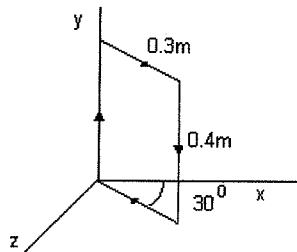


Physics 111 Homework Set #11

- 1) What magnetic force is experienced by a proton moving North to South with a velocity of $4.8 \times 10^6 \text{ m/s}$ at a location where the vertical component of the earth's magnetic field is $75 \mu\text{T}$ downward? In what direction is the proton deflected?
- 2) An electron is projected into a uniform B-field $\mathbf{B} = 1.4\hat{i} + 2.1\hat{j} \text{ T}$. Find the force on the electron if $\mathbf{v} = 3.7 \times 10^5 \hat{j} \text{ m/s}$.
- 3) A conductor has mass per unit length of 0.04 kg/m . What current must be in the wire for the weight to be balanced by the magnetic force if $B=3.6\text{T}$ into the page.
- 4) A rectangular loop of 100 turns has dimensions 0.4m by 0.3m as shown. The loop is hinged on the y-axis and is at an angle of 30° with respect to the x-axis. What is the torque on the loop by a B-field of 0.8 T along the x-axis when there is a 1.2A current in the loop as shown? In what direction will the loop rotate?



- 5) A proton, a deuteron and an alpha particle are accelerated through a common potential difference, V . The particles then enter a region of uniform magnetic field where the B-field is perpendicular to the velocity of the particles. The proton moves in a circular path of radius r_p . Find r_d and r_α in terms of r_p .
- 6) At the equator, the magnetic field is approximately $50 \mu\text{T}$ N and the electric field is approximately 100 N/C down. Find the gravitational, electric and magnetic forces on a 100 eV electron that is moving due east.
- 7) Singly charged Uranium ions are accelerated through a 2keV potential difference and enter into a region of uniform magnetic field $B=1.2\text{T}$ that is perpendicular to the velocity. Determine the radii of the Uranium ions assuming (a) ^{235}U and (b) ^{238}U .
- 8) The Hall effect can be used to measure the number of electrons per unit volume, n , for an unknown sample. The sample is 15mm thick and when in a 1.8T magnetic field it produces a Hall voltage of $0.12\mu\text{V}$ while carrying a 12A current. What is n ?
- 9) A Hall effect probe is designed to use $I=120\text{mA}$. When placed in a 0.08T magnetic field, $V_H=0.7\mu\text{V}$. (a) When in an unknown field, $V_H=0.33\mu\text{V}$. What is the unknown field strength? (b) Find n if $t=2\text{mm}$.
- 10) A uniform magnetic field ($B=0.15\text{T}$) is directed along the x-axis. A positron with a speed of $5 \times 10^6 \text{ m/s}$ enters the field along a direction that makes an 89° angle with respect to the x-axis. Calculate (a) the pitch and (b) the radius of the resulting helical path.