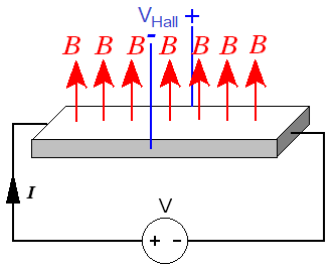
Physics II

Hall Effect

Problem 1.- An experiment is done with a sample of doped silicon (with electrons as carriers of electricity) as shown in the schematic figure below. Calculate the Hall voltage if the drift velocity of the electrons is v=0.55 m/s, the magnetic field is 0.95T and the width of the sample is 2.0 cm.

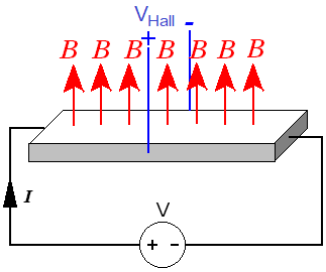


Solution: The magnetic force and the electric force due to the Hall voltage will cancel each other in equilibrium, so:

$Bqv = qE_{Hall} \rightarrow Bv = E_{Hall} = \frac{V_{Hall}}{D}$, where D is the width of the sample.

And the Hall voltage is then: $V_{Hall} = BvD = (0.95T)(0.55)(0.02) = \mathbf{10.5\ mV}$

Problem 2.- An experiment done with a sample of doped silicon reveals a Hall voltage as shown in the schematic figure below. With this information determine if the carriers are positive or negative and give a short rationale of your reasoning.



Solution: If the carriers are positive, they will move from left to right in the sample and so the magnetic force on them will be towards us. They will accumulate there creating an electric potential with the positive on this side of the sample as shown in the figure, so **the carriers are positive**.