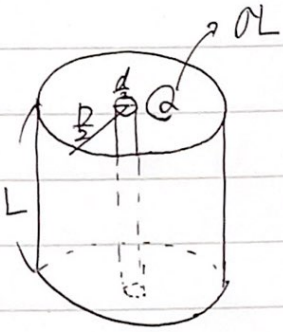
2012 秋 電磁気

(1) ガウスの法則より



$2\pi r \times L \times E = \frac{\sigma L}{\varepsilon_0}$

$E = \frac{\sigma}{2\pi\varepsilon_0 r}$

(2) $V = -\int_{\infty}^{\frac{D}{2}} 0\,dr - \int_{\frac{D}{2}}^{r} \frac{\sigma}{2\pi\varepsilon_0 r}\,dr$

$= -\left[\frac{\sigma}{2\pi\varepsilon_0}\log r\right]_{\frac{D}{2}}^{r}$

$= \frac{\sigma}{2\pi\varepsilon_0} * \log\frac{D}{2r}$

$V_0 = -\int_{\infty}^{\frac{D}{2}} 0\,dr - \int_{\frac{d}{2}}^{\frac{D}{2}} \frac{\sigma}{2\pi\varepsilon_0 r}\,dr$

$= \frac{\sigma}{2\pi\varepsilon_0}\log\frac{D}{d}$ より

$V = V_0 + \frac{\sigma}{2\pi\varepsilon_0}\log\frac{1}{2r}$

(3) 単位長さ当たりより

$Q = \sigma$

$Q = CV$ より

$\sigma = C\left(V_0 + \frac{\sigma}{2\pi\varepsilon_0}\log\frac{1}{2r}\right)$, $C = \frac{\sigma}{V_0 + \frac{\sigma}{2\pi\varepsilon_0}\log\frac{1}{2r}}$

V_0 を使おう.

$V_0 = \frac{\sigma}{2\pi\varepsilon_0}\log\frac{D}{d}$ より

$\sigma = \frac{C\sigma}{2\pi\varepsilon_0}\log\frac{D}{d}$, $C = \frac{2\pi\varepsilon_0}{\log\frac{D}{d}}$ //