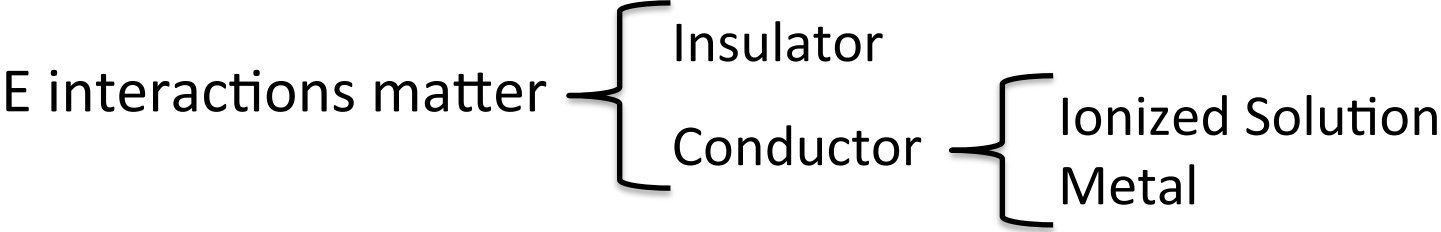
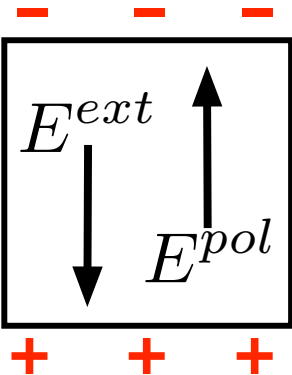


Lecture 6



Mobile Electrons

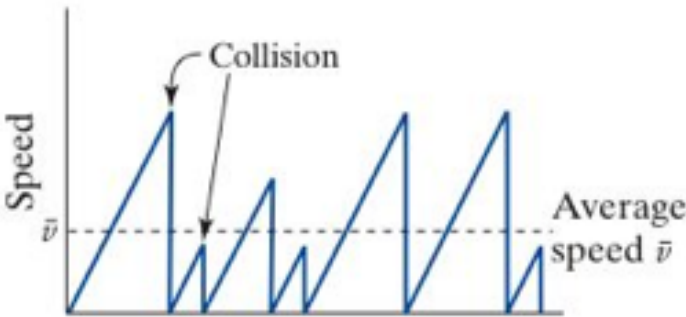


$$F = qE = ma$$
$$a = \frac{qE}{m}$$

Initial Drift Velocity:

$$v = a\Delta t = \frac{qE}{m}\Delta t$$

Collision: Δt



$$\bar{v} = \left(\frac{q\Delta t}{m}\right) E = \underset{\substack{\uparrow \\ \text{electron mobility}}}{u} E$$

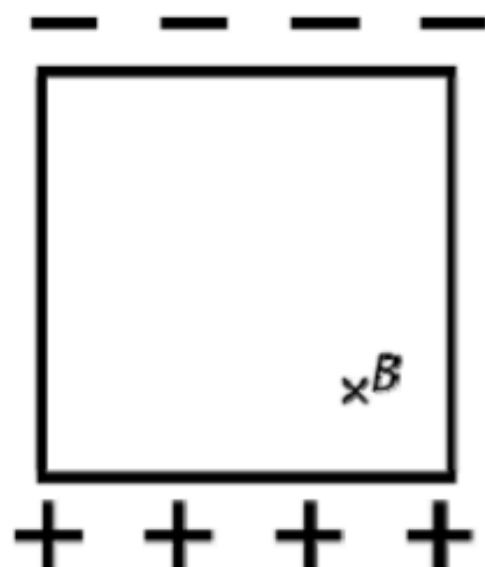
Intermediate:

$$\bar{v} = \left(\frac{q\Delta t}{m}\right) (E^{ext} - E^{pol})$$

Eventually

$$\bar{v} = 0, \quad E_{net} = 0$$

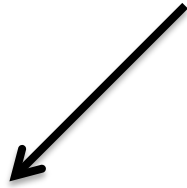
Q14.4f A neutral copper block is polarized as shown, due to an electric field made by external charges (not shown). What is the direction of the **net** electric field at location **B**, which is inside the copper block?



Choice	Direction of E_B , the net electric field at B
1	Up
2	0
3	Down

Verify Following Answer:

A. E at B due to positive surface charge



B. E at B due to all charges

Resultant field at B = 0

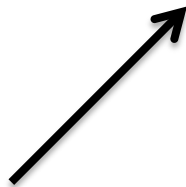
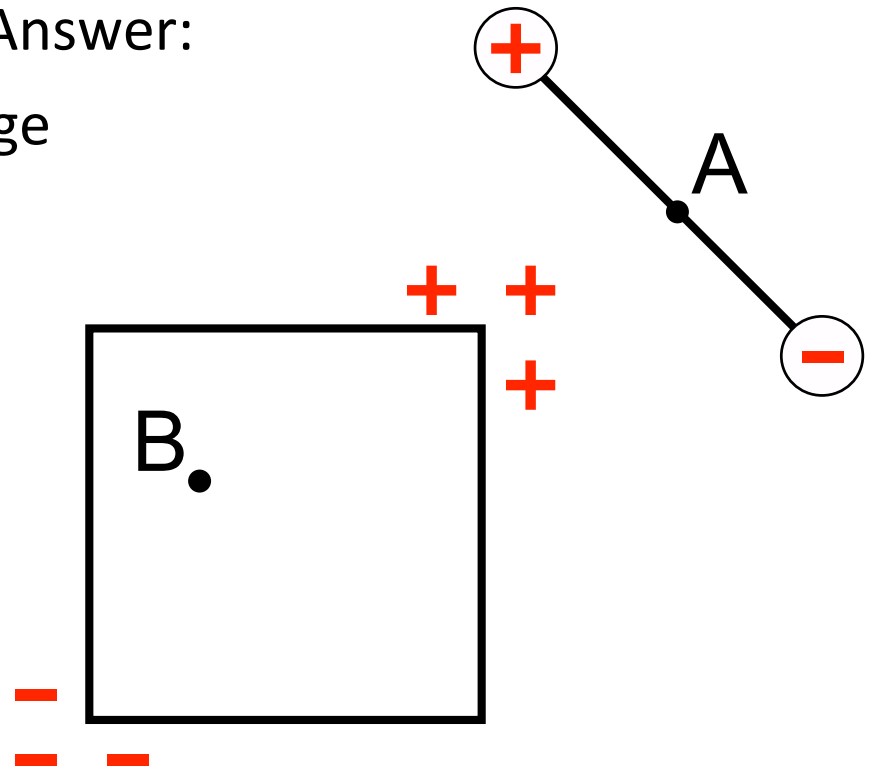
C. E at B due to all surface charges

At B:

$$E^{+} + E^{-} + E_B^{dipole} = 0$$

$$E^{+} + E^{-} = -E_B^{dipole}$$

D. E_A due to all charges, due to all surface charges



Example HW problem

Example: let $Q < 0$

For a conducting sphere with charge Q on it...

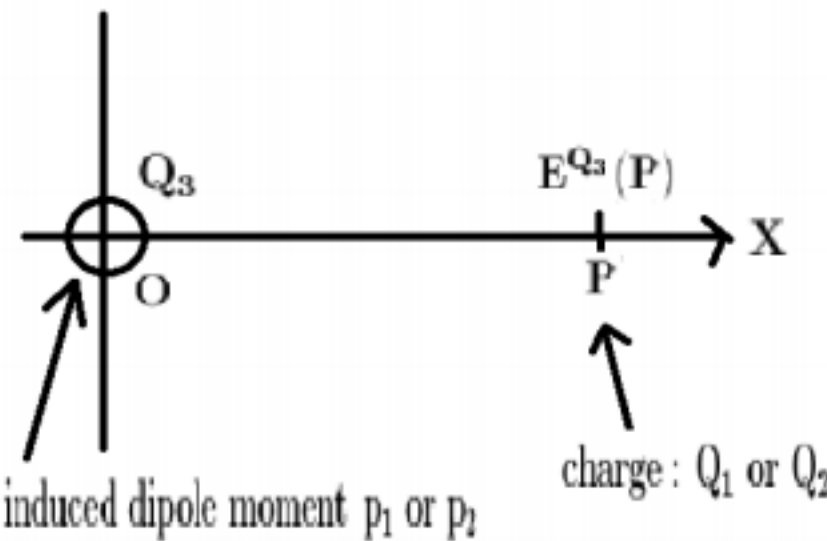
Place positive q_1 at P , get F_1

Place positive q_2 at P get F_2

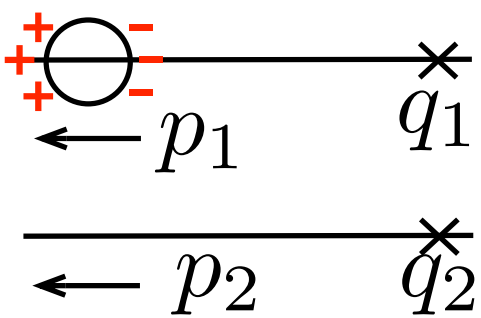
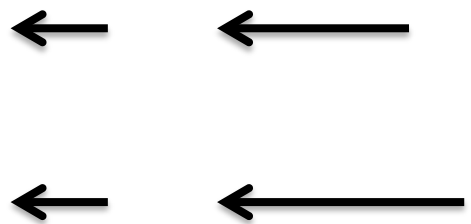
If $q_2 > q_1$ shows that $E_2 = \frac{F_2}{q_2} > \frac{F_1}{q_1} = E_1$ then $E_2 > E_1$

Reasoning:

q_1 leads to $E_0^{q_1} \rightarrow p_1$

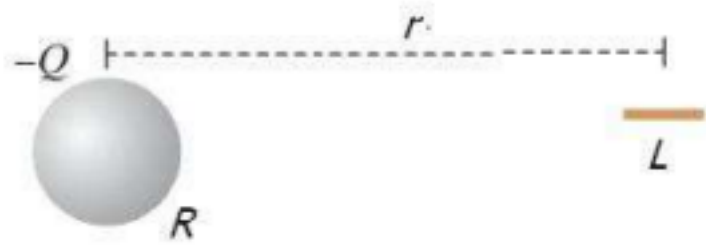


$$E'_P = E_P^Q + E_P^{p_1}$$



$$\therefore E''_P > E'_P$$

Example HW problem



Read, Problem Assumes:

$$E_0^{dipole} + E_0^Q = 0$$

Calculate Polarizability

$$p = \alpha E_0^Q$$

Equal condition: at 0 $E_0^{dipole} + E_0^Q = 0$

$$\begin{array}{c}
 \begin{array}{c} -q \quad +q \\ \bullet \quad \quad \bullet \end{array} \\
 E_0^{dipole} = E_0^{-q} + E_0^{+q} = \frac{2kq}{\left(\frac{L}{2}\right)^2}
 \end{array}$$

$\uparrow$
 kq
 $\frac{\left(\frac{L}{2}\right)^2}$
 $\leftarrow$

$\uparrow$
 kq
 $\frac{\left(\frac{L}{2}\right)^2}$
 $\leftarrow$