

Problem 16.49

The voltage across an air filled cap is 85 volts. With a dielectric between the plates, the voltage is 25 volts.

a.) What is the dielectric constant? Can you tell what the dielectric is?

b.) If the dielectric doesn't completely fill the space, what can you conclude about the voltage across the plates?

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The presence of a dielectric decreases the effective voltage across the plates. If the dielectric doesn't completely fill the space, the voltage won't drop all the way to the 25 volt point, which means voltage across the plates with the dielectric partially filling the space will be *between* 25 volts and 85 volts.

3.)

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a.) What is the dielectric constant? Can you tell what the dielectric is?

$$C_{\text{with dielectric}} = \kappa C_{\text{w/o dielectric}}$$
$$\Rightarrow \kappa = \frac{C_{\text{with dielectric}}}{C_{\text{w/o dielectric}}}$$

$$\text{As } C = \frac{Q}{V}$$

$$C_{\text{with dielectric}} = \kappa C_{\text{w/o dielectric}}$$
$$\Rightarrow \frac{Q}{V_{\text{with dielectric}}} = \kappa \frac{Q}{V_{\text{w/o dielectric}}}$$
$$\Rightarrow \kappa = \frac{V_{\text{w/o dielectric}}}{V_{\text{with dielectric}}}$$
$$\Rightarrow \kappa = \frac{85 \text{ V}}{25 \text{ V}}$$
$$\Rightarrow \kappa = 3.4$$

According to the Table 16.1, this will be nylon.

2.)