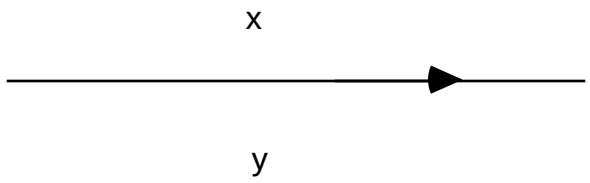
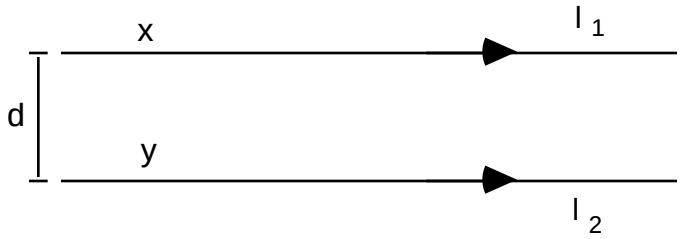
Magnetic Forces and Fields : W.S.-18

1)a) Find the direction of the magnetic field at point x and point y around the current carrying wire.



b) Find the magnitude of the field at a distance of 1.5 cm from the wire, if the current is 4.3 amps.

2) Two long parallel current carrying wires are shown. The currents are I_1 = 2.0 A, I_2 = 5.0 A and d = 3.0 cm. Answer the following questions.



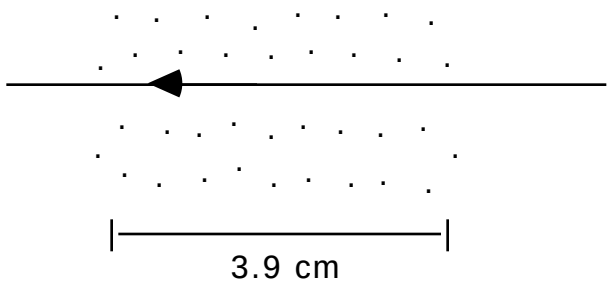
a) Find the direction of the field at y due to the wire x.

b) Find the magnitude of the field at y due to the wire x.

c) Find the magnitude and direction of the force (per unit length) on wire y due to the wire x.

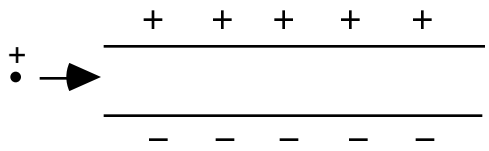
d) Find the magnitude and direction of the force (per unit length) on wire x due to the wire y.

3) A wire carrying a current of 650 mA is in a 4.3 T field that is directed out of the paper.



Find the force on the wire and its direction.

4) A positive charge q enters an electric field between two charged parallel plates as shown. The velocity is v. The electric field between the plates is E.

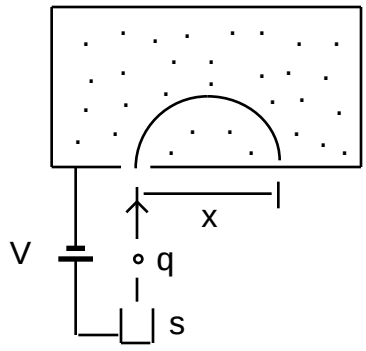


a) Find the electric force on the charge (give direction).

b) A magnetic field is directed into the page, inside the plates. Show that the magnitude of the field required so that the positive charge passes through the plates undeflected is given by E/v.

5) A mass spectrograph is used to measure the mass of ions. The ion from source s is accelerated towards the slit in the box which has a magnetic field B in it. The accelerating voltage is V. Show that the mass of the positively charged ion q, is given by: $m = \{qB^2x^2\}/8V$. The mass depends on the distance x, which is measured using a photographic plate as shown.

Mass Spectrograph



Answers: 1)a) x (out of page), y (into page), b) 5.7×10^{-5} T, 2)a) into page, b) 1.3×10^{-5} T, c) 6.7×10^{-5} N/m [up], d) 6.7×10^{-5} N/m [down], 3) 0.11 N [up], 4)a) qE [down], b) $F_E = F_B$, therefore; $qE = qvB$, 5) Use $qV = (1/2)mv^2$ and $v = qrB/m$. Eliminate v.