Problem 26.7

The most general form of the derived capacitance for a parallel plate capacitor in terms of the physical parameters of the cap is: $C = \varepsilon_d \varepsilon_o \frac{A}{d}$,

where ε_d is the dielectric constant for the material between the plates (the dielectric constant for air is "1"—note that sometimes the symbol used is κ --I don't like this symbol as it looks like "k," the symbol normally used for the combination of constants $1/4\pi\varepsilon_o$), ε_o is the permittivity of free space, "A" is the area of one plate and "d" is the distance between the plates. With all of this:

$$C = (1)\varepsilon_o \frac{A}{d} = \frac{Q}{V_C}$$

$$\Rightarrow \quad d = \varepsilon_o V_C \left(\frac{A}{Q}\right)$$

But

$$\sigma = \frac{Q}{A} \quad \Rightarrow \quad d = \frac{\varepsilon_o V_C}{\sigma}$$

$$= \frac{\left(8.85\text{x}10^{-12}\ \text{C}^2/\text{N}\bullet\text{m}^2\right)(150\ \text{V})}{\left(3.00\text{x}10^{-8}\ \text{C/cm}^2\right)\left(10^4\ \text{cm}^2/\text{m}^2\right)}$$

$$= 4.43\text{x}10^{-6}\ \text{m}$$