9.32 (1) $C=\dfrac{2\pi\varepsilon_0\varepsilon_r L}{\ln(b/a)}$ (2) $A=\dfrac{\pi\varepsilon_0 L}{\ln(b/a)}(\varepsilon_r-1)U^2$

(3) $\dfrac{\pi\varepsilon_0 L}{\ln(b/a)}(\varepsilon_r-1)\varepsilon_r U^2$

9.33 (1) $\dfrac{e^2}{8\pi\varepsilon_0 r_0}$ (2) $\dfrac{e^2}{40\pi\varepsilon_0 r_0}$ (3) $\dfrac{3e^2}{20\pi\varepsilon_0 r_0 c^2}$ (4) $\dfrac{3e^2}{20\pi\varepsilon_0 m_0 c^2}$

9.34 (1) 2:1 (2) 1:2 (3) 2:9

9.35 1.9×10^{-2} J

9.36 $2\pi\varepsilon_0 R_1 R_2 U^2/(R_2-R_1)$

第 十 章

10.1 (1) B (2) C (3) D (4) C

10.2 (1) 正西方向 (2) $\mu_0 I$,0,$2\mu_0 I$ (3) $\mu_0 i$,沿轴线方向朝右

(4) N 型,P 型

10.3 (1) 0 (2) 0.24 Wb (3) −0.24 Wb

10.4 $B_P=\dfrac{\mu_0 NIR^2}{2}\left\{\dfrac{1}{\left[R^2+\left(\dfrac{R}{2}-x\right)^2\right]^{3/2}}+\dfrac{1}{\left[R^2+\left(\dfrac{R}{2}+x\right)^2\right]^{3/2}}\right\}$

$B_O=0.72\dfrac{\mu_0 NI}{R}$, $B_{O_1}=B_{O_2}=0.68\dfrac{\mu_0 NI}{R}$

10.5 $B=\dfrac{\mu_0 qv}{4\pi l}\left(\dfrac{1}{a}-\dfrac{1}{a+l}\right)=5.00\times10^{-16}$T

10.6 $\dfrac{2}{3}\mu_0\varepsilon_0 U\omega$

10.7 $\dfrac{\mu_0\sigma\theta\omega R}{4\pi}$

10.8 (1) $\dfrac{\lambda\mu_0\omega}{4\pi}\ln\dfrac{a+b}{a}$ (2) $\dfrac{\lambda\omega}{6}[(a+b)^3-a^3]$ (3) $\dfrac{\mu_0\omega q}{4\pi a}$, $\dfrac{1}{2}q\omega a^2$

10.9 $\dfrac{\mu_0 NI}{4R}$

10.10 $\boldsymbol{B}=-\dfrac{\mu_0 j}{2}\boldsymbol{i}(z>0)$, $\boldsymbol{B}=-\dfrac{\mu_0 j}{2}\boldsymbol{i}(z<0)$

10.11 (1) $\dfrac{\mu_0 Ir^2}{2\pi d(R^2-r^2)}$ (2) $\dfrac{\mu_0 d}{2}\cdot\dfrac{I}{\pi(R^2-r^2)}$

10.12 $B=\dfrac{\mu_0 NI}{2\pi r}$, $\Phi=\dfrac{\mu_0 NIh}{2\pi}\ln\dfrac{R_2}{R_1}$

8.10 4.5 年,0.2 年

8.11 (1) 2.25×10^{-7} s (2) 3.75×10^{-7} s

8.12 (1) $L\sqrt{1-v^2/c^2}$ (2) $\dfrac{L\sqrt{1-v^2/c^2}+l_0}{v}$

8.13 $t_1'-t_2'=5.77\times10^{-6}$ s

8.14 (1) 5.82×10^{-13} J (2) 0.08

8.15 $\dfrac{m_0}{v_0(1-v^2/c^2)}$

8.16 (1) $\dfrac{m}{LS}$ (2) $\dfrac{25\,m}{9\,LS}$

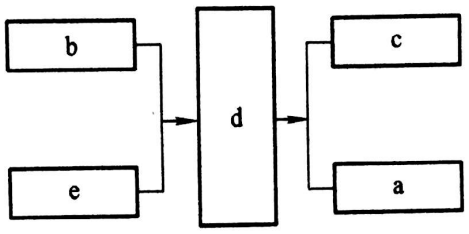
8.17 0.866c,0.786c

8.18 1.798×10^{4} m

第 九 章

9.1 (1) A (2) C (3) C (4) A

9.2 (1) $\dfrac{q}{4\pi\varepsilon_0 r^2}$,0 (2) 负,8.85 $\times10^{-10}$ C/m^2 (3) 答案见图 (4) 2:1,1:2



9.2(3)解图

9.3 $\dfrac{qQ}{\pi\varepsilon_0(4a^2-L^2)}$

9.4 $\dfrac{q}{\pi^2\varepsilon_0 R^2}$,+$x$ 方向

9.5 $\dfrac{\lambda_0}{4\varepsilon_0 R}$,-$x$ 方向

9.6 $\dfrac{\sigma}{4\varepsilon_0}$,-$x$ 方向

9.7 $\dfrac{Q}{4\pi\varepsilon_0 L}\left(\dfrac{1}{R}-\dfrac{1}{\sqrt{R^2+L^2}}\right)$,沿轴

9.8 $\dfrac{\lambda\lambda'}{2\pi\varepsilon_0\sin\theta}\ln\dfrac{a+L}{a}$

9.9 (1) $\dfrac{q}{6\varepsilon_0}$ (2) $\dfrac{q}{2\varepsilon_0}\left(1-\dfrac{a}{\sqrt{R^2+a^2}}\right)$

9.10 (1) $-E\pi R^2$ (2) $E\pi R^2$ (3) 0 (4) 0

9.11 4.43×10^{-13} C/m^3

10.13 $\frac{\mu_0 I}{4\pi}+\frac{\mu_0 I}{2\pi}\ln 2$

10.14 $1.27\times10^{-3}\ \mathrm{V\cdot m^{-1}}$, $2.53\times10^{-5}\ \mathrm{V}$

10.15 N 型, $2.9\times10^{20}\ \mathrm{m^{-3}}$

10.16 $\frac{\mathrm{d}F}{\mathrm{d}S}=\frac{B_2^2-B_1^2}{2\mu_0}$, $-z$ 方向

10.17 $\frac{R^2\omega q}{4}$

10.18 0.18 N · m, $\theta=30°$ 或 150°

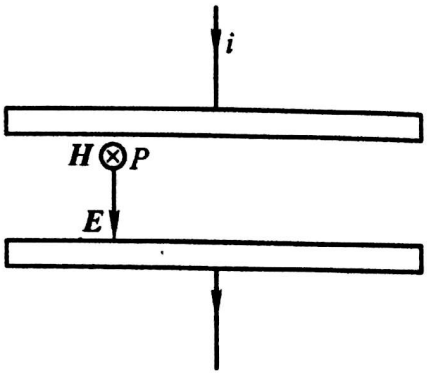
10.19 (1) 0 (2) $-\frac{\sqrt{2}}{4}a^2BI$

10.20 $\frac{\mu_0 Ir}{2\pi R_1^2}(r<R_1)$; $\frac{\mu I}{2\pi r}(R_1<r<R_2)$, $\frac{\mu I}{2\pi r}\left(1-\frac{r^2-R_2^2}{R_3^2-R_2^2}\right)(R_2<r<R_3)$, $0(r>R_3)$

第十一章

11.1 (1) B (2) C (3) C (4) A (5) D

11.2 (1) 等于, 小于 (2) 导线端点, $\omega Bl^2/2$, 导线中点, 0 (3) 小于, 有关 (4) ②, ③, ① (5) 见 11.2(5)解图



11.2(5)解图

11.3 $\frac{\sqrt{3}\pi a^2 nB}{120}\sin\frac{\pi nt}{30}$

11.4 2.79×10^{-4} V, B 端电势高

11.5 $\frac{\mu_0 Iv}{2\pi}\ln\frac{a+b}{a-b}$

11.6 (1) $\frac{\mu_0 ILav}{2\pi x(x+a)}$

(2) 3.00×10^{-6} V(顺时针)

11.7 700 V, 111 $\mathrm{V\cdot m^{-1}}$

11.8 $\mathscr{E}_{AB}=\mathscr{E}_{CD}=0$, $\mathscr{E}_{AD}=\frac{\sqrt{3}}{4}a^2\frac{\mathrm{d}B}{\mathrm{d}t}$, $\mathscr{E}_{BC}=\frac{\pi a^2}{6}\cdot\frac{\mathrm{d}B}{\mathrm{d}t}$, $\mathscr{E}_{总}=\left(\frac{\pi}{6}-\frac{\sqrt{3}}{4}\right)a^2\frac{\mathrm{d}B}{\mathrm{d}t}$

11.9 $\frac{a\mu_0 I}{2\pi}\left[\omega\sin\omega t\cdot\ln\frac{x+b}{x}+\frac{bv}{x(x+b)}\cos\omega t\right]$

11.10 300 匝

11.11 (1) $L_1=\frac{\mu_0 N_1^2 a^2}{2R}$, $L_2=\frac{\mu_0 N_2^2 a^2}{2R}$ (2) $M=\frac{\mu_0 N_1 N_2 a^2}{2R}$ (3) $M=\sqrt{L_1L_2}$

11.12 $-\dfrac{\mu_0 I_0 \omega}{\sqrt{3}\pi}\left[(b+h)\ln\dfrac{b+h}{b}-h\right]\cos\omega t$

11.13 $\dfrac{\mu_0\mu_r}{2\pi}\ln\dfrac{R_1}{R_2}$

11.14 略

11.15 (1) $\dfrac{\mu_0 Nb}{2\pi}\ln\dfrac{R_2}{R_1}$ (2) $\mu_0 NbI_0 f\ln\dfrac{R_2}{R_1}$ (3) $\dfrac{\mu_0 N^2 I_0^2 b}{4\pi}\ln\dfrac{R_2}{R_1}$

11.16 $\dfrac{\mu_0 I^2 l}{4\pi}\ln\dfrac{R_2}{R_1}$

11.17 (1) $\dfrac{0.2}{C}(1-e^{-t})$ (2) $0.2e^{-t}$

11.18 略

(4) 157 N·m (5) $\dfrac{(J+mr^2)\omega_1}{J+mR^2}$

5.3 $mr^2\left(\dfrac{gt^2}{2s}-1\right)$

5.4 $\hbar$

5.5 (1) $\dfrac{2}{5}mR^2\cdot\dfrac{2\pi}{T}$ (2) $m\sqrt{Gm_{日}r}$

5.6 (1) $\beta=10.3\ \text{rad}\cdot\text{s}^{-2}$ (2) $\omega=9.08\ \text{rad}\cdot\text{s}^{-1}$

5.7 $a=\dfrac{(m_1-\mu m_2)g}{m_1+m_2+\dfrac{1}{2}m}$, $F_{T1}=m_1g-\dfrac{m_1(m_1-\mu m_2)g}{m_1+m_2+\dfrac{1}{2}m}$,

$$F_{T2}=\mu m_2 g+\frac{m_2(m_1-\mu m_2)g}{m_1+m_2+\dfrac{1}{2}m}$$

5.8 $\dfrac{3R\omega_0^2}{16\pi\mu g}$

5.9 $\dfrac{smg}{\left(m+\dfrac{1}{2}m_0\right)l}$

5.10 (1) $\omega=\omega_0+\dfrac{2v}{21R}$ (2) $v=\dfrac{21}{2}R\omega_0$(顺 ω_0 方向)

5.11 (1) $n\approx200\ \text{r/min}$ (2) $4.19\times10^2\ \text{N}\cdot\text{m}\cdot\text{s}$

5.12 $\varphi=\dfrac{R\omega_0}{u\sqrt{2m/m_0}}\arctan\dfrac{ut\sqrt{2m/m_0}}{R}$

5.13 $\omega=\dfrac{3v_0}{2l}$

5.14 $17.9\ \text{rad}\cdot\text{s}^{-1}$

5.15 $6.3\ \text{km}\cdot\text{s}^{-1}$

第 六 章

6.1 (1) A (2) C (3) B

6.2 (1) 4 000 J (2) $\dfrac{2Gmm_0}{3R}$, $\dfrac{-Gmm_0}{3R}$ (3) −0.207

(4) 对 O 轴的角动量,对该轴的合力矩为零,机械能

6.3 4.23×10^6 J

6.4 980 J

9.12 $\frac{\rho r}{2\varepsilon_0}, \frac{\rho R^2}{2\varepsilon_0 r}$

9.13 $\frac{\rho}{3\varepsilon_0}a$

9.14 $\frac{k}{2\varepsilon_0}, \frac{kR^2}{2\varepsilon_0 r^2}$

9.15 略

9.16 均为 $\frac{q}{6\pi\varepsilon_0 L}$

9.17 $\frac{q\lambda}{12\varepsilon_0}$

9.18 $\frac{\rho}{2\varepsilon_0}(R_2^2 - R_1^2)$

9.19 $-\frac{\rho r^2}{4\varepsilon_0}, \frac{R^2\rho}{2\varepsilon_0}\ln\frac{R}{r} - \frac{\rho R^2}{4\varepsilon_0}$

9.20 $-\sigma a/\varepsilon_0 (x \leqslant -a), \sigma x/\varepsilon_0 (-a \leqslant x \leqslant a), \sigma a/\varepsilon_0 (x \geqslant a)$

9.21 $U_1 = 0, U_2 = 120\ \text{V}, U_3 = 180\ \text{V}$

9.22 略

9.23 (1) $\frac{q}{4\pi\varepsilon_0 L}\ln\frac{L + \sqrt{r^2 + l^2}}{r}$ (2) $\frac{q}{8\pi\varepsilon_0 L}\ln\frac{x + L}{x - L}$

9.24 略

9.25 $\frac{q}{4\pi\varepsilon_0}\left(\frac{1}{d} - \frac{1}{R}\right)$

9.26 (1) $U_B = \frac{q}{4\pi\varepsilon_0 R_3}$ (2) $U_B = 0$

(3) $q_A = \frac{R_1 R_2 q}{R_2 R_3 + R_1 R_2 - R_1 R_3}, q_{B内} = -q_A, q_{B外} = q_A - q, U_B = \frac{q_A - q}{4\pi\varepsilon_0 R_3}$

9.27 略

9.28 (1) $D_1 = \sigma_1 = \frac{5}{3}\sigma_0, D_2 = \sigma_2 = \frac{\sigma_0}{3}, E_1 = E_2 = \frac{\sigma_0}{3\varepsilon_0}$

(2) $\Delta U = 100\ \text{V}, \sigma_1' = \frac{4}{3}\sigma_0$

9.29 998 V/m, 12.5 V

9.30 $\varepsilon_r = 3$

9.31 (1) $\frac{\sigma_1}{\sigma_2} = \frac{\varepsilon_{r1}}{\varepsilon_{r2}}$ (2) $D_1 = \sigma_1, D_2 = \sigma_2, E_1 = E_2$ (3) $C = \frac{\varepsilon_0 S}{2d}(\varepsilon_{r1} + \varepsilon_{r2})$

6.5 3 J

6.6 (1) $\frac{1}{4}mgL$ (2) $\frac{mgy}{2L}$ (3) $\frac{1}{4}mgL$

6.7 $A_P=\frac{mg}{2L}(L^2-a^2)$, $A_f=-\frac{\mu mg}{2L}(L-a)^2$,

$v=\sqrt{\frac{g}{L}}[(L^2-a^2)-\mu(L-a)^2]^{1/2}$

6.8 $A_F=amg\sin\theta+\frac{1}{2}ka^2\theta^2$

6.9 (1) $E_k=G\frac{m_0m}{6R}$ (2) $E_p=-G\frac{mm_0}{3R}$ (3) $E=-G\frac{mm_0}{6R}$

6.10 $\frac{k}{2r^2}$

6.11 0.145 m · s^{-1}

6.12 24.8 m · s^{-1}

6.13 略

6.14 $B:\frac{1}{3}\omega_0$, $\sqrt{\frac{1}{3}R^2\omega_0^2+2gR}$, $\sqrt{2Rg+\frac{4}{9}\omega_0^2R^2}$; $C:\omega_0$, $2\sqrt{gR}$, $2\sqrt{gR}$

6.15 略

6.16 $R=2.96\times10^3$ m, $\rho=1.84\times10^{19}$ kg · m^{-3}

6.17 $\frac{12A}{x^{13}}-\frac{6B}{x^7}$, $\left(\frac{2A}{B}\right)^{1/6}$

6.18 (1) $x\geqslant1$ m (2) 1 m $<x<4$ m, $x>9$ m (3) $x=4$ m, $v_m=2\sqrt{2}$ m · s^{-1}

第 八 章

8.1 (1) B (2) C (3) C (4) A (5) C

8.2 (1) 1.29×10^{-5} s (2) 2.91×10^8 m · s^{-1} (3) $1/\sqrt{1-(u/c)^2}$ (m)
(4) $m_0c^2(n-1)$

8.3 $0.816c$, 0.707 m

8.4 7.2 cm^2

8.5 $0.4c=1.2\times10^8$ m · s^{-1}

8.6 (1) 6.24 m (2) 10.4 m

8.7 能达地面

8.8 $x=6.00\times10^{16}$ m, $y=1.20\times10^{17}$ m, $z=0$, $t=-2.00\times10^8$ s

8.9 2.5×10^{-9} s

3.15 $(17\boldsymbol{j}-5\boldsymbol{k})\,\mathrm{m\cdot s^{-1}}$，$(-12\boldsymbol{i}+17\boldsymbol{j}-5\boldsymbol{k})\,\mathrm{m\cdot s^{-1}}$

3.16 2.83 km/h，45°

3.17 $\boldsymbol{v}_{AB}=(-693\boldsymbol{i}-600\boldsymbol{j})\,\mathrm{km/h}$，$\boldsymbol{v}_{BA}=(693\boldsymbol{i}+600\boldsymbol{j})\,\mathrm{km/h}$

3.18 南偏西 30°

第 四 章

4.1 (1) C (2) D (3) B (4) C (5) C

4.2 (1) 18 N·s (2) 0.003 s，0.6 N·s，2 g (3) $\dfrac{m_0v_0}{m\cos\theta}$

(4) $mv_0\sin\theta$，竖直向下 (5) 4 $\mathrm{m\cdot s^{-1}}$，2.5 $\mathrm{m\cdot s^{-1}}$

4.3 $a_1=\dfrac{m_1g-m_2g+m_2a}{m_1+m_2}$（向下为正），$a_2=\dfrac{m_1g-m_2g-m_1a}{m_1+m_2}$（向上为正）

$F_T=F_f=\dfrac{2m_1m_2g-m_1m_2a}{m_1+m_2}$

4.4 217 m

4.5 $F_T=\dfrac{m\omega^2(L^2-r^2)}{2L}$

4.6 10 800 N

4.7 0.58 $\mathrm{m\cdot s^{-1}}$，沿水平方向

4.8 $\dfrac{m}{m_0+m}\sqrt{2gh}$，$\dfrac{m^2h}{m_0^2-m^2}$

4.9 0.4 s，1.33 $\mathrm{m\cdot s^{-1}}$

4.10 149 N，与 $\boldsymbol{v}$ 夹角为 −122.6°

4.11 (1) $\dfrac{2mu}{2m+m_0}$ (2) $mu\left(\dfrac{1}{2m+m_0}+\dfrac{1}{m_0+m}\right)$

4.12 $mu\cos\alpha/(m_0+m)$，$ml\cos\alpha/(m_0+m)$

4.13 $1.07\times10^{-20}\,\mathrm{kg\cdot m\cdot s^{-1}}$，与 $\boldsymbol{p}_1$ 成 149°58′角

4.14 $\Delta v=mv_1/m_0$，$\overline{F}=\dfrac{mv_2}{\Delta t}+m_0g+mg$

4.15 $\dfrac{3}{4}u$，$\dfrac{1}{4}u$

第 五 章

5.1 (1) C (2) A (3) A (4) C (5) B

5.2 (1) 5.26×10^{12} m (2) 2 275 $\mathrm{kg\cdot m^2\cdot s^{-1}}$，13 $\mathrm{m\cdot s^{-1}}$ (3) 0，$m\omega ab\,\boldsymbol{k}$

习题参考答案

第 三 章

3.1 (1) B (2) D (3) D (4) B (5) C

3.2 (1) 23 $m \cdot s^{-1}$ (2) 8 m, 10 m (3) $50(-\sin 5t\, i + \cos 5t\, j)$ ($m \cdot s^{-1}$), 0, 圆 (4) $-\frac{g}{2}, \frac{2\sqrt{3}v^2}{3g}$ (5) $y=\frac{gx^2}{2(v_0+v)^2}, y=\frac{gx^2}{2v^2}$

3.3 17.5 m 东偏北 9°, 1.2 $m \cdot s^{-1}$ 向东, 1.0 $m \cdot s^{-1}$ 向南, 1.2 $m \cdot s^{-1}$ 向西北, 0.35 $m \cdot s^{-1}$ 东偏北 9°, 1.16 $m \cdot s^{-1}$

3.4 (1) $-0.5\ m \cdot s^{-1}$ (2) $-6\ m \cdot s^{-1}$ (3) 2.25 m

3.5 (1) $y=19-\frac{1}{2}x^2$ (m) (2) $\boldsymbol{v}=(2\boldsymbol{i}-4t\boldsymbol{j})$ ($m \cdot s^{-1}$); $\boldsymbol{a}=-4\boldsymbol{j}\ m \cdot s^{-2}$

(3) $t=0$: $\begin{cases} x=0 \\ y=19\ m \end{cases}$, $\begin{cases} v_x=2\ m \cdot s^{-1} \\ v_y=0 \end{cases}$; $t=3$ s: $\begin{cases} x=6\ m \\ y=1\ m \end{cases}$,

$\begin{cases} v_x=2\ m \cdot s^{-1} \\ v_y=-12\ m \cdot s^{-1} \end{cases}$ (4) $t=3$ s: $r_{min}=6.08$ m

3.6 $x=\left(\frac{5}{8}+t-\frac{1}{2}t^2\right)$ (m)

3.7 $v=\frac{H}{H-h}v_0$

3.8 $69.8\ m \cdot s^{-1}$

3.9 $a_t=10\ m \cdot s^{-2}$, $a_n=83.3\ m \cdot s^{-2}$

3.10 $a_t=0.2\ m \cdot s^{-2}$, $a_n=0.36\ m \cdot s^{-2}$

3.11 (1) 230.4 $m \cdot s^{-2}$, 4.8 $m \cdot s^{-2}$ (2) 3.15 rad (3) 0.55 s

3.12 (1) 16 rad/s, 12 rad/s^2

(2) 1.4 $m \cdot s^{-1}$, 9.87 $m \cdot s^{-2}$, $\boldsymbol{a}$ 与 $\boldsymbol{v}$ 夹角 83°

3.13 $\theta=\frac{4}{3}t^3-\frac{\pi}{4}$ (SI)

3.14 略