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$$L = \hbar \Rightarrow \hbar = 1,055 \times 10^{-34} \text{ J}\cdot\text{s}$$

$$r = a_0 = \frac{4\pi\epsilon_0 \hbar^2}{m e^2}$$

a)

$$L = I\omega \quad \therefore I = m r^2 \quad ; \quad v = \omega \cdot r$$

$$L = I\omega$$

$$\hbar = m r^2 \cdot \frac{v}{r} \Rightarrow \boxed{r = \frac{\hbar}{m v}}$$

$$F = q \cdot E$$

$$m a = e \frac{k e}{r^2} \Rightarrow m a = \frac{e^2}{4\pi\epsilon_0 \frac{\hbar^2}{m^2 v^2}} \Rightarrow$$

$$m a = \frac{e^2 m^2 v^2}{4\pi\epsilon_0 \hbar^2}$$

$$\frac{v^2}{r} = \frac{e^2 m v^2}{4\pi\epsilon_0 \hbar^2} \Rightarrow \boxed{r = \frac{4\pi\epsilon_0 \hbar^2}{m e^2}}$$

$$r = \frac{4\pi \cdot 8,85 \times 10^{-12} \cdot (1,055 \times 10^{-34})^2}{9,1 \times 10^{-31} \cdot (1,6 \times 10^{-19})^2}$$

$$r = \frac{1,24 \times 10^{-78}}{2,33 \times 10^{-68}} \Rightarrow \boxed{r = 5,32 \times 10^{-11} \text{ m}}$$

b)

$$F = B i l$$

$$m a = B i l \quad \text{como}$$

$$q v B = m a$$

$$q v B = m \frac{v^2}{r}$$

$$\boxed{B = \frac{m v}{r \cdot e}}$$

logo;  $ma = Bil \quad \therefore l = 2\pi r$

$$m \frac{v^2}{r} = \frac{mv^2 \cdot i 2\pi r}{\pi e}$$

$$i = \frac{v \cdot e}{2\pi r} \quad \therefore v = \frac{h}{mr}$$

$$i = \frac{e \cdot h}{2\pi r m r} \Rightarrow i = \frac{e \cdot h}{2\pi m r^2}$$

$$i = \frac{1,6 \times 10^{-19} \cdot 1,055 \times 10^{-34}}{2\pi \cdot 9,11 \times 10^{-31} \cdot (5,32 \times 10^{-11})^2} \Rightarrow \boxed{i = 1,04 \times 10^{-3} \text{ A}}$$

c) O campo magnético p/ uma espira de raio  $r$  é:

$$B = \frac{\mu_0 i}{2r} \Rightarrow B = \frac{4\pi \times 10^{-7} \cdot 1,04 \times 10^{-3}}{2 \cdot 5,32 \times 10^{-11}} \Rightarrow \boxed{B = 12,4 \text{ T}}$$

d)  $\mu_B = iA$

$$\mu_B = \frac{e \cdot h \pi r^2}{2\pi m r^2}$$

$$\frac{\mu_B}{h} = \frac{e}{2m} \Rightarrow \boxed{\frac{\mu_B}{L} = \frac{e}{2m}}$$

$$\mu_B = \frac{eL}{2m} \Rightarrow \mu_B = \frac{1,6 \times 10^{-19} \cdot 1,055 \times 10^{-34}}{2 \cdot 9,11 \times 10^{-31}} = \frac{1,69 \times 10^{-53}}{1,82 \times 10^{-30}} \Rightarrow$$

$$\boxed{\mu_B = 9,3 \times 10^{-24} \text{ A} \cdot \text{m}^2}$$

