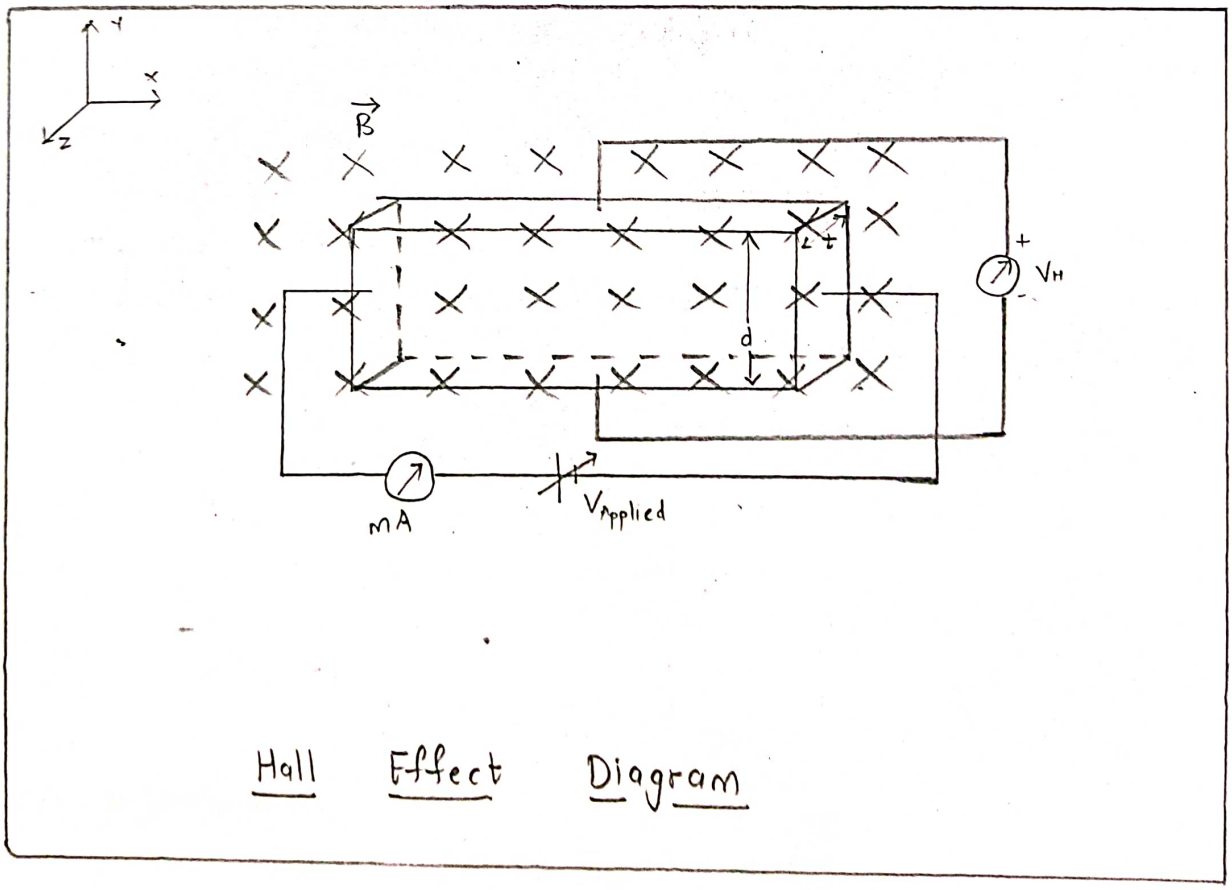
Name:	Ritesh S. Jha
Roll Number:	16010423076
Batch:	P4-1
Experiment performed on (date):	19/10/23

Title of the Experiment: Hall Effect

Aim: To determine carrier concentration of a semiconductor sample using Hall effect.

Apparatus: Electromagnet, power supply, current source, voltmeter, ammeter, Hall probe

Diagram:



Hall Effect Diagram

Procedure:

1) Connect electromagnet to its power supply. Connect hall probe into probe socket. Keep magnet and probe current knobs nearly in midway position.
2) Switch on power supply. Adjust magnet current and probe current to zero. Adjust probe setting to read zero on voltmeter display.
3) Set 1 cm gap between pole pieces. Insert hall probe between the pole pieces and adjust its position so that the poles are perpendicular to the flat side of probe. Assure that the probe does not touch the pole pieces.
4) Slowly increase magnet current (I_M) and set it to +200 mA. Vary probe current (I_P) from 0 to 100 mA in equal steps and note down corresponding Hall voltage (V_H) each time. Repeat procedure by varying I_P in reverse order (100 mA to 0). Find average value of V_H.

Observations:

Electromagnet current = 200 mA
Intensity of magnetic field = 1050 Gauss
Error Voltage V_R = −0.02

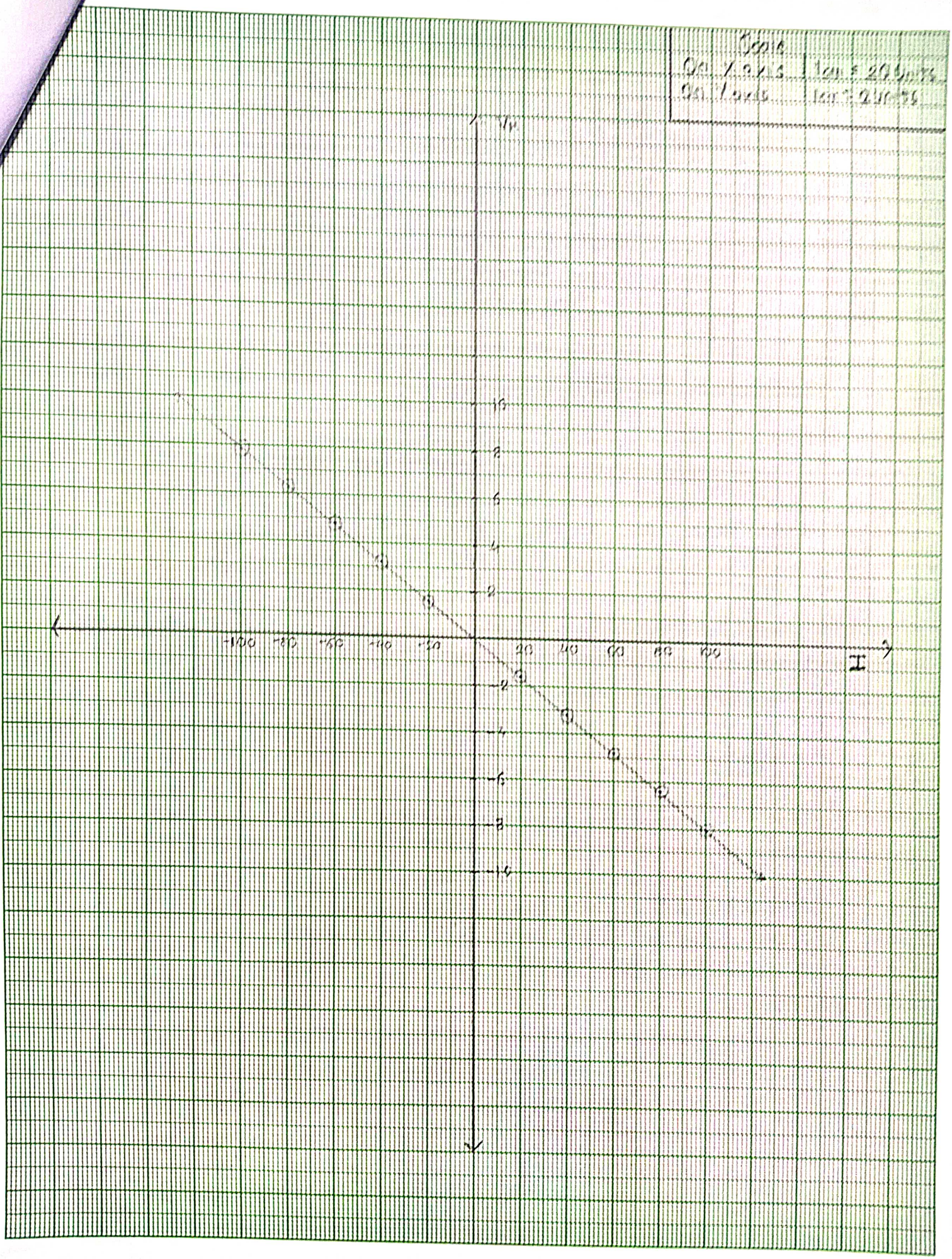
Sr. No	Positive I_P (mA)	V_{H2} (mV)	Corrected V_{H1} $V_{H1} \pm V_R$	Negative I_P (mA)	V_{H2} (mV)	Corrected V_{H2} $V_{H2} \pm V_R$
1	20	−1.64	−1.62	−20	1.60	1.62
2	40	−3.22	−3.20	−40	3.18	3.20
3	60	−4.82	−4.80	−60	4.80	4.82
4	80	−6.46	−6.44	−80	6.36	6.38
5	100	−8.08	−8.06	−100	7.96	7.98

Calculations:

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= -0.080$$

$$n = \frac{B}{q \times t \times \text{slope}}$$
$$= \frac{1050 \times 10^{-4}}{1.6 \times 10^{-19} \times 450 \times 10^{-6} \times (-0.080)}$$
$$= \frac{1050 \times 10^{-4}}{5.76 \times 10^{-24}}$$
$$= -1.82 \times 10^{22}$$

Result/s and Conclusion/s: The charge carrier concentration (n) is $-1.82 \times 10^{22}\ m^{-3}$


Scale
On x axis 1cm = 20 units
On y axis 1cm = 2 units
y
x
-100
-80
-60
-40
-20
20
40
60
80
100
16
14
12
10
8
6
4
2
-2
-4
-6
-8
-10

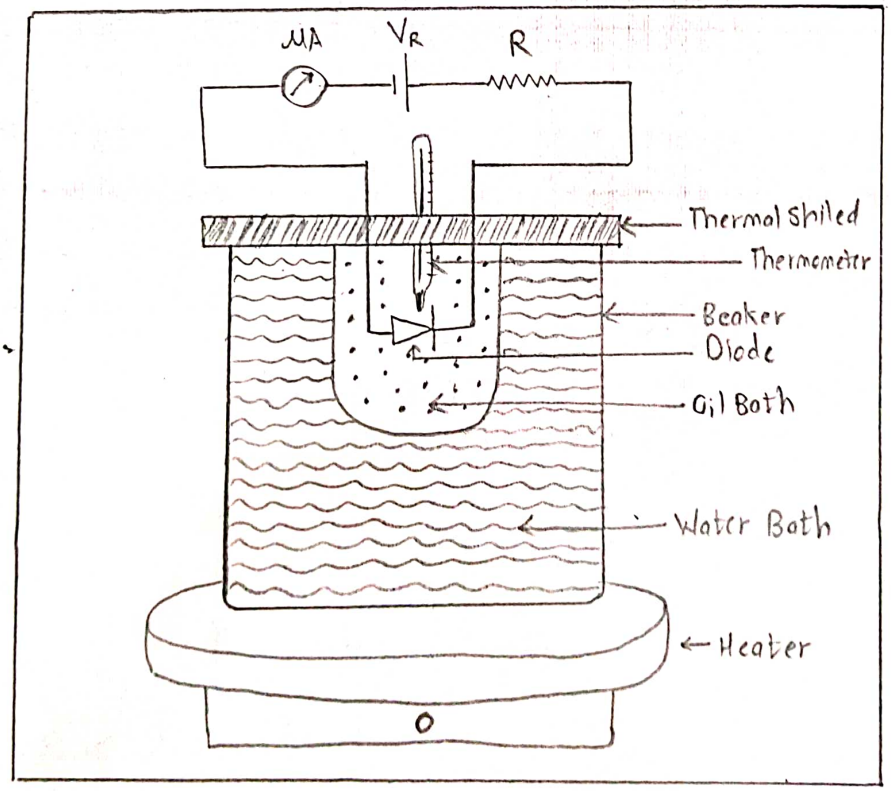
Name:	Ritesh S. Jha
Roll Number:	16010423076
Batch:	P4-1
Experiment performed on (date):	26/10/23

Title of the Experiment: Energy Band Gap

Aim: To determine energy band gap of the material of semiconductor p-n junction diode using temperature dependence of reverse saturation current

Apparatus: DC power supply, voltmeter, micro-ammeter, semiconductor diode, heating bath, thermometer, and connecting wires

Diagram:



Procedure:

1) Connect the circuit as shown in experimental set-up. Adjust 2 V on the dc power supply and note the reverse saturation current (I_S) at room temperature (RT).
2) Insert the diode in heating bath assuring that it is in contact with the bulb of thermometer. Start heating the diode.
3) Record I_S for every 5°C rise in temperature (T) up to a maximum of 70°C. Switch off heater when temperature rises above 65°C.

Observations:

Sr No.	Temperature (T)		Reverse Current Is (amp)	$1/T(K^{-1})$	$\ln\left(\frac{I_s}{T^2}\right)$
	°C	kelvin			
1					
2	40	313	45×10^{-6}	3.194×10^{-3}	-21.501
3	45	318	50×10^{-6}	3.144×10^{-3}	-21.427
4	50	323	60×10^{-6}	3.095×10^{-3}	-21.276
5	55	328	70×10^{-6}	3.048×10^{-3}	-21.153
6	60	333	80×10^{-6}	3.003×10^{-3}	-21.049
7	65	338	90×10^{-6}	2.958×10^{-3}	-20.961
8	70	343	110×10^{-6}	2.915×10^{-3}	-20.790

Calculations:

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1} = -2527$$

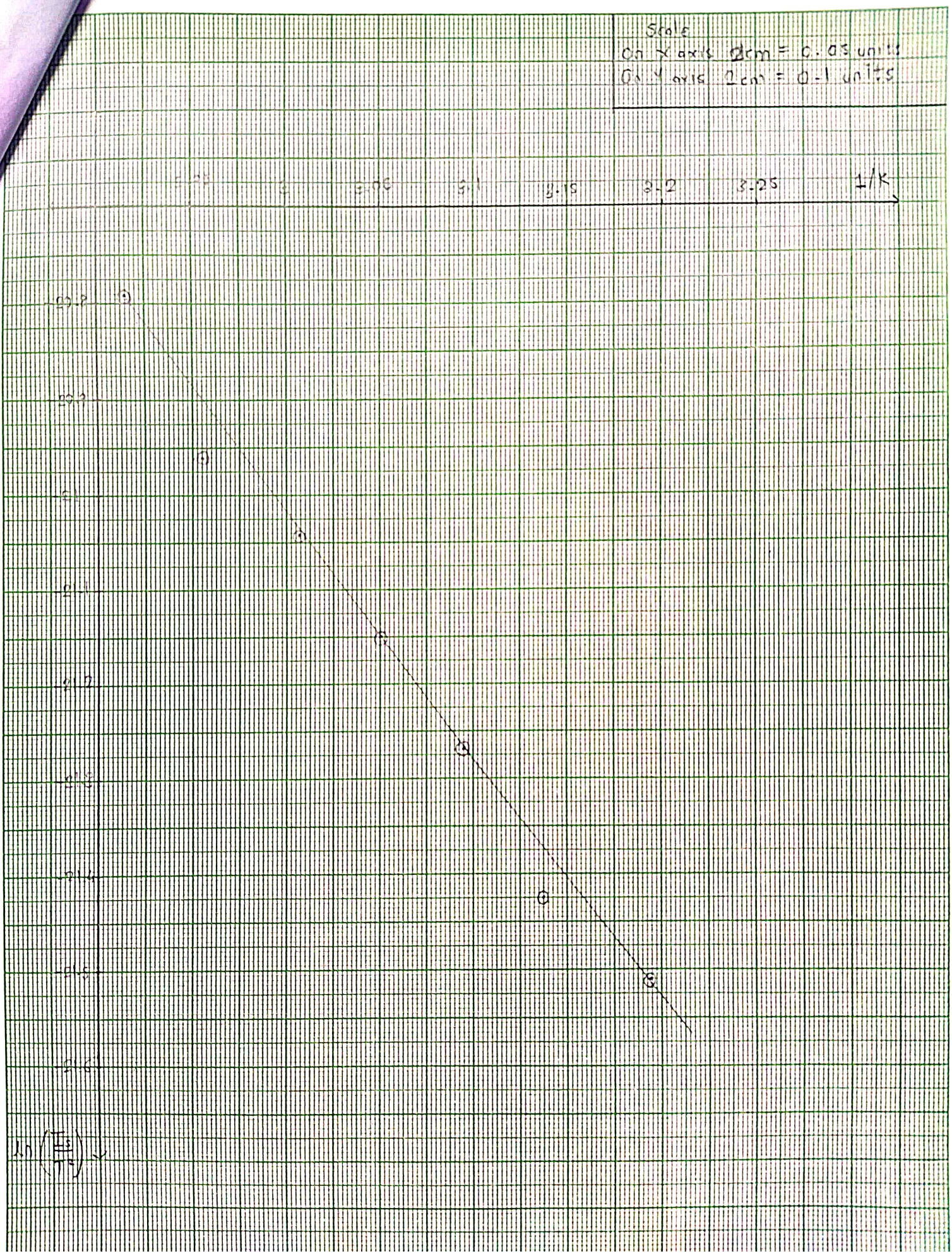
$$E_g = K \times |\text{slope}|$$
$$= 1.38 \times 10^{-23} \times |-2527|$$
$$= 1.38 \times 10^{-23} \times 2527$$
$$= 3.4872 \times 10^{-20} \text{ J} \;/\; 1.6 \times 10^{-19}$$
$$= 0.217 \text{ eV}$$

Result/s and Conclusion/s: The energy band gap of the material is 3.4872×10^{-20} J / 0.217 eV

Scale

On X axis 2cm = 0.05 units

On Y axis 2cm = 0.1 units



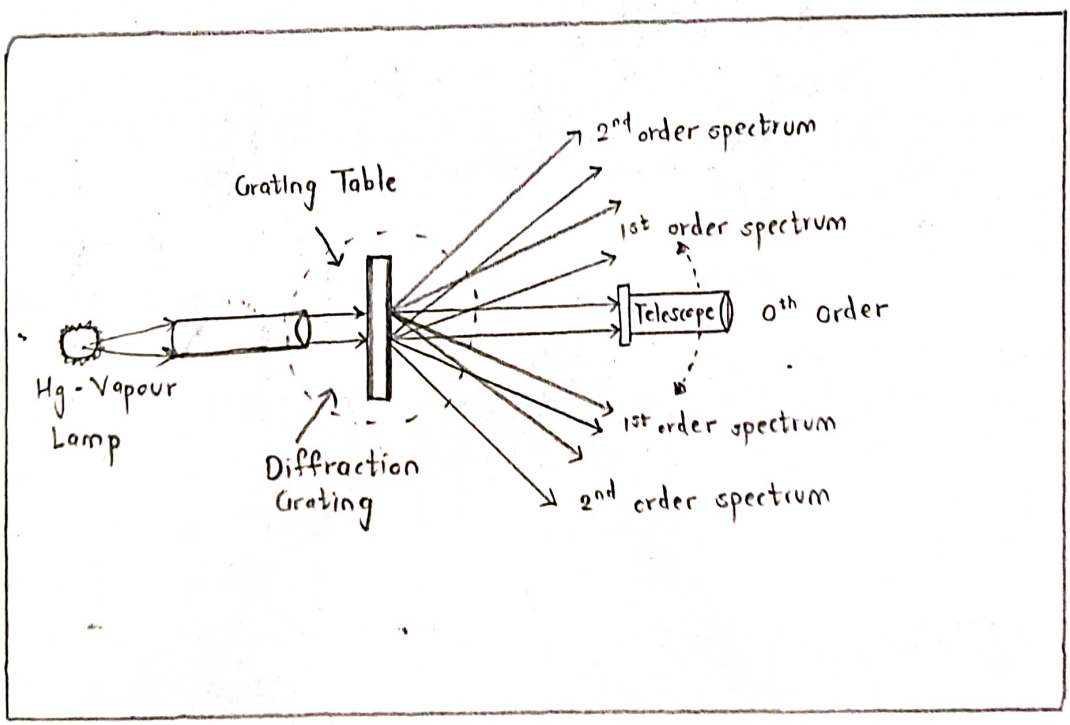
Name: Ritesh S. Jha
Roll Number: 16010423076
Batch: P4 – 1
Experiment performed on (date): 2/11/23

Title of the Experiment: Hg - Spectrum

Aim: To determine wavelengths of different spectral lines (colours) emitted from a mercury vapour lamp (Hg-source).

Apparatus: Spectrometer, Hg-vapour lamp and diffraction grating.

Diagram:



Procedure:

1) Level the spectrometer, prism table, collimator and telescope. Illuminate collimator-slit with Mercury source. Bring telescope in line with collimator and focus it on the illuminated slit. The slit must be sufficiently narrow.
2) Adjust the eyepiece of the telescope so that the crosswire is distinctly visible and vertical crosswire is coinciding with the sharp image of the slit. Mount diffraction grating on prism table, perpendicular to incident light (i.e. to the collimator). Lock prism table.
3) Move telescope to one side of the incident direction (say, to the left) until you see the first order spectrum. Spectral lines will be visible in the order from violet to red from the incident direction i.e. white line. Focus on the bright-coloured violet/blue spectral line. Adjust the vertical crosswire so that it coincides with the violet/blue line. If required, fix telescope & use its fine motion for this adjustment. Note down readings in both the windows.
4) After violet/blue, release the telescope and move it further to get green line. Follow the same procedure as in step 3. Repeat the same for one of the yellow lines and brightest red line from the spectrum.
5) Now take the telescope to the right side of the incident direction and follow the procedure of steps 3 and 4.
6) The angle 2θ for a particular spectral line is the difference between its readings on the LHS and RHS of incident direction from the same window.

Observations:

Sr No.	Spectral Line	Spectrometer Readings (degrees & minutes)						Diffraction Angle# $\theta = \frac{L \sim R}{2}$ (deg-min)
		* On Left L = M+V			*On Right R = M+V			
		M	V	L	M	V	R	
1	Blue/Violet	347.5°	27′	347°57′	378°	20′	378°20′	15°11′30″
2	Green	344°	2′	344°2′	382°	20′	382°20′	19°9′
3	Yellow	342.5°	15′	342°45′	383.5°	1′	383°31′	20°23′
4	Red	341.5°	5′	341°35′	384.5°	10′	384°40′	21°32′30″

M : MSR , V : VSR = CD × LC , L : Total on Left side
R : Total on Right side

The sign ~ means find whichever difference is positive

Calculations:

$\sin(15°11'30'') = 0.262$
$\sin(19°9') = 0.328$
$\sin(20°23') = 0.348$
$\sin(21°32'30'') = 0.367$

$\lambda = \frac{0.262}{5905} = 4.43 \times 10^{-5}$ cm = 443 nm
$\lambda = \frac{0.328}{5905} = 5.55 \times 10^{-5}$ cm = 555 nm
$\lambda = \frac{0.348}{5905} = 5.89 \times 10^{-5}$ cm = 589 nm
$\lambda = \frac{0.367}{5905} = 6.21 \times 10^{-5}$ cm = 621 nm

Result/s and Conclusion/s: The wavelength of Blue, Green, Yellow and Red are 443nm, 555nm, 589nm and 621nm respectively.