3-17. $\because B = \frac{\mu_0 I_1}{2\pi R \cancel{\cos\theta} \sin\theta}$　设电流元与圆心所连半径与 I_1 夹角为 θ.

$\therefore dF = I_2 dl \cdot B\sin\theta = I_2 \cdot R d\theta \cdot \frac{\mu_0 I_1 \sin\theta}{2\pi R \sin} = \frac{\mu_0 I_1 I_2}{2\pi} \cancel{\cos\theta} d\theta$

$F = 2\int_0^{\frac{\pi}{2}} dF = \frac{\mu_0 I_1 I_2}{2}$　方向向右

3-19. 设电流线密度为 i.　$\int (\vec{B_2} - \vec{B_0}) d\vec{l} + \int_L (\vec{B_1} - \vec{B_0}) d\vec{l}$

则在板左右取矩形回路. $\cancel{\int_{L_2} \vec{B_2} d\vec{l} + \int_{L_1} \vec{B_1} d\vec{l}} = \mu_0 i l$

$B_2 l - B_1 l = \mu_0 i l$　$\because B_0 = \frac{B_1 + B_2}{2}$

$i = \frac{B_2 - B_1}{\mu_0}$

单位面积下. $F = i\int_L dl \cdot B_0 + i\int_L dl \cdot B_0 = \frac{(B_1+B_2)(B_2-B_1)}{2\mu_0}$

3-21. $\because T = \frac{2\pi}{\omega}$　$\cancel{I = \frac{Q}{T} = \frac{Q\omega}{2\pi}}$　$dI = \frac{Q}{l} \cdot \frac{\omega}{2\pi} dx$

$\therefore \cancel{B = \int_0^l \frac{\mu_0 I}{2R} dR =}$

$\therefore dm = \frac{\omega Q}{2\pi l} \cdot \pi x^2 dx$

$m = \int_0^l \frac{\omega Q}{2l} x^2 dx = \frac{\omega Q l^2}{6}$　方向与旋转方向符合右手定则

3-23. $\because \int_t F dt = \int_t I(\int_L dl) \cdot B \cdot dt = BL\int_t I dt = BLq$

$\because BLq = mv_0$　$v_0 = \frac{BLq}{m}$

$\therefore mgh = \frac{1}{2} m v_0^2 = \frac{(BLq)^2}{2m}$

$\therefore q = \sqrt{\frac{2m^2 gh}{B^2 L^2}} = \frac{m}{BL}\sqrt{2gh}$.

实验报告

课程名称：大物　　实验名称：________　　实验日期：______年______月______日

班　　级：________　　教学班级：________　　学　　号：________　　姓　　名：刘昱尘

3-25. $\because T=\frac{2\pi m}{Bq}=3.58\times10^{-10}S$

$h=V_{\parallel}T=\frac{2\pi mV\cos\theta}{Bq}$

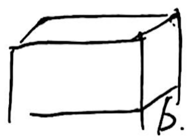
$r=\frac{mV\sin\theta}{Bq}$

$\because V=\sqrt{\frac{2Ee}{me}}=2.65\times10^{7}m/s$

$\therefore h=1.66\times10^{-4}m\qquad r=1.51\times10^{-3}m$

3-28. $\because U_H=\frac{IB}{nbq}$

$B=\frac{U_Hnbq}{I}=0.1T$



3-29. ∵ 当 $r<R_1$. $\oint \vec{H_1} d\vec{l} = \frac{\pi r^2}{\pi R_1^2} I$

$$H_1 \cdot 2\pi r = \frac{r^2}{R_1^2} I$$

$$H_1 = \frac{rI}{2\pi R_1^2}$$

$$B_1 = \mu_1 H = \frac{\mu_1 r I}{2\pi R_1^2}$$ 方向顺时针

当 $R_1<r<R_2$ $\oint \vec{H_2} d\vec{l} = I$

$$H_2 = \frac{I}{2\pi r}$$

$$B_2 = \frac{\mu_2 I}{2\pi r}$$ 方向同 B_1

$r>R_2$. $H_3 = B_3 = \frac{I}{2\pi r}$ 方向同 B_1

3-30. $\oint \vec{H} d\vec{l} = nIl$

$$\vec{H} l = nIl$$

$$H = nI$$

$B = \mu_0 \mu_r H = \mu_0 \mu_r n I$ 方向遵循右手螺旋

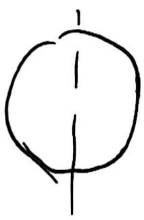
$M = (\mu_r - 1) H = (\mu_r - 1) nI$

$\vec{j} = \vec{M} \times \vec{e_n} = (\mu_r - 1) nI$ 方向沿介质圆面切向

4-1. $\psi = 2\Phi = 2\int_a^{a+b} \frac{\mu I}{2\pi x} l \, dx = \frac{\mu I_0 l \sin\omega t}{\pi} \ln \frac{a+b}{a}$

$\therefore \mathcal{E} = -\frac{d\psi}{dt} = -\frac{\mu I_0 l \omega}{\pi} \cos\omega t \ln \frac{a+b}{a}$.

4-2. ∵ $\psi = NBS = NB \cdot \pi R^2 \cos\theta$



$= NB\pi R^2 \cos\omega t$

$\therefore \mathcal{E} = NB\pi R^2 \omega \sin\omega t$　　$\mathcal{E}_{max} = NB\pi R^2 \omega$

设起始面线圈平面与 B 垂直. 则 $\mathcal{E}_{max}$ 出现在 $t = \frac{(2n-1)\pi}{2\omega}$ $(n=1,2,3\ldots)$ 时

即 $\sin\omega t = 1$