Problem 1: (11-11-56)

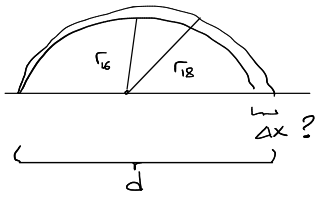
O^{16} O^{18}

$M_{16} = 2.66 \cdot 10^{-26}$ kg $B = 1.20$ T

Singly charged

$v = 5.00 \cdot 10^6$ m/s

$\frac{M_{16}}{M_{18}} = \frac{16}{18}$



$r = \frac{mv}{qB}$

$\Delta x = 2r_{18} - 2r_{16} = 2(r_{18} - r_{16})$

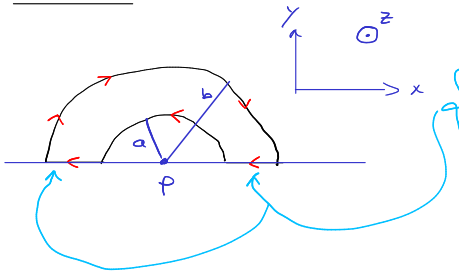
$= 2\frac{v}{qB}\{M_{18} - M_{16}\}$

$= \frac{2v}{qB} M_{16}\left\{\frac{M_{18}}{M_{16}} - 1\right\}$

$\Delta x = \frac{2v}{qB} M_{16}\left\{\frac{18}{16} - 1\right\}$

$= \frac{2 \cdot 5 \cdot 10^6 \cdot 2.66 \cdot 10^{-26}}{1.602 \cdot 10^{-19} \cdot 1.20}\left(\frac{18}{16} - 1\right) \approx 0.173$ m

Problem 2: (11-12-18)



use Biot-Savart and Ex. 12.2

B-S gives B(P) = 0 for the straight segments, but not for the arcs

Inner arc:

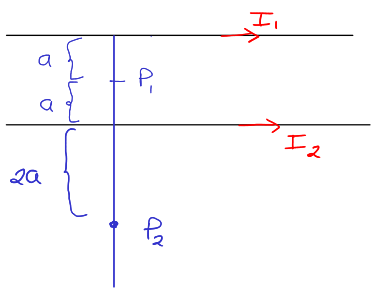
$\vec{B} = -\frac{\mu_0 I \pi}{4\pi a}\hat{z}$

outer arc:

$\vec{B} = +\frac{\mu_0 I \pi}{4\pi b}\hat{z}$

$\rightarrow$ $\vec{B}_P = -\frac{\mu_0 I}{4}\hat{z}\left(\frac{1}{a} - \frac{1}{b}\right)$

Problem 3: (11-12-26)



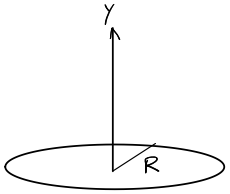
Use $B = \frac{\mu_0 I}{2\pi R}$

with right hand rule

P_1: $\vec{B} = \frac{\mu_0 I_2}{2\pi a}\hat{z} - \frac{\mu_0 I_1}{2\pi a}\hat{z} = \frac{\mu_0 \hat{z}}{2\pi a}\{I_2 - I_1\}$

P_2: $\vec{B} = -\frac{\mu_0 I_2}{2\pi 2a}\hat{z} - \frac{\mu_0 I_1}{2\pi 4a}\hat{z} = -\frac{\mu_0 \hat{z}}{4\pi a}\left\{I_2 + \frac{I_1}{2}\right\}$

Problem 4: (11-12-38)



At what distance B(y) = B(0)/2

use section 12.4

$\frac{\mu_0 I \pi R^2}{2\pi(y^2+R^2)^{3/2}} = \frac{\mu_0 I}{4R}$

$\rightarrow \frac{R^2}{2(y^2+R^2)^{3/2}} = \frac{1}{4R} \rightarrow \frac{4R^6}{(y^2+R^2)^3} = 1$

or $\frac{4^{1/3}R^2}{(y^2+R^2)} = 1 \rightarrow 4^{1/3}R^2 = y^2 + R^2$

$\rightarrow y^2 = (4^{1/3} - 1)R^2 = 0.5874\,R^2$

$y = \sqrt{4^{1/3} - 1} \cdot R \approx 0.7664\,R$