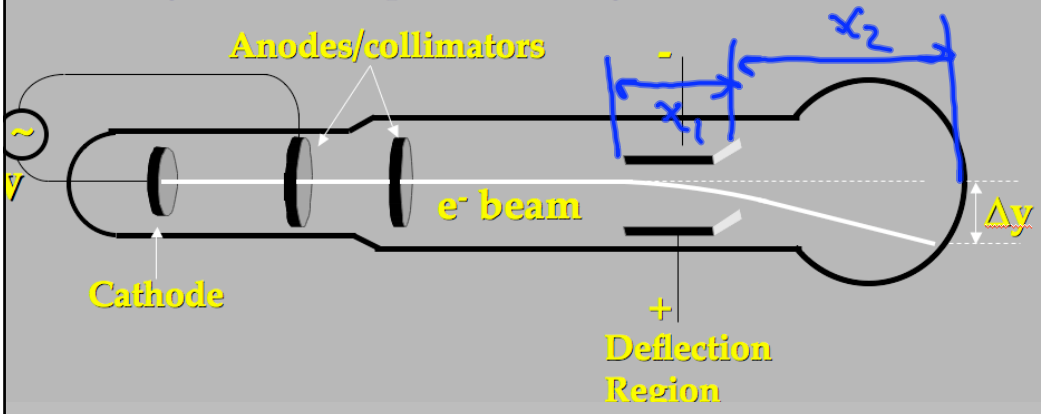
Reminders 3-11-08:
-Next Webassign Due March 16
-Magnetic Field Conceptual Questions Due March 13
-Exam 2 Average 67.7%
-Electrophorous
-Lab Time
-Will Need to End 2Y Early Today!
-We will start Chapter 20 Thursday!

Objectives:
-Magnetic Forces (Lorentz Force)
-Applications e.g. Mass Spectrometers
-Forces on Current Carrying Wires
-Magnetic Torque
-DC Motors
-Magnetic Fields Due to Wires

Derive expression for three extra credit points on next exam. Due Thursday at beginning of class. No late papers will be accepted!

- **Charge-to-Mass ratio of Electron**
  - Use velocity selector to measure velocity of electrons from electron gun.
  - What is the direction of B-field in figure?
  - Turn off magnetic field, measure deflection.
  - Thomson's value, $q_e/m_e=1.76\times10^{11}$C/kg
  - Can you derive expression for Δy?



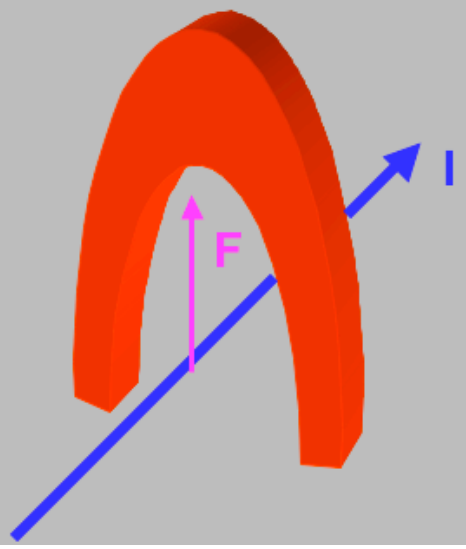
Charge-to-Mass ratio of Electron (cont'd)

- Using simple kinematics one can show that the vertical deflection of the electron is

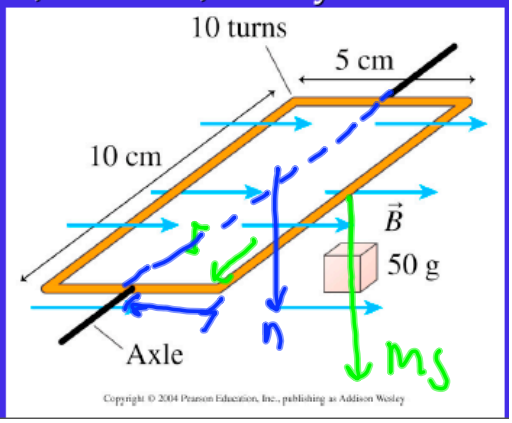
$$\Delta y = \frac{1}{2}\frac{qE}{m}\left(\frac{x_1}{v}\right)^2 + \frac{qE}{m}\frac{x_1 x_2}{v^2}$$

- where x_1 is the length of the plates and x_2 is the length of the drift region.
- Thomson measured $q/m=1.76\times10^{11}$C/kg
- Complete the derivation and turn it in next time.

From the drawing shown indicate the north and south poles of the horseshoe magnet.



Example:
Consider the current-carrying loop below. It has 10 turns and lies in a plane parallel to the magnetic field, carrying 2 A of current. A 50 g mass hangs from one wire as shown. What magnetic field strength prevents the loop from rotating about the axle? Now, if the loop were to be rotated counterclockwise about the axle by 30°, would the needed magnetic field strength increase, decrease, or stay the same?



Ans: 0.12T;same

$NAIB = mg\,.025_m$

$B = \frac{mg(.025)}{NAI} = \frac{(.050)(9.8)(.025)}{(10)(.1)(.05)\,2}$

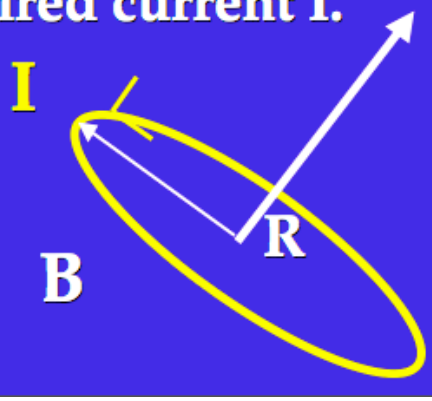
$= .12T$

$NAIB\sin\phi = mg\,\frac{1}{2}\sin\phi$

doesn't make a difference!

Magnetism

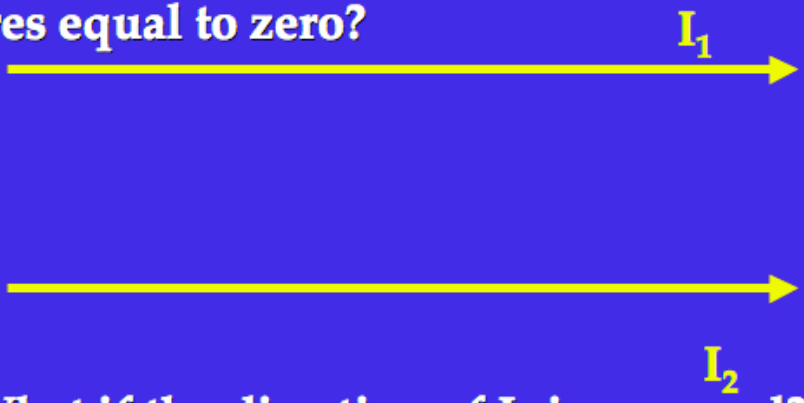
- A scientist uses a loop of wire with 100 turns to cancel the Earth's magnetic field (0.7 gauss) for an experiment. If the diameter of the loop is 0.50m, find the required current I.



Ans: 0.28A

Example:

Two long, parallel, current-carrying wires are separated by a distance d. Calculate the force (magnitude and direction) on wire exerted by the other. Where is the field due to the two wires equal to zero?



What if the direction of I_2 is reversed?

What if three long wires formed an equilateral triangle, how would you calculate the force on one wire?