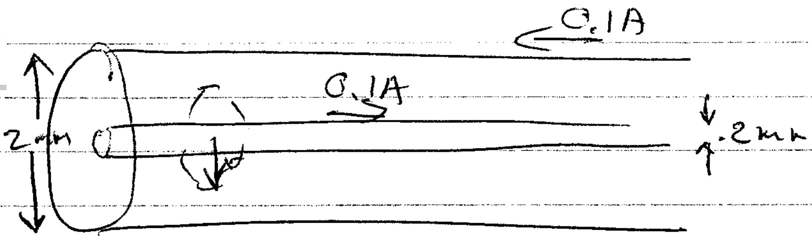
HW Xb PHY 132

Session X.3

1)



Ampere tells us $\oint B\cdot dl = B\cdot 2\pi r = \mu_0 I_{enc}$

$$B = \frac{\mu_0 \cdot .1A}{\cancel{2}\pi r} = \frac{2\cancel{4\pi}\times 10^{-7}\cdot .1A}{\cancel{2\pi}\, r}$$

$$= \frac{2\times 10^{-8}\ T\cdot m}{r}$$

Fields circles around inner wire

2) Field from single wire is $\frac{\mu_0 I}{2\pi r}$. Field point is at $r = 0.005m$ from each wire. These two fields add, each going into the page.

$$B_{total} = \frac{2\cdot\mu_0\cdot I}{2\pi r} = \frac{4\cancel{\pi}\times 10^{-7}\cdot 5A}{\cancel{\pi}\cdot .005}$$

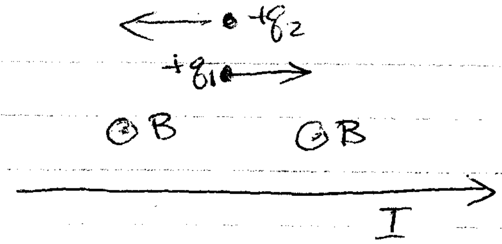
$$= 4\times 10^{-4}\ T$$

3) Use $B_{loop} = \frac{\mu_0 I}{2R}$, so $B_{small} = \frac{\mu_0 I}{2R_1}$ (out of page) & $B_{large} = \frac{\mu_0 I}{2R_2}$ into page, so $B_{net} = \frac{\mu_0 I}{2}\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ (out of page)

Phy 132 HW X

Session X.4

1)



Try both ways. RH rule on q_1 gives force ~~toward~~ wire, & RH rule on q_2 gives F away from wire. So charge must be moving opposite to current direction

2) If for prob 4, $q = 2\times10^{-6}C$, $I = 10A$, $r = 1cm$, & $v = 5\times10^5 m/s$, then

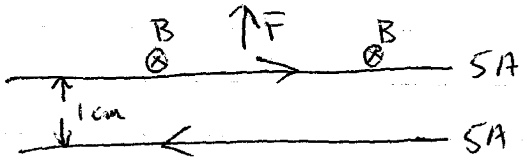
$$B(1cm) = \frac{\mu_0 I}{2\pi r} = \frac{4\pi\times10^{-7}\cdot 10A}{2\pi\cdot 10^{-2}m} = 2\times10^{-4}T$$

$$\vec{F} = q\vec{v}\times\vec{B}, \text{ so } |F| = qvB = 2\times10^{-6}C\cdot 5\times10^5 m/s\cdot 2\times10^{-4}T$$

$$\boxed{= 2\times10^{-4}N}$$

(Not much!)

3)



Let's consider bottom wire causing force on the top wire. Bottom wire creates a B field into page at top wire by RH rule. F is then upward on that top wire as shown.

3b-cont) In terms of magnitude of F, we first need to know B at upper wire:

$$B_{wire} = \frac{\mu_0 I}{2\pi r} = \frac{4\pi \times 10^{-7} \cdot 5A}{2\pi \cdot 1cm}$$

$$= \frac{2\times 10^{-7} \cdot 5}{.01} T = 10^{-4} T$$

Now, use $F = \left| \int I \vec{dl} \times \vec{B} \right| = IlB = 5A \cdot .1m \cdot 10^{-4} T$

$$\boxed{= 5\times 10^{-5} N}$$

Again, pretty small!