14-5 (1) ∵内球壳带电Q ∴S内带电-Q

S外带电+Q.

(2) ∵内壳带电+Q

$\therefore \varphi = k\frac{Q}{r} = \frac{1}{4\pi\varepsilon_0}\cdot\frac{Q}{a}$

设外壳带电q

$\left|\frac{1}{4\pi\varepsilon_0}\cdot\frac{q}{b}\right| = \frac{1}{4\pi\varepsilon_0}\cdot\frac{Q}{a}$

$\therefore |q| = \frac{b}{a}Q$ ∴带电 $-\frac{b}{a}Q$.

14-7. (1) $V = 19.0V$

$C = \frac{q}{V} = \frac{3.8\times10^{-11}C}{19.0V} = 2\times10^{-12}F$

(2) 电容大小与带电量无关

$\therefore C = 2\times10^{-12}F$

$V = \frac{q}{C} = \frac{7.6\times10^{-11}C}{2\times10^{-12}F} = 38.0V$

14-13 $2\pi rL\cdot E = \frac{\lambda L}{\varepsilon_0}$

$\therefore E = \frac{\lambda}{2\pi\varepsilon_0 r}$ ⇒ $r=R_1$时 E取max值.

$U = \int E\,dr = \frac{\lambda}{2\pi\varepsilon_0}\cdot\ln\frac{R_2}{R_1}$ ⇒ $E_{max}\cdot R_1\cdot\ln\frac{R_2}{R_1}$

⇒ $U = 2\times10^7\times1\times10^{-2}\cdot\ln2 = 2\ln2\times10^5 V$

$\therefore U \approx 1.39\times10^5 V$

14-18

(1) $D = \varepsilon \varepsilon_0 E$

$\therefore D = 3 \times \frac{1}{4\pi \times 9 \times 10^9} \cdot 1 \times 10^6 = 2.65 \times 10^{-5}\ C/m^2$

$P = \chi_e \varepsilon_0 E$

$1 + \chi_e = \varepsilon$

$\therefore P = (\varepsilon - 1)\varepsilon_0 E = \frac{2}{3} D = 1.77 \times 10^{-5}\ C/m^2$

(2) $E = \frac{D}{\varepsilon \varepsilon_0}$

$\because \oint D \cdot dS = q = \sigma_0 \cdot \Delta S = D \Delta S$

$\therefore D = \sigma_0 \quad \therefore E = \frac{\sigma_0}{\varepsilon \varepsilon_0} = \frac{E_0}{\varepsilon}$

$\therefore E_0 = \varepsilon E = 3 \times 1 \times 10^6\ V/m = 3 \times 10^6\ V/m$

$E_0 - E' = E$

$\therefore E' = 2 \times 10^6\ V/m$

14-20

(1) $\oint D \cdot dS = q \quad \therefore D = \frac{Q}{4\pi r^2}$

① $r < R_1 \quad E = 0, \ D = 0$

② $R_1 < r < R_2 \quad D = \frac{Q}{4\pi r^2} \quad E = \frac{D}{\varepsilon \varepsilon_0} = \frac{Q}{4\pi \varepsilon_0 r^2}$ (玻璃中)

③ $R_2 < r < R_3 \quad D = \frac{Q}{4\pi r^2} \quad E = \frac{D}{\varepsilon \varepsilon_0} = \frac{Q}{4\pi \varepsilon \varepsilon_0 r^2}$ (石蜡中)

④ $r > R_3 \quad D = \frac{Q}{4\pi r^2} \quad E = \frac{D}{\varepsilon \varepsilon_0} = \frac{D}{4\pi \varepsilon_0 r^2}$ (空气中)

场均沿半径向外

(2) $P = \chi_e \varepsilon_0 E$

$\because R_1 < r < R_2$

$E = \frac{Q}{4\pi \varepsilon_0 r^2}$

且 $1 + \chi_e = \varepsilon$

$\therefore P = (\varepsilon - 1) \frac{Q}{4\pi r^2}$

沿半径向外

$\because$ 对 $r = R_2$

$\sigma_1' = -\frac{(\varepsilon - 1) \cdot Q}{4\pi R_2^2}$

对 $r = R_3$

$\sigma_2' = \frac{(\varepsilon - 1) Q}{4\pi \cdot R_3^2}$