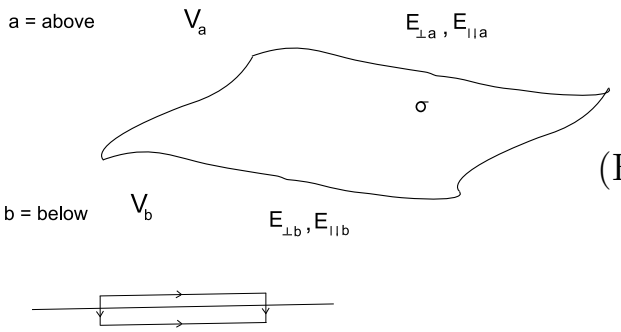
8.022 Lecture Notes Class 11 - 09/26/2006



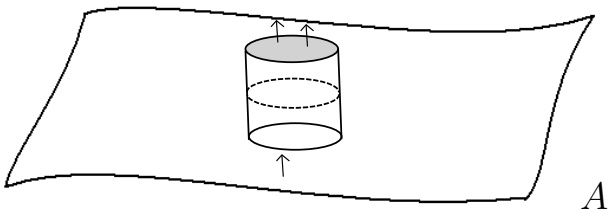
Can the electric field be parallel to a surface jump?

$$E_{||,a} - E_{||,b} = 0$$

(Electric field on both sides must be the same)

$$\oint \vec{E} \cdot d\vec{l} = \int E_{||,b} \cdot dx - \int E_{||,a} \cdot dx$$
$$0 = \int dx(E_{||,b} - E||, a)$$
$$E_{||,a} = E_{||,b}$$

$$E_{\perp,a} - E_{\perp,b} = \frac{\sigma}{\epsilon_0}$$

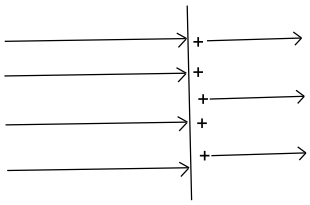


Use Gauss's Law :

$$\int_S \vec{E} \cdot d\vec{a} = \frac{Q_{enclosed}}{\epsilon_0} = \frac{\sigma A}{\epsilon_0}$$
$$A \cdot E_{||,a} - A \cdot E_{||,b} = \frac{\sigma A}{\epsilon_0}$$

$$\begin{aligned}\int_b^a &= \int_{-\epsilon}^{0} E_{b,\perp}\,dx + \int_0^{\epsilon} E_{a,\perp}\,dx \\ &= E_{b,\perp}\int_{-\epsilon}^{0} dx + E_{a,\perp}\int_0^{\epsilon} dx \\ &= -E_{b,\perp}\int_0^{\epsilon} dx + E_{a,\perp}\int_0^{\epsilon} dx \\ \Delta V = &\quad \epsilon(E_a - E_b) \to 0\end{aligned}$$

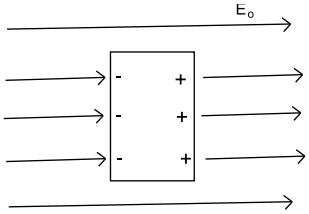
How do you get electric field discontinuities?



# of lines indicate strength (field lines begin & end on charges)

Conductors

Perfect conductors: charges move freely and instantaneously



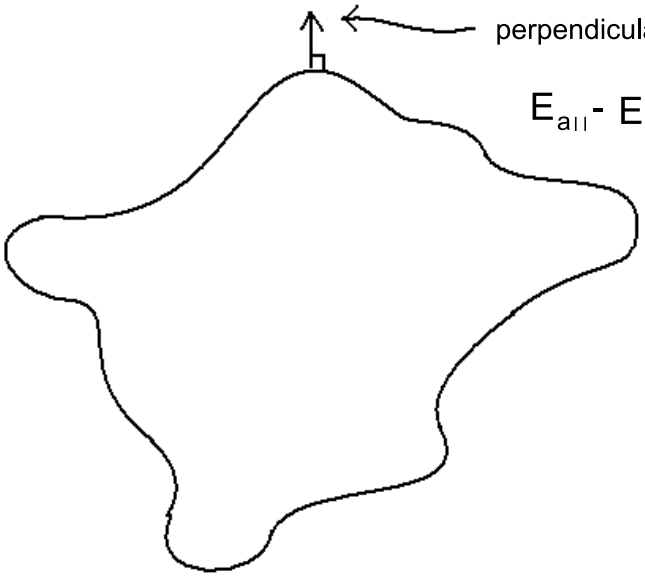
$\vec{E} = 0$ inside

$\rho = 0$ inside

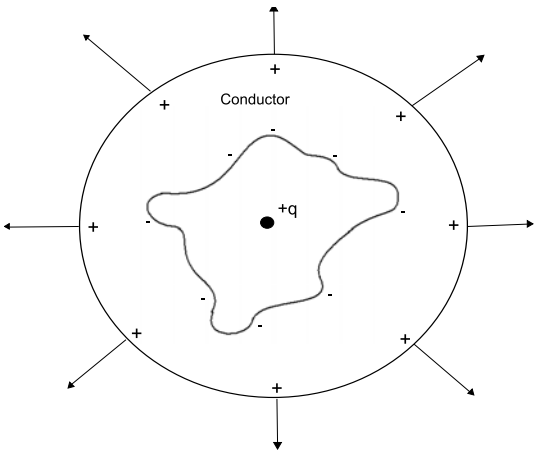
net charge is on surface

(conductor is equipotential)

$\vec{E}$ at surface?



$$\oint_S \vec{E} \cdot d\vec{a} = \frac{q}{\epsilon_0}$$



- Conductor will let you know that there's a charge inside, but nothing else
- How a faraday cage works