

Ch 8 Prob 61

$$K = 3.60 \quad E = 1.60 \times 10^7 \text{ V/m}$$

$$C = 1.25 \text{ nF} = 1.25 \times 10^{-9} \text{ F}$$

$$\Delta V = 5.5 \text{ kV} = 5.5 \times 10^3 \text{ V}$$

Find the minimum area of the plates

First use the dielectric strength and voltage to determine the distance between the plates

$$\Delta V = E \cdot d \rightarrow d = \frac{\Delta V}{E} = \frac{5.5 \times 10^3 \text{ V}}{1.60 \times 10^7 \text{ V/m}}$$

$$d = 3.44 \times 10^{-4} \text{ m}$$

Now use the formula for capacitance on a set of parallel plates

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

Solve for area,

$$A = \frac{d \cdot C}{K \epsilon_0} = \frac{(3.44 \times 10^{-4} \text{ m})(1.25 \times 10^{-9} \text{ F})}{(3.60)(8.85 \times 10^{-12} \text{ C}^2/\text{Nm})}$$

$$A = 0.0135 \text{ m}^2$$