PhysicsByAaryan

CSIR NET . GATE . JEST . BARC - Physics

Hall effect - CSIR NET Physics PYQs

Solid State Physics . All PYQs (2015-2025) with answer key

4 questions . Answer key included

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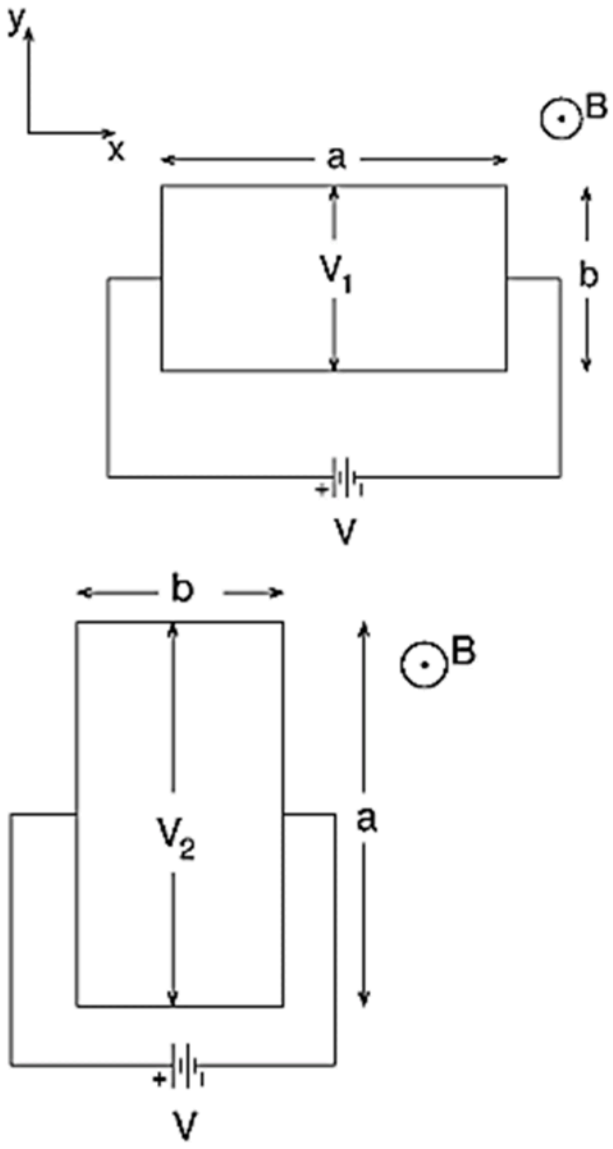
Q1. [Dec 2016] . 5.0 marks

Solid State Physics > Hall effect

CSIR NET	2016 Dec	5M

A thin rectangular conducting plate of length a and width b is placed in the xy-plane in two different orientations, as shown in the figures below. In both cases a magnetic field B is applied in the z-direction and a current flows in the x direction due to the applied voltage V. If the Hall voltage across the y-direction in the two cases satisfy $V_2 = 2V_1$, the ratio $a:b$ must be

1. $1:2$
2. $1:\sqrt{2}$
3. 2:1
4. $\sqrt{2}:1$



Q2. [Dec 2017] . 5.0 marks

Solid State Physics > Hall effect

CSIR NET	2017 Dec	5M

Consider a two-dimensional material of length l and width w subjected to a constant magnetic field B applied perpendicular to it. The number of change carries per unit area may be expressed as $n = k|q|\frac{B}{(2\pi\hbar)}$, where k is appositive real number and q is the carrier charge. Then the Hall resistivity ρ_{xy} is

1. $\frac{2\pi\hbar k}{q^2}\sqrt{\frac{l}{w}}$
2. $\frac{2\pi\hbar}{kq^2}\sqrt{\frac{w}{l}}$
3. $\frac{2\pi\hbar}{kq^2}$
4. $\frac{2\pi\hbar k}{q^2}$

Q3. [Dec 2019] . 5.0 marks

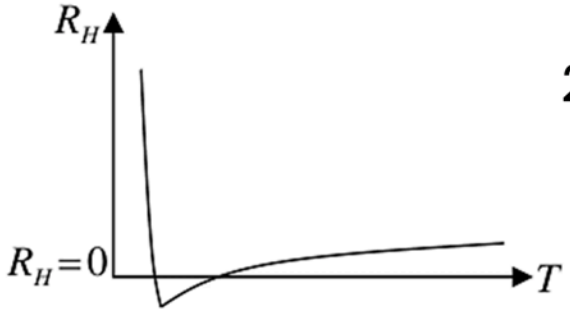
Solid State Physics > Hall effect

CSIR NET	2019 Dec	5M

The Hall coefficient for a semiconductor having both types of carriers is given as

$$R_H = \frac{p\mu_p^2 - n\mu_n^2}{|e|\left(p\mu_p + n\mu_n\right)^2}$$

where p and n are the carrier densities of the holes and electrons, μ_p and μ_n are their respective mobilities. For a p-type semiconductor in which the mobility of holes is less than that of electrons, which of the following graphs best describes the variation of the Hall coefficient with temperature?

1.


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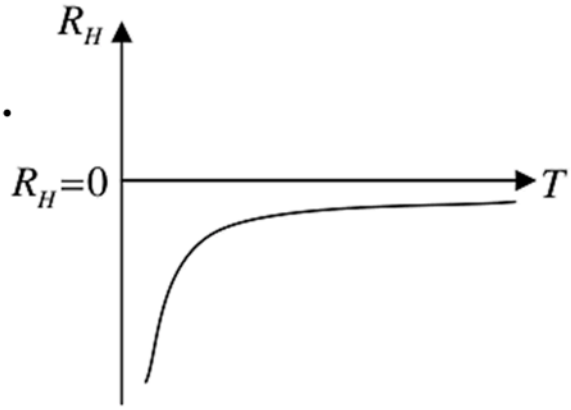

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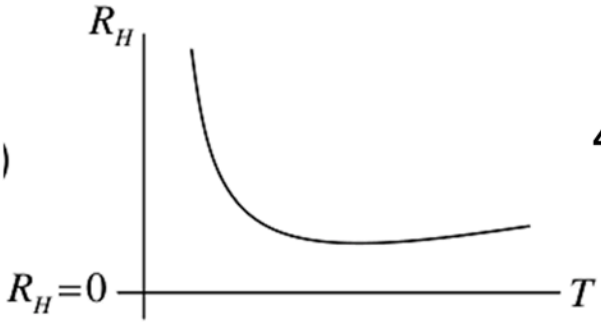
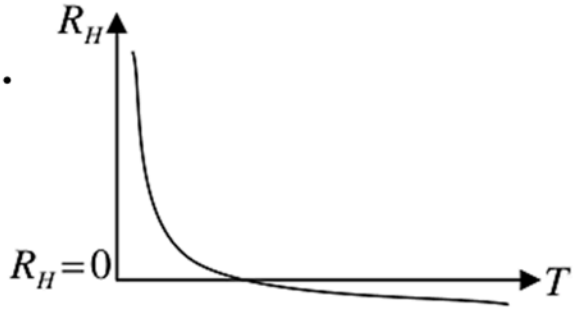


4.


Q4. [June 2023] . 5.0 marks

Solid State Physics > Hall effect

CSIR NET	2023 June	5M

The Hall coefficient R_H of a sample can be determined from the measured Hall voltage $V_H = \frac{1}{d} R_H BI + RI$, where d is the thickness of the sample, B is the applied magnetic field, I is the current passing through the sample and R is an unwanted offset resistance. A lock-in detection technique is used by keeping I constant with the applied magnetic field being modulated as $B = B_0 \sin \Omega t$, where B_0 is the amplitude of the magnetic field and Ω is frequency of the reference signal. The measured V_H is

1. $B_0 \left(\frac{R_H I}{d}\right)$
2. $\frac{B_0}{\sqrt{2}} \left(\frac{R_H I}{d}\right)$
3. $\frac{I}{\sqrt{2}} \left(\frac{R_H B_0}{d} + R\right)$
4. $I \left(\frac{R_H B_0}{d} + R\right)$

Answer Key

4 questions . Subject and topic for quick revision

Q. No	Subject	Topic	Answer
Q1	Solid State Physics	Hall effect	**4**
Q2	Solid State Physics	Hall effect	**3**
Q3	Solid State Physics	Hall effect	**4**
Q4	Solid State Physics	Hall effect	**2**

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