25PY101: Engineering Physics

Course instructor: Dr. Sreekar Guddeti

October 21, 2025

Test 3: Model graphs

Name:_____ Marks scored: ____

Registration No.:_____ Total marks: 20

Instructions:
1. Each MCQ carries 1 mark.
2. Each MCQ may have more than one or no options.
3.
$$\text{sgn}(q) = \begin{cases} +1 & q > 0 \\ -1 & q < 0 \end{cases}$$

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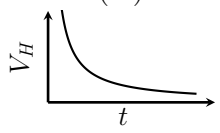
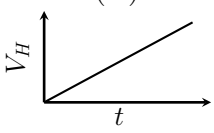
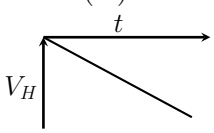
1 Hall effect

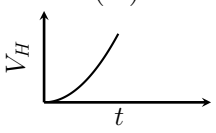
Problem. A thin conducting foil of fixed width and length carries a steady current I and is placed in a uniform magnetic field $\vec{B}$ perpendicular to the plane of the foil. The transverse (Hall) voltage is measured between points on opposite faces across the thickness of the foil while the current and magnetic field are held constant. Which of the following model graphs best represents the dependence of

1. Hall voltage V_H on the foil thickness t?

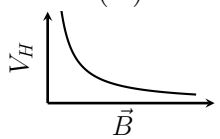
(A)


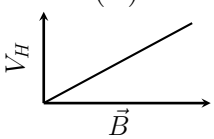
(B)


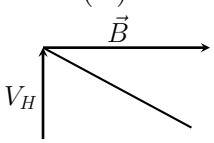
(C)


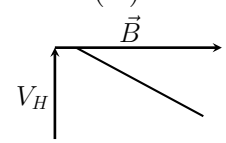
(D)


2. Hall voltage V_H on the magnetic field $\vec{B}$?

(A)


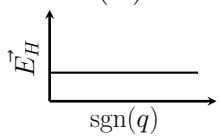
(B)


(C)


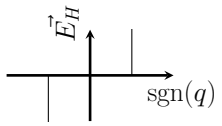
(D)


3. Hall field $\vec{E_H}$ on the sign of carriers $\mathrm{sgn}(q)$?

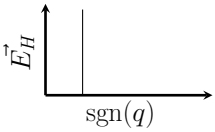
(A)



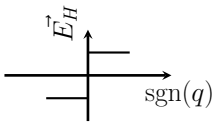
(B)



(C)

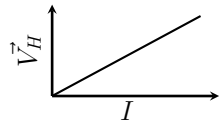


(D)

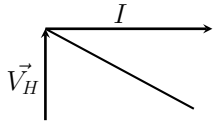


4. Hall voltage V_H on the applied current I?

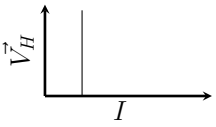
(A)



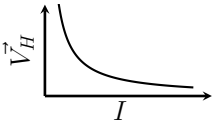
(B)



(C)

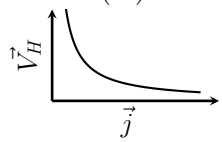


(D)

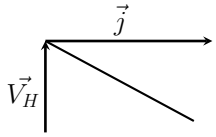


5. Hall voltage V_H on the applied current density $\vec{j}$?

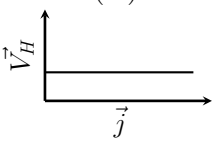
(A)



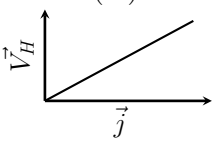
(B)



(C)

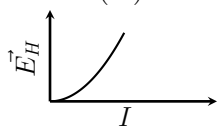


(D)

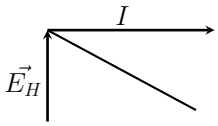


6. Hall field E_H on the applied current I?

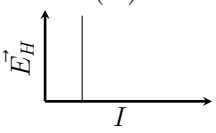
(A)



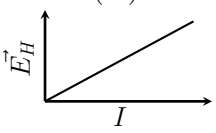
(B)



(C)

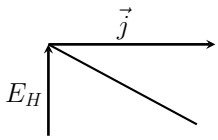


(D)

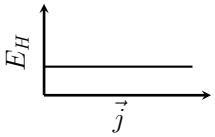


7. Hall field E_H on the applied current density $\vec{j}$?

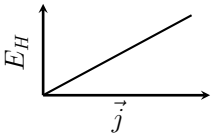
(A)



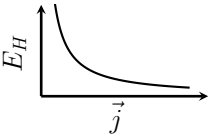
(B)



(C)

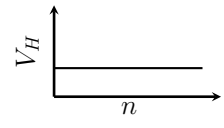


(D)

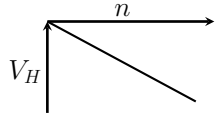


8. Hall voltage V_H on the majority carrier density n?

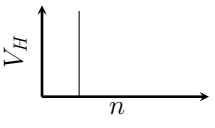
(A)



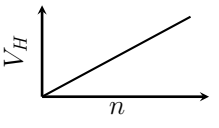
(B)



(C)

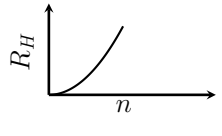


(D)

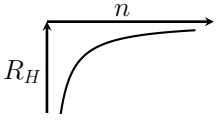


9. Hall coefficient R_H on the majority carrier density n?

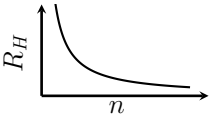
(A)



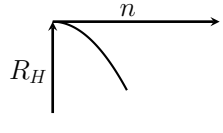
(B)



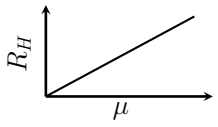
(C)

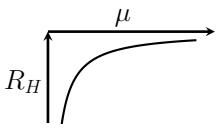


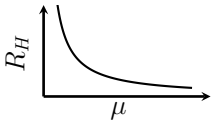
(D)

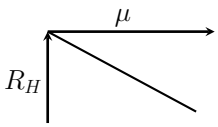


10. Mobility μ on the Hall coefficient R_H?

(A) 

(B) 

(C) 

(D) 

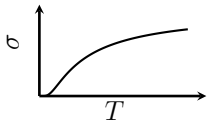
2 Energy band gap of semiconductor

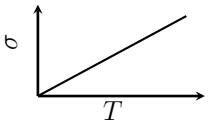
Problem. To measure the energy band gap of Germanium intrinsic semiconductor, we measure the current with varying temperature. The guiding equation is

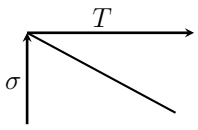
$$\sigma = \sigma_0 \exp\big(-\frac{E_g}{2k_B T}\big)$$

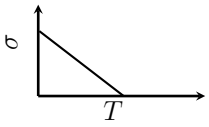
[**Hint** For the following analysis, take the logarithm of above equation.]
Which of the following model graphs best represents the dependence of

11. conductivity σ on the temperature T?

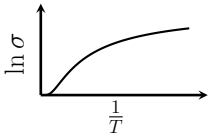
(A) 

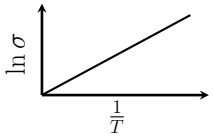
(B) 

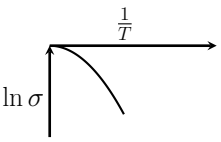
(C) 

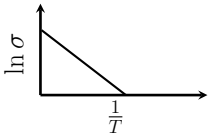
(D) 

12. logarithm of conductivity $\ln\sigma$ on the inverse of temperature $\frac{1}{T}$?

(A) 

(B) 

(C) 

(D) 

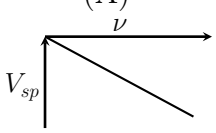
3 Photoelectric effect

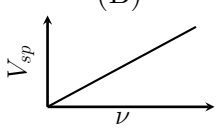
Problem. To measure the photoelectric effect in Au, we measure the stopping potential V_{sp} vs photon frequency ν to estimate the work function Φ and threshold frequency ν_0. The separation of light source and vacuum phototube determines the intensity of light I. The guiding equation is

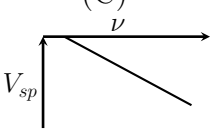
$$eV_{sp} = h\nu - \Phi$$

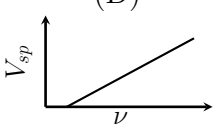
Which of the following model graphs best represents the dependence of

13. stopping potential V_{sp} on the photon frequency ν?

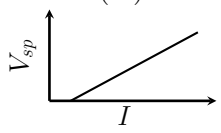
(A) 

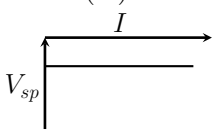
(B) 

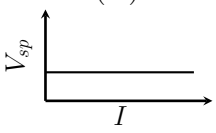
(C) 

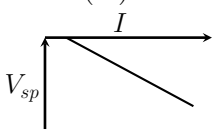
(D) 

14. stopping potential V_{sp} on the intensity I of a light of fixed frequency?

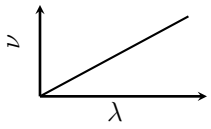
(A) 

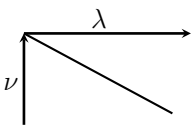
(B) 

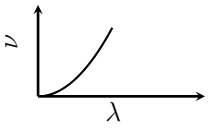
(C) 

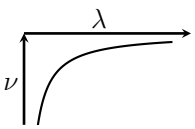
(D) 

15. frequency ν on the wavelength λ of photon?

(A) 

(B) 

(C) 

(D) 

4 Answers

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.

End of Test

Marking done by:

Name:_____

Registration No.:_____