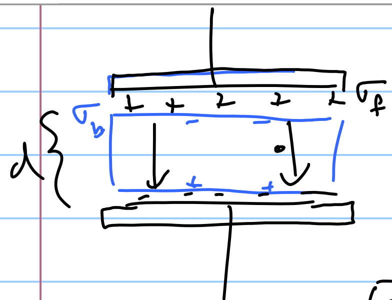
Lecture 23

Note Title 3/13/2006



$$E_{tot} = \frac{\sigma_f}{\epsilon_0} - \frac{\sigma_b}{\epsilon_0} = \frac{\sigma_f - P}{\epsilon_0}$$

linear material $P = \epsilon_0 \chi_e E_{tot}$

$$E_{tot} = \frac{\sigma_f}{\epsilon_0} - \chi_e E_{tot}$$

$$E_{tot} = \underbrace{\frac{\sigma_f}{\epsilon_0}}_{E_{vac}} \frac{1}{1+\chi_e} = \frac{E_{vac}}{K}$$

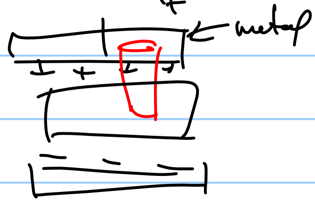
$$\Delta V = -\int \vec{E}\cdot d\vec{l}$$

$$C = \frac{Q}{|\Delta V|} = \frac{Q}{E_{tot}\, d} = \frac{\sigma A}{\frac{\sigma d}{\epsilon_0}\frac{1}{1+\chi}} = \frac{\epsilon_0 A}{d} K$$

$\vec{\nabla}\cdot\vec{D} = \rho_f$ Gauss's Law

$$\Downarrow$$

$$DA = \sigma_f A$$



$$\underbrace{D = \epsilon_0 E + P}_{} = \sigma_f$$

$$E = \frac{\sigma_f}{\epsilon_0} - \frac{P}{\epsilon_0}$$

1.) Expt. we measure capacitance $\Rightarrow K = 1 + \chi_e$
macroscopic system composed of atoms or molecules $\Rightarrow$ measurement of K infers atomic properties

$$\vec{P} = \epsilon_0 \underline{\chi_e} \vec{E} = N \vec{p} = N \alpha \vec{E}$$

$\vec{P}$: dipole mom / vol

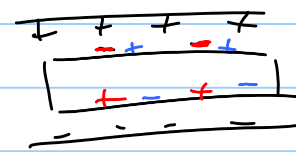
N: # molecules / vol

$\vec{p}$: dipole of atom

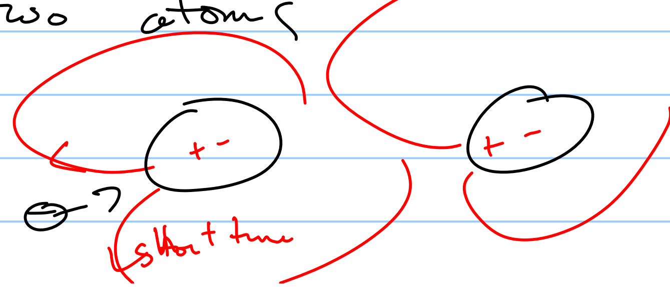
gas of non interacting atoms (each dipole doesn't influence others)

2.) $$E_{tot} = \frac{\sigma_f}{\epsilon_0} \frac{1}{1+\chi}$$

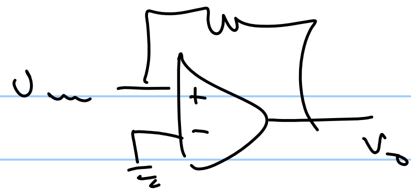
$$\vec{P} = \epsilon_0 \chi \vec{E}$$

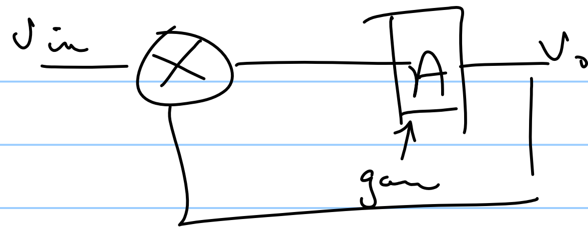


two atoms



positive (or neg) feedback



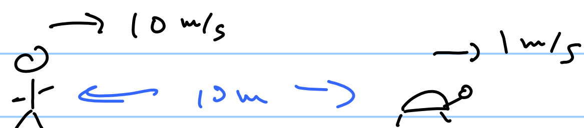


$$V_o = V_{in} A \pm V_o A$$

$$\frac{V_o}{V_{in}} = \frac{A}{1 \mp A}$$

$A \to 1$ pos feedback ∞

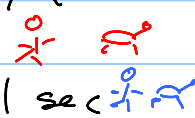
Zeno's paradox



Achilles

n	a_n
1st	1 sec
2nd	.1 sec
3rd	.01

after 1 sec



$$\sum a_n$$