Date 21·3·22

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DETERMINATION OF HALL COEFFICIENT AND CARRIER TYPE FOR A SEMICONDUCTING MATERIAL

★ AIM:

→ To determine the hall coefficient of the given n-type or p-type semiconductor.

★ APPARATUS REQUIRED:

→ Hall Probe (n-type or p-type), Hall effect setup, electromagnet, constant current power supply, gauss meter, etc.

★ FORMULAE:

(1) Hall Coefficient $(R_H) = \frac{V_H \cdot t}{I_H} \times 10^8 \ cm^3 C^{-1}$

where V_H = Hall Voltage (volt)
t = Thickness of the sample (cm)
I = Current (ampere)
H = Magnetic field (gauss)

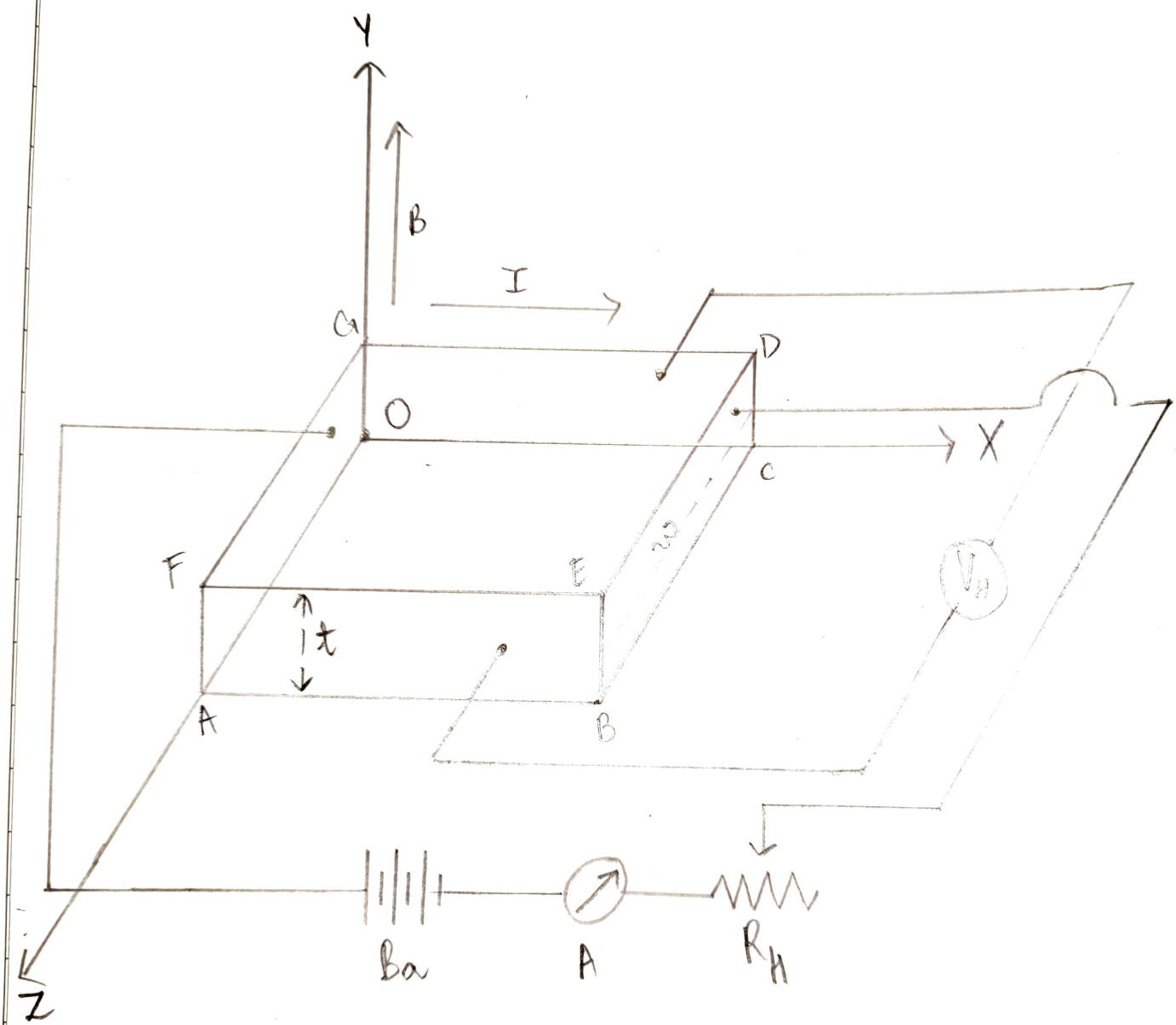
(2) Carrier Density $(n) = \frac{1}{R_H q} \ cm^{-1}$

where R_H = Hall Coefficient $(cm^3 C^{-1})$
q = Charge of electron or hole (C)

(3) Carrier Mobility $(\mu) = R_H \sigma \ cm^2 V^{-1} s^{-1}$

where R_H = Hall Coefficient $(cm^3 C^{-1})$
σ = Conductivity $(C V^{-1} s^{-1} cm^{-1})$

Teacher's Signature



HALL EFFECT SETUP

★ OBSERVATIONS:

→ Current in the Hall coefficient (I) = 2 mA.

Current in the constant current power supply (A)	Magnetic field (H) (Gauss)	Hall Voltage (V_H) (mV)	Hall Coefficient (R_H) ($cm^3 C^{-1}$)
1.0	1320	12.5	2.3679×10^4
1.5	1940	18.1	2.3329×10^4
2.0	2620	23.2	2.2137×10^4
2.5	3040	27.4	2.2532×10^4
3.0	3600	31.2	2.1666×10^4
3.5	4390	35.6	2.0273×10^4

→ Thickness of the sample, $t = 0.05$ cm
Resistivity of the sample, $\rho = 10\ VC^{-1}s$ cm
Conductivity of the sample, $\sigma = 0.1\ CV^{-1}s^{-1}$ cm
Charge of electron on hole, $q = 1.6 \times 10^{-19}$ C

★ CALCULATIONS:

→ The Hall Coefficient of the sample = $R_H = \frac{V_H \times t}{I_H} \times 10^8\ cm^3 C^{-1}$

$\Rightarrow 2.23 \times 10^4\ cm^3 C^{-1}$ //

→ The Carrier Density of the sample = $n = \frac{1}{R_H \times q}\ cm^{-3}$

$\Rightarrow 0.28 \times 10^{15}\ C\ cm^{-3}$ //

→ The Carrier Mobility of the sample = $\mu = R_H \times \sigma \Rightarrow 2330\ cm^2 V^{-1} s^{-1}$ //

★ **RESULT:**

→ The Hall Coefficient of the given semi conducting material $\approx 2.23 \times 10^4 \ cm^3 C^{-1}$.

→ The Carrier Density of the sample $\approx 0.28 \times 10^{15} \ C cm^{-3}$.

→ The Carrier Mobility of the sample $\approx 2330 \ cm^2 V^{-1} s^{-1}$.

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