

Name _____

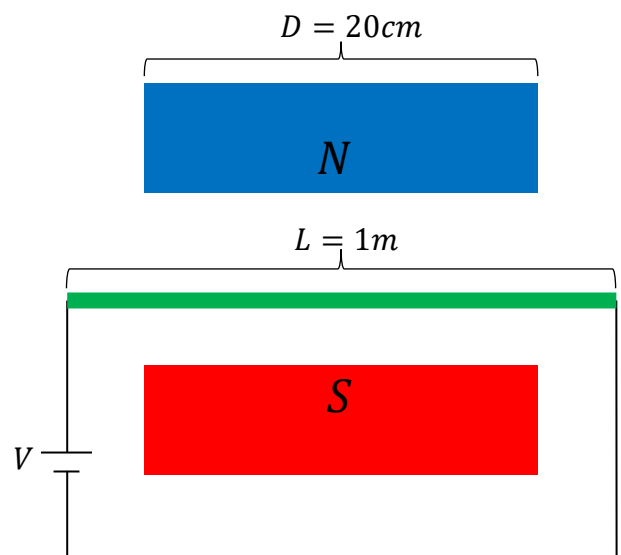
Physics 111 Quiz #4, October 7, 2024

Please show all work, thoughts and/or reasoning to receive partial credit. The quiz is worth 10 points total, and all parts may not be of equal weight.

I affirm that I have carried out my academic endeavors with full academic honesty.

1. Suppose that you have a wire of radius $r = 50\mu\text{m}$ and length $L = 1\text{m}$ that will be used in a circuit as a resistor. The wire is made out of tungsten ($\rho_{M,W} = 19300\frac{\text{kg}}{\text{m}^3}$, $M_W = 0.1833\frac{\text{kg}}{\text{mol}}$, $\rho = 5.6 \times 10^{-8}\Omega\text{m}$), which donates two charges carriers to the current, and is connected to a $V = 20\text{V}$ battery. How much current is produced by the battery?

2. Suppose that this wire was placed between the poles of a square magnet, shown below, with side length $D = 20\text{cm}$. The magnetic field has a strength $|\vec{B}| = B = 3\text{mT}$. When placed between the poles of the magnet, what force would the wire segment feel? Assume that $\vec{I} \perp \vec{B}$.



3. What is the drift velocity of charge carriers in tungsten wire if the current in part 1 flows?

4. What is the Hall voltage induced across the diameter of the wire?

5. Although they cannot physically do this, assume that the charge carriers could make a circular orbit about the magnetic field in the wire. If the charge carriers have charge $q = +e$ and mass $m = m_e = 9.11 \times 10^{-31} kg$, what would be the radius of their circular orbit? Assume that $\vec{v}_d \propto \vec{I} \perp \vec{B}$.