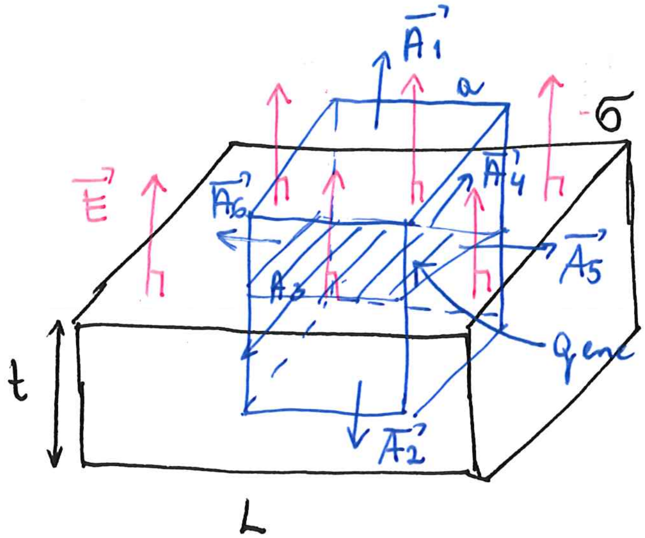
# Electric field near a conductor




$L \gg t$

$\vec{E} = 0$ inside

$\vec{E} \perp$ surface outside.
has constant magnitude at constant hight.

Planar symetry.

Choose Gaussian surface
→ pillbox (side a)
half inside & half outside the conductor

$$\underbrace{\oiint \vec{E} \circ d\vec{A}}\ = \frac{q_{enc}}{\varepsilon_0}$$

$$\underbrace{\underset{\substack{\text{bottom} \\ A_2}}{\int \vec{E} \cdot d\vec{A}}}_{\substack{\text{zero because} \\ \vec{E}=0 \text{ inside}}} + \underset{\substack{\text{top} \\ A_1}}{\int \vec{E} \cdot d\vec{A}} + \underbrace{\underset{\substack{\text{sides} \\ (A_3 - A_6)}}{4\int \vec{E} \cdot d\vec{A}}}_{\substack{\text{zero because} \\ \vec{E} \perp \vec{A_3} - \vec{A_6}}} = E \cdot A = E a^2$$

Find charge enclosed:

$$q_{enc} = \sigma \cdot a^2$$

From Gauss' law: $\oiint \vec{E} \circ d\vec{A} = \frac{q_{enc}}{\varepsilon_0}$

$$E \cdot \cancel{a^2} = \frac{\sigma \cdot \cancel{a^2}}{\varepsilon_0}$$

$$E = \frac{\sigma}{\varepsilon_0}$$

→ relationship between the strength of electric field near a conductor and the local surface charge density.

This relationship is what ensures that $\vec{E} = 0$ inside the conductor.