$D = \varepsilon \vec{E}$

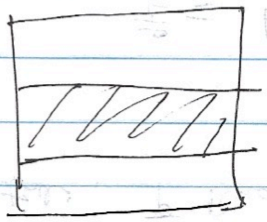
Griffiths 4.19

$$C = (\varepsilon_r C_{vac})\frac{1}{2} + C_{vac}$$

$$= \left(\frac{\varepsilon_r}{2} + 1\right) C_{vac}$$

$$= \boxed{\frac{\varepsilon_r + 2}{2} C_{vac}}$$

Q



$-Q$.

d. $\quad \frac{\sigma}{2\varepsilon_0} = E_1$.

$$\frac{\sigma}{2\varepsilon}.$$

$$\frac{\sigma}{2\varepsilon_0} \times \frac{d}{2} + \frac{\sigma}{2\varepsilon}\frac{d}{2}$$

$$= \frac{\sigma d}{4}\left[\frac{1}{\varepsilon_0} + \frac{1}{\varepsilon}\right].$$

$$V = \frac{\sigma d}{2\varepsilon_0}$$

$$\frac{Q}{V} = \frac{\sigma 2\varepsilon_0}{\sigma d}$$

$$= \frac{2\varepsilon_0}{d}.$$

$$\frac{Q}{V} = \frac{\sigma 4}{\sigma d}\left[\frac{1}{\varepsilon_0} + \frac{1}{\varepsilon}\right]^{-1}$$

$$\frac{\varepsilon + 2\varepsilon_0}{2\varepsilon_0} = \boxed{1 + \frac{\varepsilon}{2\varepsilon_0}}$$

$$= \frac{4}{d}\left[\frac{1}{\varepsilon_0} + \frac{1}{\varepsilon}\right]^{-1}$$

$$= \frac{4}{d}\left[\frac{\varepsilon_0 \varepsilon}{\varepsilon_0 + \varepsilon}\right]$$

$$= \left[\frac{2\varepsilon}{\varepsilon_0 + \varepsilon}\right]\frac{2\varepsilon_0}{d}$$

$$\frac{\varepsilon/\varepsilon_0 + 2}{2} \quad \text{vs} \quad \frac{2\varepsilon}{\varepsilon_0 + \varepsilon}$$

$$\boxed{1 + \frac{\varepsilon - \varepsilon_0}{\varepsilon_0 + \varepsilon}}$$