

Sample Problem 25.06

Main Problem 48-52, 70

25.06

$$a) \quad C_0 = \frac{\epsilon_0 A}{d}$$

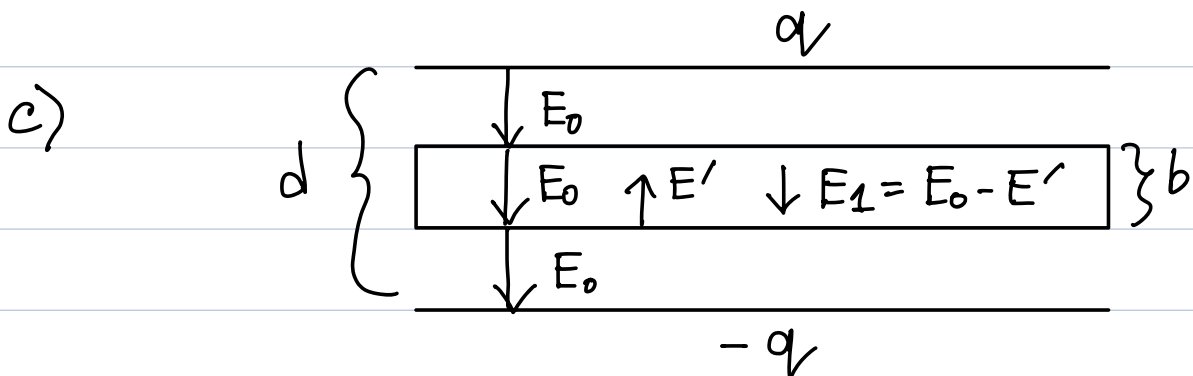
$$= \frac{8.854 \times 10^{-12} \times 115 \times 10^{-4}}{1.24 \times 10^{-2}} \text{ F}$$

$$= 8.21 \times 10^{-12} \text{ F}$$

$$b) \quad q = C_0 V_0$$

$$= 8.21 \times 10^{-12} \times 85.5$$

$$= 7.02 \times 10^{-10} \text{ C}$$



$$k \oint \vec{E}_0 \cdot d\vec{A} = \frac{q}{\epsilon_0}$$

$$\Rightarrow \oint \vec{E}_0 \cdot d\vec{A} = \frac{C_0 V_0}{\epsilon_0}$$

$$\Rightarrow \oint E_0 dA \cos 0^\circ = \frac{C_0 V_0}{\epsilon_0}$$

$$\Rightarrow E_0 \oint dA = \frac{C_0 V_0}{\epsilon_0}$$

$$\Rightarrow E_0 A = \frac{C_0 V_0}{\epsilon_0}$$

$$\therefore E_0 = \frac{C_0 V_0}{\epsilon_0 A}$$

$$d) \quad E_1 = E_0 \frac{1}{k} = \frac{C_0 V_0}{A \epsilon_0} \times \frac{1}{k}$$

e)

$$d \left\{ \begin{array}{l} \overline{\quad E_0 \quad} \left. \vphantom{\begin{array}{c} \overline{\quad E_0 \quad} \\ \overline{\quad E_1 \quad} \\ \overline{\quad E_0 \quad} \end{array}} \right\} x \left. \vphantom{\begin{array}{c} \overline{\quad E_0 \quad} \\ \overline{\quad E_1 \quad} \\ \overline{\quad E_0 \quad} \end{array}} \right\} v_1 \\ \overline{\quad E_1 \quad} \left. \vphantom{\begin{array}{c} \overline{\quad E_0 \quad} \\ \overline{\quad E_1 \quad} \\ \overline{\quad E_0 \quad} \end{array}} \right\} b \left. \vphantom{\begin{array}{c} \overline{\quad E_0 \quad} \\ \overline{\quad E_1 \quad} \\ \overline{\quad E_0 \quad} \end{array}} \right\} v_2 \\ \overline{\quad E_0 \quad} \left. \vphantom{\begin{array}{c} \overline{\quad E_0 \quad} \\ \overline{\quad E_1 \quad} \\ \overline{\quad E_0 \quad} \end{array}} \right\} y \left. \vphantom{\begin{array}{c} \overline{\quad E_0 \quad} \\ \overline{\quad E_1 \quad} \\ \overline{\quad E_0 \quad} \end{array}} \right\} v_3 \end{array}$$

$$\begin{aligned}
 V &= V_1 + V_2 + V_3 \\
 &= E_0 x + E_1 \cdot b + E_0 y \\
 &= E_0 (x + y) + E_1 \cdot b \\
 &= E_0 (d - b) + E_1 \cdot b
 \end{aligned}$$

$$\begin{aligned}
 x + b + y &= d \\
 x + y &= d - b
 \end{aligned}$$

f)

$$q = C_0 V_0 = C V$$

$$\Rightarrow \frac{C_0 V_0}{V} = C$$

48) Area parallel
Separation series

$$\begin{aligned}
 C_1 &= \frac{\epsilon A}{d} \\
 &= \frac{k_1 \epsilon_0 A/2}{d}
 \end{aligned}$$

$$C_2 = \frac{K_2 \epsilon_0 A/2}{d}$$

$$C_p = C_1 + C_2$$

$$49) \quad C_1 = \frac{K_1 \epsilon_0 A}{d/2}$$

$$C_2 = \frac{K_2 \epsilon_0 A}{d/2}$$

$$\frac{1}{C_3} = \frac{1}{C_1} + \frac{1}{C_2}$$

50) Try this at home

$$51) \quad C = 100 \times 10^{-12} \text{ F}$$

$$A = 100 \times 10^{-4} \text{ m}^2$$

$$K = 5.4$$

$$V = 50 \text{ V}$$

$$a) \quad V = Ed$$

$$C = \frac{K \epsilon_0 A}{d}$$

$$V = E \frac{K \epsilon_0 A}{C}$$

$$\Rightarrow d = \frac{K \epsilon_0 A}{C}$$

$$\Rightarrow \frac{VC}{K \epsilon_0 A} = E$$

$$\Rightarrow E = \frac{q}{K \epsilon_0 A}$$

$$K \oint \vec{E} \cdot d\vec{A} = \frac{q}{\epsilon_0}$$

$$\Rightarrow K E A = \frac{q}{\epsilon_0}$$

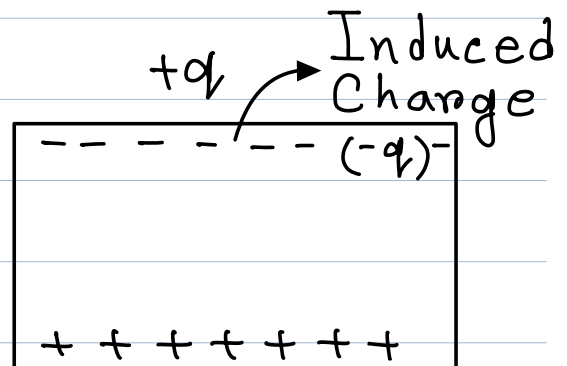
$$\Rightarrow E = \frac{q}{K \epsilon_0 A}$$

$$b) \quad q = CV$$

$$c) \quad \frac{q}{K} = q - q'$$

$$\Rightarrow q' = q - \frac{q}{K}$$

$$\Rightarrow q' = q \left(1 - \frac{1}{K} \right)$$



52)

a) Try this at home.

b) Try this at home.

c) Try this at home.

d) Try this at home.

70) Try this at home.