chapter 23

9. $\delta q = \rho \delta V$ $dq = \rho dV$ $dV = \varphi \pi r^2 \cdot dr$ $dq = \rho \varphi \pi r^2 dr$

$$\int dq = 4\pi A \cdot a^2 \quad \therefore A = \frac{q}{2\pi a^2} = 5.3 \times 10^{-11} C/m^2$$

21. (a) $E = \frac{\sigma}{2\varepsilon_0}$ $E_{net} = \frac{\sigma}{\varepsilon_0}$ $\therefore E_{net左} = 2.61 \times 10^{-11} N/C$ 向上

(b) $\vec{E}_{net} = 0$

(c) $\vec{E}_{net} = 2.61 \times 10^{-11} N/C \; -\hat{j}$ 向下

23 顶面

$\phi_{顶} = 4y^2\hat{j}\oint dA$

代入

$\phi = -2y^2 \cdot a^2 + 2y'^2 a^2 = 2a^2(y'^2 - y^2)$

代入 $a = 2m^2$

$-2\times 4^2 \times 2^2 + 2\times 2^2 \times 2^2 = -96\ N\cdot m^2/C$

$\therefore q = \varepsilon_0 \phi = -8.5\times 10^{-10} C$

33. $F = q\cdot E = q\cdot\frac{6}{\varepsilon_0} = -e\frac{6}{\varepsilon_0} = ma$

$a = \frac{-e6}{\varepsilon_0 m}$ $\therefore d = \frac{\varepsilon_0 m v_0^2}{-2e6} = \frac{\varepsilon_0 K_i}{-e6}$

代入 $\therefore d = 1.45\times 10^{-3} m$

47. $\rho = 1.89\times 10^{-15} C/m^3$ $d = 9.4\times 10^{-3} m$

$\phi = Ea^2$ $\phi = \frac{q_{enclose}}{\varepsilon_0} = \frac{\rho a^2 \cdot x}{\varepsilon_0}$

$\therefore E = \frac{\phi}{a^2} = \frac{\rho x}{\varepsilon_0}$ (a) $x = 0$ 时 $E = 0$

(b) $x = 2\times 10^{-3} m$ 时 代a $E = 4.27\times 10^{-7} N/C$

(c) $x = 4.7\times 10^{-3} m$ $E = 1\times 10^{-6} N/C$

(d) $E = 1\times 10^{-6} N/C$

54. $\Phi = \frac{q_{enc}}{\varepsilon_0}$ $q_{par} = 4\times10^{5} \times 8.85\times10^{-12} = 3.54\times10^{-6}\,C$

$q_{enc\,\oplus} = q_{par} + q_A$

(b). $q_B = -8\times10^{5}\times8.85\times10^{-12} = -7.08\times10^{-6}\,C$ 以A取高斯面

$\therefore q_{shell\,A} = -7.08\times10^{-6}\,C - 3.54\times10^{-6}\,C = -1.06\times10^{-5}\,C$

(c) $q_C = 8.85\times10^{-12}\times12\times10^{5} = 1.06\times10^{-5}\,C$ 以B取高斯面

$\therefore q_{shell\,B} = 10.6\times10^{-6}\,C - 3.54\times10^{-6}\,C + 1.06\times10^{-5}\,C$

$= 1.77\times10^{-5}\,C$

55. $r = 2\times1.3\times10^{-2}\,m = 2.6\times10^{-2}\,m$

a. $q_{enc} = Q_1 + Q_2 = -5.22\times10^{-13}\,C\,\oplus - 2\times(-5.22\times10^{-13}\,C)$

$= 5.22\times10^{-13}\,C.$

$\Phi = \frac{q_{enc}}{\varepsilon_0} = E\oint dA = E\cdot 2\pi r L$ 代入 $E = 3.28\times10^{-2}\,N/C$

b. 同上

c. 同样 $E = -1.31\times10^{-1}\,N/C$ d. 同理

e. $q_{in} = 5.22\times10^{-13}\,C$

f. $Q_2 = q_{in} + q_{out}$ 代入 $q_{out} = 5.22\times10^{-13}\,C$