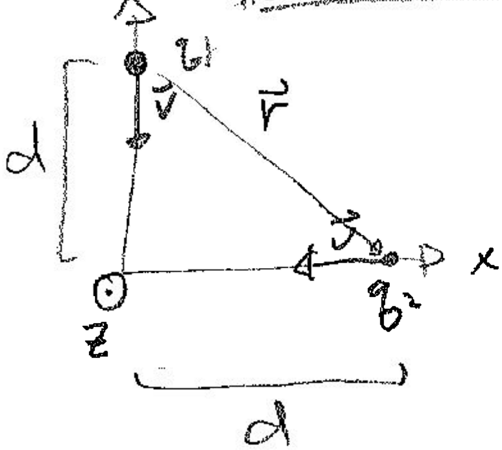
Force Bet moving charges



Sum of Electric Field force

{ magnetic Field force

choose force on q_2

$$\vec{F}_E = \frac{k q_1 q_2 \hat{r}}{r^2} = \frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2}{d^2+d^2}\hat{r}$$

$$\vec{F}_B = q_2 \vec{v}_2 \times \left(\frac{\mu_0}{4\pi} \frac{q_1 \vec{v}_1 \times \hat{r}}{r^2}\right)$$

$$= q_2 v(-\hat{x}) \times \frac{\left(\frac{\mu_0}{4\pi} q_1 v(-\hat{y}\times\hat{r})\right)}{r^2}$$

$-\hat{y}\times\hat{r} = (\sin 45^\circ)\hat{z}$

$-\hat{x}\times\hat{z} = \hat{y}$

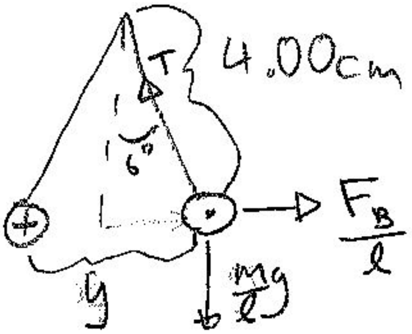
$$= q_1 q_2 v^2 \left(\frac{\mu_0}{4\pi}\right)\left(\frac{1}{2d^2}\right)\sin 45^\circ\,\hat{y}$$

$$|F_e|/|F_B| = \frac{\frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{2d^2}}{q_1 q_2 v^2\left(\frac{\mu_0}{4\pi}\right)\frac{1}{2d^2}\sin 45^\circ}$$

$$= \frac{1}{\mu_0\varepsilon_0}\frac{1}{v^2}\frac{1}{\sin 45^\circ} = \frac{c^2}{v^2}\frac{1}{\sin 45^\circ}$$

$v << c \qquad |F_e| >> |F_B|$

28.61



$y = 2(4.00\text{cm})\sin 6°$

$$B \text{ on one} = \frac{\mu_0}{2\pi}\frac{1}{y} I \quad (\perp \text{ to } I)$$

$$F_B \text{ on one} = \frac{\mu_0}{2\pi}\frac{1}{y} I^2 \ell$$

$$\tan 6° = \frac{(F_B)/\ell}{\frac{m}{\ell}g} = \frac{\mu_0 \, I^2}{2\pi y \frac{m}{\ell} g}$$

$$I = \sqrt{\frac{\tan 6° \, 2\pi y \frac{m}{\ell} g}{\mu_0}}$$

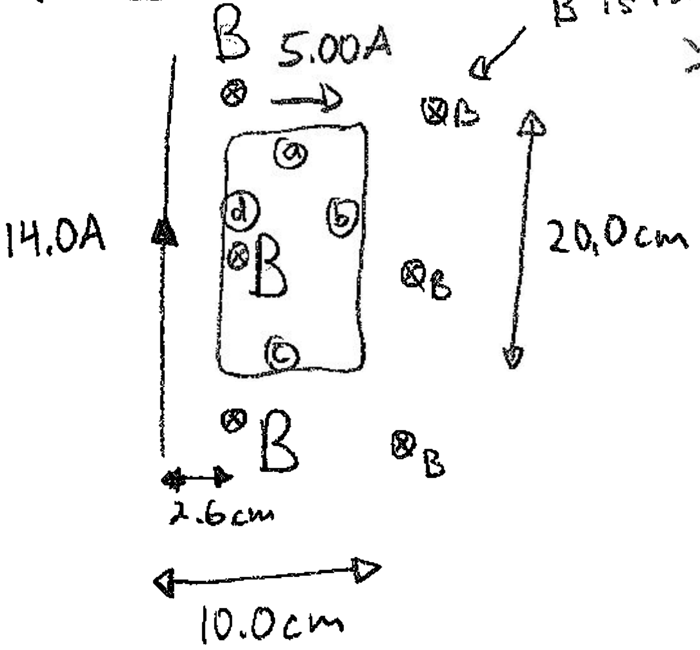
$$I = \sqrt{\frac{\tan 6° \, 2\pi(2)(0.04\text{m} \sin 6°)(0.0105\frac{\text{kg}}{\text{m}})\, 9.81\frac{\text{m}}{\text{s}^2}}{4\pi\times 10^{-7}\frac{\text{Tm}}{\text{A}}}}$$

$$= 21.3\sqrt{\text{m}\frac{\text{kg}}{\cancel{\text{m}}}\frac{\cancel{\text{m}}}{\text{s}^2} \Big/ \frac{\text{Tm}}{\text{A}}} \qquad T = \frac{\text{N}}{\text{A M}}$$

$$= 21.3\sqrt{\text{N} \Big/ \frac{\text{N}}{\text{A}^2}}$$

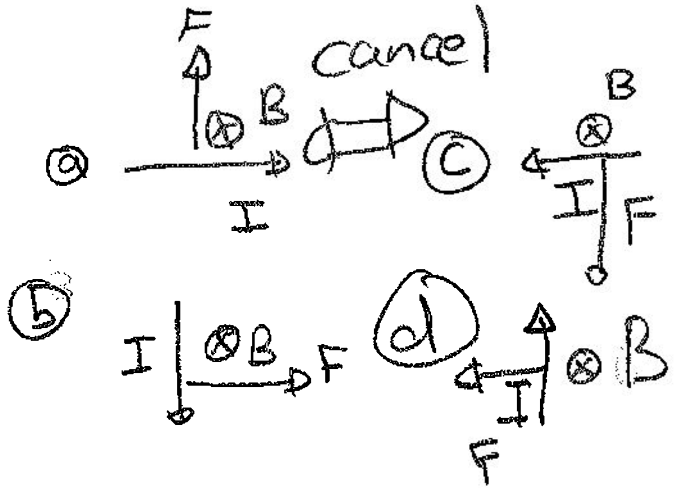
$$= 21.3\,\text{A}$$

28.62



B is Falling like $\frac{1}{y}$

Figure out Force @ each spot



expect $|F_a| > |F_b|$

net Force to left

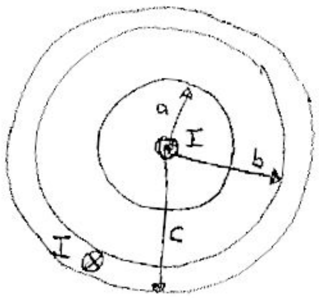
$$F_{tot} = \frac{\mu_0}{2\pi}(14A)\left(\frac{(5.00A)(0.20m)}{0.026m}(-\hat{x}) \quad \frac{5.00A(0.200m)}{0.10m}(\hat{x})\right)$$

$\frac{N}{mA}$

$$= \frac{4\pi\times10^{-7}\frac{Tm}{A}}{2\pi}14A\left(-38.46A\,\hat{x} + 10.0A\,\hat{x}\right)$$

$$= 7.97\times10^{-5}\,N(-\hat{x})$$

28.32



& the current

is

$B 2\pi r = \mu_0 I$

$B =$

$I - I = 0$ (current point opposite)

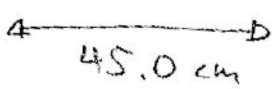
$B = 0$

Inside the wire, the current density $\frac{I}{\pi a^2}$

of curret enclose at a radius r

gives

$I_{max} =$



a) minimum n,

@ r