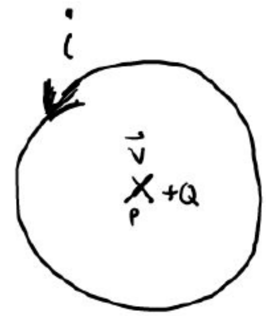
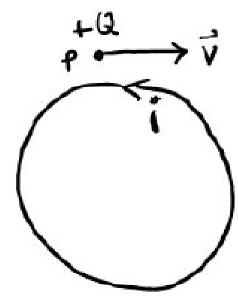
Physics 114 – Spring 2015 – Workshop module 8

1) In each of the following specify the direction of the force on the positive charge Q. Specifically, write down the appropriate choice from the list: there is no force on Q; into the paper; out of the paper; to the left (in the plane of the paper); to the right (in the plane of the paper); toward the top (in the plane of the paper); toward the bottom (in the plane of the paper).

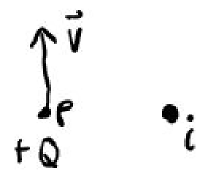
a) Point p is in center of positive current loop shown in plane of paper. Q moves into the paper.



b) Point P lies outside of the positive current loop shown in the plane of the paper. Q moves to the right.

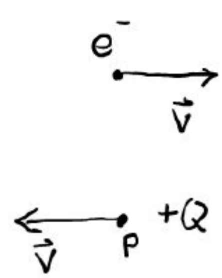


c) Current comes out of the paper toward you. Q moves upward in plane of the paper.

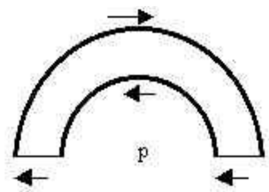


d) Current comes out of the paper toward you. Q moves to the right.

e) An electron moves to the right as shown while Q moves to the left.

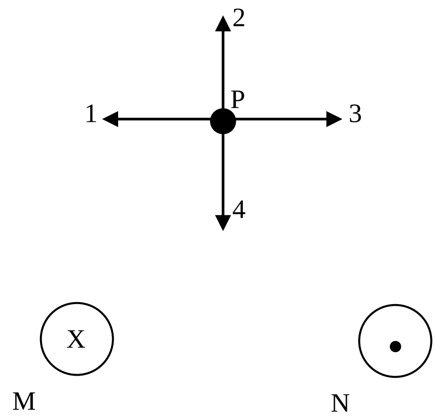


2. The wire semicircles in the figure to the right have radii a and b. Calculate the net magnetic field (magnitude and direction) at the point P (at the center of the loops) due to the current I passing through the loop in the direction shown.



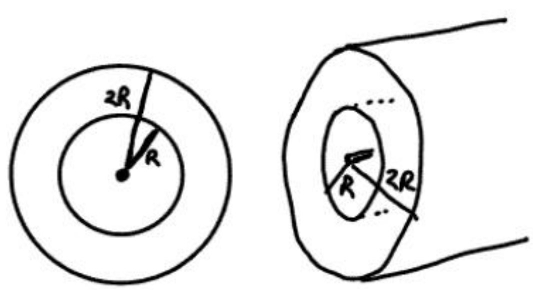
3. Two straight wires are perpendicular to the plane of this page.
One, located at point M, carries a positive current into the page. One, located at point N, carries a positive current out of the page. The vector that best represents the resultant magnetic field at point P is

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



4. A 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) $r>b$.

5. Consider a cylindrical, current-carrying shell. Referring to the sketch to the right, the shell carries a current I out of the paper spread over its surface area according to a current density $j(r)=K/r$, where K is a constant. The shell has inner radius R and outer radius 2R.



a) Determine the magnetic field in the region $r<R$ in terms of K, I, and R.

b) Determine the magnetic field in the region $R<r<2R$ in terms of K, I, and R

c) Determine the magnetic field in the region $r>2R$ in terms of K, I, and R.

d) Show that $K = I/2\pi R$