36. A wire 50.0 cm long carries a 0.500 A current in the positive direction of an x-axis through a magnetic field $\vec{B}=(3.00\text{mT})\hat{j}+(10.0\text{mT})\hat{k}$. In unit-vector notation, what is the magnetic force on the wire?

45. Fig. 28-44 shows a wood cylinder of mass m = 0.25 kg and length L = 0.100 m, with N = 10.0 turns of wire wrapped around it longitudinally, so that the plane of the wire coil contained the long central axis of the cylinder. The cylinder is released on a plane inclined at an angle θ to the horizontal, with the plane of the coil parallel to the incline plane. If there is a vertical uniform magnetic field of magnitude 0.500 T, what is the least current I through the coil that keeps the cylinder from rolling down the plane?

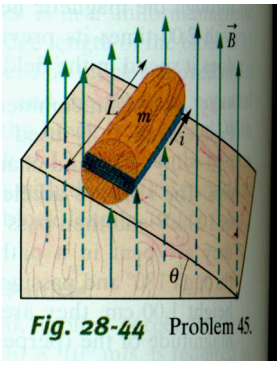

Fig. 28-44 Problem 45.

55. A wire of length 25.0 cm carrying a current of 4.51 mA is to be formed into a circular coil and placed in a uniform magnetic field $\vec{B}$ of magnitude 5.71 mT. If the torque on the coil from the field is maximized, what are (a) the angle between $\vec{B}$ and the coil's magnetic dipole moment and (b) the number of turns in the coil? (c) What is the magnitude of that maximum torque?

57. A source injects an electron of speed v = 1.5 X 10^7 m/sec into a uniform magnetic field of magnitude B = 1.0 X 10^{-3} T. The velocity of the electron makes an angle θ = 10^0 with the direction of the magnetic field. Find the distance d from the point of injection at which the electron next crosses the field line that passes through the injection point.

82. A beam of electrons whose kinetic energy is K emerges from a thin-foil 'window' at the end of an accelerator tube. A metal plate at distance d from this window is perpendicular to the direction of the emerging beam (Fig. 28-55). (a) Show that we can prevent the beam from hitting the plate if we apply a uniform magnetic filed $\vec{B}$ such that $B\geq\sqrt{\frac{2mk}{e^2d^2}}$ in which m and e are the electron mass and charge. (b) How should $\vec{B}$ be oriented?

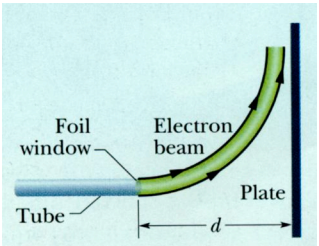

Fig. 28-55 Problem 82.