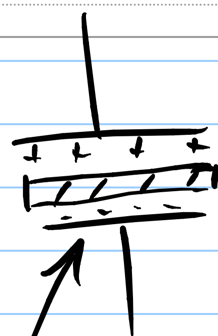
Note Title 2/27/2011

Review:

Caps:

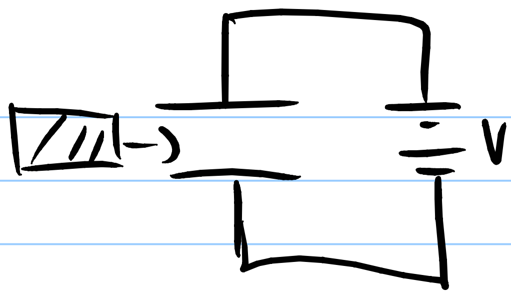


glass

fixed charge

$p = \alpha E$

atomic property



fixed V

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

3 variables

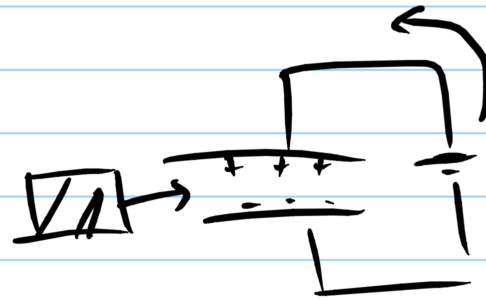
C & Q vary when V is fixed

C & V vary when Q is fixed

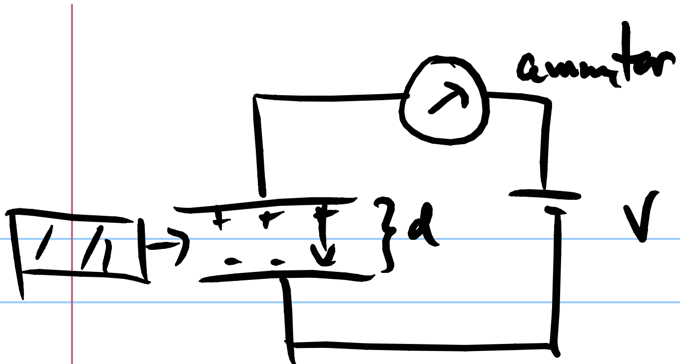
$$PV = nRT$$

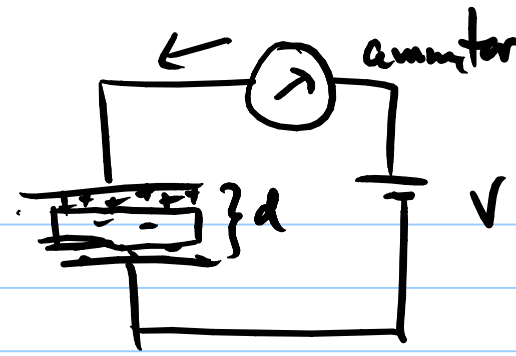
variables

$$\left.\frac{\partial P}{\partial T}\right|_V$$



$$C = \frac{Q}{V} \qquad \text{fix } V \qquad \left.\frac{\partial Q_f}{\partial C}\right|_V$$





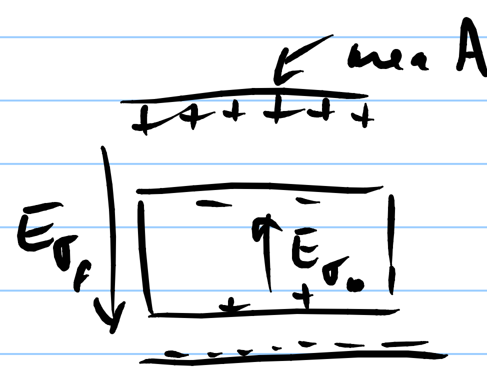
$$\int \vec{E}_{vac}\cdot d\vec{l} = E_{vac}\, d = V$$

$$\int \vec{E}_{tot}\cdot d\vec{l} = E_{tot}\, d = V$$

dielectric in cap

$E_{vac} = E_{tot}$

$$\underbrace{E_{\sigma_f} - E_{\sigma_b}}_{E_{tot}} = E_{vac}$$



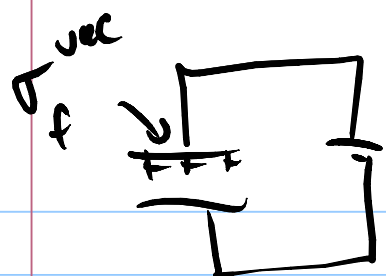
$$\boxed{\frac{\sigma_f}{\epsilon_0} - \frac{\sigma_b}{\epsilon_0} = \frac{\sigma_f^{vac}}{\epsilon_0}}$$

want to know σ_f so $Q_{diel} = \sigma_f A$

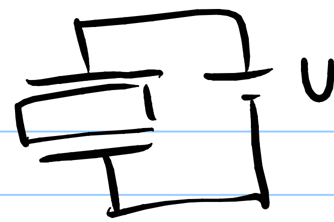
$$\boxed{\sigma_b = \frac{\chi_e \sigma_f}{1+\chi_e}}$$

eliminate σ_b & solve for σ_b

$$\sigma_f = \sigma_f^{vac}(1+\chi_e)$$



$$Q_0 = \sigma_f^{vac} A$$



$$Q_f = \sigma_f A$$
$$= \sigma_f^{vac}(1+\chi_e) A$$

$$\Delta Q = Q_f - Q_i = \sigma_f^{vac} A \chi_e$$

Const V $\qquad C = \frac{Q}{V} \qquad Q = CV$

$$\Delta Q = \frac{\partial Q}{\partial C}\bigg|_V \delta C = V\left(C_{glass} - C_{vac}\right)$$

$$\epsilon/\epsilon_0 = \frac{\epsilon_0(1+\chi_e)}{\epsilon_0}$$

$$= V\left(C_{vac}K - C_{vac}\right) = VC_{vac}\left(K - 1\right)$$

$$= V \underbrace{C_{vac}}_{=\frac{\epsilon_0 A}{d}}\left(1+\chi_e - 1\right) = V\frac{\epsilon_0 A}{d}\chi_e = \frac{V}{d}\epsilon_0 A\chi_e$$

$$|\Delta V| = \left|-\int \vec{E}\cdot d\vec{l}\,\right| = Ed$$

$$\Delta Q = E\epsilon_0 A \chi_e = \frac{\sigma_f^{vac}}{\cancel{\epsilon_0}} \cancel{\epsilon_0} A \chi_e$$

$$\Delta Q = \sigma_f^{vac} A \chi_e$$