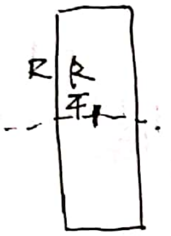
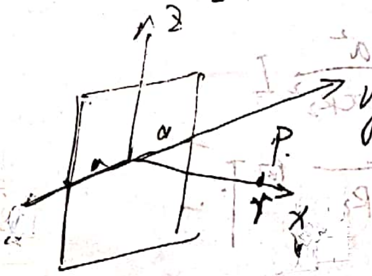
5.7.




(1). $B=\frac{\mu_0 n I}{2}\left(\frac{\frac{R}{4}}{\sqrt{R^2+(\frac{R}{4})^2}}-\frac{-\frac{R}{4}}{\sqrt{R^2+(\frac{R}{4})^2}}\right)=\frac{\mu_0 n I}{2}\cdot\frac{\frac{1}{2}}{\frac{\sqrt{17}}{4}}=\frac{\sqrt{17}\mu_0 n I}{17}\approx 6\times10^{-4}T$

(2) $B=\frac{\mu_0 n I}{2}\frac{\frac{R}{2}}{\sqrt{(R)^2+(\frac{R}{2})^2}}=\frac{\mu_0 n I}{2}\cdot\frac{\frac{1}{2}}{\frac{\sqrt{5}}{2}}=\frac{\sqrt{5}\mu_0 n I}{10}\approx 5.6\times10^{-4}T$




5.8. 由对称性可知磁场沿y轴向.

$B_x=B_z=0$.

面电流密度 $i=\frac{I}{2a}$

$dB=\frac{\mu_0}{2\pi}\cdot\frac{i\,dy}{r}=\frac{\mu_0}{2\pi}\frac{i\,dy}{\sqrt{x^2+y^2}}$ $\quad dB_y=dB\frac{x}{\sqrt{x^2+y^2}}=\frac{\mu_0 i x\,dy}{2\pi(x^2+y^2)}$

$B=\int dB=\int_{-a}^{a}\frac{\mu_0}{2\pi}\frac{i\,dy}{\sqrt{x^2+y^2}}$ $\quad B_y=\int dB_y=\frac{\mu_0 I x}{4\pi a}\int_{-a}^{a}\frac{dy}{x^2+y^2}$,

$B_y=\frac{\mu_0 I x}{4\pi a}\cdot 2\cdot\frac{1}{x}\cdot\arctan\frac{a}{x}=\frac{\mu_0 I}{2\pi a}\arctan\frac{a}{x}$.

5.10. (1). $\oint\vec{B}\cdot d\vec{l}=\mu_0\frac{\pi r^2}{\pi a^2}I=2\pi rB$.

$B=\frac{\mu_0 r I}{2\pi a^2}$

(2) $\oint\vec{B}\cdot d\vec{l}=\mu_0 I=2\pi rB$

$B=\frac{\mu_0 I}{2\pi r}$.

(3). $2\pi rB=\mu_0\left(I-\frac{\pi r^2-\pi b^2}{\pi c^2-\pi b^2}I\right)=\mu_0\frac{c^2-r^2}{c^2-b^2}I$

$B=\frac{\mu_0(c^2-r^2)}{2\pi r(c^2-b^2)}I$.

(4) $2\pi rB=0$.

$B=0$.

5.11 (1) $B_{大}=0$.

$B_{小}$: $2\pi a B = \mu_0 \cdot \frac{\pi R_2^2}{\pi R_1^2 - \pi R_2^2} I$.

$B_{小} = \frac{\mu_0 R_2^2 I}{2\pi a (R_1^2 - R_2^2)}$ 向上.

$B = B_{大} - B_{小} = \frac{\mu_0 R_2^2 I}{2\pi a (R_1^2 - R_2^2)}$ 向下.

(2). $B_{小}=0$.

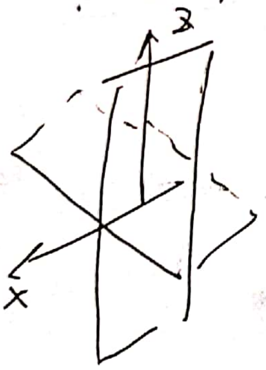
$B_{大}$: $2\pi a B = \mu_0 \frac{\pi a^2}{\pi R_1^2 - \pi R_2^2} I$

$B = B_{大} - B_{小} = \frac{\mu_0 a I}{2\pi (R_1^2 - R_2^2)}$ 向下.

(3). ① $B \approx 2\times10^{-6}$ T.

② $B \approx 2\times10^{-4}$ T.

5.12. 对于xz平板



$B$沿$\hat{x}$方向:

$\oint \vec{B} d\vec{x} = \mu_0 i x = 2 x B$

$B = \frac{\mu_0 i}{2}$ $\begin{cases} y<0, & \vec{B} = \frac{\mu_0 i}{2}\hat{x} \\ y>0, & \vec{B} = \frac{-\mu_0 i}{2}\hat{x}. \end{cases}$

同理对于xy平板:

$B = \frac{\mu_0 i}{2}$ $\begin{cases} z>0, & \vec{B} = \frac{\mu_0 i}{2}\hat{x}. \\ z<0. & \vec{B} = -\frac{\mu_0 i}{2}\hat{x}. \end{cases}$

$y^+z^+$空间: $\vec{B} = \frac{-\mu_0 i}{2}\hat{x} + \frac{\mu_0 i}{2}\hat{x} = 0$

$y^+z^-$: $\vec{B} = -\mu_0 i \hat{x}$

$y^-z^+$: $\vec{B} = \mu_0 i \hat{x}$,

$y^-z^-$: $\vec{B} = 0$

5.13. (1). $2\pi r B = \mu_0 N I$.

$$B = \frac{\mu_0 N I}{2\pi r}$$

(2) $\Phi = \iint B \cdot dS = \int_{\frac{d_1}{2}}^{\frac{d_2}{2}} \frac{\mu_0 N I}{2\pi r} \cdot h \cdot dr = \frac{\mu_0 N I h}{2\pi} \ln\frac{d_2}{d_1}$.

5.15. (1) $F_{向} = m\frac{v_\perp^2}{R} = q v_\perp B$

$\rightarrow \cancel{R = \frac{m v_\perp}{qB} = 0.02m}$ $\quad v_\perp = \frac{qBR}{m} = \frac{1.6\times10^{-19}\times 20\times10^{-4}\times 2\times10^{-2}}{9.1\times10^{-31}} \approx 7.03\times10^{6}\, m/s$.

$$T = \frac{2\pi R}{v_\perp} = \frac{2\pi m}{qB} \approx 1.79\times10^{-8} s.$$

$$v_\parallel = \frac{h}{T} = \frac{hqB}{2\pi m} \approx 2.8\times10^{6}\, m/s$$

$$v = \sqrt{v_\perp^2 + v_\parallel^2} \approx 7.57\times10^{6}\, m/s.$$

(2). ~~[illegible]~~ B沿y轴正方向.

5.16. (1). 无法判断…… 不知道~~[illegible]~~左右两面电压正负.

(2). $F = qvB = Eq = \frac{U}{b}\cdot q$.

$$v = \frac{U}{bB}$$

$$bav\rho = I \rightarrow \rho = \frac{I}{bav} = \frac{IB}{Ua} = nq$$

$$n = \frac{IB}{Uaq} = \frac{[illegible]\times 3\times10^{-1}}{6.55\times10^{-3}\times1.6\times10^{-19}} \approx 2.86\times10^{20}\,个/m^3.$$

7. $F_{向0} = qvB_0 = \frac{mv_0^2}{R_0}$ , $R_0 = \frac{mv_0}{qB_0}$

$\mu_0 = \pi R_0^2 \cdot I = \pi R_0^2 \cdot q \cdot \frac{v_0}{2\pi R_0} = qv_0 \cdot \frac{mv_0}{2qB_0} = \frac{mv_0^2}{2B_0}$ 守恒

$F_{向1} = qvB = \frac{mv^2}{R}$.

$\mu_0 = \mu_1 = \frac{mv_0^2}{2B_0}$

$\to v = \sqrt{\frac{B}{B_0}}\, v_0$.

$R = \frac{mv}{qB} = \frac{m v_0}{q\sqrt{BB_0}}$.

扫描全能王 创建