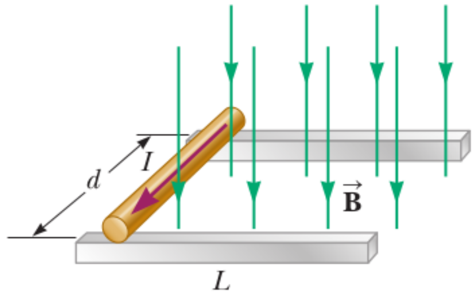
Name: ________________________________

Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page.

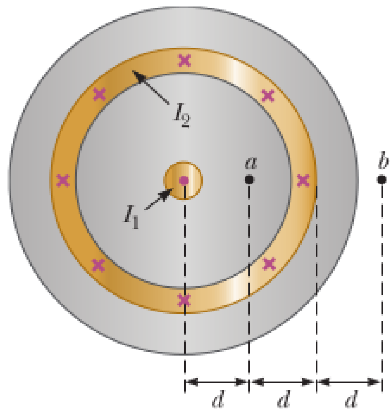
1. A proton (charge $+e$, mass m_p), a deuteron (charge $+e$, mass $2m_p$), and an alpha particle (charge $+2e$, mass $4m_p$) are accelerated from rest through a common potential difference ΔV. Each of the particles enters a uniform magnetic field $\mathbf{B}$, with its velocity in a direction perpendicular to $\mathbf{B}$. The proton moves in a circular path of radius r_p. In terms of r_p , determine (a) the radius r_d of the circular orbit for the deuteron and (b) the radius r_a for the alpha particle.

2. Singly charged uranium-238 ions are accelerated through a potential difference of 2.00 kV and enter a uniform magnetic field of magnitude 1.20 T directed perpendicular to their velocities. (a) Determine the radius of their circular path. (b) Repeat this calculation for uranium-235 ions. (c) How could this be useful information to you if, say, you were a UN inspector trying to determine the ratio of U-238 to U-235 in Iran's refined uranium supply?

3.



A rod of mass 0.720 kg and radius 6.00 cm rests on two parallel rails (see figure) that are d = 12.0 cm apart and L = 45.0 cm long. The rod carries a current of I = 48.0 A in the direction shown and rolls along the rails without slipping. A uniform magnetic field of magnitude 0.240 T is directed perpendicular to the rod and the rails. If it starts from rest, what is the speed of the rod as it leaves the rails?



4.

Behold a cross-section of Coaxial cable above. The center conductor is surrounded by a rubber layer, an outer conductor, and another rubber layer. In a particular application, the current in the inner conductor is $I_1 = 1.00$ A out of the page and the current in the outer conductor is $I_2 = 3.00$ A into the page. Assuming the distance d = 1.00 mm, determine the magnitude and direction of the magnetic field at (a) point a and (b) point b. *Hint: Use Ampere's Law.*