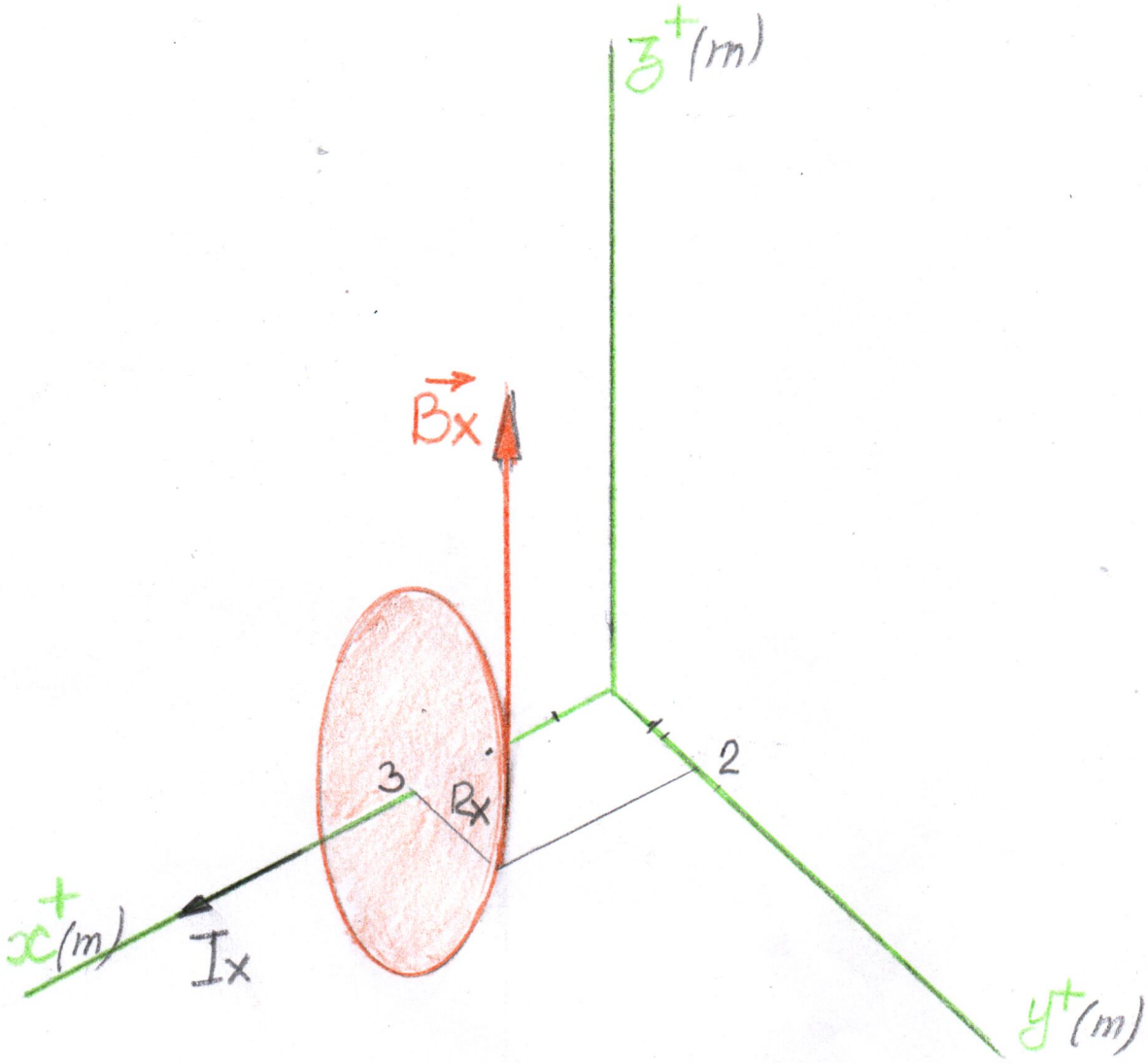
22_1

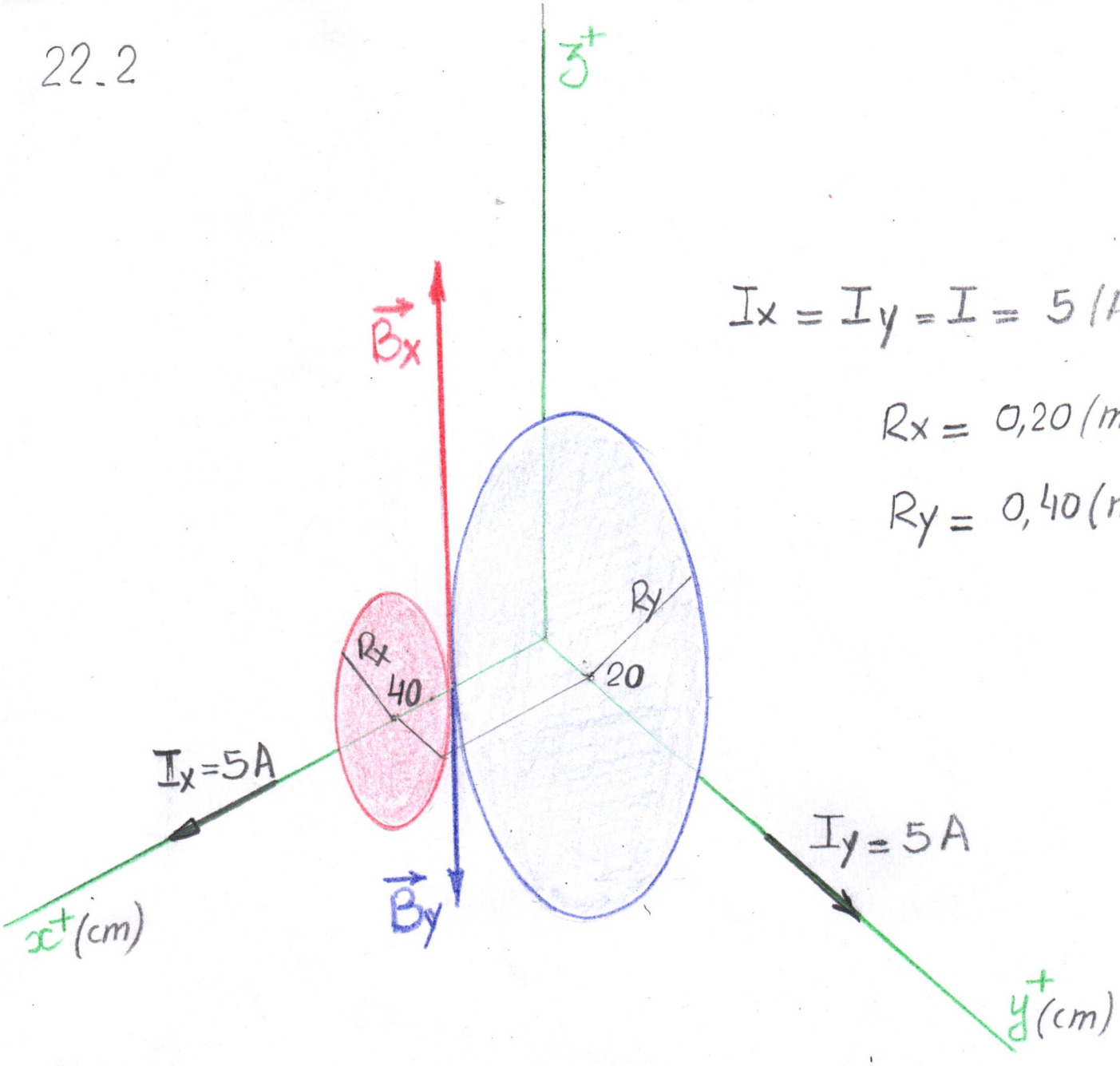


$I_x = 5(A)$

$R_x = 2\,m$

$$\|\vec{B_x}\| = \frac{\mu_0 I_x}{2\pi R_x} = \frac{4\pi 10^{-7} \cdot 5}{2\pi \cdot 2} = 0{,}5\mu T$$

22.2



$I_x = I_y = I = 5\,(A)$

$R_x = 0{,}20\,(m)$

$R_y = 0{,}40\,(m)$

$$\|\vec{B_x}\| = \frac{\mu_0 I_x}{2\pi R_x} = \frac{4\pi 10^{-7} \cdot 5}{2\pi\, 0{,}20} = 5\,\mu T$$

$$\|\vec{B_y}\| = \frac{\mu_0 I_y}{2\pi R_y} = \frac{4\pi 10^{-7} 5}{2\pi\, 0{,}40} = 2{,}5\,\mu T$$

$$\|\vec{B}\|_{(40,20,0)} = \|\vec{B_x}\| - \|\vec{B_y}\| = (5-2{,}5)\,\mu T = 2{,}5\,\mu T$$

paralelo al eje z^+ sentido z^+

22_3

$$I = 10 \ (A)$$
$$\|\vec{B}\| = 100 \ \mu T$$

$$\|B\| = \frac{\mu_0 I}{2\pi R} \longrightarrow R = \frac{\mu_0 I}{2\pi \|\vec{B}\|}$$

$$R = \frac{4\pi 10^{-7} \cdot 10}{2\pi \ 100 \ 10^{-6}}$$

$$R = 0{,}02 \ (m)$$

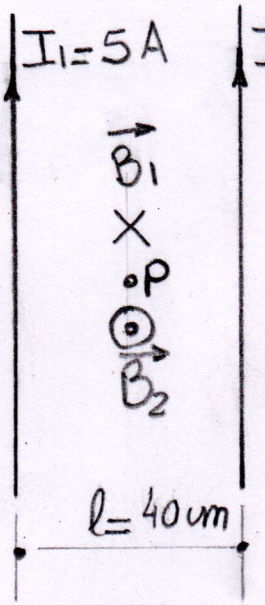
$$\frac{\mu_0}{4\pi} = Km = 10^{-7} \ Wb/A \cdot m$$

$$\mu_0 = 4\pi 10^{-7} \ Wb/A \cdot m$$

$$[B] = (T) = \left(\frac{Wb}{m^2}\right) = \left(\frac{N}{A \cdot m}\right)$$

$$1 \ (T) = 10^4 \ (G)$$

22_4 a)

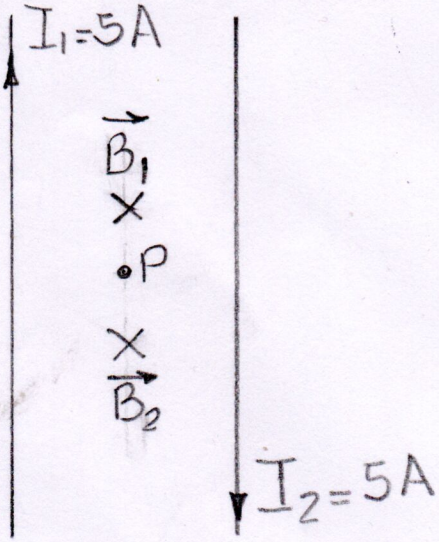


$$\|\vec{B_1}\| = \frac{\mu_0 I_1}{2\pi \frac{l}{2}} = \frac{4\pi 10^{-7} \cdot 5}{2\pi \frac{0{,}40}{2}} = \|\vec{B_2}\|$$

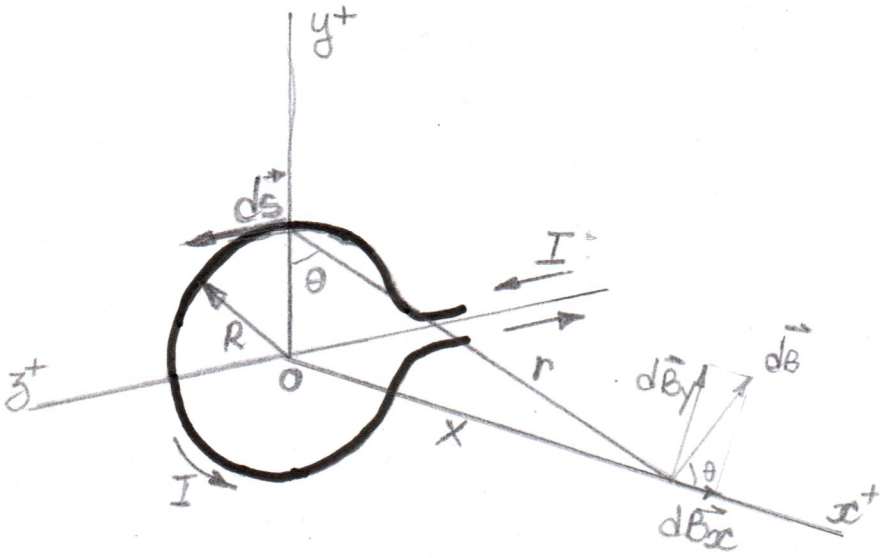
$$\|\vec{B_1}\| = \|\vec{B_2}\| = 5\mu T$$

$$\|\vec{B_P}\| = \|\vec{B_1}\| - \|\vec{B_2}\| = 0\ T$$

b)



$$\|\vec{B_P}\| = \|\vec{B_1}\| + \|\vec{B_2}\| = 10\mu T$$



$$dB = \frac{\mu_0 I}{4\pi} \frac{|ds \times \hat{r}|}{r^2} = \frac{\mu_0 I\, ds}{4\pi (x^2+R^2)}$$

$$B_x = \int dB.\cos\theta = \frac{\mu_0 I}{4\pi} \int \frac{ds\ \cos\theta}{x^2+R^2}$$

$$\cos\theta = \frac{R}{(x^2+R^2)^{1/2}}$$

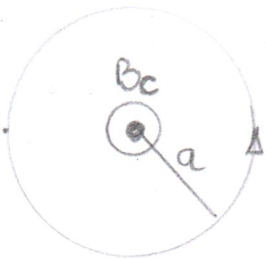
$$B_x = \frac{\mu_0 I R}{4\pi (x^2+R^2)^{3/2}} \oint ds = \frac{\mu_0 I R\, 2\pi R}{4\pi (x^2+R^2)^{3/2}}$$

$$B = \frac{\mu_0 I R^2}{2(x^2+R^2)^{3/2}}$$

$x = 0$ $\qquad B_c = \frac{\mu_0 I}{2R}\ (T)$

$x \gg\gg R$ $\qquad B = \frac{\mu_0 I R^2}{2x^3}\ (T)$

23.1

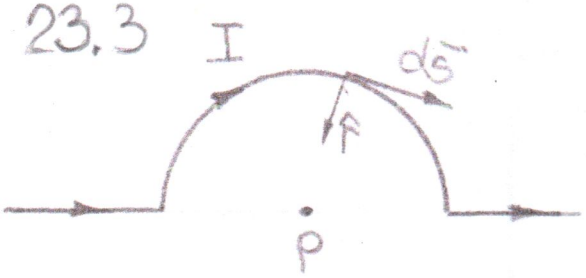


$I = 6(A)$ $\qquad \|\vec{B}\| = 15(\mu T)$

$$\|\vec{B}\| = \frac{\mu_0 I}{2a} = \frac{4\pi 10^{-7} \cdot 6}{2a} = 15(\mu T)$$

$$a = 0{,}251\ (m)$$

23.3



$$dB = \frac{\mu_0 I}{4\pi} \frac{d\vec{s} \times \hat{r}}{R^2}$$

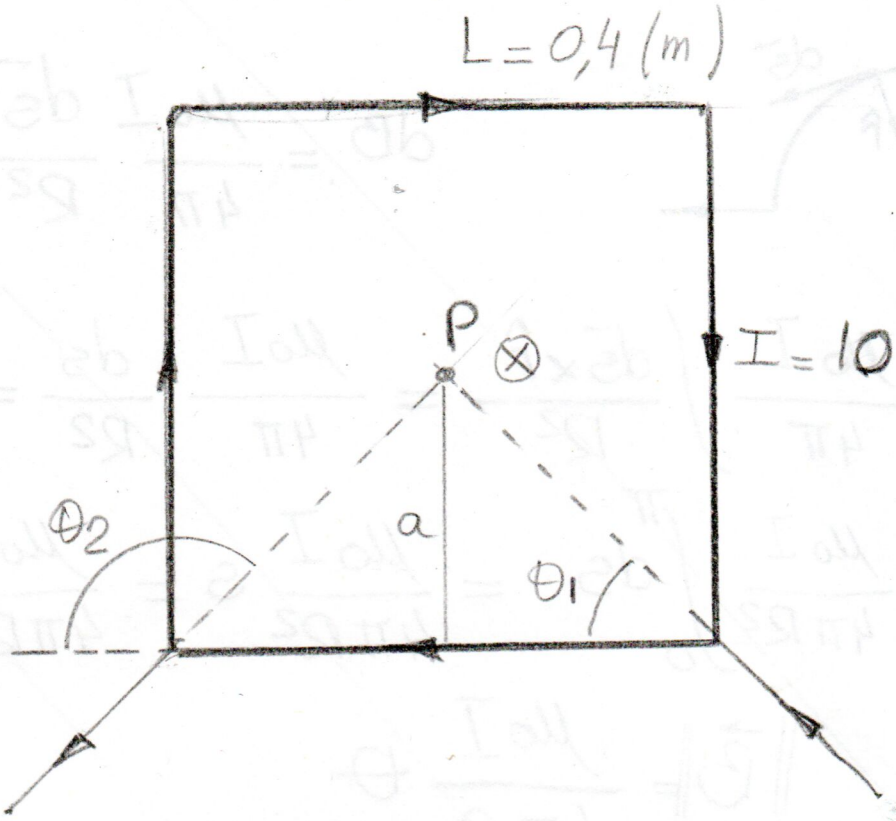
$$B = \frac{\mu_0 I}{4\pi} \int \frac{d\vec{s} \times \hat{r}}{R^2} = \frac{\mu_0 I}{4\pi} \cdot \frac{ds}{R^2} =$$

$$= \frac{\mu_0 I}{4\pi R^2} \int_0^{\pi} ds = \frac{\mu_0 I}{4\pi R^2} s = \frac{\mu_0 I}{4\pi R^2} \theta R$$

$$\|\vec{B}\| = \frac{\mu_0 I}{4\pi R} \theta$$

$$\theta = \pi \qquad \|\vec{B}\| = \frac{\mu_0 I}{4R} \left(T\right)$$

23.4



$a = \frac{L}{2} = 0,2 (m)$

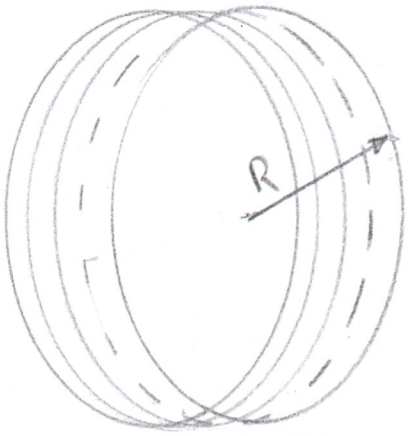
$$\|\vec{B}_P\| = 4 \frac{\mu_0 I}{4\pi \frac{L}{2}} \cdot (\cos 45° - \cos 135°) = 4 \cdot 7,071 \, (\mu T)$$

$$= 28,284 \, (\mu T)$$

$$4 \cdot 0,4 = 2\pi R \longrightarrow R = 0,255 \, (m)$$

$$\|\vec{B}_P\| = \frac{\mu_0 I}{2R} = 24,640 \, (\mu T)$$

23.5



N = ?

$R = 0,1\,(m)$

$I = 10\,(A)$

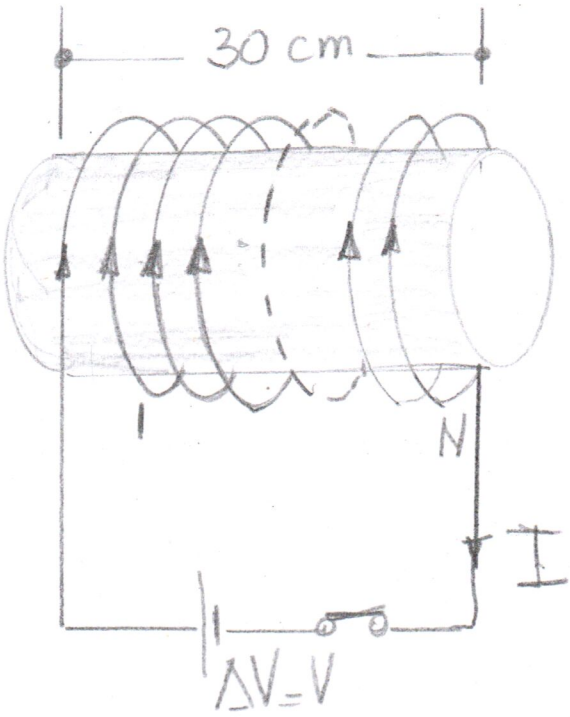
$\|\vec{B}\| = 3\,10^{-3}\,(T)$

$$\|\vec{B}\| = \frac{\mu_0 N I}{2R} = 3\,(mT)$$

$$N = \frac{\|\vec{B}\| \cdot 2 \cdot R}{\mu_0 \cdot I} = 47,7 \text{ espires}$$

N = 48 espires

23.7



N = 2000 espiras

$I = 600(mA) = 0,6(A)$

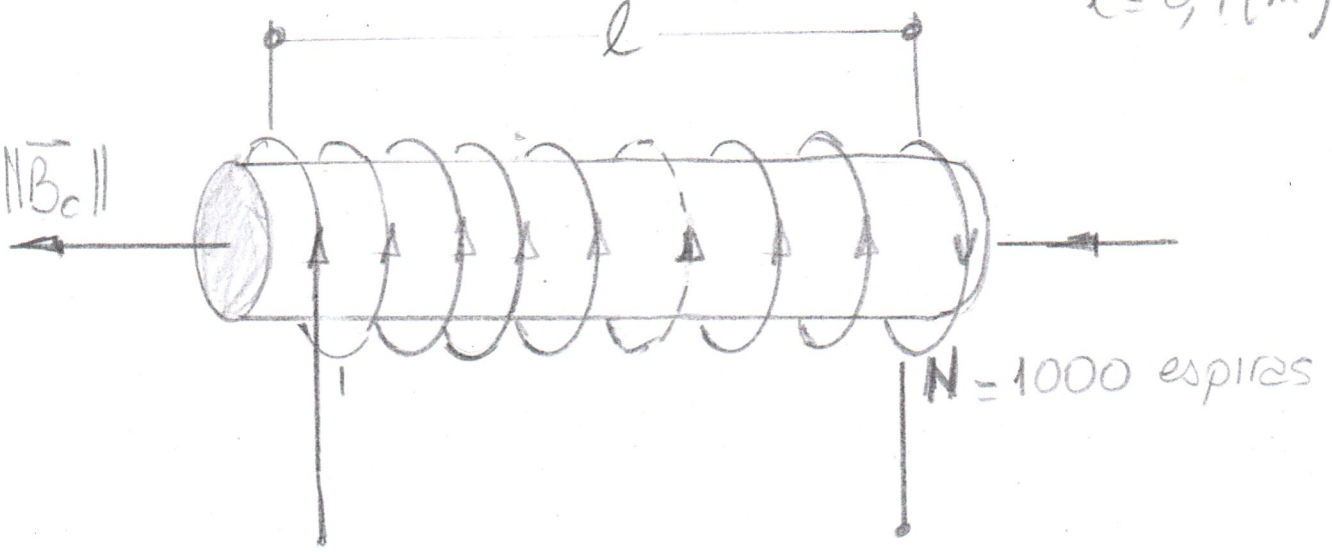
$$\|\vec{B_c}\| = \mu_0 n I = \mu_0 \frac{N}{\ell} I$$

$$= 4\pi 10^{-7} \frac{2000}{0,3} \cdot 0,6 =$$

$$= 5,027\ (mT)$$

23.8

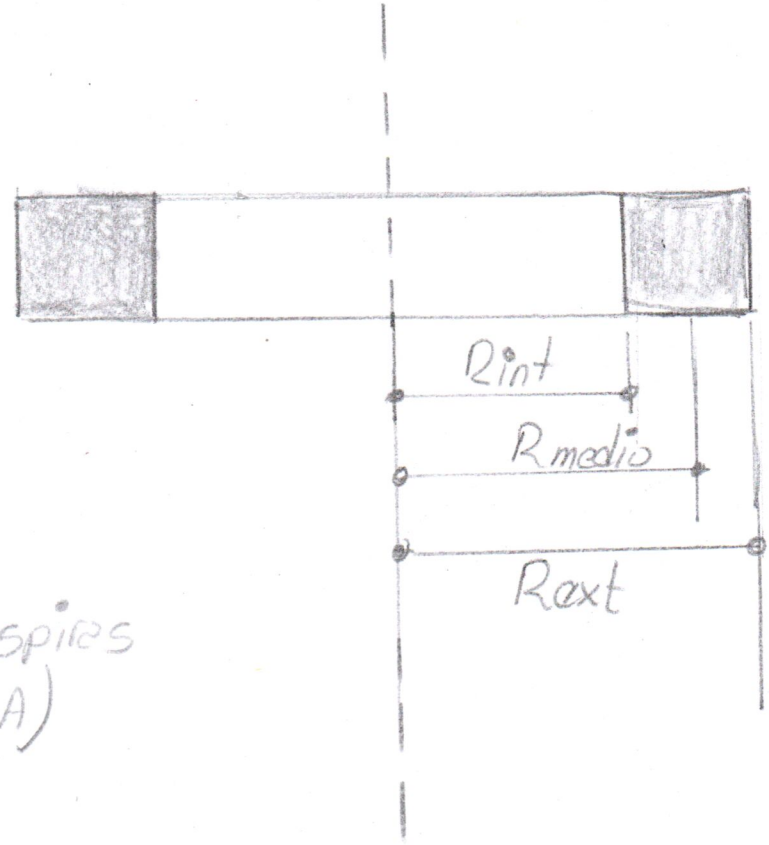
$\ell = 0{,}4\,(m)$



$$\|\vec{B}_c\| = 100(\mu T) = \mu_0 \frac{N}{\ell} \cdot I$$

$$I = \frac{\|\vec{B}_c\| \cdot \ell}{\mu_0 N} = 31{,}83 \;\; 10^{-3}\,(A)$$

24.1



$R_{int} = 4\,(cm)$

$R_{ext} = 6\,(cm)$

$N = 400$ espiras

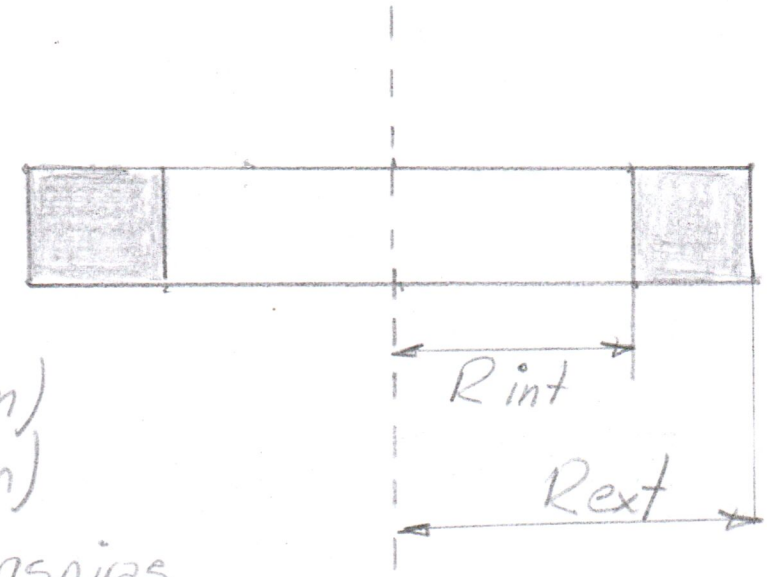
$I_0 = 0{,}5\,(A)$

$$R_{medio} = \frac{R_{int} + R_{ext}}{2} = \frac{0{,}04 + 0{,}06}{2} = 0{,}05\,(m)$$

$$\|\vec{B}\| = \frac{\mu_0 N I_0}{2\pi R_{medio}} = \frac{4\pi 10^{-7} \cdot 400 \cdot 0{,}5}{2\pi \cdot 0{,}05} =$$

$$\|\vec{B}\| = 800\,(\mu T)$$

24.2



$R_{int} = 0,7\ (m)$

$R_{ext} = 1,3\ (m)$

$N = 900$ espiras

$I_0 = 14000\ (A)$

$$\|\vec{B}\|_{Rint} = \frac{\mu_0 N I_0}{2\pi R_{int}} = \frac{4\pi 10^{-7} \cdot 900 \cdot 14000}{2\pi \cdot 0,7} =$$

$$= 3,6\ (T)$$

$$\|\vec{B}\|_{Rext} = \frac{\mu_0 N I_0}{2\pi R_{ext}} = \frac{4\pi 10^{-7} \cdot 900 \cdot 14000}{2\pi \cdot 1,3} =$$

$$= 1,94\ (T)$$