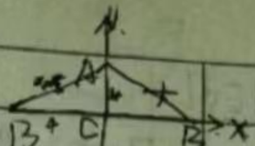
P308.

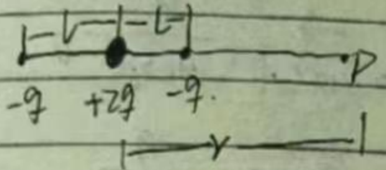
7-6 $\vec{E_1}=\frac{1}{4\pi\varepsilon_0}\cdot\frac{q}{r^2}$

$=\frac{1}{4\pi\varepsilon_0}\times\frac{1.8\times10^{-9}C}{(0.13)^2}$




$\vec{E_2}=\frac{1}{4\pi\varepsilon_0}\cdot\frac{-4.8\times10^{-9}C}{(0.12)^2}$

7-7




证 $P: E=\frac{3Q}{4\pi\varepsilon_0 r^4}$

$Q=2ql^2$

$E_1=\frac{-q}{4\pi\varepsilon_0(r+l)}$

$E_2=\frac{2q}{4\pi\varepsilon_0 r}$

$E_3=\frac{-q}{4\pi\varepsilon_0(r-l)}$

$E=\frac{-q}{4\pi\varepsilon_0(r+l)}+\frac{2q}{4\pi\varepsilon_0 r}+\frac{-q}{4\pi\varepsilon_0(r-l)}$

$=\frac{q}{4\pi\varepsilon_0}\left(\frac{2}{r}-\frac{1}{(r+l)}-\frac{1}{(r-l)}\right)$

$=\frac{q}{4\pi\varepsilon_0}\cdot\left(\cancel{\frac{2r+\dots}{r(r+l)}}-\frac{1}{(r-l)}\right)$

$=\frac{q}{4\pi\varepsilon_0}\cdot\left(\cancel{\frac{r+\dots}{r(r+l)}}-\frac{1}{(r-l)}\right)$

$=\frac{q}{4\pi\varepsilon_0}\cdot\left(\frac{2}{r}-\frac{1}{r+l}-\frac{1}{r-l}\right)$

$=\frac{q}{4\pi\varepsilon_0}\cdot\left(\frac{2r+2l-r}{r(r+l)}-\frac{1}{r-l}\right)$

$=\frac{q}{4\pi\varepsilon_0}\cdot\left[\frac{(r+2l)(r-l)}{r(r+l)(r-l)}-\frac{r(r+l)}{r(r+l)(r-l)}\right]$

$=\frac{q}{4\pi\varepsilon_0}\cdot\left(\frac{r^2-rl+2rl-2l^2-r^2-rl}{r(r+l)(r-l)}\right)$

$=\frac{q}{4\pi\varepsilon_0}\cdot\frac{-2l^2}{r^3-rl^2}$

7-18. 解:

由高斯定理 $\oint_s E_1\cdot ds=\frac{1}{\varepsilon_0}\sum q=0$

(1) ∵ $r_1=5cm$.

$E_1=0$ $\oint E_2\cdot ds=E_2 4\pi r_2^2=\frac{1}{\varepsilon_0}\int\rho dv$

(2) 当 $r_1=0.15m$.

$E_2=\frac{\rho(r_2^3-R_1^3)}{3\varepsilon_0 r_2^2}=\cancel{\frac{\dots}{\dots\varepsilon_0 r^2}}$

7-19.

(1) $r<R$ 时 以r为半径作高斯面

由高斯定理可得

$\oint E\cdot ds=\frac{q}{\varepsilon_0}$

∵ $q=\int\rho\cdot4\pi r^2\cdot dr$

$=\pi k\cdot r^4$

∴ $\oint E\cdot ds=\frac{\pi r^4}{\varepsilon_0}$

~~∴ $E=\frac{\pi r^4}{\varepsilon_0}$~~

∴ $E=\frac{\pi r^4 k}{\varepsilon_0}\times\frac{1}{4\pi r^2}$

$=\frac{kr^2}{4\varepsilon_0}$

(2) $r>R$ 时.

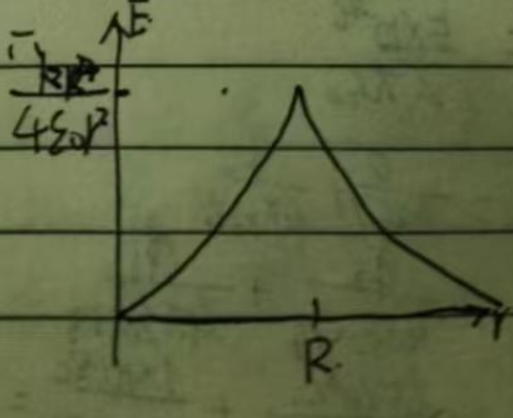
$\oint E\cdot ds=\frac{q}{\varepsilon_0}$

∴ $q_2=\int\rho\cdot4\pi r^2 dr=\pi kR^4$

∴ $E\cdot4\pi r^2=\frac{\pi kR^4}{\varepsilon_0}$

∴ $E=\frac{kR^4}{4\varepsilon_0 r^2}$

(3) 当 $r=R$ 时. $E=\frac{kR^2}{4\varepsilon_0}=\frac{kR^4}{4\varepsilon_0 r^2}$



7-35. $A=\frac{qq_0}{4\pi\varepsilon_0}\int\frac{1}{r^2}dr$  $W=q_0\int E\,dl$

$V_B=\frac{q_1}{4\pi\varepsilon_0 r}+\frac{q_2}{4\pi\varepsilon_0\sqrt{r^2+d^2}}$

$=\frac{3\times10^{-8}C}{4\pi\varepsilon_0\times6}+\frac{-3\times10^{-8}C}{4\pi\varepsilon_0\times10}$

$=\frac{3\times10^{-8}C}{4\pi\varepsilon_0}\times\left(\frac{1}{6}-\frac{1}{10}\right)$

$=\frac{3\times10^{-8}C}{4\pi\varepsilon_0}\times\frac{4}{60}$ 20

$=\frac{1\times10^{-8}C}{20\pi\varepsilon_0}$

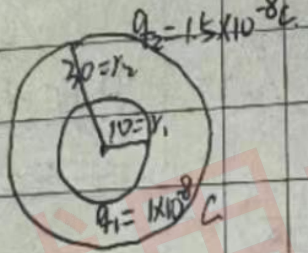
$V_B=0$. 对称.

$V_{AD}=q$

$V_A=\frac{q_1}{4\pi\varepsilon_0\sqrt{r^2+d^2}}+\frac{q_2}{4\pi\varepsilon_0 r}$

$=\frac{+3\times10^{-8}C}{4\pi\varepsilon_0 10}+\frac{-3\times10^{-8}C}{4\pi\varepsilon_0\times6}$

7-38 $Q_1=1\times10^{-8}C$.




$Q_2=1.5\times10^{-8}C$.

$r_3=20cm$.

$V_1=\frac{Q_2}{4\pi\varepsilon_0\cdot r_2}+\frac{Q_1}{4\pi\varepsilon_0 r_3}$

$=\frac{1.5\times10^{-8}C}{4\pi\varepsilon_0\times0.3}+\frac{1\times10^{-8}C}{4\pi\varepsilon_0\times0.2}$

$=\frac{1\times10^{-8}C}{4\pi\varepsilon_0}\times\left(\frac{1.5}{0.3}+\frac{1}{0.2}\right)$
5 5

$=\frac{1\times10^{-8}C}{4\pi\varepsilon_0}\times10$

$=\frac{5\times10^{-8}C}{2\pi\varepsilon_0}$

$V_2=\frac{Q}{4\pi\varepsilon_0 r}+\frac{q}{4\pi\varepsilon_0 r_1}$

$=\frac{q_2}{4\pi\varepsilon_0\times r_4}+\frac{Q_1}{4\pi\varepsilon_0\times r_3}$

$=\frac{1.5\times10^{-8}C}{4\pi\varepsilon_0\times0.5}+\frac{1\times10^{-8}C}{4\pi\varepsilon_0\times0.2}=\frac{10^{-8}C}{4\pi\varepsilon_0}(3+5)$

7-35. $A=\frac{qq_0}{4\pi\varepsilon_0}\int\frac{1}{r^2}dr$

$W=q_0\int E\,dl$

$V=\frac{q}{4\pi\varepsilon_0 r}$

$\therefore V_A=\frac{-q}{4\pi\varepsilon_0 2L}$

$V_O=\frac{-q}{4\pi\varepsilon_0 L}+\frac{q}{4\pi\varepsilon_0 L}=0$

$V_D=\frac{q}{4\pi\varepsilon_0 3L}+\frac{-q}{4\pi\varepsilon_0 L}$

$=\frac{q}{4\pi\varepsilon_0 L}\left(\frac{1}{3}-1\right)$

$=-\frac{2}{3}\times\frac{q}{4\pi\varepsilon_0 L}$

$=-\frac{q}{6\pi\varepsilon_0 L}$

7-41. $W_{+q}=-\frac{Qq}{4\pi\varepsilon_0 r}$

$W_{-q}=\frac{Qq}{4\pi\varepsilon_0(r+l)}+\frac{q^2}{4\pi\varepsilon_0 l}$

$W=W_{+q}+W_{-q}$

$W=\frac{Qql}{4\pi\varepsilon_0 r(r+l)}+\frac{q^2}{4\pi\varepsilon_0 l}$

① $V_1=\frac{q}{4\pi\varepsilon_0 R_2}$ ② $V_2=\frac{1}{4\pi\varepsilon_0}\left(\frac{q}{r}-\frac{q}{r}+\frac{q}{R_2}\right)$

$V_1=120.026V$.

$V_2=180.040V$

③ $V_0=\frac{1}{4\pi\varepsilon_0}\left(\frac{q}{r}-\frac{q}{R_1}+\frac{q}{R_2}\right)$

$V_0=300V$

$V=120.026V$

7-42. $V=$

7-4

7-42. $V=\frac{q}{4\pi\varepsilon_0 r}$

$=\frac{4.0\times10^{-10}C}{4\pi\varepsilon_0}\times\frac{1}{(0.12)}$

$=\frac{1\times10^{-8}C}{3\pi\varepsilon_0}$

② $q=\oint\rho\cdot4\pi R^2\cdot dR$  $V=1$

$E\cdot4\pi R^2=\frac{q}{\varepsilon_0}$

$\therefore E=\frac{\pi kR^4}{\varepsilon_0}\times\frac{1}{4\pi R^2}$

$=\frac{kR^2}{4\varepsilon_0}=\frac{kx}{4\varepsilon_0}=\frac{k}{4\varepsilon_0}$

③ $q=\oint\rho\,4\pi R^2\cdot dR$

$\oint E\cdot dr=\frac{q}{\varepsilon_0}$

7-43.

① $V_{R_1}=\frac{1}{4\pi\varepsilon_0}\cdot\left(\frac{q}{R_1}-\frac{q}{R_2}+\frac{q+Q}{R_3}\right)$

$=\frac{1}{4\pi\varepsilon_0}\times\left(1\times10^{-10}C-\frac{1\times10^{-10}}{3}+\frac{1\times10^{-10}}{4}\right)$

$V_2=\frac{1}{4\pi\varepsilon_0}\cdot\left(\frac{q}{R_2}-\frac{q}{R_2}+\frac{q+Q}{R_3}\right)$

$=\frac{1}{4\pi\varepsilon_0}\times\left(\frac{q+Q}{R_3}\right)$

$=\frac{1}{4\pi\varepsilon_0}\times\frac{1\times10^{-10}+1\times10^{-10}C}{4cm}$

② $V_1-V_2=\frac{q}{4\pi\varepsilon_0}\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

$=\frac{1\times10^{-10}C}{4\pi\varepsilon_0}\times\left(\frac{1}{1cm}-\frac{1}{3cm}\right)$

③ $V_{R_1}=\frac{q}{4\pi\varepsilon_0}\cdot\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

$=\frac{1\times10^{-10}C}{4\pi\varepsilon_0}\times\left(\frac{1}{1cm}-\frac{1}{3cm}\right)$

$V_2=V_3=0$

7-44. 1) $Q_{外}=-q$

$V=\frac{-q}{4\pi\varepsilon_0 r_2}$

② $Q_{外}=0$

$V=0$

③ $Q_{内}=0$

$V=0.$

7-48 1) $\frac{1}{C}=\frac{1}{(C_1+C_2)}+\frac{1}{C_3}$

$\therefore C=3.75\mu F$

2) $q_{总}=U_{AB}C$

$q_2=C_2U_2$  $q_1=C_1U_1$

$q_3=C_3\cdot(U_{AB}-U_1)$

$q_2+q_1=q_3$  $U_2=U_1=25V$

$q_2=1.25\times10^{-4}C$

3) $\frac{1}{C'}=\frac{1}{C_2}+\frac{1}{C_3}$

$q_{总}=U_{AB}C'$

$q_2'=C_2U_2$

$q_3'=C_3U_3$  $U_2+U_3=U_{AB}$

$U_3=50V$, $q_3'=2.5\times10^{-4}C$

7-49 1) $E=\frac{\sigma}{\varepsilon_0}$  $U_{AC}=\frac{\sigma}{\varepsilon_0\varepsilon_r}(d-\delta)$

$U_{DB}=\frac{\sigma}{\varepsilon_0\varepsilon_r}(d-\delta)\cdot\frac{1}{2}$

$\frac{1}{C}=\frac{U_{AC}}{q}+\frac{U_{DB}}{q}$  $\therefore C=\frac{\varepsilon_0\varepsilon_r S}{d-\delta}$

$\delta=0,\ \varepsilon_r=1 \quad \therefore C=\frac{\varepsilon_0 S}{d}$

$2>U_0=\frac{\sigma}{\varepsilon_0}\cdot d$

$U=\frac{\sigma b\cdot(d-\delta)}{\varepsilon_0\varepsilon_r}$

$\frac{U_0}{U}=\frac{d\cdot\varepsilon_r}{d-\delta}$

11.23

8-8. $\Phi=B\cdot S=(B_{\parallel}\cdot S)+(B_{\perp}\cdot S)$

$\because B_{\perp}\cdot S=0$

$\therefore \Phi=B_{\parallel}\cdot S$

$=B\cdot S\cdot\cos\angle e_n$

$\because e_n\cdot S=\pi R^2$

$\therefore \Phi=B\pi R^2\cos\alpha$

8-9. $\because I_1=I_2$

$\therefore B_1=B_2=\frac{\mu_0 I}{2\pi d}$

$B_P=\sqrt{B_1^2+B_2^2}$

$=\sqrt{B_1^2+B_1^2}$

$=\sqrt{2}\,B_1$

$=\sqrt{2}\cdot\frac{\mu_0\cdot I}{2\pi d}$

$=\frac{\sqrt{2}}{2}\times\frac{\mu_0\cdot 10A}{\pi\times 0.5}$

$=10\sqrt{2}\times\frac{\mu_0}{\pi}$

8-21.

$1>B_A=\frac{\mu_0\cdot I_1}{2\pi\cdot\frac{d}{2}}+\frac{\mu_0\cdot I_2}{2\pi\cdot\frac{d}{2}}$

$=\frac{\mu_0\cdot I_1}{\pi d}+\frac{\mu_0\cdot I_2}{\pi d}$

$=\frac{\mu_0}{\pi d}\cdot(I_1+I_2)$

$=\frac{\mu_0}{\pi \cancel{d}\,40}\cdot 40=\frac{\mu_0}{\pi}$

$2>dS=ldr$

$\Phi=B\cdot S$

$=\frac{\mu_0 I}{2\pi r}\cdot S$

8-24.

$1>r<R_1 \quad \oint B\cdot dl=\mu_0\cdot I_1,$

$B\cdot 2\pi r=\frac{\mu_0\cdot I}{\pi R_1^2}\cdot\pi r^2$

$=\frac{\mu_0\cdot I}{R_1^2}\cdot r^2$

$\therefore B=\frac{\mu_0\cdot I r}{2\pi R_1^2}$

(2) $\oint B\cdot dl$

$=B\cdot 2\pi r=\mu_0 I$

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

(3) $\oint B\cdot dl=B\cdot 2\pi r$

$=\mu_0\cdot I_3$

$\because \cancel{I_3}$

8-38.

$F_{左} = IBL = \frac{\mu_0 \cdot I_1 \cdot l \cdot I_2}{2\pi d}$

$F_{右} = BIL = \frac{\mu_0 I_1 \cdot I_2 \cdot l}{2\pi (d+b)}$

$\therefore F = F_1 - F_2$

$= \frac{\mu_0 \cdot I_1 \cdot l \cdot I_2}{2\pi d} - \frac{\mu_0 \cdot I_1 \cdot I_2 \cdot l}{2\pi (d+b)}$

$= \frac{I_1 \cdot I_2 \cdot l \cdot \mu_0}{2\pi} \left( \frac{1}{d} - \frac{1}{d+b} \right)$

8-42.

$M = mB\sin\theta \qquad \theta = 60°$

$= mB \cdot \sin 60°$

$= IBS\sin 60°$

$= 0.1 \times 0.5 \times 48 \times \frac{\sqrt{3}}{2} \cdot \times 10^{-4}$

$\approx 2.08 \times 10^{-4}$

12.20.