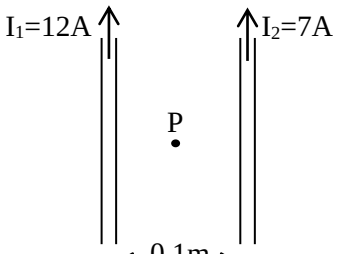
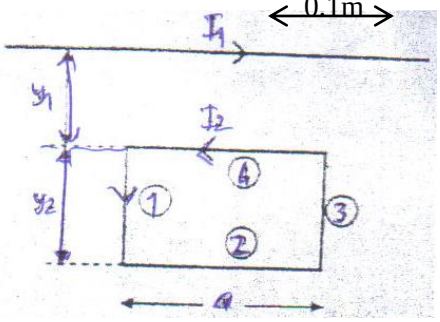
SOURCE OF MAGNETIC FIELD & BIOT SAVART-AMPERE'S LAWS



1-Two long straight wires separated by 0.1m carry currents as shown.
a) What is the net magnetic field at point P, midway between the two wires?
b) Find the location of a point in the region near the two wires where the net magnetic field is zero.

2- A long straight wire carries a current of I_1 and the rectangular loop carries a current of I_2. Determine the direction and the magnitude of the force acting on the each labeled segment (1, 2, 3, 4) of the loop. What is the magnitude and the direction of the net resultant force?

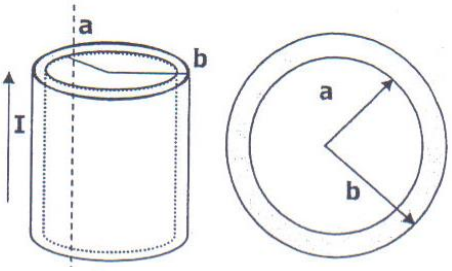


3- A hollow cylindrical wire of inner diameter "a" and outer diameter "b" is carrying a current "I". The current density is uniform within the wire. Find an expression for the magnetic field B(r) for

a) r < a

b) a < r < b

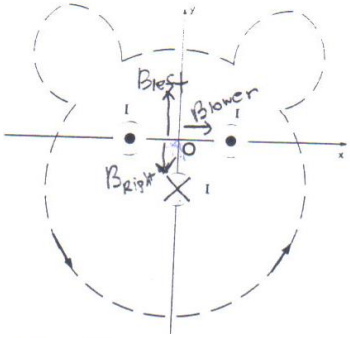
c) r > b.



4- There is a current I out of the xy plane at (-a, 0) and (a, 0) and a current I into the xy plane at (0, -a).

a) Find the magnetic field at the origin.

b) What is the $\oint \vec{B} \cdot d\vec{l}$ line integral along the dash line?

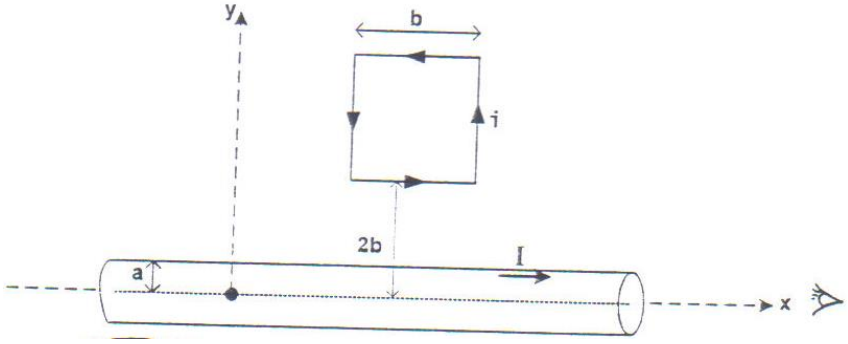


5-(Vize-2 18.07.2009)

Consider a long conducting cylindrical *shell* of radius a, lying along the x-axis as shown in the figure. The current on the shell is I.

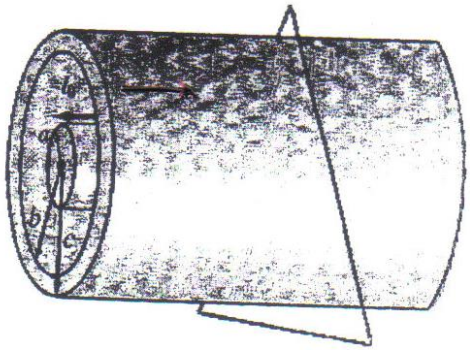
(i) Find the magnetic field vector $\vec{B}(r)$ in the regions $r < a$ and $r > a$ where r is the distance measured from the axis of the cylinder. (You must show Amperian loops and directions on them clearly.)

(ii) Now suppose that a square loop of each side b carrying a current i lies in the xy-plane with horizontal sides parallel to this cylindrical shell as in the figure. The distance between the cylindrical shell and the nearest side of the current loop is $2b$. Find the magnitude and direction of the net force exerted on the loop by the magnetic field of the cylindrical shell. (In calculating the force on each side, neglect the effect of other sides of the square and consider only the force acted by the cylindrical shell.)



6- (Vize-2 11.04.2009)

An infinitely long coaxial cable consists of a solid inner conductor of radius a, surrounded by a concentric cylindrical tube of inner radius b and outer radius c. The inner conductor carries current I_0 while the outer conducter carries current $3I_0$. The currents are distributed **uniformly** across the cross-sections of the conductors.



a) Find $\oint \vec{B}.d\vec{l}$ along the triangular closed loop outside the cable.

b) Find the magnetic field B at distance r from the axis for $a<r<b$.

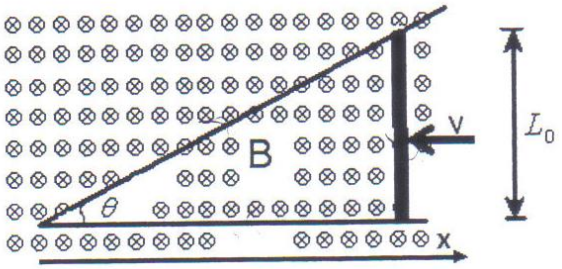
c) Find B at distance r from the axis for $r<a$.

d) Find B at distance r from the axis for $b<r<c$.

ELECTROMAGNETIC INDUCTION & FARADAY'S LAW

7-(Final 25.05.2009)

A bar with resistance R_0 and length L_0 is placed on another wire that is bent with angle θ as shown in the figure. The bent wire has negligible resistance and fixed in its place. The wire and the bar are in contact and placed in a uniform magnetic field. The field is inwards as shown in the figure. The bar is pushed towards left with a constant velocity v. The wire and the bar do not change their shape and orientation during the motion.



Find:

a) the emf induced around the triangular loop;

b) the magnitude and direction of the induced current;

c) the magnitude and direction of the induced force on the bar.