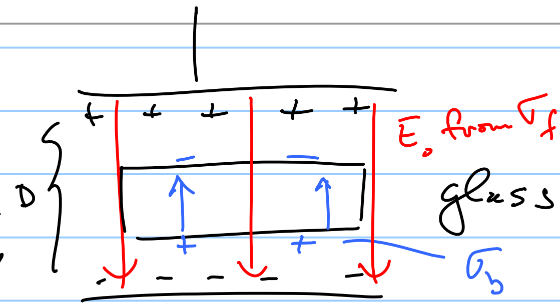
Lecture 21

Note Title 3/8/2006

material in caps



net or E_{tot} is due σ_f & σ_b

$E_{tot} < E_0$

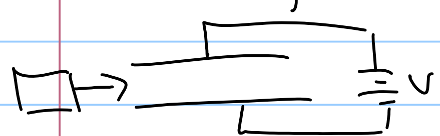
$C = \frac{Q}{|\Delta V|}$ $\quad \Delta V = \int \vec{E} \cdot d\vec{l} = |E_{tot}| D < \Delta V_0$ ← vac

$C_{glass} > C_{vac}$

$C = \frac{Q}{V}$ 3 variables $PV = nRT$

fix Q vary V, C

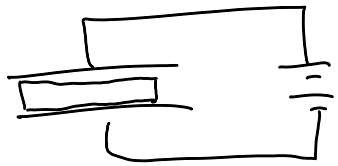
V vary Q, C

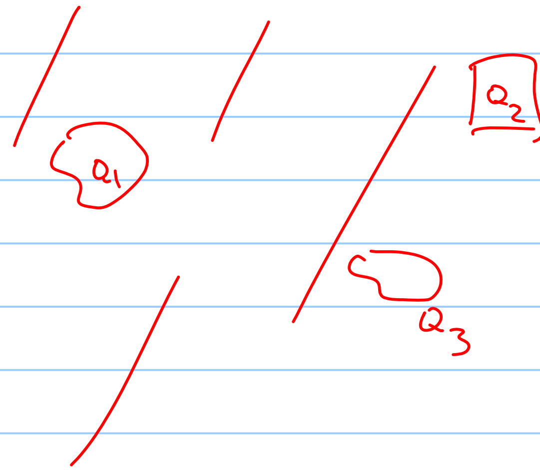


fix P vary T, V

fix T vary P, V

fix V vary P, T



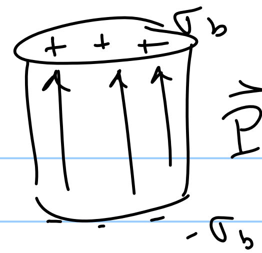


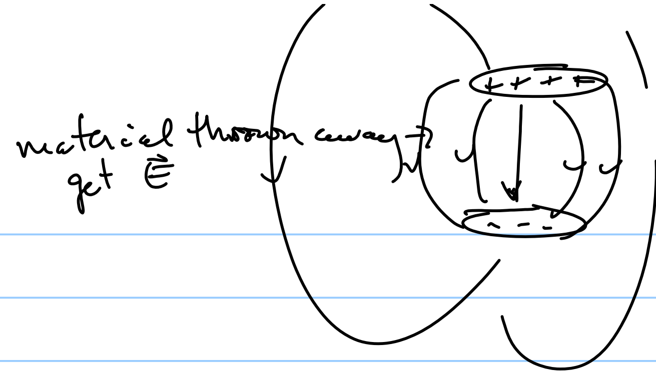
find σ_f σ_b ρ_f ρ_b

throws away material & solve electrostatic problem with the $\sigma_f, \sigma_b, \rho_f, \rho_b$

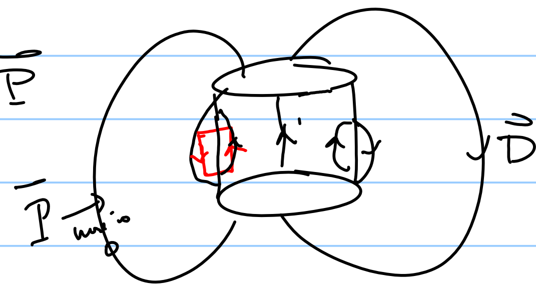
$$\vec{\nabla}\cdot\vec{E} = \frac{\rho}{\epsilon_0} = \frac{\rho_f}{\epsilon_0} + \frac{\rho_b}{\epsilon_0} \qquad \rho_b \leftarrow -\vec{\nabla}\cdot\vec{P}$$

$$\vec{\nabla}\cdot\underbrace{(\epsilon_0\vec{E} + \vec{P})}_{\vec{D}} = \rho_f \qquad \oint \vec{D}\cdot d\vec{a} = Q_f$$





$$\vec{D} = \epsilon_0 \vec{E} + \vec{P}$$

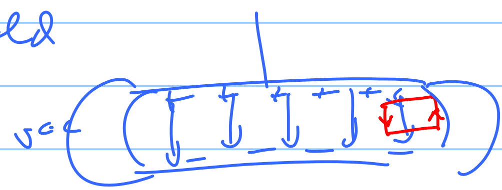


$$\vec{\nabla} \times \vec{D} = \vec{\nabla}(\epsilon_0 \vec{E} + \vec{P}) = \epsilon_0 \underbrace{\vec{\nabla} \times \vec{E}}_{0} + \vec{\nabla} \times \vec{P} =$$

$$\int \vec{\nabla} \times \vec{P} \cdot d\vec{a} = \oint \vec{P} \cdot d\vec{l} \neq 0$$

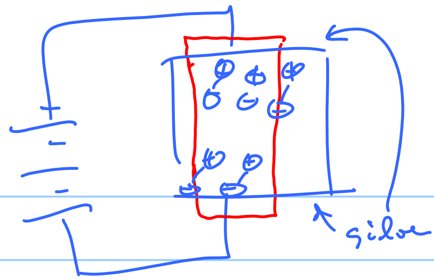
For any vector field you can uniquely specify it if you know $\vec{\nabla} \times V = \_$ & $\vec{\nabla} \cdot V = \_$

Electric field



$$\vec{\nabla} \times \vec{E} = 0$$

$$\oint \vec{E} \cdot d\vec{l} = 0$$



piezoelectric crystal has a $\vec{P}$

$$\vec{D} = \epsilon_0 \vec{E} + \vec{P}$$

↑ is material dependent

hard to find

Easy case $\vec{P} \propto \vec{E}$ linear material

↑ is ~~this E_{free}~~ or $E_{all\ charge}$ or E_{tot}