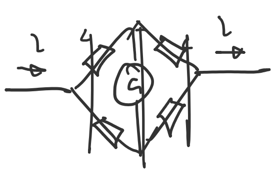
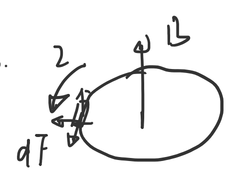
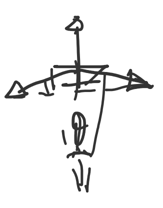
课后题

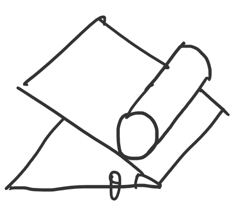
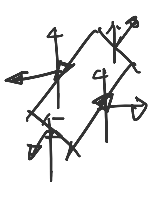
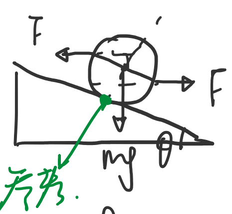
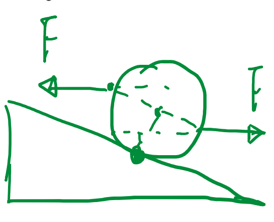
2022年5月5日 星期四　　上午11:13

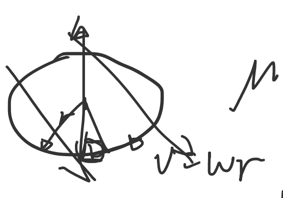
1. $F = Il \times B = 3\times 0.1 \times \begin{vmatrix} x & 4 & 8 \\ -1 & 4 & 3 \\ 2 & -3 & 5 \end{vmatrix} = 0.3\,(29, 12, -5)$ $\frac{}{\sqrt{1+16+9}}$ $\times\ \sqrt{}\ \frac{1}{|e|}$

2. 
$F = Il_{\triangle} B = \frac{\sqrt{2}}{2} aB$ 外.
$I_B = \sqrt{2} I_C B$

3. 
$dF = I dl \cdot B$
$= 2T s\, d\frac{\theta}{2}$
$= T d\theta$

$F = 2\pi R I B.\quad T = \frac{F}{\theta} = RIB = \_\_\_$

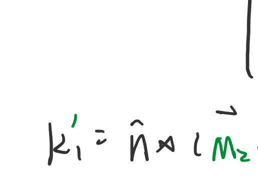
4. $F = Il \times B = \frac{q}{\Delta t} lB = ma$
$F\Delta t = mv.\quad v = \sqrt{2gh}.$
$\therefore q l B = mv,\quad q = \frac{mv}{lB} = \frac{m\sqrt{2gh}}{lB} = \_\_\_.$

5.  

$FR\sin\theta + FR\sin\theta = fR.$
$2F\sin\theta = f = mg\sin\theta$
$f = mg\sin\theta.\quad F = \frac{mg}{2}.$
$F = nIlB \geq \frac{mg}{2}.$
考虑. $mg\sin\theta = N$

磁矩 $NIS = 2NIRl$. 与斜面垂直.
力矩 $2NIRlB\sin\theta$.
$\therefore 2N \cdot 2RlB = mgR,\quad I_{min} = \frac{mg}{2NlB}.$

6. 
$\mu = NIS = IS$
$v = \omega r$
$dI = \frac{dq}{dt} = \frac{\sigma r dr d\theta}{dt} = \sigma\omega r dr$
$L = r\times F = r\times dI\,dl\,B$

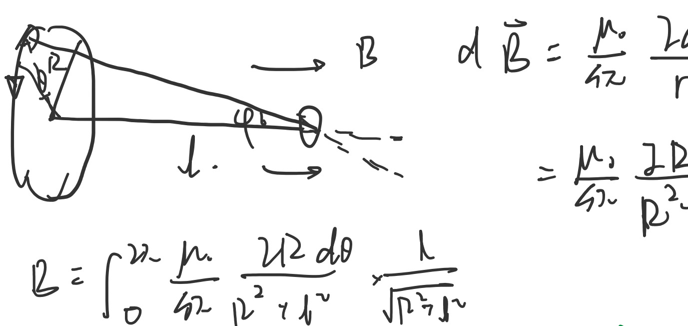
$\vec{L} = \vec{m}\times\vec{B}$
$d\vec{F} = dq\,\vec{v}\times\vec{B}$
$\mu = \int_0^R \pi r^2 dI$
$= \int_0^R \pi r^2 \sigma\omega r\, dr$
$L = \mu B.$

8. 略了比赛了..

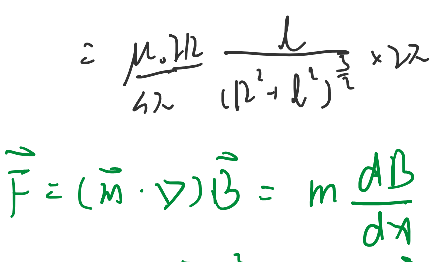
9. $H\times 2\pi r = I.$

$r < R_1,\ H = \frac{1}{2\pi r}\times\frac{r^2}{R_1^2} I.$
$R_1 < r < R_2,\ H = \frac{1}{2\pi r} I.$
$r > R_2,\ H = \frac{1}{2\pi r} I.$

$\therefore B = \frac{H}{\mu} = \begin{cases} \frac{\mu_0 r}{2\pi R_1^2} I, & r < R_1 \\ \frac{\mu}{2\pi r} I, & R_1 < r < R_2 \\ \frac{\mu_0}{2\pi r} I, & r > R_2 \end{cases}$

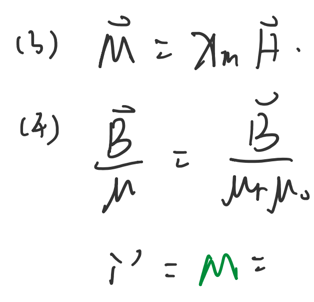
$K_1' = \hat{n}\times(\vec{M_2} - \vec{M_1}) = \frac{I}{2\pi}\left(\frac{\mu_0 r}{R_1^2} - \frac{\mu}{r}\right),\ r = R_1,\ \frac{I}{2\pi R_1}(\mu_0 - \mu)$
$K_2' = \hat{n}\times(\vec{M_3} - \vec{M_2}) = \frac{I}{2\pi r}(\mu_0 - \mu),\ \frac{I}{2\pi R_2}(\mu_0 - \mu)$

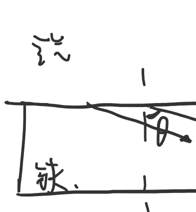


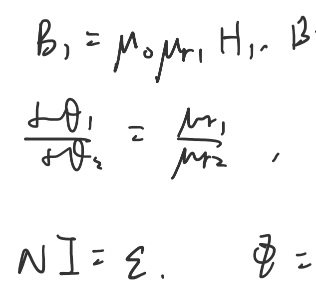
$\vec{B_2} \to \vec{M}.$
$\vec{m} = \vec{M} V$
$\vec{P} = \frac{\Sigma\vec{P}}{V}.$
$W = \vec{m}\cdot\vec{B}$
$F = -\nabla(\vec{m}\cdot\vec{B})$

10. 
$d\vec{B} = \frac{\mu_0}{4\pi}\frac{I dl}{r^2}$
$= \frac{\mu_0}{4\pi}\frac{IR\,d\theta}{R^2 + l^2}$
$B = \int_0^{2\pi}\frac{\mu_0}{4\pi}\frac{IR\,d\theta}{R^2+l^2}\frac{l}{\sqrt{R^2+l^2}}$
$= \frac{\mu_0 IR}{4\pi}\frac{l}{(R^2+l^2)^{\frac{3}{2}}}\times 2\pi = \frac{\mu IR^2 l}{2(R^2+l^2)^{\frac{3}{2}}}.\quad V = \frac{4}{3}\pi r^3 = \frac{m}{\rho}.$

$\vec{F} = (\vec{m}\cdot\nabla)\vec{B} = m\frac{dB}{dx}\vec{e_x}$
$\vec{m} = MV = \chi_m H V$
$= \chi_m\frac{B}{\mu} = \chi_m\frac{B}{\mu_0\mu_r} = \chi_m\frac{B}{\mu_0(1+\chi_m)}$
$= \frac{\chi_m}{\mu_0}\frac{\mu_0 IR^2}{2(R^2+l^2)^{\frac{3}{2}}}\frac{\mu_0 IR^2}{2}\frac{\frac{3}{2}(R^2+l^2)^{\frac{1}{2}}2l}{(R^2+l^2)^3}\approx\frac{\chi_m B}{\mu_0}\frac{m_0}{\rho}$
$= \frac{3}{4}\frac{\chi_m\mu_0 I^2R^4 l}{(R^2+l^2)^4}\frac{m}{\rho}\approx \cdots$

11. 
$I = 20A.$
$B = 1T.$
$N = \frac{400}{0.4m}$
(1) $H\cdot 2\pi r = NI,$
$H = \frac{NI}{c} = \frac{400\times 20}{0.4} = 20000$
(2) $\frac{\vec{B}}{\mu_0} - \vec{M} = \vec{H}.$
$\vec{M} = \frac{\vec{B}}{\mu_0} - \vec{H} = \frac{B}{\mu_0} - \frac{NI}{c}$
(3) $\vec{M} = \chi_m\vec{H}.\quad \chi_m = \frac{M}{H} =$
$\vec{B} = \mu_0\vec{M} + \mu_0\vec{H}$
(4) $\frac{\vec{B}}{\mu} = \frac{\vec{B}}{\mu_r\mu_0} = \vec{H},\quad \mu_r = \frac{B}{H\mu_0} =$
$i' = M =$

12. 
$H\cdot 2\pi r = \frac{\pi r^2}{\pi a^2} I,\quad H = \frac{r^2}{2\pi r a^2} I = \frac{rI}{2\pi a^2}.$
$B = \mu H = \frac{\mu r I}{2\pi a^2}.$
$j' = M = \frac{B}{\mu_0} - H = \frac{\mu H}{\mu_0} - H = \left(\frac{\mu}{\mu_0} - 1\right)H = \left(\frac{\mu}{\mu_0} - 1\right)\frac{rI}{2\pi a^2}.$
$r = a$ 处 $i' = \frac{I}{2\pi a}\left(\frac{\mu}{\mu_0} - 1\right).$

13. 
$\frac{\tan\theta_1}{\tan\theta_2} =$
B 法向连续. $B_{n1} = B_{n2}$. $B_1\cos\theta_1 = B_2\cos\theta_2$
$B_1 = \mu_0\mu_{r1}H_1.\ B_2 = \mu_0\mu_{r2}H_2,\ \frac{H_1}{\mu_{r1}}\cos\theta_1 = \frac{H_2}{\mu_{r2}}\cos\theta_2$
$\frac{\tan\theta_1}{\tan\theta_2} = \frac{\mu_{r1}}{\mu_{r2}},\quad \tan\theta_1 = \frac{1}{7500}\times\tan 85^\circ,\ \theta_1 = \cdots.$

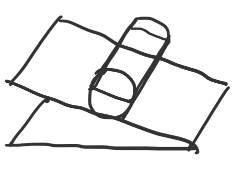
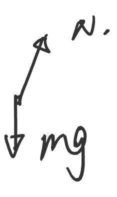
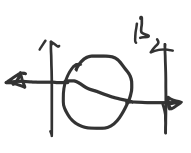
17. $NI = \varepsilon.\quad \Phi = BA.$
$NI = 3B_0Al + B_0A(l-d) + BAd.$
$H\times 4l = NI,\ H = \frac{NI}{4l}.\quad B_0 = \frac{NI}{4l\mu_0}$
$B = \frac{NI - 3B_0Al - B_0A(l-d)}{Ad} = \frac{NI - 3\frac{NI}{4l\mu_0}Al - \frac{NI}{4l\mu_0}A(l-d)}{Ad}$
$= \frac{NI}{Ad}\left(1 - \frac{4A}{4\mu_0} + \frac{Ad}{4\mu_0 l}\right) = \frac{NI}{Ad}\left(1 - \frac{A}{\mu_0}\right) + \frac{NI}{4\mu_0 l}.$
$NI = \left(\frac{4l-d}{\mu A} + \frac{d}{\mu_0 A}\right)\Phi_B$　$B = \frac{\mu\mu_0 NI}{(\mu-\mu_0)d + 4\mu_0 l}.$

18.
$NI = \left(\frac{l - 0.1m}{\mu S} + \frac{0.1m}{S}\right)BS$
$= \frac{1}{\mu}(l - 0.1m) + 0.1m$

19. $\varepsilon = \left(\frac{L}{\mu_0 S} + \frac{\frac{3L}{\mu_0 S}\times\left(\frac{3L-d}{\mu_0 S} + \frac{d}{\mu S}\right)}{\frac{3L}{\mu_0 S} + \frac{2L}{\mu_0 S} + \frac{L-d}{\mu_0 S} + \frac{d}{\mu S}}\right)BS$ ×

$= \left(\frac{L}{\mu_0 S} + \frac{\frac{3L(3L-d)}{\mu_0^2 S^2} + \frac{3Ld}{\mu_0\mu S^2}}{\frac{6L-d}{\mu_0 S} + \frac{d}{\mu S}}\right)BS$

$= \left(\frac{L}{\mu_0 S} + \frac{3L(3L-d)\frac{\mu}{\mu_0} + 3Ld}{(6L-d)\mu S + d\mu_0 S}\right)BS$
$= \frac{L}{\mu_0} + \frac{(9L^2 - 3Ld)\mu + 3Ld\mu_0}{(6L-d)\mu\mu_0 + \mu_0^2 d}B$ ×
$B = \frac{\left(\varepsilon - \frac{L}{\mu_0}\right)\left[(6L-d)\mu\mu_0 + \mu_0^2 d\right]}{(9L^2 - 3Ld)\mu + 3Ld\mu_0}$

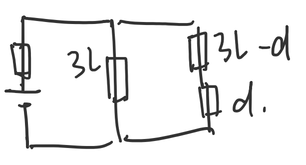
5.  


6. $m = IS = \frac{\sigma\pi R^2}{\frac{2\pi}{\omega}}\times\pi R^2 = \frac{1}{2}\sigma\pi\omega R^4.$
$m = \int_0^R \pi r^2 dI = \int_0^R \pi r^2\sigma\omega r\,dr = \frac{1}{4}\sigma\pi\omega R^4.\quad L = mB.$

10. $B = \frac{\mu_0}{4\pi}\int_0^{2\pi}\frac{IR\,d\theta}{R^2+l^2}\frac{l}{\sqrt{R^2+l^2}} = \frac{\mu_0}{4\pi}\frac{2\pi IRl}{(R^2+l^2)^{\frac{3}{2}}}.$
$M = mV =$

17.

18. $NI = B_0 S\frac{l}{\mu_0 S} + BS\frac{d}{\mu S}.$

19. 
$\varepsilon = B_0 S\frac{L}{\mu_0 S} + B_0 S\frac{3L}{\mu_0 S} = \frac{4B_0}{1200\mu_0}L =$
$\varepsilon = B_0 S\frac{L}{\mu_0 S} + B_0 S\frac{3L - l_g}{\mu_0 S} + BS\frac{l_g}{\mu_0}$　$\frac{B_0}{1200\mu_0} = \frac{\varepsilon}{4L}$
$= \frac{B_0 L}{1200\mu_0} + \frac{B_0(3L - l_g)}{1200\mu_0} + \frac{Bl_g}{\mu}$
$\varepsilon = \frac{\varepsilon}{4L}\times L + \frac{\varepsilon}{4L}(3L - l_g) + \frac{Bl_g}{\mu_0}$
$\frac{l_g}{4L}\varepsilon = \frac{Bl_g}{\mu_0}$