2 231.4 230.8	230.8	28.67	29.67
		V_2	50 49 50	5 6 2	50.5 49.6 50.2	50.1	30.67	
2	18%	V_1	235 234 235	6 9 2	235.6 234.9 235.2	235.23	24.24	24.56
		V_2	55 56 55	8 2 7	55.8 56.2 55.7	55.9	24.87	
3	15%	V_1	239 238 239	2 9 5	239.2 238.9 239.5	239.2	20.27	20.385
		V_2	60 59 60	5 5 8	60.5 59.5 60.8	60.27	20.5	

Graph C vs θ.


1 smallest division of c along x axis = 0.125
1 smallest division of θ along y axis = 0.1875 degree.
30
24.375
18.75
11.25
5.625
(0,0)
3.75
7.5
12.5
16.25
20
% Strength (c) of Solution
Rotation θ in degree

No of obs.	% strength of solution (c)	vernier	Circular scale (s) in degree	Vernier readings (v.r)	Total in degree	Mean readings in degree	Rotation of the vernier in degree	Mean Rotation =Θ in degree
4	12.5%	V_1	241	4	241.4	241.6	17.87	17.685
			242	3	242.3			
			241	1	241.1			
		V_2	63	6	63.6	63.27	17.5	
			63	3	63.3			
			62	9	62.9			
5	10%	V_1	245	1	245.1	245.2	14.27	14.535
			245	5	245.5			
			245	0	245			
		V_2	65	5	65.5	65.97	14.8	
			66	9	66.9			
			65	5	65.5			
6	7.5%	V_1	249	1	249.1	249.27	10.19	10.595
			249	9	249.9			
			248	8	248.8			
		V_2	69	5	69.5	69.77	11	
			70	3	70.3			
			69	5	69.5			
7	5%	V_1	254	1	254.1	254.6	5.47	5.585
			254	6	254.6			
			253	3	253.3			
		V_2	75	6	75.6	75.07	5.7	
			75	5	75.5			
			74	1	74.1			

DISCUSSION ON THE RESUIT

There are various empirical relations concerning dependence of refractive index of a medium on its density proposed. For example, $\mu^2\text{-}1/\rho$ = constant. This is the Laplace's formula, $(\mu^2\text{-}1/\ \mu^2+2)1/\rho$ = constant which is called Lorentz-Lorentz formula. Recently Macdonald has given a dependence, $\mu^2\text{-}1/\mu\rho$= constant. However in the project work we found that our result is in good agreement with the Laplace's formula. The nature of μ^2 vs. concentration graph.

The specific rotation polarized of the sugar solution increase with concentration. Actually rotation of polarization plane is connected to the structure of sugar molecule, therefore the specific rotation naturally increase with the concentration. This does not mean that the specific rotation is directly related to the phenomena of origin of refractive index. This is because only the optically active materials are of importance in case of specific rotation. But in case of refractive index, all transparent medium are concerned.

PRECAUTION

1) Each time the reading must be taken for particular surface of the convex lens.
2) Focussing of the index rod must be accurate as possible.
3) Preparation of a solution of different concentrations must be done with high accuracy because the change in focal length is small due to change in concentration.
4) If we had used travelling microscope in place of centimetre scale to measure the highest than we would get more accurate result.

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6) Introduction to optics, Brijlal, Subramanian.

"MEASUREMENT OF FERMI ENERGY AND FERMI TEMPERATURE OF THE COPPER WIRE BY STUDDING RESISTANCE VARIATION WITH TEMPERATURE".

A project work performed & submitted according to the syllabus of B.Sc. part-III Physics (honours) examination-2019

Of

VIDYASAGAR UNIVERSITY

BY

ANUPAM BARIK

ROLL-31217101 NO-0170

REG.NO-1011341

UNDER THE GUIDENCE OF

ISMAIL SK

Asst. Prof. of Physics

DEPT. OF PHYSICS

BAJKUL MILANI MAHAVIDYALAYA

FORWARD

Anupam Barik is a student of B.Sc, Physics Honours, Part-III of Bajkul Milani Mahavidyalaya. He has performed the project work on, **"Measurement of Fermi energy and Fermi temperature of cooper wire by studying resistance variation with temperature"** with great effort under the guidance and supervision of Prof. Ismail Sk, Assistant professor of physics Department.

Date:

Prof. Biswanath Dolai

Assistant Prof. & H.O.D

Department of Physics

Bajkul Milani Mahavidyalaya

CERTIFICATE

This is to certify that Anupam Barik ,ROLL.-31217101 NO.-0170 ,REGISTRATION NO-1011341,SESSION.-2016-2017 is a student of the B.Sc (Hons in physics) 3rd year of Bajkul Milani Mahavidyalaya under Vidyasagar University. He is performed the project work entitled, **"Measurement of Fermi energy and Fermi temperature of cooper wire by studying resistance variation with temperature"** under my supervision and is in partial fulfillment of the requirements for the award of the degree of **Bachelor of Science** under Vidyasagar University.

He has done experimental work very sincerely with limited facility of our laboratory and consulted me as and when required.

I wish his success in life.

Date- 29/03/19

Ismail sk

Prof. Ismail SK

Department of Physics

Bajkul Milani

Mahavidyalaya

ACKNOELEDGEMENT

At first, I would like to express my heartfelt gratitude Prof. Ismail Sk, Department of Physics, Bajkul Milani Mahavidyalaya, who provided his invaluable guidance throughout to complete this work. For his encouragement, support and kind attention have enabled me to prepare this project report. I also offer my best regard to my respected teacher Prof. Biswanath Dolai, Head of the Department of physics, and all teacher's of our department. I also acknowledge our lab assistants, also grateful to my friends for their all around cooperation and encouragement.

Date -

Anupam Barik

Roll No -31217101-170

ABSTRACT

In this project work, Fermi energy and Fermi temperature of cooper is determined by studying resistance variation at different temperature. The resistance of the material increases linearly with variation of temperature. The obtained numerical values are compared with slandered values.

CONTENT

AIM OF THE WORK

1. Determination of Fermi energy of Good conductor (copper) by study -ing, resistance variation at different temperatures.
2. Therefore, calculation of Fermi temperature of the specimen.

Introduction:

"Fermi level" is the term used to describe the top of the collection of electronic energy levels at absolute zero temperature. This concept comes from Fermi Dirac statistics. Electrons are fermions and by the Pauli's Exclusion Principle cannot exist in identical energy states. So at absolute zero they pack into the lowest available energy states and build up a "Fermi sea" of electron energy states. The Fermi level is the surface of that sea at absolute zero where electrons will have enough energy to rise above the surface. The concept of the Fermi energy is important for the understanding of the electrical and thermal properties of the solids. Both ordinary electrical and thermal processes involve energies of a small fraction of an electron volt. But the Fermi energies of metals are of the order of few electron volts. This implies that the vast majority of the electrons cannot receive energy for these processes because there are no available energy states for them to go to within a fraction of an electron volt of their present energy. At higher temperatures a certain fraction, characterized by the Fermi function, will exist above the Fermi level. For a metal, the density of conduction electrons can be implied from the Fermi energy. The Fermi energy also plays an important role in
understanding the mystery of why electrons do not contribute significantly to the specific heat of solids at ordinary temperatures.Further, in metals, Fermi energy gives us information about the velocities of the electrons, which participate in ordinary electrical conduction.

THEORY

The Fermi velocity V_F of these conduction electrons can be calculated from the Fermi energy E_F using the relation,

$$V_F = \sqrt{(2E_F/m)}$$

Where m = 9.1 x 10^{-31} kg is the mass of electron.E_F is Fermi energy.V_F is Fermi Velocity

This speed is a part of the microscopic Ohm's Law for electrical conduction. A Fermi gas is a Collection of non-interacting fermions. It is quantum mechanical version of ideal gas. Electrons in metals and semiconductors can be approximately considered as Fermi gases. The Energy distribution of the fermions in a Fermi gas in thermal equilibrium is determined by their density, the temperature and the set of available energy states using Fermi-Dirac statistics. It is possible to define a Fermi temperature below which the gas can be considered degenerate. This temperature depends on the mass of the fermions and the energy. For metals, the electron gas's Fermi temperature is generally many thousands of Kelvin, so they Can be considered degenerate. Fermi temperature T_F can be obtained by the relation

$$E_F = kT_F$$

Where k = 1.38 x 10^{-23} J K^{-1} is Boltzmann constant.

The number of free electrons in metal per unit volume is given by,

$$n = N_A \rho / M$$

Where N = 6.023 x 10^{26} per m^3 is Avogadro number.ρ = density of the metal
M = Mass number of the metal

The electrical conductivity of the metal,

$$\sigma = L/RA$$

Where L is the length of the metal wire, R is its resistance at a reference temperature a is the area of cross-section of the wire.

The relaxation time is given by

$$\tau = \sigma m / ne^2$$

Where e = 1.602 x 10^{-19} C is electron charge.

If V_F is Fermi velocity, then mean free path of electrons,

$$\lambda_F = V_F \tau$$

With all these, expression of Fermi energy comes out

$$E_F = [(Ane^2 \pi r^2)/L\sqrt{2m}]^2 \times \left(\frac{\Delta R}{\Delta T}\right)^2$$

Where the constant A = λ_F x T, T is the reference temperature of the wire in Kelvin, r is the radius of the wire and (ΔR/ΔT)is the slope of the straight line obtained by plotting resistance of the metal wire against absolute temperature of the metal wire.

APPARTUS USED:

1. Solenoid of copper wire.
2. D.C regulated power supply (0-2V).
3. Meter bridge.
4. Thermometer of range (0-200) degree.
5. Table galvanometer.

Experimental Procedure

1. About 6 meter length copper wire is taken and its radius is determined and cross sectional area is calculated. Its mass number and density are noted from Clark's table.

L_{copper} =6 m, Radius r =0.112× 10^ − 3

Density ρ = 8930 Kg m-3

Mass number M = 63.54 gm

2. The wire is wound over an insulating tube (10-15mm dia) to form a coil. The coil is Immersed in pre heated water as shown in the experimental setup. The two end of the coiled wire is connected across another gap of Meter Bridge and power supply is connected to the bridge.

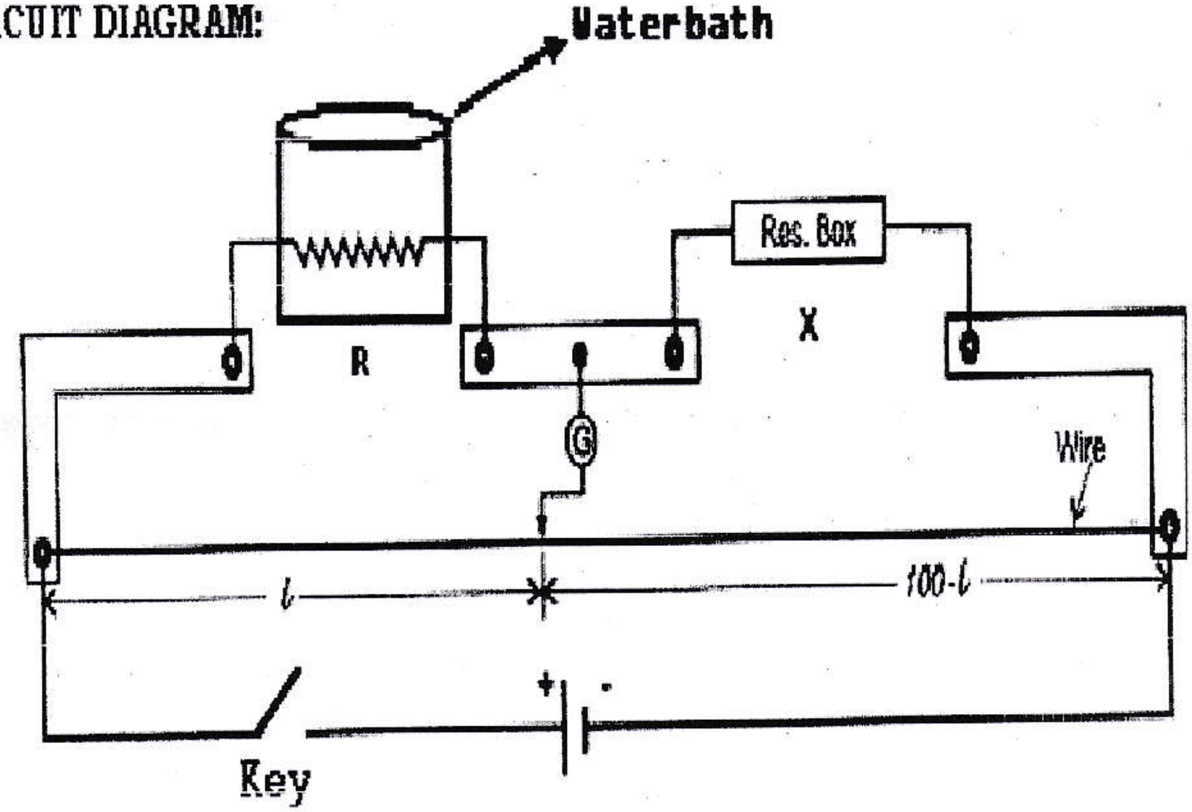
3. A thermometer is immersed in the beaker containing water and coil. When the
Thermometer attains steady temperature the temperature is noted.

4. The power supply is switched on and voltage and currents are noted In Table-1. The Liquid is allowed to cool and power supply is switched off until another steady Temperature is reached.

5. Trial is repeated taking reading in the interval of 5 degree and until the temperature reach 45 degree. At each temperature the voltages and currents measured are noted in Table-1.

6. A graph is drawn taking temperature in degree K along X-axis and resistance on Y axis as Shown in Figure-2. The slope of straight line is calculated and substituting this value find Fermi energy of the wire.

CIRCUIT DIAGRAM:



EXPERIMENAL DATA

Measurement of resistivity of Meter Bridge wire (ρ):

No of obs.	Resistance in Ω		Null point in cm		$l_2 - l_1$ in cm	$\rho = X/l_2 - l_1$ in Ω/m	Mean ρ in Ω/cm
	left	right	l_1	l_2			
1	2	0	18.9			0.03129	
	0	2		82.8	63.9		
2	2.5	0	11.4			0.03457	
	0	2.5		83.7	72.3		
3	3	0	3.8			0.03172	0.03211
	0	3		98.4	94.56		
4	2.7	0	8.7			0.03187	
	0	2.7		93.4	84.7		
5	2.2	0	15.9			0.0311	
	0	2.2		85.9	70		

DATA FOR RESISTANCE VARIATION WITH TEMPERATURE

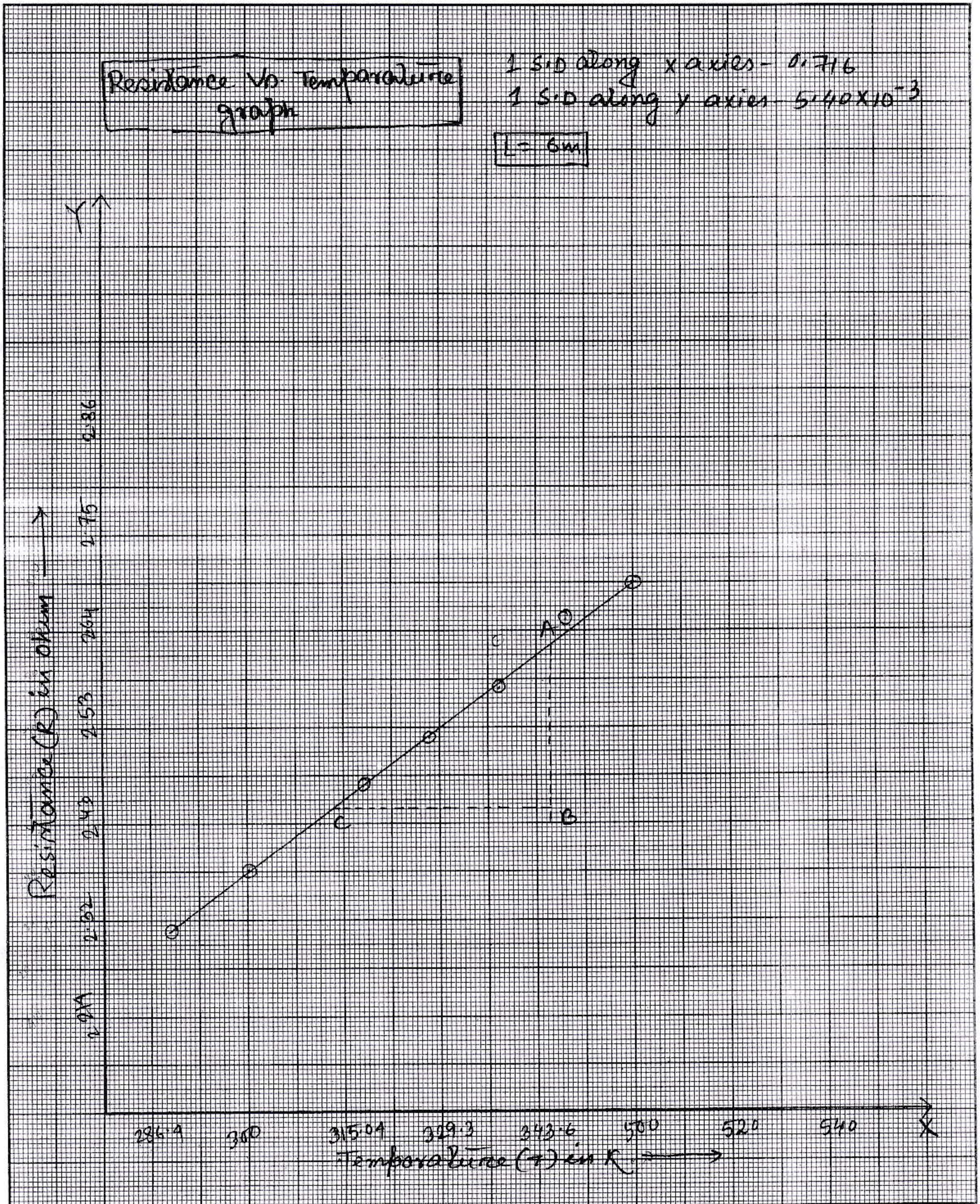
Density of meter bridge wire ρ =0.03211 Ω/cm, L=6m , resistance in box at room temperature r=2.1 Ω

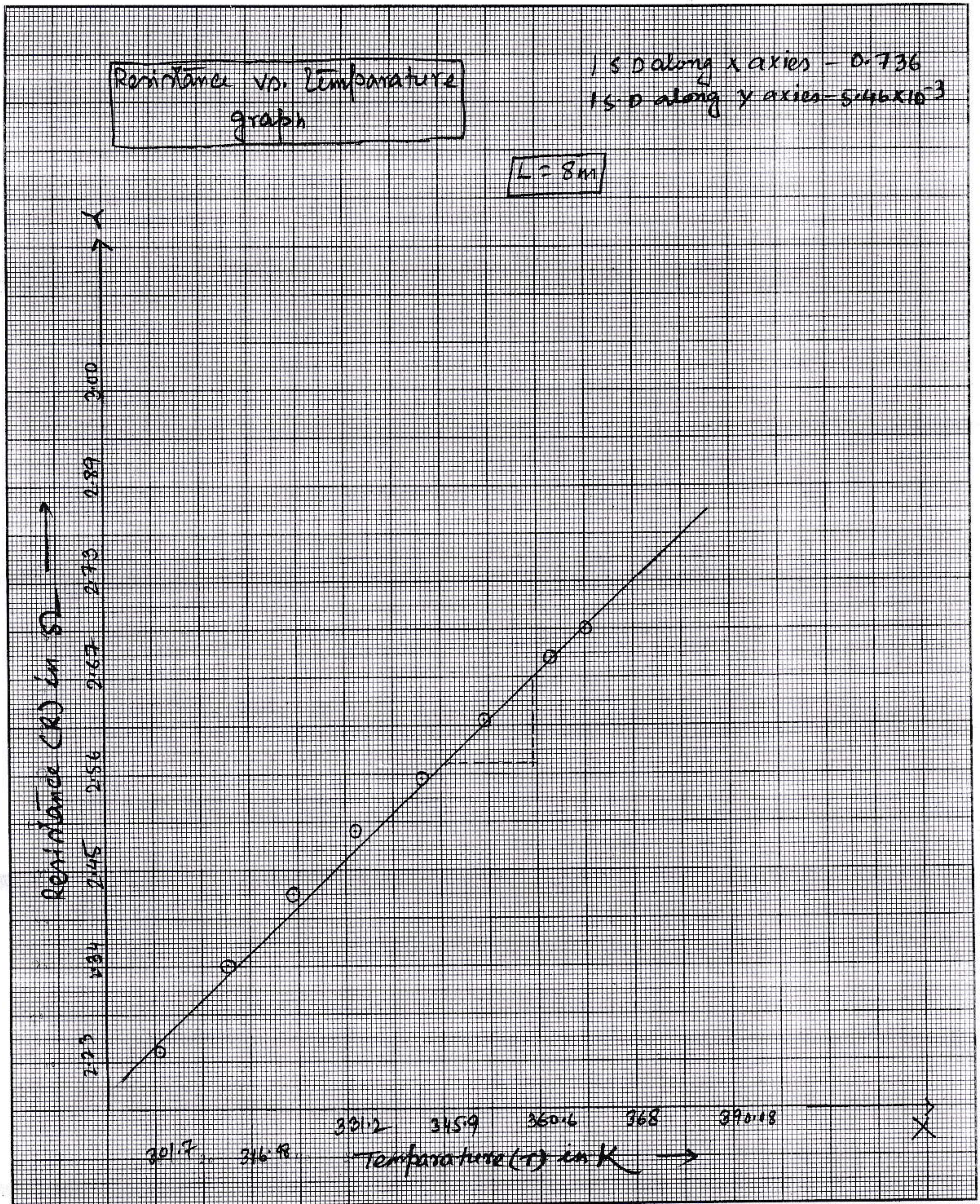
Temperature		Null point in cm at corresponding temperature(l)	$(l-l_0)$ in cm	Corresponding copper wire resistance $R=r+2\rho(l-l_0)$ in cm
In 0_c	In k			
85	358	59.96	13	2.93
75	348	57.62	11.6	2.78
65	338	56.05	9.4	2.68
55	328	54.96	8.0	2.60
45	318	53.56	6.7	2.53
35	308	52.77	5.9	2.40
30	303	50.90	4.0	2.35

DATA FOR RESISTANCE VARIATION WITH TEMPERATURE

Density of meter bridge wire ρ =0.03211 Ω/cm, L=8m, resistance in box at room temperature r=2.1 Ω

Temperature		Null point in cm at corresponding temperature(l)	(l-l$_0$) in cm	Corresponding copper wire resistance R=r+2ρ(l-l$_0$) in cm
In 0$_c$	In k			
95	368	56.84	9.84	2.73
90	363	56.37	9.37	2.70
80	353	55.59	8.59	2.63
70	343	54.70	7.70	2.568
60	333	53.24	6.24	2.50
50	323	52.15	5.15	2.43
40	313	50.90	3.90	2.43
30	303	49.96	2.96	2.35


Resistance Vs Temperature graph
1 S.D along x axies - 0.716
1 S.D along y axies 5.40x10^-3
L = 6m
Y
Resistance (R) in ohm
2.86
2.75
2.64
2.53
2.43
2.32
A
B
C
284.9
300
315.04
329.3
343.6
500
520
540
X
Temperature (T) in K



Resistance vs. Temparature graph
1 s.D along x axies - 0.736
1 s.D along y axies - 5.46x10^{-3}
L = 8m
Y
3.00
2.89
2.73
2.67
2.56
2.45
2.34
2.23
Resistance (R) in Ω
301.7
316.48
331.2
345.9
360.6
368
390.08
X
Temparature (T) in K

CALCULATION

Length of the copper wire (L)= 6m , radius of wire (r)=0.12×10^{-3}m

Cross sectional area of the wire =πr^2=$4.53\times 10^{-8} m^2$

Density ρ= 8930 kg/m^3

Mass number M = 63.54 g

At T=303K

Electron density=n =$N_A\rho/M$=($6.023\times 10^{23}\times 8930$)/0.06354

=8.46×10^{28} /kg .mol

The electrical conductivity σ=L/RA= $6/(2.35\times 4.53\times 10^{-8})$

=0.563×10^{8} /Ωm

Fermi velocity for copper =V_F= 1.57×10^{6}m/s

The relaxation time $\tau=\sigma m/ne^2$=2.37×10^{-14}s

Mean free path $\lambda_F=V_F\times \tau = 1.57\times 10^{6}\times 2.37\times 10^{-14}$ =$3.72\times 10\text{-}^{8}$m

Constant, A= $\lambda_F T$= $3.72\times 10^{-8}\times 303 = 1.12\times 10^{-5}$

Slope of the resistance versus temperature graph= $(\Delta R/\Delta T) = 5.86\times 10^{-3}$

With all these, Fermi energy comes out to be

$$E_F = [(Ane^2\pi r^2)/L\sqrt{2m}]^2\times \left(\frac{\Delta R}{\Delta T}\right)^2$$

$$=[(1.51\times 10^{-21})/(1.079\times 10^{-14})]^2\times (7.014\times 10)^2$$

$$=6.28\times 10^{-19}J = 4.0ev$$

Fermi temperature $T_F=(6.28\times 10^{-19})/(1.38\times 10^{-23})$

$$=45.68\times 10^3 k$$

CALCULATION

Length of the copper wire (L)= 8m , radius of wire (r)=0.12× 10^{-3}m

Cross sectional area of the wire =πr^2=4.53× 10^{-8} m^2

Density ρ= 8930 kg/m^3

Mass number M = 63.54 g

At T=303K

Electron density=n =$N_A\rho$/M=(6.023× 10^{23}× 8930)/0.06354

=8.46× 10^{28} /kg .mol

The electrical conductivity σ=L/RA= 8/(2.25× 4.53 × 10^{-8})

=0.78× 10^{8} /Ωm

Fermi velocity for copper =V_F= 1.57× 10^6m/s

The relaxation time τ=σm/ne^2=3.28× 10^{-14}s

Mean free path λ_F=V_F× τ = 1.57× 10^6× 3.28 × 10^{-14} =5.14× 10^{-8}m

Constant, A= λ_FT= 5.14× 10^{-8}× 303 = 1.55× 10^{-5}

Slope of the resistance versus temperature graph= (ΔR/ΔT) = 7.014× 10^{-3}

With all these, Fermi energy comes out to be

$$E_F = [(Ane^2\pi r^2)/L\sqrt{2m}]^2 \times \left(\frac{\Delta R}{\Delta T}\right)^2$$

Fermi energy $E_F = [(1.51 \times 10^{-21})/(1.079 \times 10^{-14})]^2 \times (7.014 \times 10^{-3})^2$

$= 9.63 \times 10^{-19}$ J

=6.02 ev

Fermi temperature $= (9.63 \times 10^{-19})/(1.38 \times 10^{-23})$

$= 69.782 \times 10^3$ K

RESULT:

Metal wire	length	Fermi energy		Fermi temperature	
		theoretical	experimental	experimental	theoretical
Copper	6 m	7 ev	4.0 ev	45.68×10^3 K	80×10^3 k
	8m	7 ev	6.02 ev	69.78×10^3 k	80×10^3 k

DISCUSSION

1. Since copper wire is good conductor, the variation of its resistance with temperature is very small.
2. The variation in low temperature is uniform than in high temperature.
3. If we increase the radius of the wire, then resistance will decrease. To
4. Get better result we have to take large length and small radius of the wire.

References

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2. Neil W. Ashcroft and N. David Mermin, Solid State Physics

"SURFACE TENSION OF LIQUID AT DIFFERENT TEMPARATURE"

PROJECT REPORT SUBMITTED IN PARTIAL FULLFILLMENT OF THE REQUIREMENTS FOR THE 3 DEGREE OF BACHELOR SCIENCE WITH HONOURS IN PHYSICS UNDER VIDYASAGAR UNIVERSITY

PROJECT REPORT SUBMITTED BY

Nandan Maity

B.Sc. PART – III EXAMINATION – 2019

ROLL- 31216101 NO. – 0182

REG. NO. – 011285 OF 2015-2016

UNDER THE SUPERVISION OF

Prof. Biswanath Dolai

(H.O.D)

DEPARTMENT OF PHYSICS

BAJKUL MILANI MAHAVIDYALAYA

BAJKUL :: KISMAT BAJKUL

PURBA MEDINIPUR

CERTIFICATE

This is to certify that Nandan Maity, a student of 3rd year of B.Sc. Physics honours being Roll- 31216101 No- 0182 has successfully performed the project work entitled ***"THE VARIATION OF SURFACE TENSION OF LIQUID AT DIFFERENT TEMPARATURE"*** the laboratory of the Physics dept., Bajkul Milani Mahavidyalaya, under my guidance and supervision.

I shall be glad to see his every success in life.

Date ....

With best wishes

....

(Prof. Biswanath Dolai)
(H.O.D)
Department of Physics
Bajkul Milani Mahavidyalaya

ACKNOWLEDGEMENT

I am indebted to my teacher Prof. Biswanath Dolai for his active help, guidance and advice during the project work. I am also grateful to the other teacher Prof. Ismail, Sk, Dr. Sourav Samanta, Mr. Debasis jana, Mr. Subhasis Jana, Mr. Dipesh Das, Mr. Swarnakamal Jana, Mr. Rajkumar Mahesh and no teaching employees, department of Physics for their kind co-operation.

I am indebted to the authorities of this college for providing me of the facilities for this work and permitting me to work in laboratory.

Nandan Maity

Roll- 31216101 No- 0182

Bajkul Milani Mahavidyalaya

Kismat Bajkul, Purba Medinipur

CONTENT

ABSTRACT

Using U tube arrangement the surface tension of water at different temperatures are determined. The phenomena of capillary rising are implied. The result of the experiment is in agreement with the standard result.

INTRODUCTION

Surface tension is a fundamental property of all liquid surfaces and exhibits itself in many ways. In our daily life we see that small quantities of liquids tend to become spherical in shape and soap film, tend to become extended. This phenomenon is mentioned above lead us to belief the skin like behavior of the surface of the liquid i.e, as if a thin membrane is covering the liquid surface.

The contractile character of the surface layer of a liquid is not due to any real existence of surface tension but it is due to the intermolecular actions resulting in the existence of molecular surface energy and the contractile character of the surface as evidenced is not due to any tension coming to play but due to the fact that surface molecules of a system in equilibrium tend to attain minimum potential energy.

The surface tension of all liquids decrease linearly with rise of temperature, when the temp. range is small. Surface tension S at temperature t is $S=S_0(1-\alpha t)$

Where S_0 is the value of the surface tension at o degree centigrade and α is the temperature coefficient of surface tension. The above expression may also be written in the from

$$dS/dt=-S_0\alpha=-K$$

At critical temperature T_c the value of surface tension is zero. According to Vander walls the surface tension at absolute temperature T is

$S=S_0[1-(T/T_c)]^{3/2}$.

Where S_o is the constant for the liquid.

Then $\frac{ds}{dt}=-\frac{3S_0}{2T_C}(1-T/Tc)^{1/2}$.

or, $\frac{1}{S_0}\frac{ds}{dt}=-\frac{3}{2T_C}(1-T/Tc)^{1/2}$.

Therefore $\frac{ds}{dt}=0$, when T= Tc

Thus both S and $\frac{ds}{dt}$ are zero at critical temperature.

A modify formula, according to Ferguson $S=S_0[1-(T/T_c)]^n$

where n is constant. For a single liquid but varies slightly from liquid to liquid. The mean value of is 1.21.

Let M be the molecular weight of the liquid and ρ its density. The surface area occupied by by gm-molecule, assuming the molecule are symmetrical in shape, is proportional to $(M/\rho)^{2/3}$. This surface is called molar surface. Surface energy in the molar surface is proportional to $S(M/\rho)^{2/3}$ and is known as molar energy

According to Eotvos law, $S(M/\rho)^{2/3}=K(T_c-T)$,where K is universal constant known as Eotvos constant. The approximate value of K is 2.2.

The relation was corrected by Ramsey and Shilds giving $S(M/\rho)^{2/3}=K(T_c-T-\delta)$,

The constant δ has a value between 6 and 8 for more solids. From this relation we see that the surface tension is zero when $T = T_c-\delta$.

Differentiating we get,

$$d/dT[S(M/\rho)^{2/3}]=-K$$

THEORY

This method is used to compare the surface tension of a liquid at different temperatures. The apparatus consists of a U-tube with limbs of different cross-sections. The experimental liquid is taken in the U-tube and the same is mounted inside a suitable temperature bath.

The pressure just below the meniscus in the limb AB, inside the liquid is

$$P-(2S/r_1) \quad \text{[P is the atmospheric pressure]}$$

The pressure just below the meniscus in the limb CD, inside the liquid is

$$P-(2S/r_2)$$

Where $r_1$and r_2 the radii of the bores of the two limbs.

Therefore the difference of pressures in the two limbs of the U-tube

$$p= 2S[(1/r_1)-(1/r_2)]$$

$$=h\rho g \quad \text{or } S= h\rho g/2[(1/r_1)-(1/r_2)]$$

The values of S are found for different temperatures t and a graph is then plotted between the temperatures t and the corresponding values of S.From the graph we see that surface tension of the liquid decreases with rise of temperature and becomes zero at a particular temperature t_c known as critical temperature which depends on the nature of the liquid.Taking two points $A(t_1,S_1)$ and $B(t_2,S_2)$ on the graph,we see that the gradient of the graph gives us the temparatures coefficient of surface-tension i.e.,

$$dS/dt=(S_1-S_2)/(t_2-t_1)$$

APPARATUS

1. A capillary U-tube
2. A thermometer
3. Microscope
4. Electric heater

PROCEDURE

1. At first we take a U-tube and its contain water. There is no bubble.
2. A thermometer and this U-tube are dropped into the cold water partially.
3. We set up the travelling microscope and then we take the reading of cross-mark.
4. With increasing temperature, we reading the height of the liquid at two part of the U-tube I,e; narrow and wide tube.
5. Next we calculate the radius of the narrow and wide tube.
6. We already calculate the value of h and also we know at particular temperature value of p is constant. Then we calculate the value of surface tension of the liquid. Hence we plotted this value of surface tension of the liquid at different temperature on the graph paper.

Experimental data

Reading for mark point:

Narrow tube of U tube			Wide tube of U tube		
Scale reading in cm	v.r.	Total in cm (x_1)	Scale reading in cm	v.r.	Total in cm (x_2)
1.35	44	1.394	7.95	40	7.99

Data for measurement of x'_1 and x'_2 .

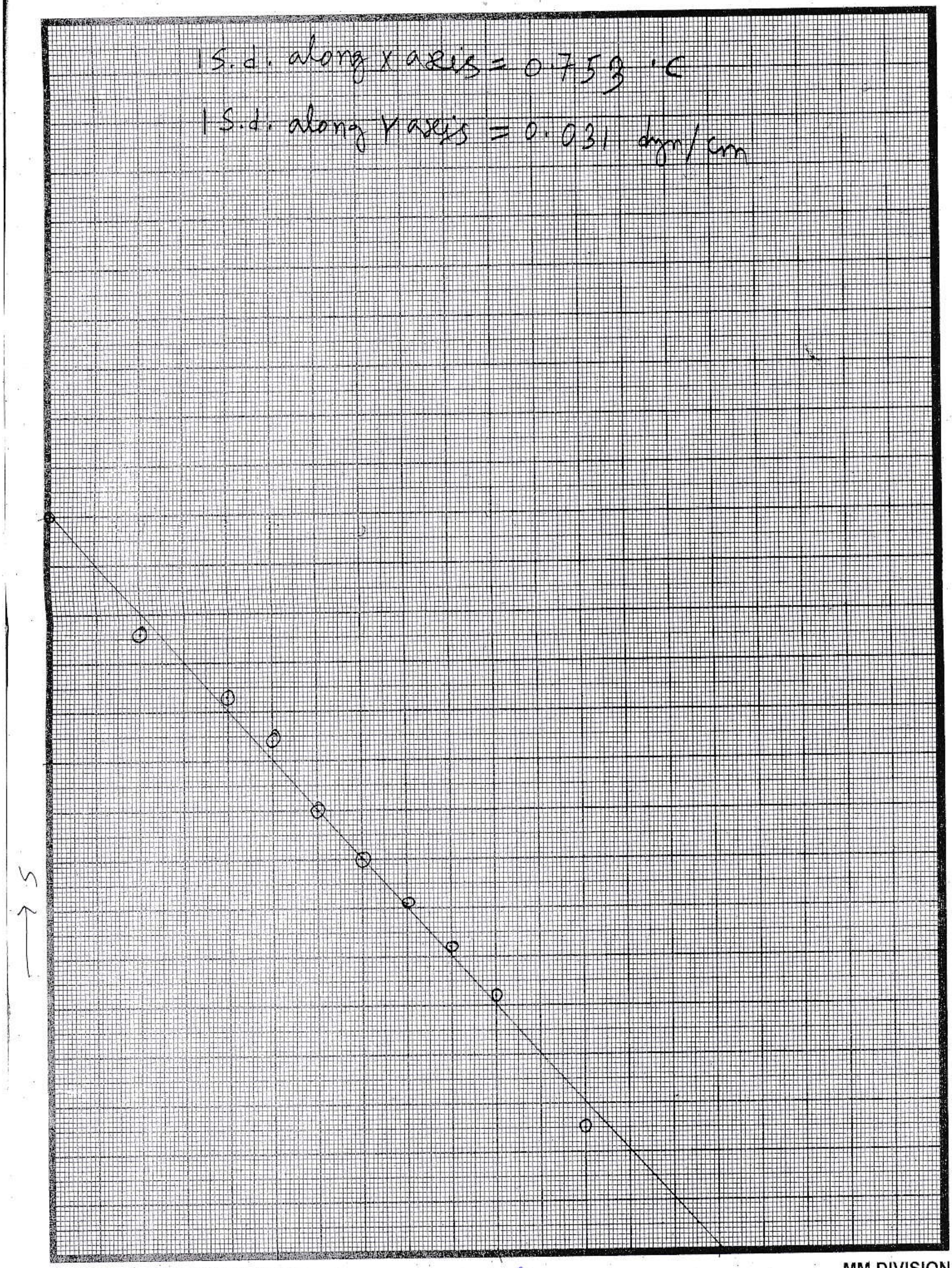
Temp. Of liq. °C	For wide tube height of liquid level in cm			For narrow tube height of liquid level in cm		
	Scale reading in cm	v.r.	Total in cm (x'_2)	Scale reading in cm	v.r.	Total in cm (x'_1)
10	10.4	3	10.403	7	47	7.047
14	10.4	15	10.415	7	26	7.026
18	10.4	38	10.438	7	34	7.034
20	10.50	2	10.502	7.05	36	7.086
22	10.55	41	10.591	7.15	8	7.158
24	10.65	4	10.654	7.2	9	7.209
26	10.70	42	10.742	7.25	36	7.286
28	10.9	21	10.921	7.45	4	7.454
30	11.10	16	11.116	7.6	36	7.638
34	11.3	46	11.346	7.8	36	7.836
40	11.5	32	11.532	7.95	44	7.994

Data for measurement of r_1 and r_2 :-

Direction of obs.	Reading for left and lower end of the bore			Reading for right to upper end of the bore			D = R1-R2 in cm	$D_1^1 = \frac{D1+D2}{2}$	D in cm
	Scale	v.r.	Total in cm	Scale	v.r.	Total in cm			
Horizontal	14	49	14.049	14	32	14.032	0.017	0.0115	
Vertical	6.45	20	6.47	6.45	26	6.476	0.006		0.0475
Horizontal	14.2	4	14.204	14.1	22	14.122	0.082	0.0835	
Vertical	6.35	29	6.279	6.35	14	6.364	0.085		
Horizontal	13.95	12	13.962	13.95	2	13.952	0.01	0.0065	
Vertical	6.65	43	6.693	6.65	40	6.69	0.003		
Horizontal	6.65	30	6.68	6.6	10	6.61	0.07	0.09	0.0965
Vertical	14	30	14.03	14.1	40	14.14	0.11		

Radius of Narrow tube $r_1 = \frac{D_1}{2} = \frac{0.0475}{2} = 0.02375$ cm

Radius of wide tube $r_2 = \frac{D_2}{2} = \frac{0.0965}{2} = 0.04825$ cm


1 s.d. along x axis = 0.753 °C
1 s.d. along Y axis = 0.031 dyn/cm
→ S
→ T (Temperature)

Data for measurement of h_2 and h_1 :-

Tempr. Of liquid in Degree Centegrate	For wide tube $h_2 = x_2^1 - x_2$ in cm	For nano wtube $h_1 == x_1^1 - x_1$ in cm	$h = h_2 - h_1$ in cm	Surface tension $s = \frac{h\rho g}{2(\frac{1}{r_1} - \frac{1}{r_2})}$ dyn/cm
10	2.413	5.653	3.24	74.29
14	2.425	5.632	3.207	73.49
18	2.448	5.64	3.192	73.107
20	2.512	5.692	3.180	72.804
22	2.602	5.764	3.163	72.38
24	2.664	5.815	3.151	72.07
26	2.752	5.892	3.14	71.79
28	2.931	6.06	3.129	71.50
30	3.126	6.244	3.118	71.20
34	3.356	6.442	3.086	70.38
40	3.542	6.6	3.058	69.59

PRECATION

1. The radius of the both of the narrow and wide tube measure carefully. Otherwise large error will be occurred.
2. When we noted the height of the liquid level, the venire reading must be measured carefully.

DISCUSSION

The result is in good agreement with the standard result. The temperature dependence of surface tension of liquid can be determined in other many ways. But this method is suitable to perform in the laboratory setup.

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2. A Text book on GPM by A.B.Gupta

3. Advance Practical Physics by D.Chattopadhyay And P.C.Rakshit

"To Study the Intensity Distribution for Sunlight Visible Range"

PROJECT REPORT SUBMITTED IN PARTIAL FULLFILLMENT OF THE REQUIREMENTS FOR THE 3 DEGREE OF BACHELOR SCIENCE WITH HONOURS IN PHYSICS UNDER VIDYASAGAR UNIVERSITY

PROJECT REPORT SUBMITTED BY

Subhendu Pramanik

B.Sc. PART – III EXAMINATION – 2019

ROLL- 31216101 NO. – 0196

REG. NO. – 011397 OF 2015-2016

UNDER THE SUPERVISION OF

Mr. Debasis Jana

DEPARTMENT OF PHYSICS

BAJKUL MILANI MAHAVIDYALAYA

BAJKUL :: KISMAT BAJKUL

PURBA MEDINIPUR

FORWARD

In the project work entitled ***"Study of the Intensity Distribution for Sunlight Visible Range"***, Subhendu Pramanik a student of B.Sc.(Hons) in Physics of Bajkul Milani Mahavidyalaya has successfully investigated under the guidance and supervision of Mr. Debasis Jana, Department of Physics.

……………………………………

Prof. Biswanath Dolai
H.O.D
Bajkul Milani Mahavidyalaya
Kismat Bajkul, Purba Medinipur

Certificate

This is to certify that Subhendu Pramanik, a student of 3rd year B.Sc . Physics Honours being Roll – 31216101 No. – 0196 has successfully performed the project work entitled "Study of the Intensity Distribution for Sunlight Visible Range".

In the labotory of the [Physics Department, Bajkul Milani Mahavidyalaya, Kismat Bajkul under my guidance and supervion.

I shall be glad to see her every success in life.

.....Debasish Jana.....

28.3.19

Mr. Debasish Jana

Department of Physics

Bajkul Milani Mahavidyalay

Acknowledgement

A moment comes which comes but rarely in a student's life, when with utmost pleasure and satisfaction, I myself, ***Subhendu pramanik****, submit my project on* ***"Study of the Intensity Distribution for Sunlight Visible Range".*** *I take this opportunity to express my gratitude and sincere thanks to my project guide,* ***Mr. Debasish Jana*** *whose motivating personality, constant encouragement and sustained guidance has made this project to come true.*

I am also thankful to my teachers Prof. Biswanath Dolai, Mr. Debasish Jana, Mr. Subhashis Jana, Dr. Sourav Sasmal, Prof. Ismil Sk, Mr. Swarnakamal Jana, Mr. Rajkumar Mahes and non teaching employees for their continuous inspiration. I also acknowledge all the staff members of our department.

I am very much thankful to my project friends for their co-operation during my project period. Finally I acknowledge to all my friends.

I also acknowledge my parents, brother, my best friend and other family members for their moral support in my academic pursuits.

Subhendu Pramanik

Department of Physics
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Contents

Abstract

Black body radiation follows the well known Planck distribution law. At a particular temperature energy density has a peak value at certain wavelength. Then energy decreases on both sides of that wavelength. In this project we take sun as a black body and measure its energy distribution. By the sunlight through the filter we get sunlight of particular wavelength and measure its intensity by using LDR circuit. Then we plot the intensity Vs. wavelength. This confirms the radiation law.

Introduction

Sunlight itself approximates ideal black body radiation outside the earth's atmosphere. The inability to explain such black body radiation by classical theory was itself responsible for the development of quantum mechanics. As well as reflecting light from the sun centre at much greater wavelengths because of its lower temperature.

Absorption & scattering of light by the earth's atmosphere reduce the intensity & wavelength distribution of light reaching the earth's surface.

The energy received throughout the day increasing from low intensity in the morning peaking at solar noon & declining during the afternoon.

The maximum radiation tricks the earth's surface when the sun is directly overhead & sunlight has the shortest path length through the atmosphere. This path length can be approximate by $1/\cos\phi$, Where ϕ is the angle between the sun & the point directly overhead.

The sun is a hot sphere of gas heated by nuclear fusion reactions at its centre. Internal temperature reach a very warm 20 million K , the intense radiation from the interior is absorbed by a lower of hydrogen ions closer to the sun's surface. Energy is transferred by convection through this optical barrier & than reradiated from the outer surface of sun, the photo sphere. This can emits radiation approximately that from a black body with a temperature of nearly 6000K.

A black body is an ideal absorber & emitter of radiation. As it is heated, it starts to glow that is to emit the electromagnetic radiation. A common example is when a metal is heated. The hotter it gets, the shorter wavelength of light emitted & an initial red glow gradually turns white.

Classical physics was unable to describe the wavelength distribution of light emitted from such a heated objected. However, in 1900, Max Planck derived a mathematical expression describing this distribution.

Theory

If the incident light intensity is I and the LDR current is i.

Then,

$$i \propto I \qquad \text{.......... (1)}$$

The above proportionality relation is a direct consequence of the interpretation of intensity and photoelectric effect. Intensity is nothing but the member of photon passing unit area per unit time in a normal direction.

Thus the variation of intensity with wavelength is to be similar to the variation of LDR current with wave length of incident radiation.

In the present work we have used the radiation of visible range for study. Thus we expect as intensity distribution as shown in the ***Fig.(1)***.

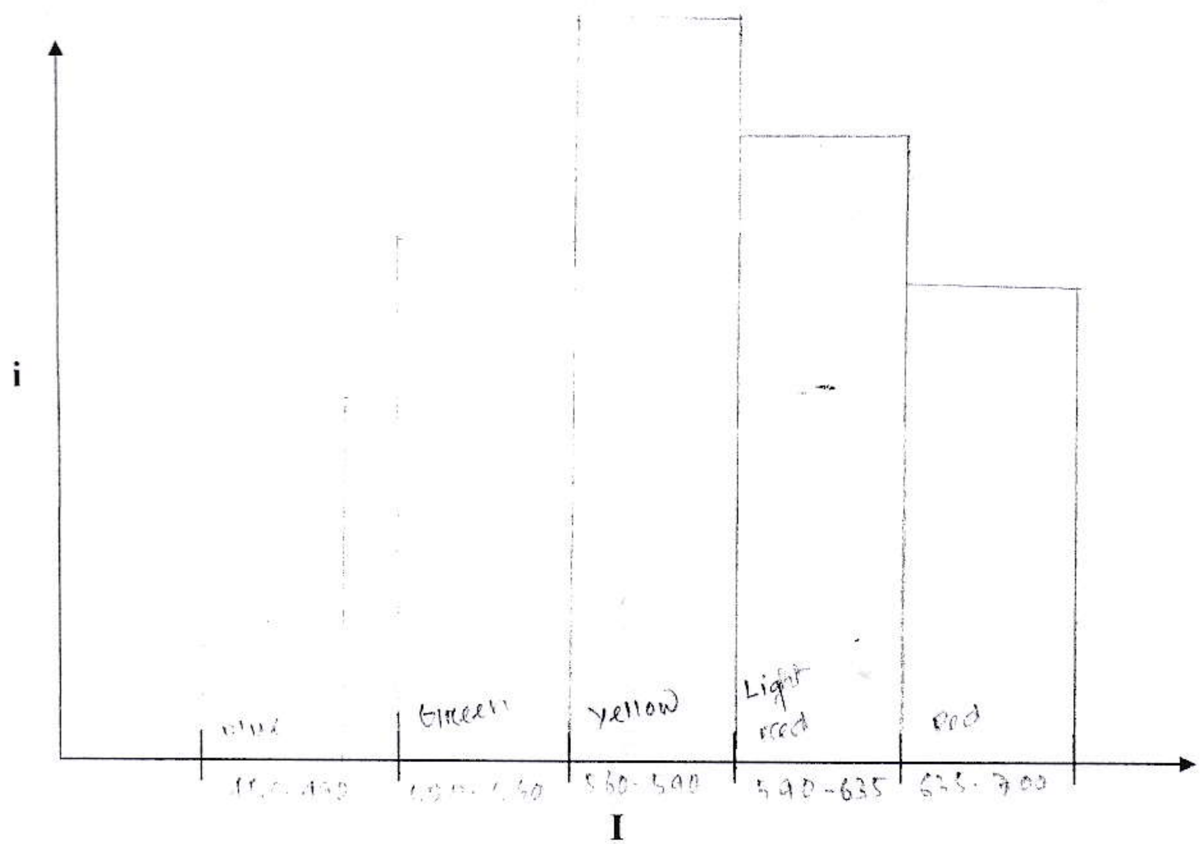


Fig. 1

Apparatus

I) Color filter
II) LDR
III) Regulated Power Supply
IV) Ammeter
V) Bread board
VI) Some connection wires
VII) An extension board

Procedure

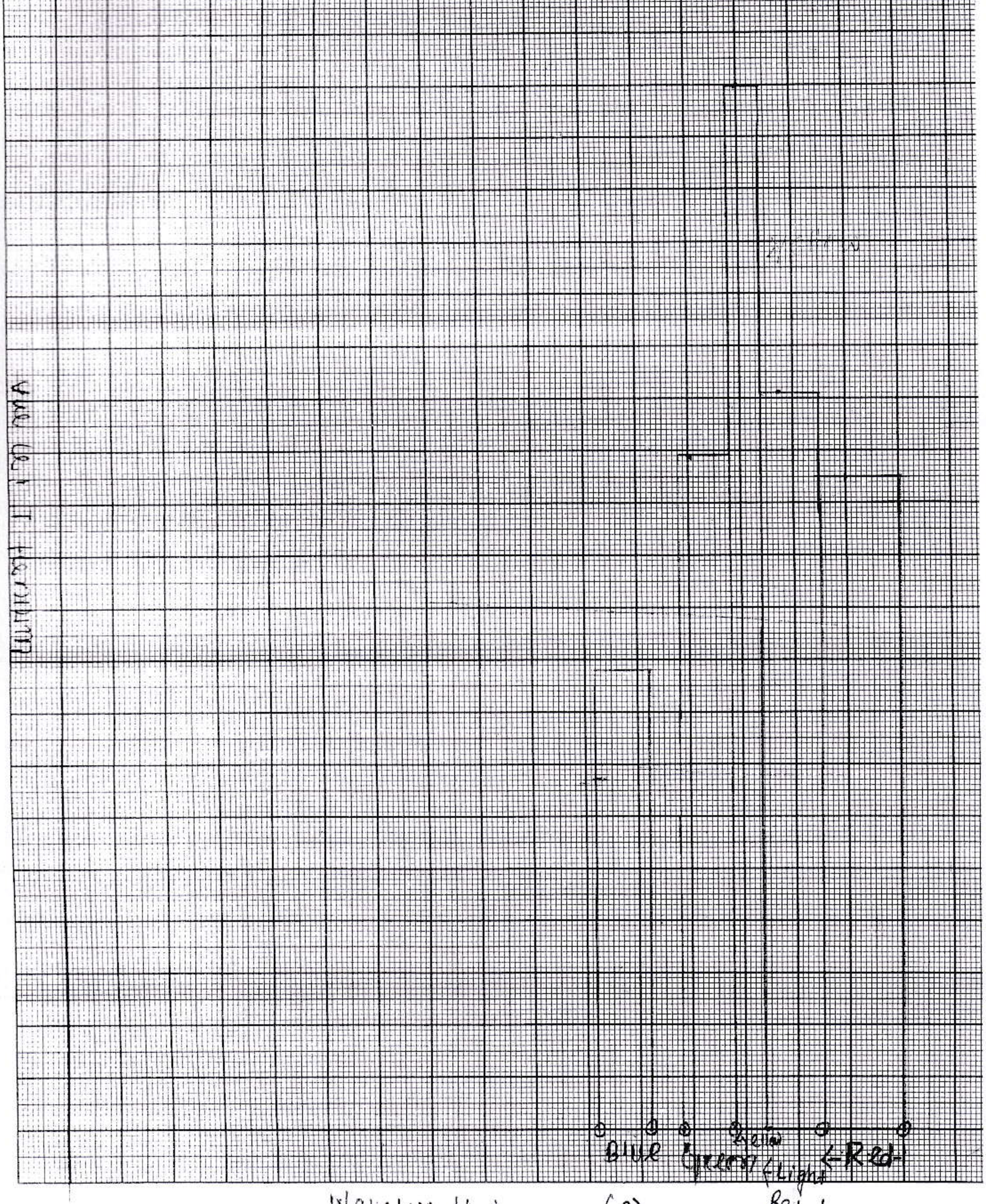
First the LDR is connected to regulated power supply. A fixed voltage of 2 volts is applied. The LDR is kept in a dark box with a hole of appropriate radius. Color paper is placed blocking the hole. Now the set-up is faced toward the sunlight such that sunlight can fall normally on LDR after passing the color paper filter.

The corresponding LDR current is noticed.

The same thing is performed using different color filter. The investigation is performed in different four times of a day.

Plot wavelength (λ) vs current at time 1:00 PM

1 Smallest division along X axis = 4.375 nm
1 Smallest division along Y axis = 0.0565 mA



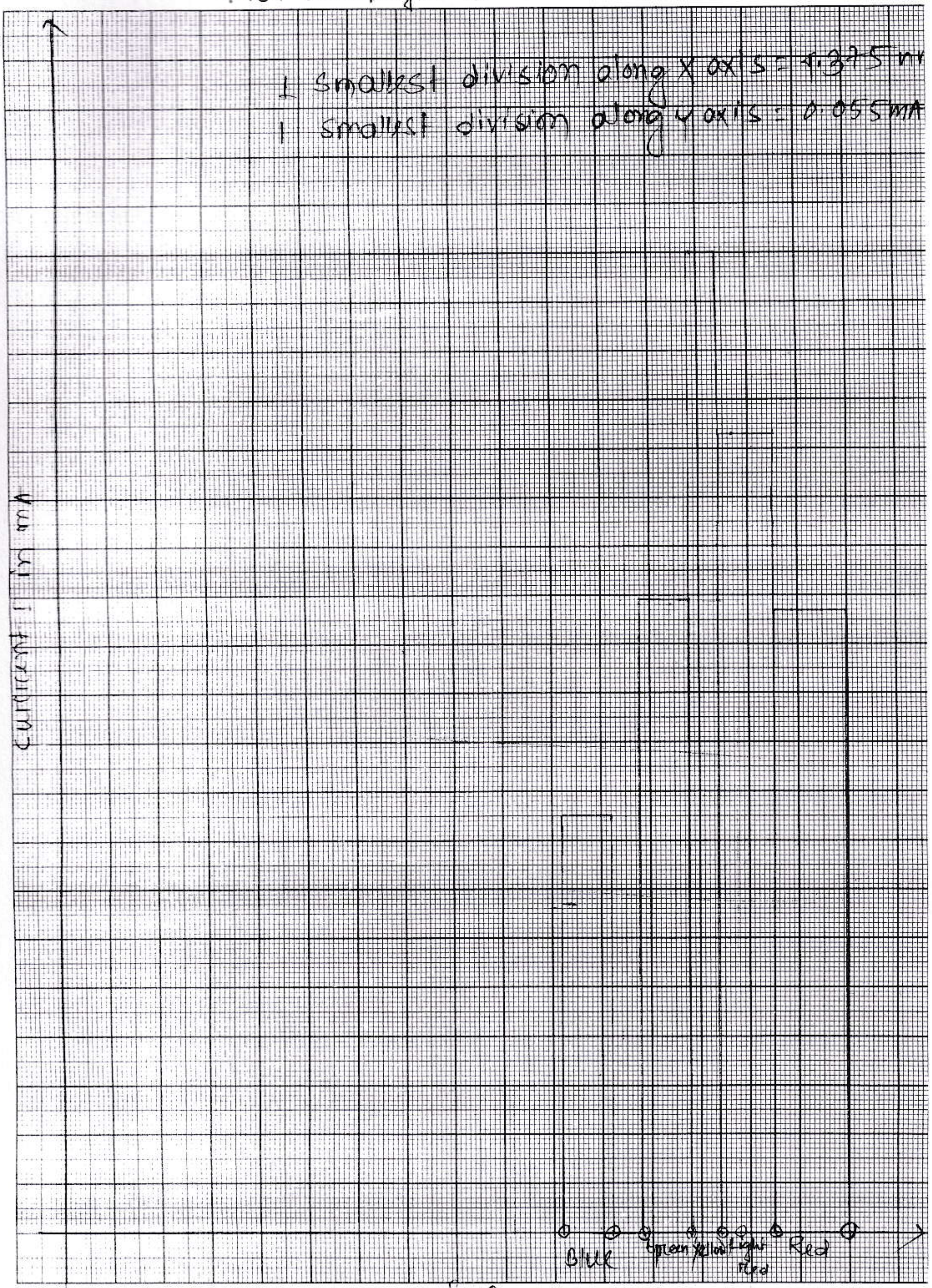
Experimental Data

Observation at time 1:00 PM and date 20/02/19

Colour filter	Wavelength (λ) in nm	LDR current (I) in mA
Red	636 – 700	7.1
Green	520 – 560	7.3
Light Red	590 – 635	8.0
Yellow	560 – 590	11.3
Blue	450 – 490	5.0

Table – 1

Plot wavelength vs current at 1:30 PM



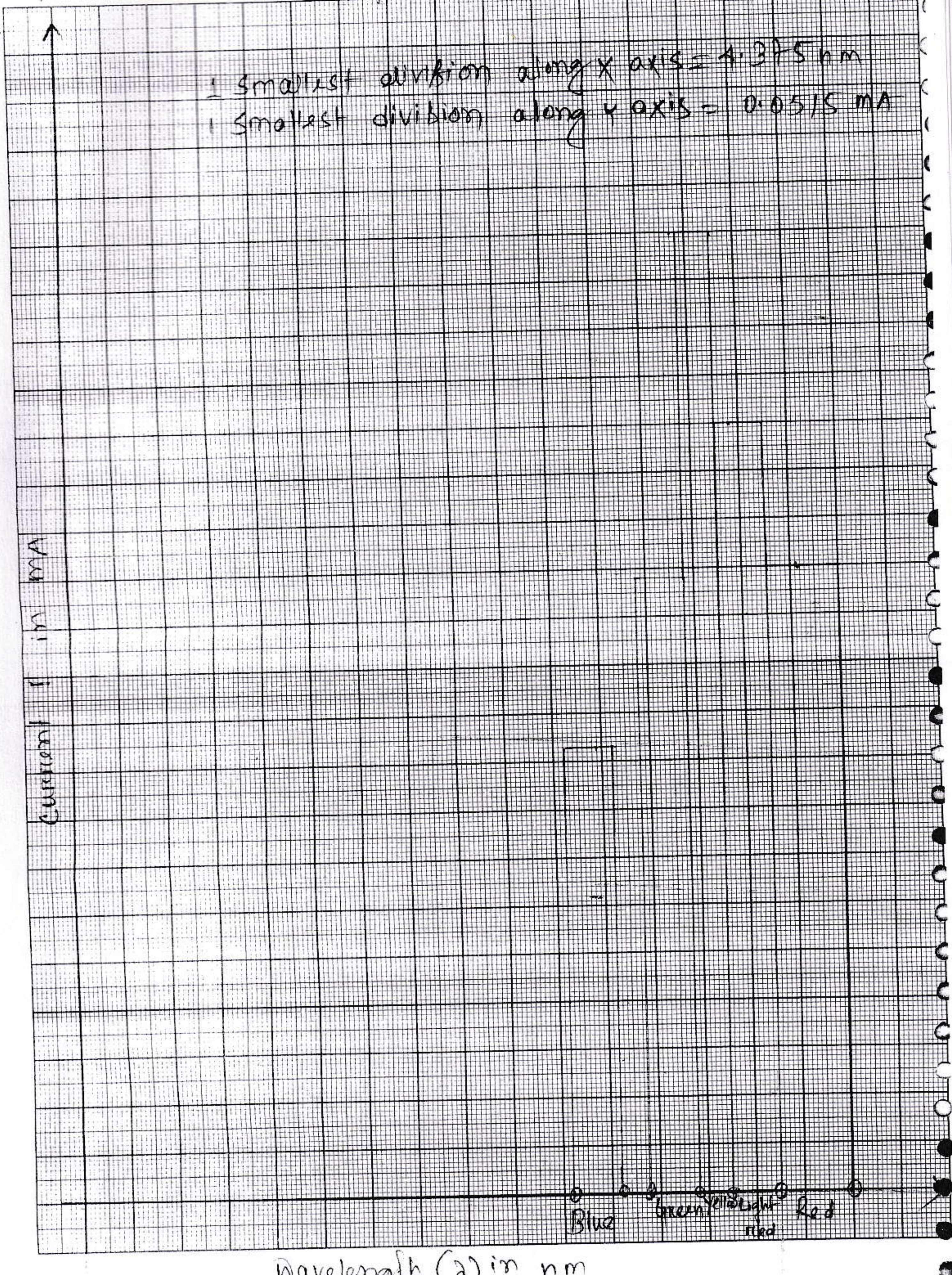
Experimental Data

Observation at time 1:30 PM and date 20/02/19

Colour filter	Wavelength (λ) in nm	LDR current (I) in mA
Red	700 – 636	7.0
Green	560 – 520	7.1
Light Red	635 – 590	9.0
Yellow	590 – 560	11.0
Blue	490 - 450	4.7

Table – 2

2:0 Plot wavelength Vs current at 2:00PM



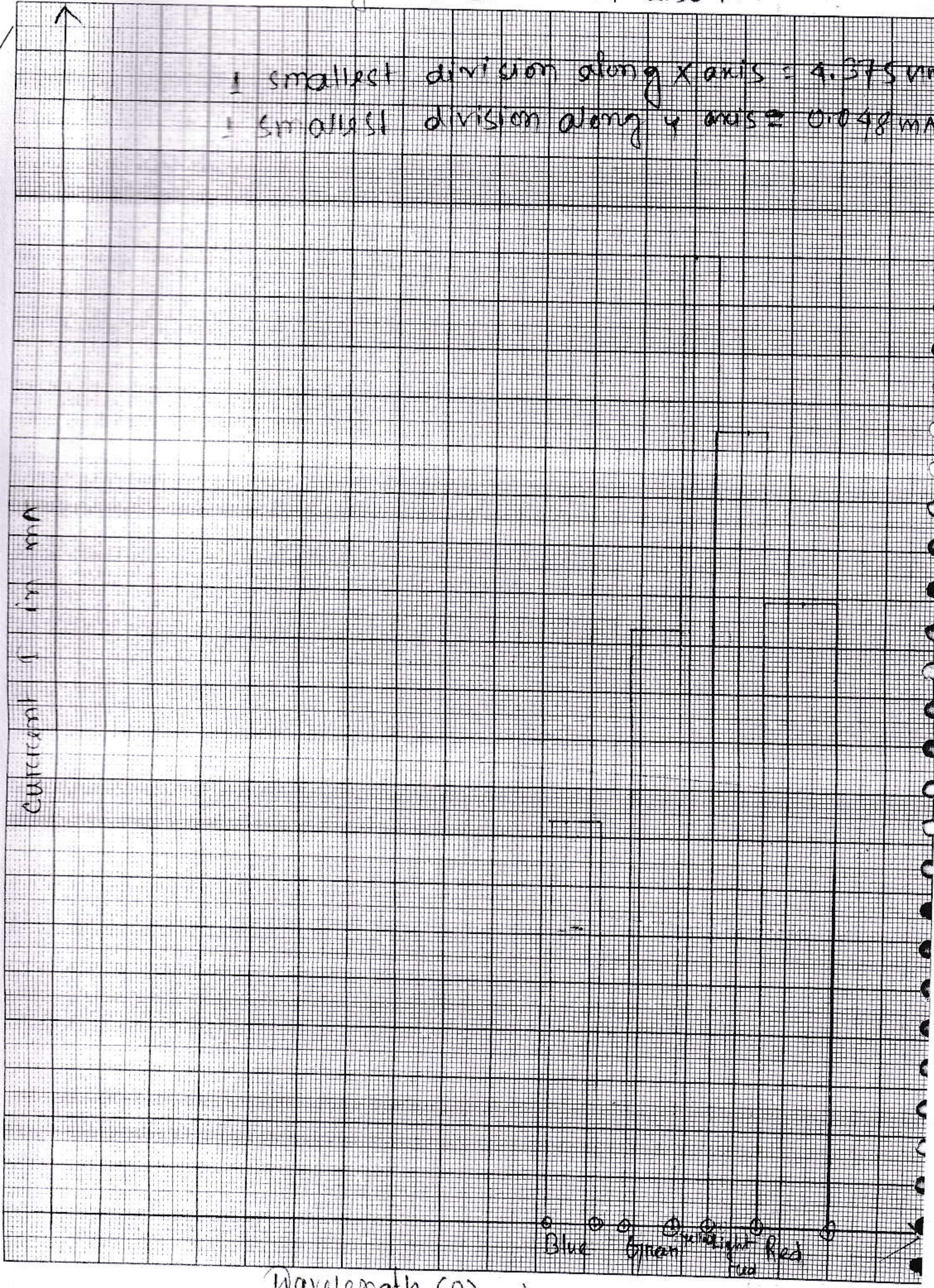
Experimental Data

Observation at time 2:00 PM and date 20/02/19

Colour filter	Wavelength (λ) in nm	LDR current (I) in mA
Red	700 – 636	6.7
Green	560 – 520	6.6
Light Red	635 – 590	8.2
Yellow	590 – 560	10.3
Blue	490 - 450	4.8

Table – 3

Plot wavelength vs current at 2:30 PM



Wavelength (λ) in nm

Experimental Data

Observation at time 2:30 PM and date 20/02/19

Colour filter	Wavelength (λ) in nm	LDR current (I) in mA
Red	700 – 636	6.2
Green	560 – 520	5.9
Light Red	635 – 590	7.9
Yellow	590 – 560	9.6
Blue	490 - 450	4.0

Table – 4

Discussion

The experiment was performed for five different colours namely blue, yellow, red, light red and green. The corresponding wavelength are taken from supplied data but here due to lack of wavelength detector the average values of wavelengths corresponding to the above mentioned five colours are taken. However the Experiment results (through for very small range of wavelength spectra) is in well agreement with the previously predicted accurate resulting experts.

Refference

1. An advanced course in Practical Physics, D. Chattopadhay and P.C. Rakshit.

2. Thermal Physics, Amulya Bhusan Gupta and Haripada Kar.

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Sr. No.	CBR Number	Reference Number /Application Type	Application Number	Title/Remarks	Amount Paid	Amount Computed
1	23265	ORDINARY APPLICATION Pages:-3 , Claims:-0,Drawings:-0,Abstract:-0,Claims pages:-0	201731040603	A SAFETY KIT FOR TWO-WHEELER.	1750	1750
2		E-101/87/2017-KOL	201731040603	Correspondence	0	0
3		E-2/307/2017-KOL	201731040603	Form2	0	0
4		E-3/6072/2017-KOL	201731040603	Form3	0	0
Total Amount					**1750**	**1750**

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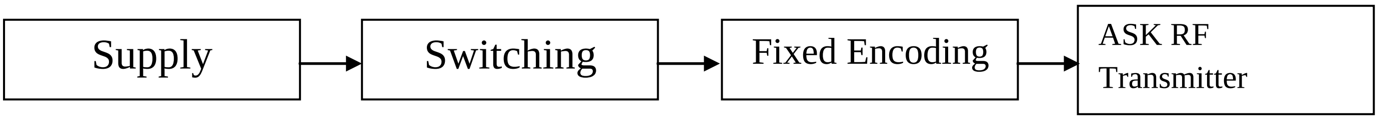
TITLE OF PROJECT:-BIKE CANNOT START WITHOUT HELMET

Our project consist of two circuit. One is transmitter circuit (helmet unit) another receiver circuit (bike unit) transmitter circuit block diagram given below.

Transmitter circuit (helmet unit):-

Block diagram of transmitter circuit (helmet unit)



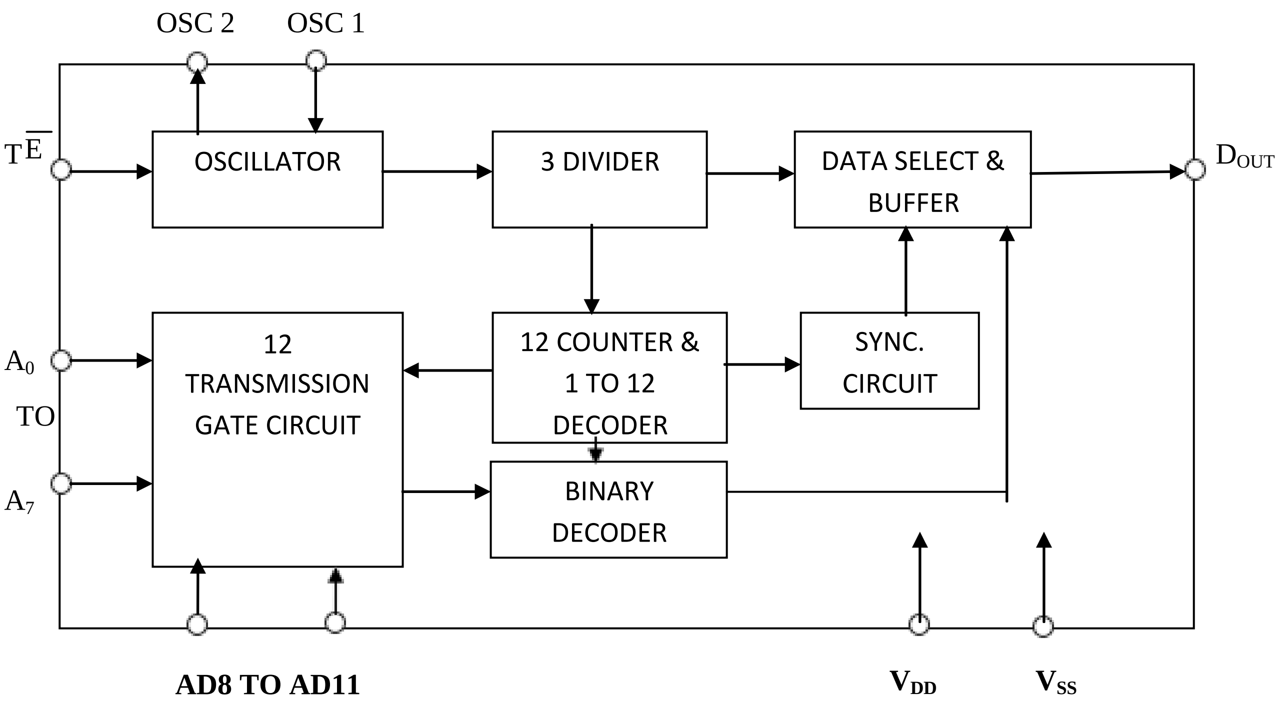
Power supply of our helmet kit is two pair of Batteries connected in parallel battery consist of three 1.5 v button cell connected in series. For emergency use of supply we use two set of Battery. One for main supply and another for emergency use. The switch is two way slideing switch.

Switching part of helmet kit (Transmitter circuit) consist of three micro limit switch connected in parallel. One is pleased inside helmet at upper pressure point and another two pleased inside the helmet at two sides of ear pressure point. At the time of use if any one/all connects the circuit will be closed. We use three switches to eliminate chattering effect at running time of bike.

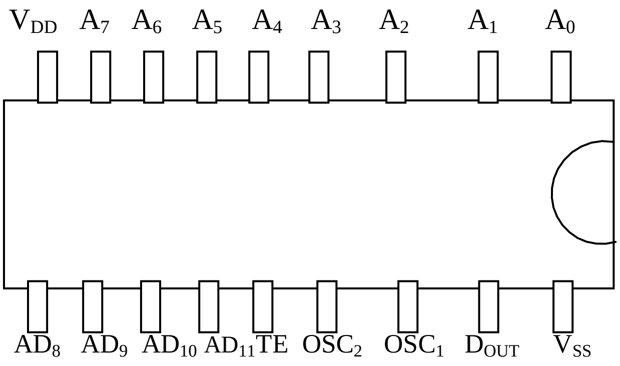
To increase the force of limit switches we use pressure plate. we use for upper pressure point oval type and ear side pressure point rectangular pressure plate .

As fixed encoding we use IC HT12E.Though this IC can be use as variable or changing addressing and data. For separate addressing we choose separate addressing terminals (Pin No. 1-8) and also separate data terminals (Pin No. 10-13). Selecting address terminals connect with negative (GND) and selected data terminals and connected with positive terminals through 1 Killo ohom resistors . HT12E has own oscillator. Oscillator in put (Pin No.-16) and output (Pin No.-15)are shot by a 1MΩ resistor. From Pin No-17 we get serial data out put

Block diagram of ICHT12E

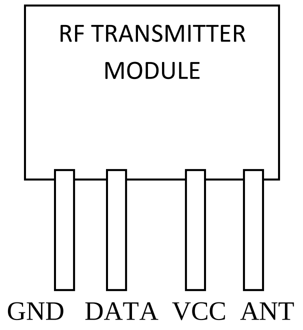


Pin configuration of HT12E

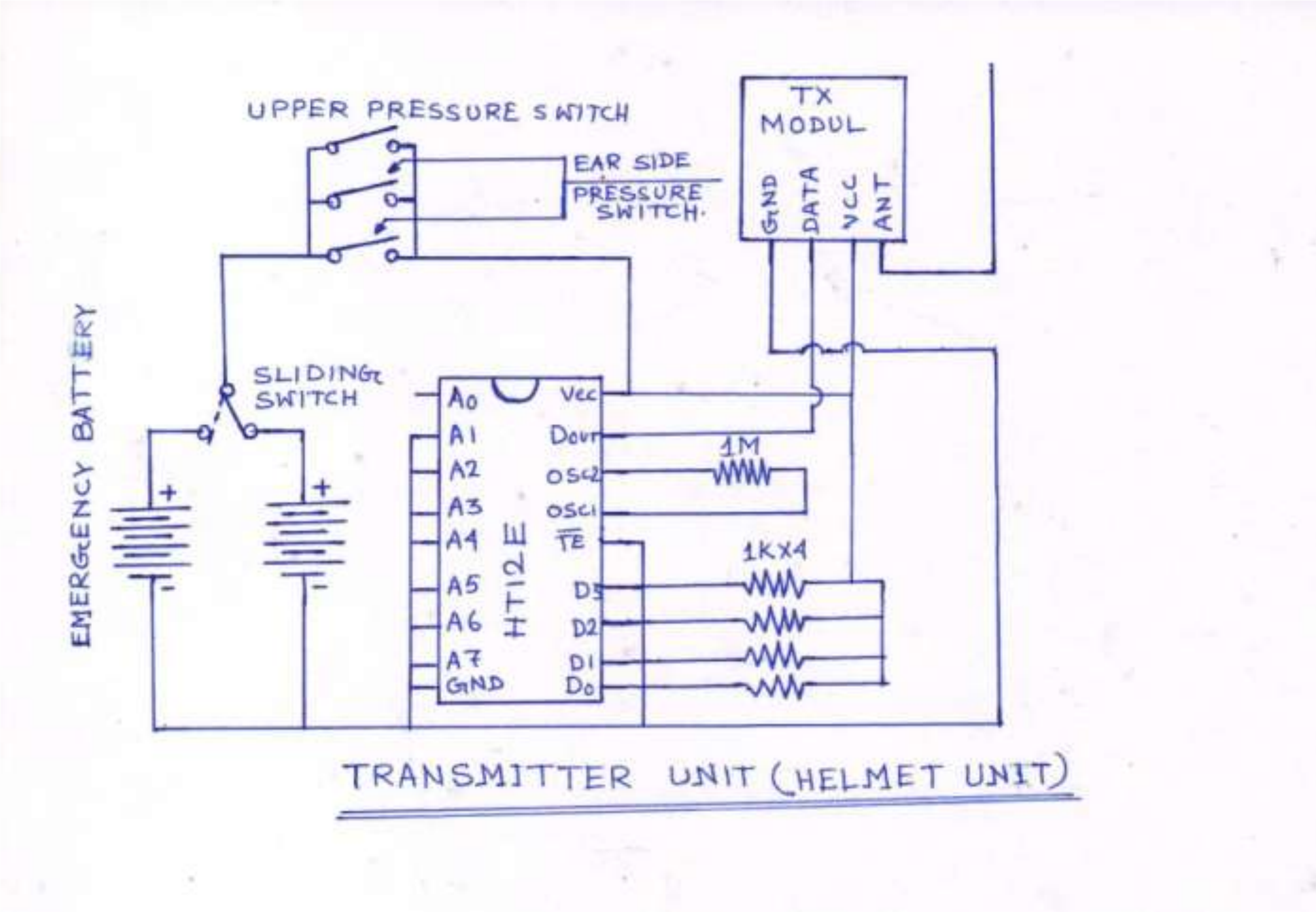


PIN NO	FUNCTION	NAME
1-8	8 BIT ADDRESS	A_0 – A_7
9	GROUND	V_{DD}
10 -13	4 BIT DATA/ADDRESS PIN FOR INPUT	AD_0 – AD_3
14	TRANSMISSION ENABLE ACTIVE LOW	TE
15	OSCILLATOR INPUT	OSC2
16	OSCILLATOR OUTPUT	OSC1
17	SERIAL DATA OUTPUT	D_{OUT}
18	SUPPLY 2.4V – 12V	V_{SS}

Serial data output from pin no.-17 of IC HT12E send to DATA pin of 433.9MHz RF transmitter module. This transmitter module convert serial data to 433.9 MHz radio frequency and spread to air through antenna(ANT)of helmet unit.



__Circuit Diagram of__ Transmitter (Helmet) Unit



Bike unit (Receiver Kit):-

It consist of

1. Supply
2. Voltage
3. RF Receiver Module
4. Data decoding
5. Switching

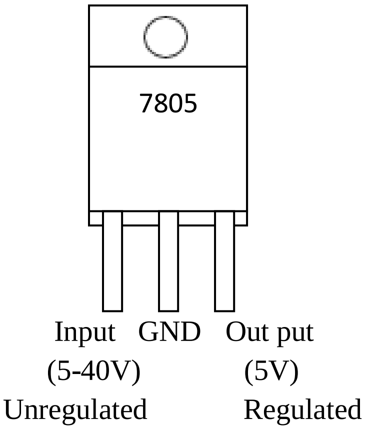
1. **Supply:-**

   Power supply for this bike unit does not need extra supply. We use bike's battery which is already fixed in bike as supply the power of bike electrical accessories. We connect our receiver kit to this battery through a switch.

2. **Voltage Regulator:-**

   Requirement of this circuit voltage are 5V and 12V (For relay operation). We get 5V de from 12v battery through 7805 voltage regulator and 12v from battery.

   Pin configuration of 7805



3. R.F Receiver Module:-

   This R.F module works for 433.9 MHZ Radio frequency. Data transmitted from transmitter module received by Antenna of this receiver module and then transfer into serial data. Receiver module output this serial data into a decoder IC HT12D. This module have 8 pin. They are ANTINA, VCC (2 No), Ground (3Nos) and Digital data (1 no) Analog data (1 no)

   All GND connect with negative terminal of battery. All
   vcc connect with 5V de of 7805 voltage output pin.
   ANTINA connect with a 20 cm (approx) cu wire.
   Digital data connect with Decoder IC HT12D.
   Analog data blank.

4. HT12D is a decoder IC which is same pair of encoder IC HT12E. Addressing pin connection is same as encoder IC. Also data pin will be get as encoder data put. For oscillation a 47KΩ resistor connect with pin 15 and 16. Serial data output of receiver module feed to pin 14 of this IC. This serial data converted in to separate data and get from pin 10 to 13 if addressing matched.
5. Switching:-

   Output data from decoder IC fed to switching transistor BC548 and this transistor operate a relay (12 v). The relay's switching terminal (NO) connect operate the bike power supply and also a No helmet indication lamp(12v) from NC relay contact.

Circuit Diagram of Receiver (Bike) Unit