PHYSICS

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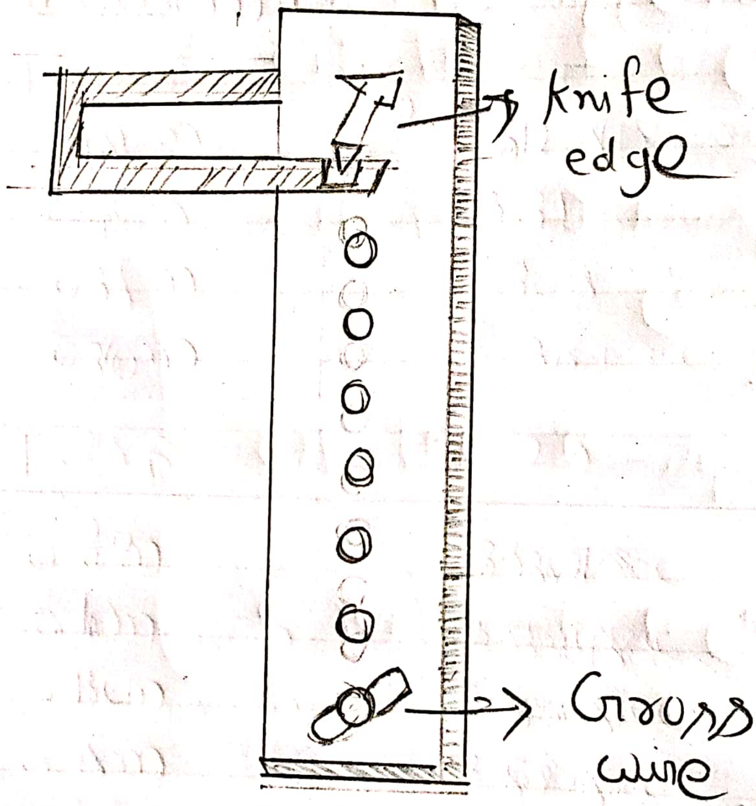


Bar pendulum

Aim ⇒ To plot a graph b/w the distance of the knife edge from the centre of the gravity and time period of bar pendulam from graph, find.

1 The accleration due to gravity.
2 The radius of gyration and the moment of inertia of the bar about on axis.

Apporatus: -
A bar pendulum, meter scale, stop watch, grap paper and sharp edge.

Theory and formula: -
The bar pendulum consist of a uniform metal bar about a meter long with holes drilled along its length at equal interval of about 5 cm.
If, T is the time period
L is the length of the pendulum
g is the accleration due to gravity.
Then, we know that, $T = 2\pi\sqrt{\frac{l}{g}}$

$$T^2 = 4\pi^2\frac{l}{g}$$

$$g = \frac{4\pi^2 l}{T^2}$$

Radius of gyration, $k = \sqrt{l'l''}$

Observations: —

Least count of the stop watch = 0.1 sec

Least count of metre scale = 0.01 m

Mass of the bar pendulum = 1.45 kg

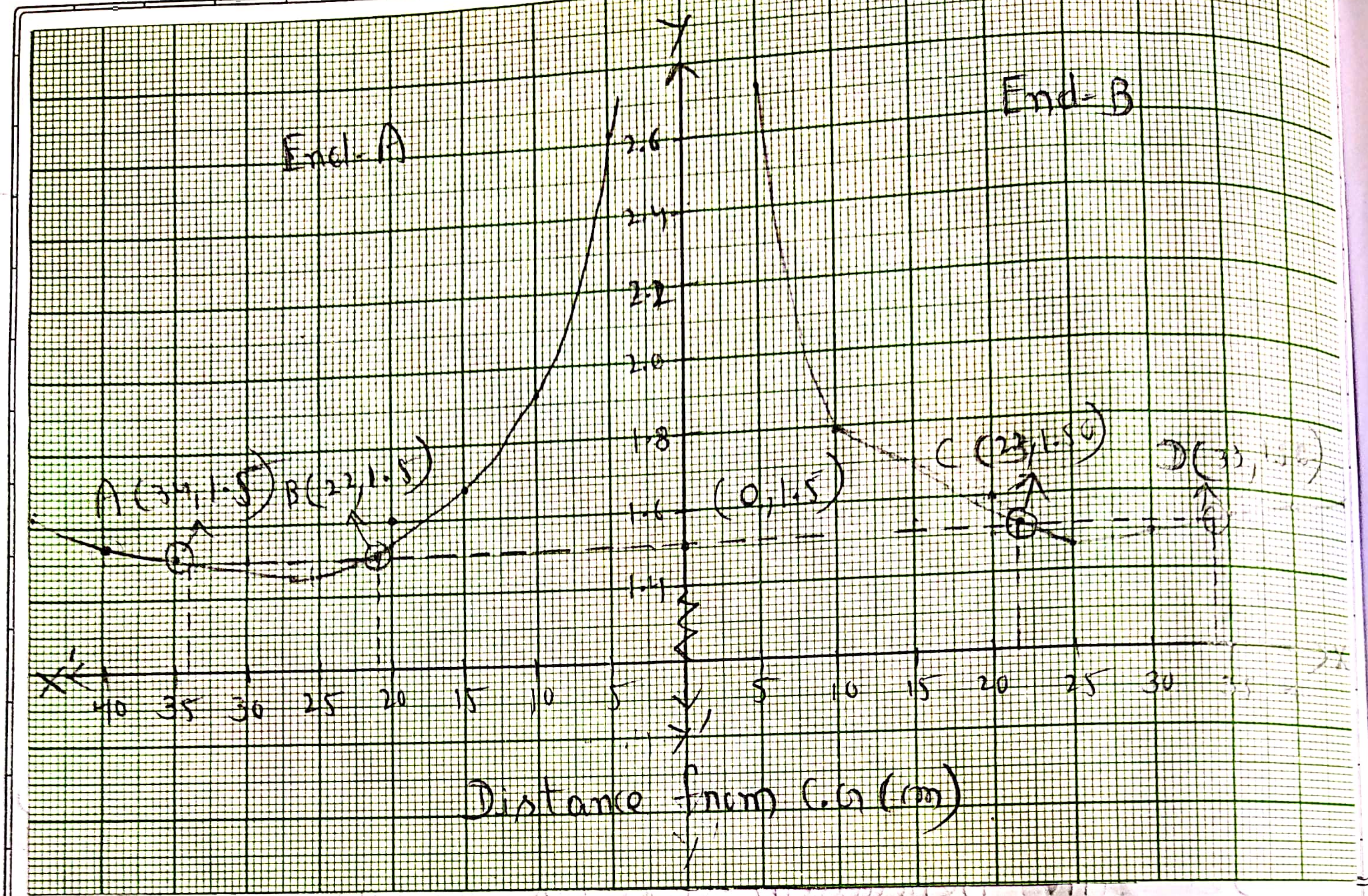
S.NO.	Distance from C.G (cm)	Time taken for 20 oscillations (sec)	Time period (T) t/20
	End - A		
1	45	32.5	1.625
2	40	31	1.55
3	35	30.5	1.525
4	30	30	1.5
5	25	29	1.45
6	20	32	1.6
7	15	33.75	1.687
8	10	38.5	1.925
9	5	52.5	2.625
	END-B		
1	5	32	2.725
2	10	31.5	1.925
3	15	30.75	1.7
4	20	30	1.6
5	25	29.5	1.475
6	30	32	1.5
7	35	34	1.537
8	40	38.5	1.575
9	45	54.5	1.6

where l' and l'' are distance of the points of suspension and point of oxillation.

$$I = mk^2$$

where, m = Mass of bar pendulum
and, k = Radius of gyration.

Procedure :-
1 Put the knife-edge in I^{st} hole on both sides of the bar.
2. Suspend the pendulum into from the knife edge on the side end A of bar.
3. Set the pendulum into oscillations with small amplitude. $(\sim 3^\circ - 5^\circ)$.
4 Note the time taken for 20 oscillations and measure the distance of the hole from the C.G of the bar.
5 Repeat the observation with knife edges in the 2nd, 3rd and 4th holes.
6. Now suspend the bar from the knife edge on side B.
7. Note the time taken for 20 oscillations with knife edges in the 1st, 2nd, 3rd hole and the distance of edges from the C.G of the bar.
8. Note down the mass of bar pendulum.



$AC = 34 + 23 = 57\ cm \Rightarrow l' = \frac{57}{2} = 28.5$

$BD = 22 + 33 = 55\ cm \Rightarrow l'' = \frac{55}{2} = 27.5$

$$l = \frac{AC + BD}{2} = \frac{57 + 55}{2} = 56$$

$$g = \frac{4\pi^2 L}{T^2} = \frac{4 \times (3.14)^2 \times 56}{(1.5)^2} = 981.5779\ cm/s^2$$
$$= 9.815779\ m/s^2$$

$$\%\ error = \left[\frac{9.81577 - 9.81}{9.81}\right] \times 100 = 0.057\ \%$$

$$K = \sqrt{l'l''} = \sqrt{0.28 \times 0.27} = 0.274\ m$$

$$I = mk^2 = 1.45 \times (0.27)^2 = 0.1057\ kg/m^2$$

Experiment :

Date

Result

1. The acceleration due to gravity, $g = 9.8157\ m/s^2$
2. The radius of gyration = 0.274 m
3. Moment of Inertia = $0.1057\ kg/m^2$

Precautions: -

1. The amplitude of vibration should be small.
2. The bar pendulum should be hang in vertical plane and knife edge should be in horizontal plane.
3. The knife should be sharp.
4. The time of oscillations should be counted for atleast 20 oscillations.

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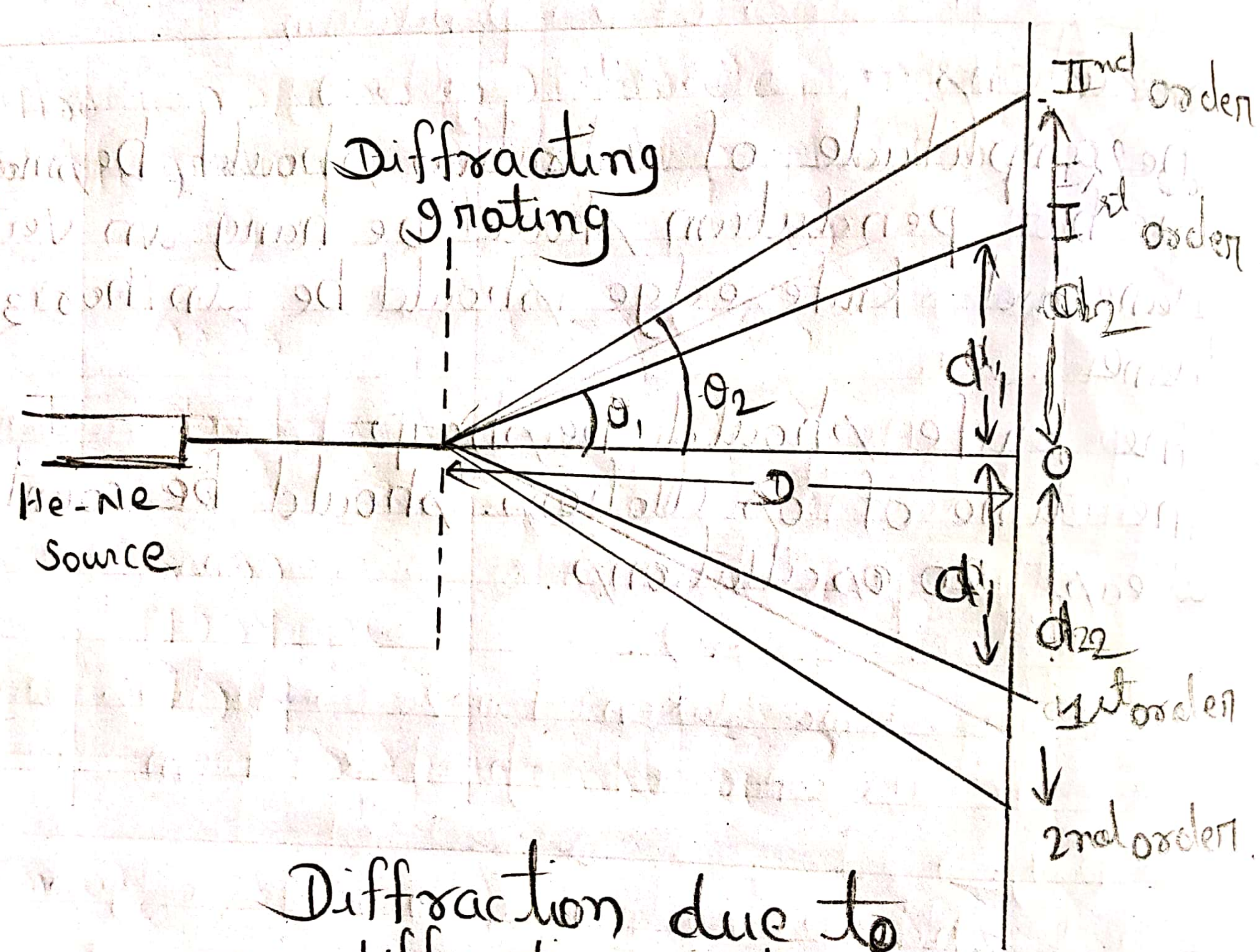

Diffraction due to diffraction grating

Aim ⇒ To find the wavelength of He-Ne laser source using transmission diffraction grating.

Apparatus:-
He-Ne laser source, diffraction grating, screen, stands, meter scale and power supply.

Theory and formula:-
When a parallel beam of light of wave length λ be the incident normally on a diffraction grating. The principal maxima of n^{th} order is given by:-

$$(e+d)\sin\theta_n = n\lambda$$

$$\Rightarrow \quad \lambda = \frac{(e+d)\sin\theta_n}{n}$$

where, e = width of each slit,
d = width of each opaque space b/w two slits
θ_n = an angle of diffraction
n = order
(e+d) = grating element (inch)

$$(e+d) = \frac{\cancel{2.54}\ 1}{\cancel{N}\ 1000} \text{ per cm.}$$

Normally, N = No. of ruled lines on a grating (12,000 to 34,000 per inch].

Observations: —

No. of lines on diffraction grating, N = 100 per mm

grating element, $(e+d) = \frac{[illegible]}{1000}$ per/cm

$= 0.001$ per/cm

	Order (n).	Diffraction b/w screen and diff. grating (cm) (D)	Distance of max from central point O (cm) (d_n)	$\sin\theta_n = \frac{d_n}{\sqrt{D^2+d_n^2}}$
1	1	98.28	6.5	0.065989
2	2	98.07	13.5	0.13637
3	3	98.08	19.5	0.19500
4	1	80.99	15.7	0.19030
5	2	79.57	33.4	0.38712
6	3	79.07	33.3	0.38911

We know, $\lambda = \frac{(e+d)\sin\theta_n}{n}$

$\boxed{1\,A^\circ = 1 \times 10^{-8}\,cm}$

$\lambda_1 = 6.5989 \times 10^{-5}$ cm

$\lambda_2 = 6.8185 \times 10^{-5}$ cm

$\lambda_3 = 6.5000 \times 10^{-5}$ cm

$\lambda_4 = 1.90300 \times 10^{-5}$ cm

$\lambda_5 = 1.93500 \times 10^{-5}$ cm

$\lambda_6 = 1.29703 \times 10^{-5}$ cm

$\therefore \lambda = \frac{\lambda_1+\lambda_2+\lambda_3+\lambda_4+\lambda_5+\lambda_6}{6}$

$= 4.17540 \times 10^{-5}$ cm

$= 4175.4\ A^\circ$

% error $= \frac{(4175.4 - 6328)}{6328}$

$\Rightarrow \frac{(2152.6)}{6328} \times 100 = 34.01$

Procedure:-

1 Set the He-Ne laser source horizontally.
2 Place the diffraction grating between He-Ne laser source and screen.
3 Find out the principal maximum, 1st and 2nd order maximum.
4 Now measure the distance b/w diffraction grating and screen that is D (cm).
5 Measure the distance from principal maximum to 1st maximum that is d (n=1)
6. Now find out the value of $\sin\theta$, by formula.
7. Repeat the steps 1-6 three times for different distance D and note down the reading.

Result:-

1 The wave length of He-Ne laser = 6532.5 $\mathring{A}$

Precautions:-

1 Never look directly into the laser source.
2 The He-Ne laser should be horizontal.
3 Adjust the distance b/w diffraction grating and screen properly.
4 The diffraction grating should be handled by the edges.

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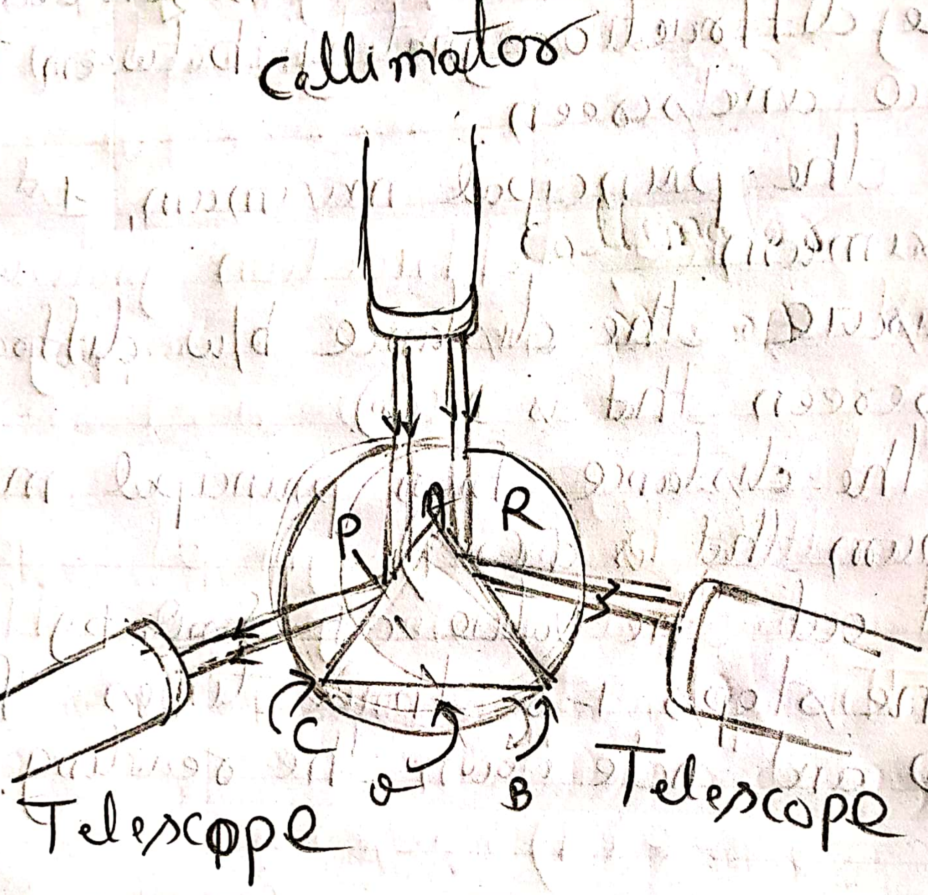

Spectrometer

Experiment : - 3 Date 28/08/19
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Aim ⇒ To determine the dispensive power of a glass prism using spectrometer and mercury source.

Apparatus: ⇒ Spectrometer, mercury source, glass prism, magnifying lens and spirit level.

Theory and Formula
It is a measure of the changes of the refrective index of the medium with wave length. The dis-persive power of a prism is given by

$$\omega = \frac{\mu_v - \mu_r}{\mu - 1}$$

where, μ_v = refrective index for violet colour.
μ_r = refrective index for red colour.
μ = Mean of refrective index of violet and red colour.
i.e $\mu = \frac{\mu_v + \mu_r}{2}$

Calculate value of μ_r

$$\mu = \frac{\sin \frac{A + \delta_m}{2}}{\sin A/2}$$

where δ_m = angle of minimum deviation.

Observation table

S. No.	Vernier Reading	Reading focused on left faced (θ_1)	Reading focused on right faced (θ_2)	$\theta = \theta_1 - \theta_2$	A=θ/2
1	V_1	33°6'	272°5'	121°1'	60°31'
	V_2	213°2'	92°4'	120°58'	60°29'

Mean A = 60°30'
= 60.5°

1) For Violet light

S. No.	Vernier Reading	Telescope reading (min. dev. Pos. (A)	Direct (B) reading	Diffrence $D_m = A - B$
1	V_1	400°9'	349°6'	51°3'
	V_2	220°3'	169°5'	50°58'

Mean D_m = 51°34'

2) For Red light

47.9
48.4

S. No.	Vernier Reading	Telescope reading min dev. pos. A	Direct reading (B)	Diffrence $D_m = A - B$
1	V_1	402°.8'	357.9	44.9'
	V_2	223°.1'	175.7	47.4'

Mean D_m = 46°.15'

Procedure: —

1 For calculation of A.

(1) Adjust the spectrometer to get parallel light beam and check prism table is horizontal to spirit level.

(2) Now put prism on prism table such that two refracting edges should point towards the light source.

(3) Rotate the telescope in the dirn OP and then along OO to see the diffraction pattern that is the slit of white light on the crosswire of the telescope. Write down the position of these two images from the vernier scales. The diffrence b/w these two points gives twice the value of A.

2 For measurment of δm

(1) Now, remove the prism from the table. Bring the telescope to the straight position and note down the reading.

(2) Choose any two colours in the spectrum. Rotate the telescope to right side and look for the slit of the two colour of the crosswire. Note down these positions from the vernier scale.

(3) The d/f b/w position of a particular colour with position of straight view will give the angle of min. deviation for the particular colour.

(4) Now calculate μ and ω.

$$\mu_v = \frac{\sin\left(\frac{60^\circ 5' + 51^\circ 34'}{2}\right)}{\sin\left(60^\circ 5'/2\right)} = \frac{\sin 56^\circ 02'}{\sin 30^\circ 25'}$$

$$= \frac{0.811}{0.507} = 1.60$$

$$\mu_r = \frac{\sin\left(\frac{60^\circ 5' + 46.15}{2}\right)}{\sin\left(60^\circ 5'/2\right)} = \frac{\sin 53^\circ 32'}{\sin 30^\circ 25'}$$

$$= \frac{0.801}{0.507}$$

$$= 1.571$$

$$\therefore \mu = \frac{\mu_v + \mu_r}{2} = \frac{1.6 + 1.57}{2}$$

$$= \frac{3.17}{2} = 1.585$$

$$\omega = \frac{\mu_v - \mu_r}{\mu - 1} = \frac{1.61 - 1.57}{1.59 - 1} = \frac{0.03}{0.59}$$

$$= 0.05$$

Result:-

The dispersive power of prism = 0.05

Precautions:-

1 The reading should be noted properly

2 Cross wire should be focussed properly.

3 Prism tabled should be levelled.

4 Pattern should be narrow and sharp.

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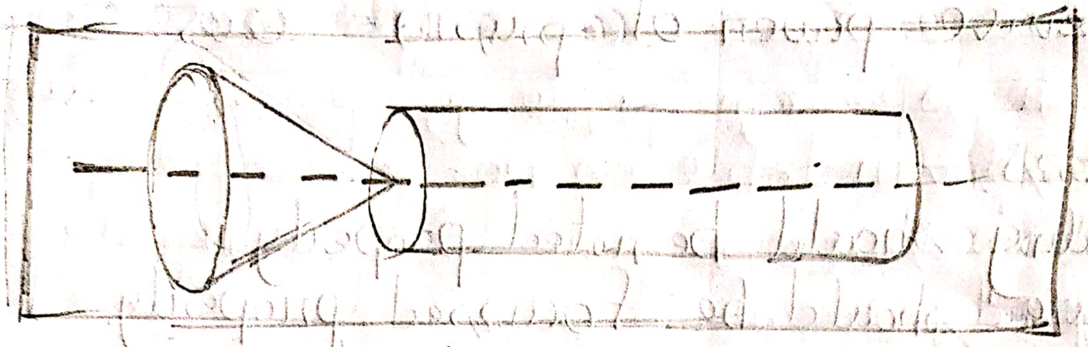
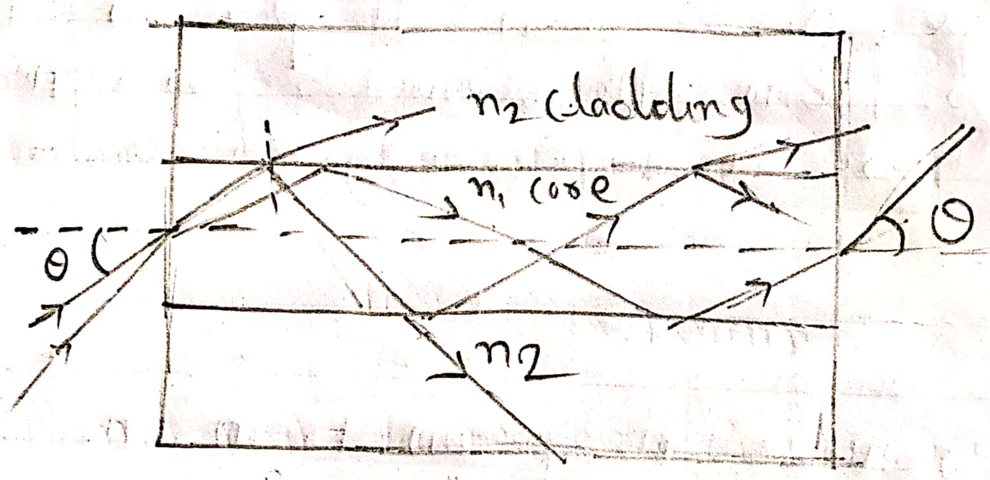
Diagram

(1)

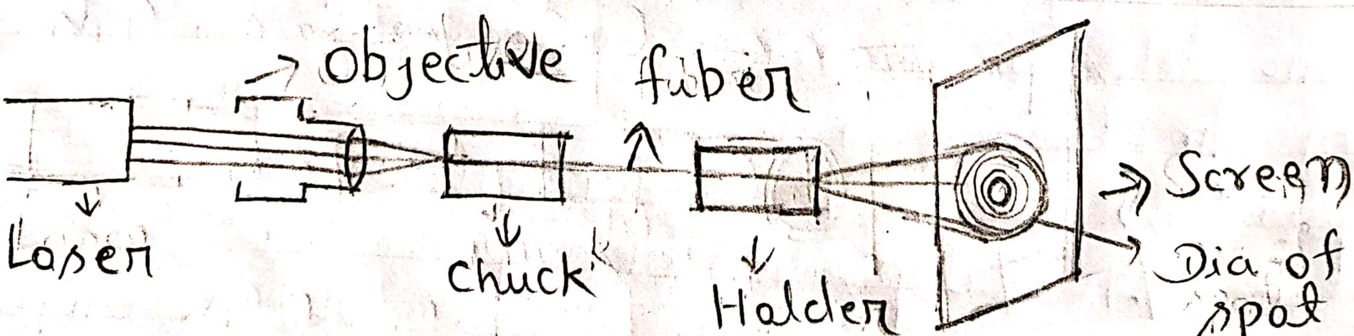


Numerical apperture

(2)



(3)



N.A of fibre

Aim :) To measure the numerical aperature (NA) of an optical fibre.

Apparatus ⇒ Optical fibre, fibre optic chuck, He-Ne laser source, microscopic objective, screen graph paper, scale.

Theory and formula
Snells law can be used to calculate the maximum angle with in which light will be accepted into and conducted through a fiber

$$N.A = \sin\theta_n = (n_1^2 - n_2^2)^{1/2}$$

where, $\sin\theta_n$ is numerical aperature
n_1 and n_2 are the refrective indices of the core and the cladding.

Procedure :-
1 Mount both the ends of the optical fibre on the fibre optic chucks.
2 Couple the light from the He-Ne laser source onto one of the fiber ends using a 10x microscopic objective.

Observations: —

S.NO.	Distance (L) in cm	Diameter (d) in cm
1	0.7	1.6 cm
2	1.3	2.0 cm
3	1.7	2.4 cm
4	2.3	3.2 cm
5	2.8	3.6 cm
6	3.1	4.0 cm

Calculations: —

Mean of distance $(L) = \frac{0.7+1.3+1.7+2.3+2.8+3.1}{6}$

$\Rightarrow \quad = \frac{11.9}{6} = 1.98$ cm

Mean of diameter $(d) = \frac{1.6+2.0+2.4+3.2+3.6+4.0}{6}$

$= \frac{16.8}{6} = 2.80$ cm

So, $N.A = \sin\left(\tan^{-1}\left[\frac{D}{2L}\right]\right)$

$= \sin\left[\tan^{-1}\left[\frac{2.8}{2\times1.98}\right]\right)$

$= \sin\left(\tan^{-1}\left[\frac{2.8}{3.96}\right]\right.$

$= \sin(35.26] = 0.577$

3 Place the screen at some distance from the output end of the fiber such that it is ⊥ to the axis of fiber.

4 Now move screen towards output end of a optical fibre, such that a circular spot is formed on the screen.

5 Measure the distance b/w the output end of optical fibre and screen. Let this be l. Also measure diameter of circular spot formed on screen.

6 Use the formula, $NA = \sin\theta_a \, [\tan^{-1} D/2L]$

7 Repeat the above procedure for diffrent values of L and D and calculate the averge of NA.

Result:-

N.A of given optical fibre is 0.577

Precautions:-

1 Mounting and coupling should be carefully done.
2 The laser source shouldn't fall into eye directly.
3 The screen should be held vertically.
4 As far as possible, experiment should be conducted in dark room enviroment.

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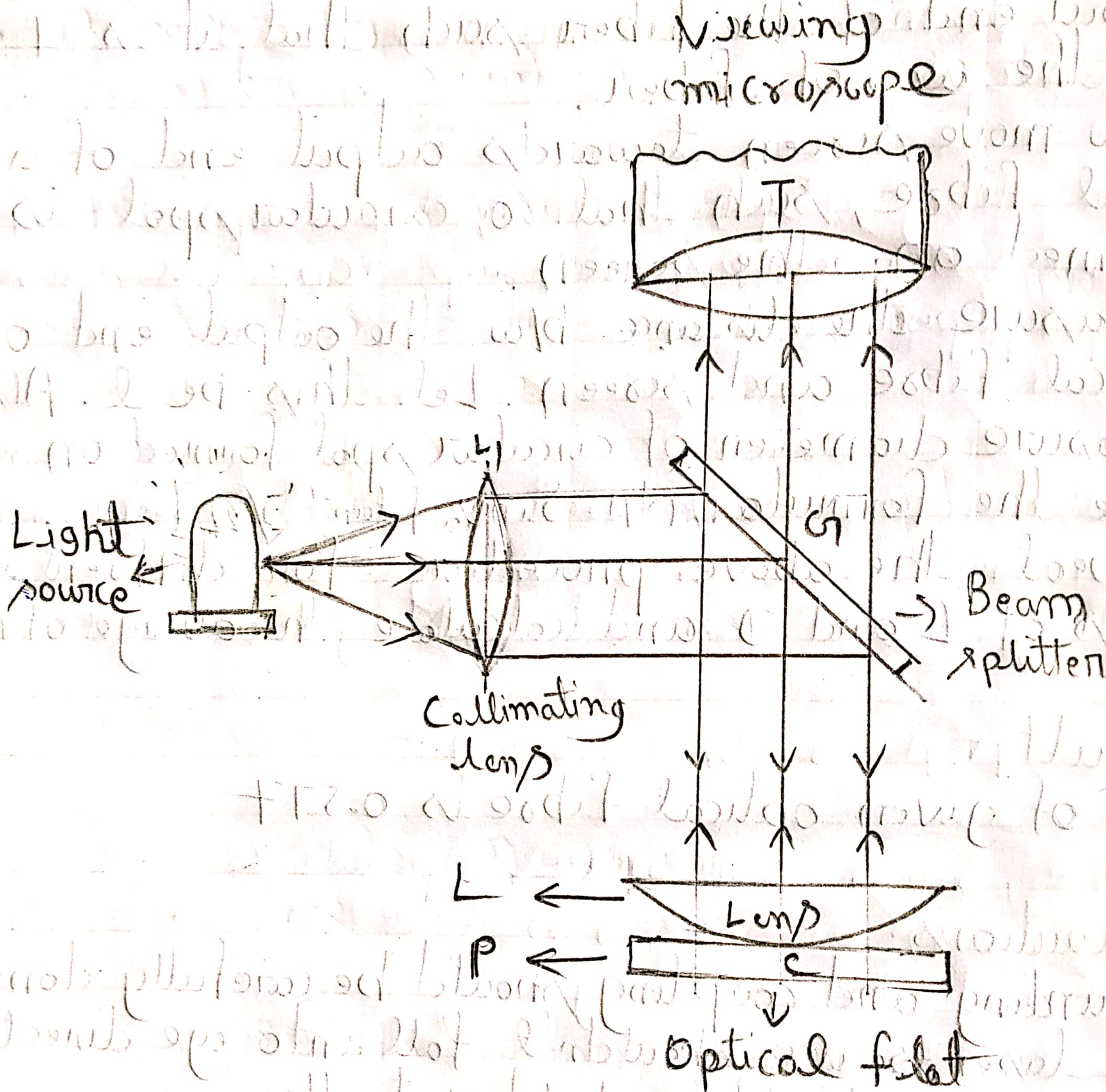

⇒ Newton's rings

Aim ⇒ To determine the wavelength of sodium light by Newton's ring.

Apparatus:-
A plano convex lens of large radius of curvature, a travelling microscope, a sodium lamp, plane glass plate, spectrometer and reading lens.

Theory and formula:-
Let R be the radius of curvature of the surface in contact with the plate, λ be the wavelength of light used D_n and D_{m+n} the diameter of n^{th} and $(m+n)^{th}$ dark rings respectively, then

$$D_n^2 = 4n\lambda R$$

and $$D_{m+n}^2 = 4(m+n)\lambda R$$

or $$D_{m+n}^2 - D_n^2 = 4mR\lambda$$

$$\Rightarrow \quad \lambda = \frac{D_{m+n}^2 - D_n^2}{4mR} \quad \text{---(1)}$$

Using eq. (1), λ can be determined.

Procedure:-

1. All the eyepiece of microscope adjusted on its cross wires.
2. Now, distance of microscope from the film is adjusted at the rings with dark centre in well focus.

Observations:—

S No.	Microscope reading LHS. (cm)	RHS (cm)	D (a+b)	$D^2 (a+b)^2$	P=4 $D'^2_{n+p} - D^2_n$	Mean
1	45.705	40.4	5.303	28.143	6.669	14.4215
2	45.1	40.703	4.116	16.945	20.252	
3	46.103	40.509	5.594	31.292	9.616	
4	46.801	41.109	5.642	37.404	21.149	
5	46.908	41.007	5.400	34.812		
6	46.906	40.807	6.009	37.197		
7	47.303	40.907	6.396	40.908		
8	47.705	41.106	6.599	43.553		

Calculation:—

$$\lambda = \left(\frac{D^2_{n+p} - D^2_n}{4PR}\right)_{mean} = \frac{14.4215}{4 \times 4 \times 2} \times 10^{-3}$$

$$= 0.4506718 \times 10^{-3}\ mm = 4506.71\ A^\circ \quad \left[\because 1 \times 10^{-7}\ mm = 1\ A^\circ\right]$$

But, wavelength of sodium light = 589.3 nm
= 5890 A°

$$\%\ error = \left[\frac{5890 - 4506}{5890}\right] \times 100 = 23.49\ \%$$

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3 The centre of cross wires is adjusted at the centre of fringe pattern.
4 By counting no. of fringes, the microscope is moved to the extreme left of the pattern and the cross wire is adjusted tangentially in the middle of n^{th} (say 20^{th}) bright or dark fringes.
5 The reading of micrometer screw is noted.
6 The microscope is now moved to the right and readings of micrometer screw are noted successively at $(n-2)^{th}$ (say 18^{th}), $(n-4^{th})$ (say 16^{th}) ___ rings etc.
7 Now, plotted a graph b/w a no. of rings (n) and squre of corresponding diameter.

From the graph, $\dfrac{D^2_{m+n} - D^2_n}{m} = \dfrac{AB}{CD}$ — (2)

Radius of planoconvex lens, $(R) = \dfrac{l^2}{6h} + \dfrac{h}{2}$ — (3)

Result
The wavelength of sodium light by Newton's rings experiment is 3725 A°

Precautions:—
1 Glass plate and lens should be cleaned throughly.

P.T.O ⟹

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2 The lens used should be large radius of curv.
3 Source of light used should be extended one.
4 Before measuring the diameter of the rings, the range of the microscope should be properly adjusted.
5 Cross wire should be focused on a bright ring tangentially.
6 Radius of curvature should be measured accurately.

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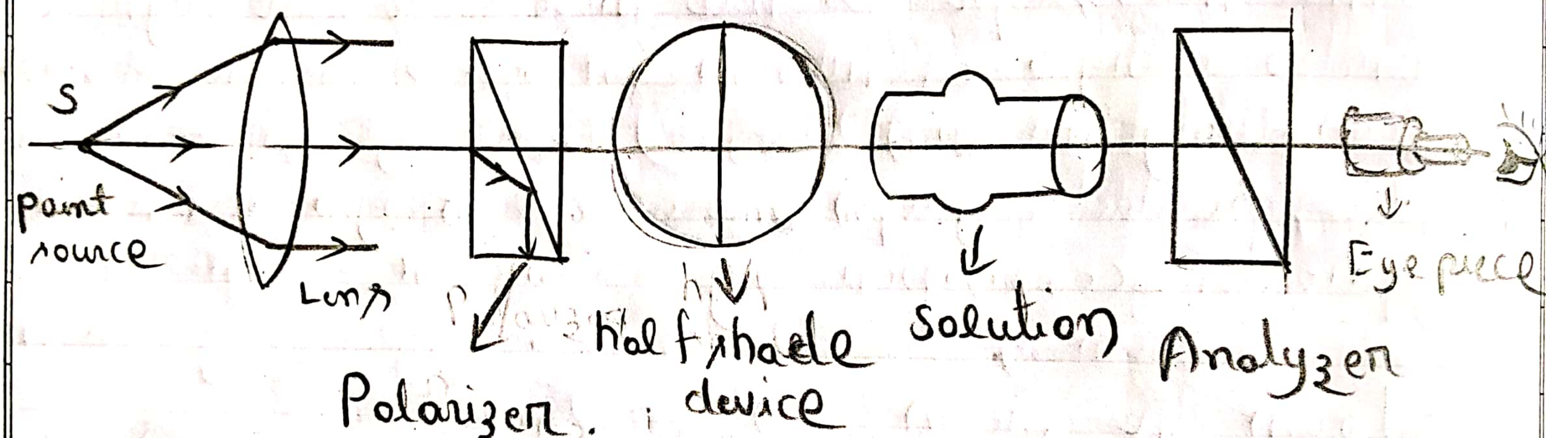
Diagram: —



half shade
Polarimeter

—— x —— x —— x ——

Aim ⇒ To determine the specific rotation of can sugar solⁿ with the help of a half shad polarimeter.

Apparatus :-
Polarimeter, solium light, flask, beaker, funnel, pipette, sugar and distilled water.

Formula / Theory
The specific rotation of sugar solⁿ, $S = \frac{\theta v}{lm}$

where, θ - rotation produces in degrees,
m = mass of the sugar dissolved,
l = length of tube in decimeter.
v = Volume of the solⁿ.

Procedure :-
1 Fill the polarimeter tube with water minimizing the air gap and place it in proper posⁿ.
2 The slit is illuminated by sodium light and focus the eye piece such that the field of view is sharp and unequal illuminated columns are seen in the two halves of the field of view.
3 The analyser is rotated till the two position or colours change into homogeneous colour.

Observation: —

Analyser reading with pure water		Mean(a) $=\frac{x+y}{2}$ deg.	conc^n of sol^n in gm/cc	Analyser reading with sugar sol^n		Mean(b) $=\frac{x+y}{2}$ deg.	$\theta=(a-$ deg
Clockwise	Anticlock			Clockwise	Anticlock		
Total(x) = M.S + VS × LC	Total(y) MS + VS × LC			Total(x′) = M.S + VS × LC	Total(y′) = MS + VS × LC		
1 103.7	201.2	152.45	$\frac{5}{100}=0.05$	138.1	144.1	141.1	11.35
2 198.4	223.3	211.35	$\frac{2.5}{100}=0.025$	125.5	170.9	148.2	63.15
3 138.9	232.4	180.65	$\frac{1.25}{100}=0.0125$	100.4	280.2	190.3	4.65

Calculation: —

Least count of polarimeter = 0.1 deg.
Mass of sugar (m) = 10g
Volume of water (V) = 100g
length of polarimeter tube (l) = 2 dm

$$S = \frac{\theta . V}{l \times m} = \frac{11.35 \times 100}{2 \times 10} = 56.75^{\circ}\ \mathrm{dm/gm/cm^3}$$

$$\%\ \text{error} = \left[\frac{\text{Standard value} - \text{exp. value}}{\text{Standard value}}\right] \times 100$$

$$= \left[\frac{66 - 56.75'}{66}\right] \times 100 = 14.01\%$$

4 Take the measurment on circular and Vernier scales Rotate the analyser about 180° for same colour and take the measurment again
5 Prepare the sugar soln of known concentration (Say 10 gm in 100 ml). Fill the polarimeter tube with sugar solution.
6 The diffrence in the observations taken in distilled water and in sugar soln is the angle of rotation (θ) for one concentration
7 Repeat the experiment by changing concentration of sugar soln and take atleast five sets of readings.
8 Plot the graph b/w concentration and the angle of rotation. It will be a straight line.

Result:-

dm/gm/cm³
The specific rotation of canesugar is 56.75° ~~degree/cc/dm~~

Precautions:-

1 There should not be any air bubbles in polarimeter.
2 Caps must be put on the tube tightly without undue strain
3 Water used should pure/ distilled.
4 Sugar must be dust free.
5 Before filling the tube, it should be rinsed with the soln to be filled.

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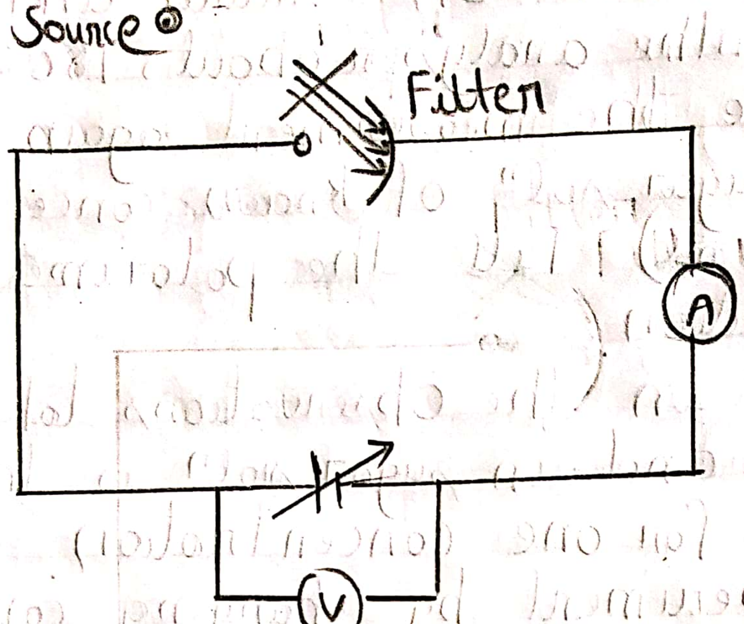
Diagram: —



Observations: —

S. No.	Filter Colour	Wavelength (λ) nm	Frequency $\nu = \frac{c}{\lambda}$ (T.Hz)	Stopping potential (E_0)
1	Blue	460	625.47	1.16
2	ORange	500	600	0.89
3	Green	540	555.5	0.73
4	Yellow	570	526.3	0.55
5	Red	635	472.4	0.34

Calculation: —

A/c to Einstein's eqs: —

$h\nu = h\nu_0 + e\Delta E_0$

$h(\nu - \nu_0) = e\Delta E_0 \Rightarrow h = \frac{e\Delta E_0}{\Delta \nu} = e \tan\theta$

$= e \times \text{slope}$

Aim ⇒ To determine Planck's constant.

Apparatus: —
A vaccum photo cell, mercury lamp, five optical fibres (Red, yellow, green, blue, orange).

Theory
The experiment is based on the phenomenon of photo-electric effect. A/c to this when a radiation of energy $h\nu$ incident on metal surface then a photoelectron is emitted. A/c to Einstein Eqⁿ: —

$$h\nu = \frac{1}{2}mv_m^2 + W_0$$

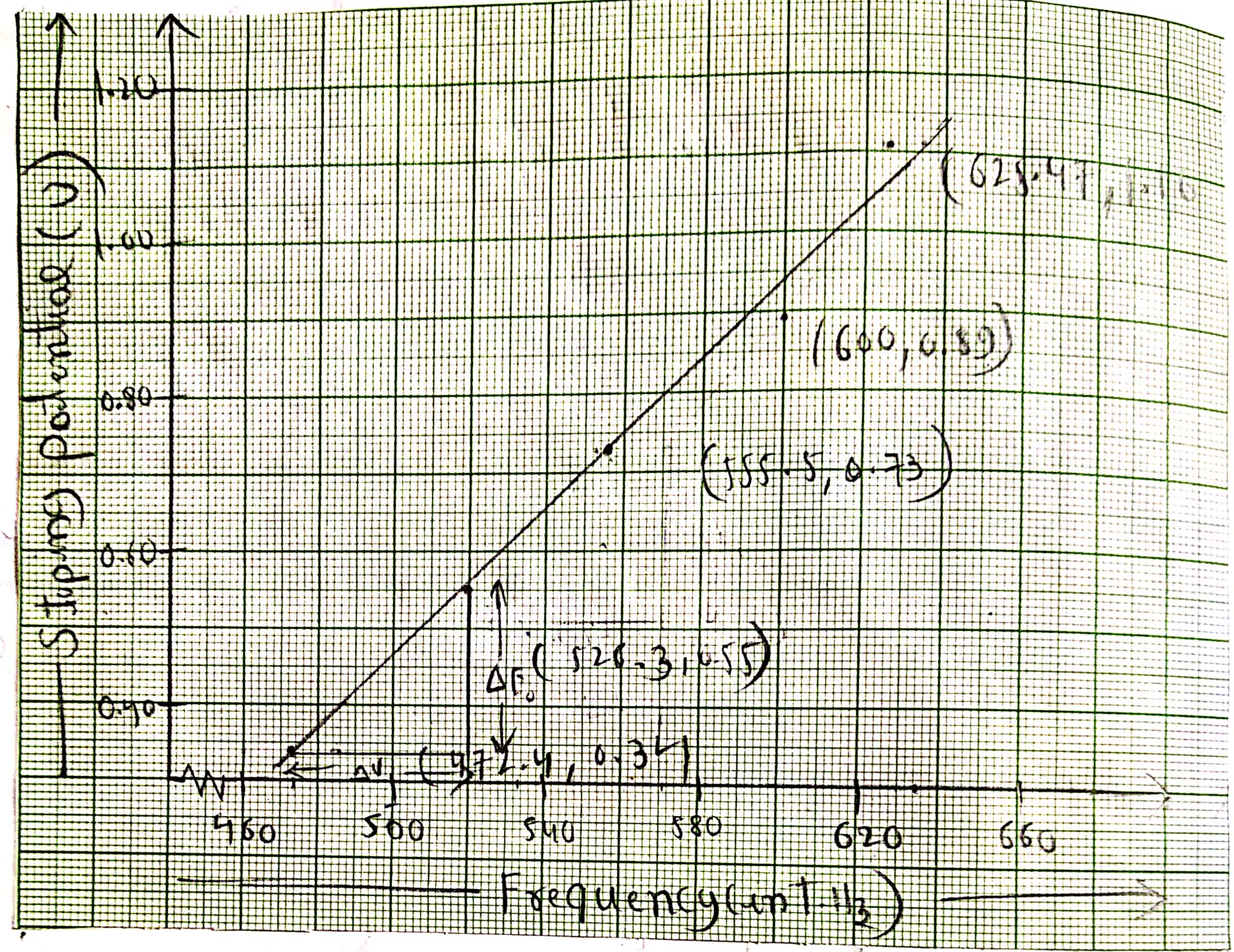
$$eE_0 = \frac{1}{2}mv_m^2$$
$$= h\nu - h\nu_0$$

$$\Rightarrow \quad E_0 = \frac{h}{e}\nu - \frac{h}{e}\nu_0$$

If θ is inclination of line from frequency axis, then, $\tan\theta = \frac{h}{e} = \frac{\Delta E_0}{\Delta \nu}$

$$\Rightarrow \quad h = \frac{e\Delta E_0}{\Delta \nu}$$

Graph:



$\therefore$ Slope $= \dfrac{y_2 - y_1}{x_2 - x_1}$

$$= \frac{0.55 - 0.34}{(526.3 - 472.4)\times 10^{12}} = \frac{0.21}{53.9 \times 10^{12}}$$

$$= 3.89 \times 10^{-15}\ V/Hz$$

So, h = Slope $\times e$

$$= 3.89 \times 10^{-15} \times 1.6 \times 10^{-19}$$

$$= 6.224 \times 10^{-34}\ Js$$

$$\%\,\text{error} = \left[\frac{6.626 - 6.224}{6.626}\right] \times 100 = 6.06\,\%$$

Procedure: —

1. Note the wavelength of given filter.
2. Switch on the Planck's constant measuring kit.
3. Keep a fix distance b/w source and cathode.
4. Place the filter towards cathode and vary the anode voltage negatively starting from zero. Measure the corresponding voltage and current till the current is equal to zero. The voltage at zero current is called as stoping potential.
5. Repeat step 4, using diffrent filters.
6. Make a table between frequency of light emitted by filter and stoping potential.
7. Make a graph b/w F. and V and find the slope.

Result: —

The value of planck's const. using photocell is 6.224×10^{-34} J.S

Standard value of Planck's const. $= 6.626 \times 10^{-34}$ JS

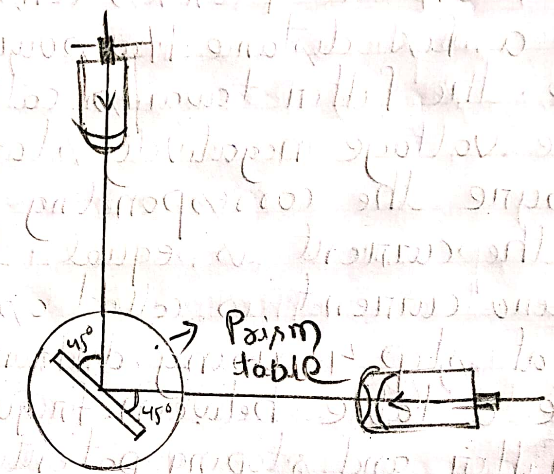
Precautions: —

1. Avoid the extra light falling on the photocell.
2. Set ~~a~~ experiment at a place where it can be avoided from outside disturbances.
3. Phototube shouldn't be exposed to direct sunlight.
4. Power should switch off on finishing the experiment.

30/10/2019.

Spectrometer

Diagram: —



Observations: —

Order of spectrum	Colour of light	Kind of Vernier	LHS reading of spectrometer: M.S Reading	V.S×L.C Reading	Total(a) degree	RHS reading of spectrometer: M.S Reading	V.S Reading	Total(b) degree	$\theta = \frac{a-b}{2}$ degree
1st Order	Violet	V_1	280	26	280.43	306.5	32	307.03	26.60
		V_2	100	17	100.28	126.5	33	127.05	26.77
	Green	V_1	276.5	2	276.51	310	26	310.43	33.92
		V_2	96.5	41	97.18	130	23	130.38	32.58
	Yellow	V_1	275.5	13	275.71	311	29	311.48	35.77
		V_2	95.5	9	95.65	131	30	131.50	35.85

Experiment :- 8

Date 23/10/19
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Aim ⇒ To determine the wavelength of spectral lines using diffraction grating.

Apparatus:-
Spectrometer, mercury lamp, prism, diffraction grating, reading lens.

Formula/ Theory
The wavelength of any spectral line,

$$\lambda = \frac{(a+b)\sin\theta}{n}$$

where, $(a+b)$ = grating element
θ = angle of diffraction
n = order of spectrum

Procedure:-
1 Prism table should be leveled.
2 Telescope and collimator are adjusted for parallel rays.
3 The axis of the telescope and collimator must intersect the vertical axis of rotation of the prism table.
4 Grating should be normal to the axis of collimator.

Calculation: —

No. of rulings on the grating $= N = 15000$

Least count of spectrometer $= 1' = \frac{1}{60}^\circ$

Grating element $(a+b) = \frac{2.54}{N} = \frac{2.54}{15000}$ cm

$= 1.693 \times 10^{-6}$ cm

where, N = no. of lines per inch

Now, for 1st order $\lambda_v = \frac{(a+b) \sin\theta}{1}$

For violet, $\lambda_v = 1.693 \times 10^{-6} \sin(26.68)$

$= 1.693 \times 10^{-6} \times 0.449$

$= 0.7601 \times 10^{-6}$ cm

$= 0.7601 \times 10^{2}$ A°

For green, $\lambda_G = 1.693 \times 10^{-6} \sin(33.25)$

$= 1.693 \times 10^{-6} \times 0.548$

$= 0.927 \times 10^{-6}$ cm

$= 0.927 \times 10^{2}$ A°

For yellow, $\lambda_y = 1.693 \times 10^{-6} \sin(35.81)$

$= 1.693 \times 10^{-6} \times 0.5850$

$= 0.990 \times 10^{-6}$ cm

$= 0.990 \times 10^{2}$ A°

5 After obtaining spectrum, rotate the telescope to the left side of the direct image.

6 Now, adjust the cross wire on violet, green, and red spectral lines turn for the 1st order.

7 For each setting, the reading of Verniers should be noted down.

8 Now, rotate the telescope to the right side of the direct image.

9 Again, note down the position of both the verniers turn by turn for diffrent colours for 1st order.

10 Find out the diffrence of the same kind of verniers (V_1 from V_1 and V_2 from V_2) for each spectral lines.

11 Repeat all the observations for second order in similar way.

Result :-

The wavelength of various colours (violet, green, yellow) of white light (mercury light) with the help of plane transmission grating are 0.760×10 0.927×10^2 A° and 0.990×10^2 A° respectively.

Precautions :-

1 Rack and pinion arrangement of telescope once set for parallel rays should not be disturbed through out the experiment.

Experiment :

Date

2 Ruled surface of grating should not be touched
3 Ruled surface of the grating should face the telescope.
4 Set the grating normal to the incident ray.
5 While taking observations, telescope, and prism should be kept fixed.

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