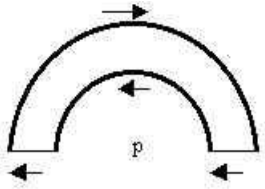
Physics 114 – Spring 2006 – Workshop module 7

1. A ^{7}Li nucleus contaminates a beam of protons used for cancer treatment. The ^{7}Li nucleus has a charge of +3|e| and a mass of $7m_p$. Protons have a charge of +1|e| and a mass of $1m_p$.
   Both the protons and the lithium move in a plane perpendicular to a magnetic field. The particles all have the same momentum. The ratio of the radius of curvature of the path of the proton (R_p) to that of the ^{7}Li nucleus (R_{Li}) is

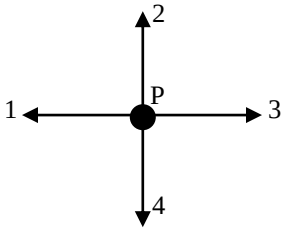
   a) $R_p/R_{Li}=3$
   b) $R_p/R_{Li}=1/3$
   c) $R_p/R_{Li}=1/7$
   d) $R_p/R_{Li}=3/7$
   e) $R_p/R_{Li}=7$
   f) None of the above

2. The wire semicircles in the figure to the right have radii a and b. Calculate the net magnetic field (magnitude and direction) at the point P (at the center of the loops) due to the current I passing through the loop in the direction shown.



3. Two straight wires are perpendicular to the plane of this page.
   One, located at point M, carries a positive current into the page. One, located at point N, carries a positive current out of the page. The vector that best represents the resultant magnetic field at point P is

a) 1
b) 2
c) 3
d) 4
e) none of these is correct.



4. A 1.0-kg copper rod rests on two horizontal rails 1.0 m apart and carries a current of 50 A from one rail to the other. The coefficient of static friction is 0.60. Suppose a uniform magnetic field exists in this region of space which is perpendicular to the bar, parallel to the rails and incident on the rail at a 20 degree angle with respect to the horizontal. What is the smallest magnetic field strength that would cause the bar to slide?

5. A conductor is made in the form of a hollow cylinder with inner and outer radii a and b, respectively. It carries a current I, uniformly distributed over its cross section. Derive expressions for the magnitude of the magnetic field in the regions a) r<a; b) a<r<b; c) r>b.