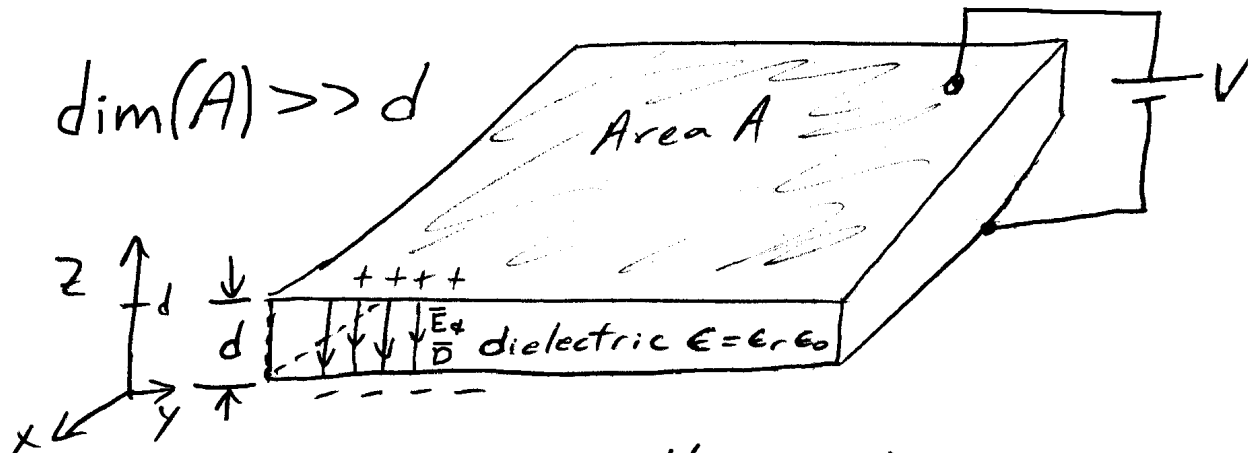


Example- Look at polarization of a dielectric slab inside a parallel-plate capacitor.



$$\vec{E} = -\vec{\nabla}V = -\hat{a}_z \frac{V}{d} \quad (\text{V/m})$$

$$(5.34) \quad \vec{D} = \epsilon \vec{E} = \epsilon_r \epsilon_0 \left(-\hat{a}_z \frac{V}{d} \right) = \underline{\underline{-\hat{a}_z \frac{\epsilon_r \epsilon_0 V}{d} \quad (\text{C/m}^2)}}$$

$$(5.31) \quad \vec{P} = \vec{D} - \epsilon_0 \vec{E} = -\hat{a}_z \frac{\epsilon_r \epsilon_0 V}{d} + \hat{a}_z \frac{\epsilon_0 V}{d}$$

$$\underline{\underline{\vec{P} = -\hat{a}_z (\epsilon_r - 1) \frac{\epsilon_0 V}{d} \quad (\text{C/m}^2)}}$$

$$(5.27a) \quad P_{ps} = \vec{P} \cdot \hat{a}_n = \begin{cases} 0 & \text{sides} \\ \vec{P} \cdot \hat{a}_z & z=d \quad (\text{Top}) \\ \vec{P} \cdot -\hat{a}_z & z=0 \quad (\text{Bottom}) \end{cases}$$

$$\underline{\underline{P_{ps} = \begin{cases} 0 & \text{sides} \\ -(\epsilon_r - 1) \frac{\epsilon_0 V}{d} & \text{Top } (z=d) \quad \leftarrow \text{adj. to pos. plate} \\ (\epsilon_r - 1) \frac{\epsilon_0 V}{d} & \text{Bottom } (z=0) \quad \leftarrow \text{adj. to neg. plate} \end{cases}}}$$

$$(5.27b) \quad \underline{\underline{P_{pv} = -\vec{\nabla} \cdot \vec{P} = 0 \quad (\vec{P} \text{ is a constant})}}$$