Electricity and Magnetism

- Physics 259 – L02
- Lecture 18

Chapter 23

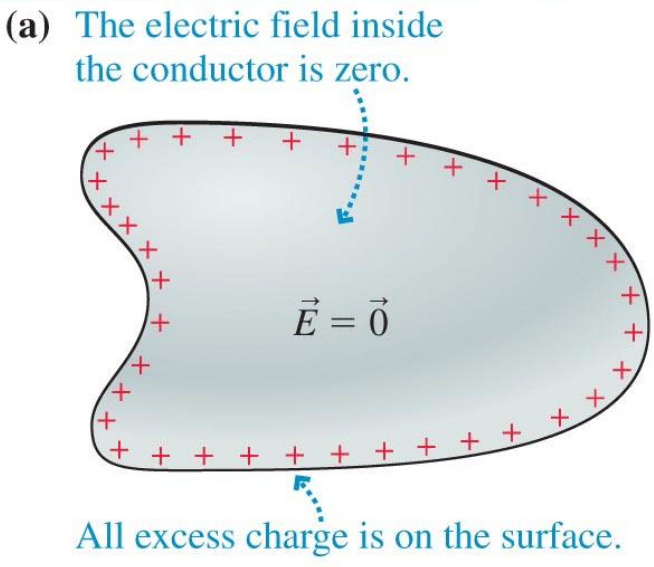
Last time

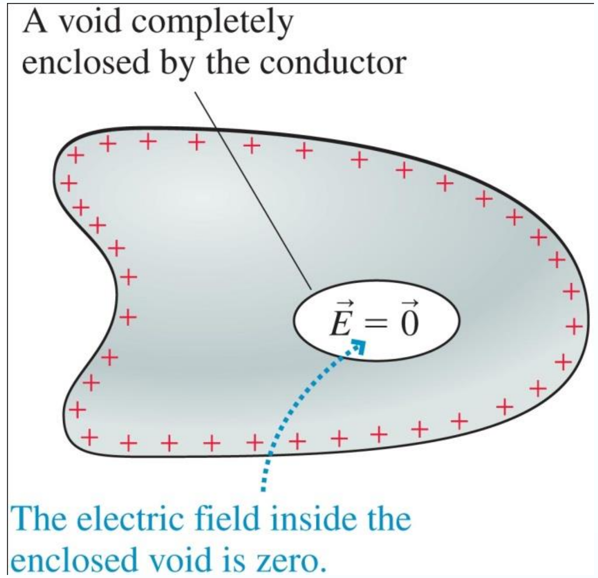
- Chapter 23.2 and 23.3 

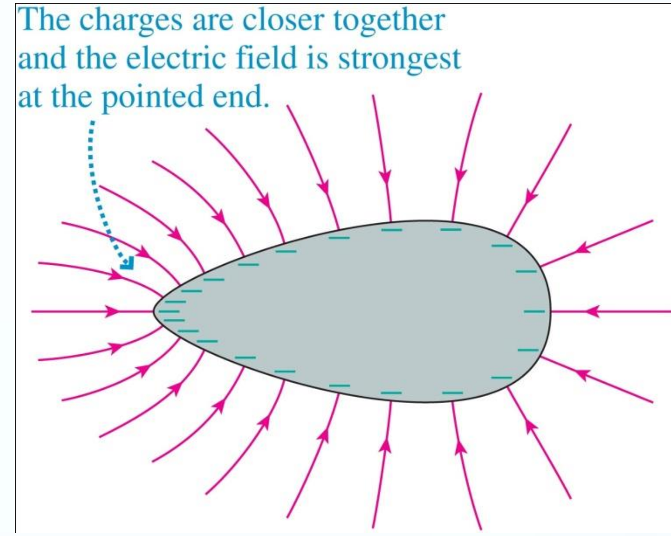
This time

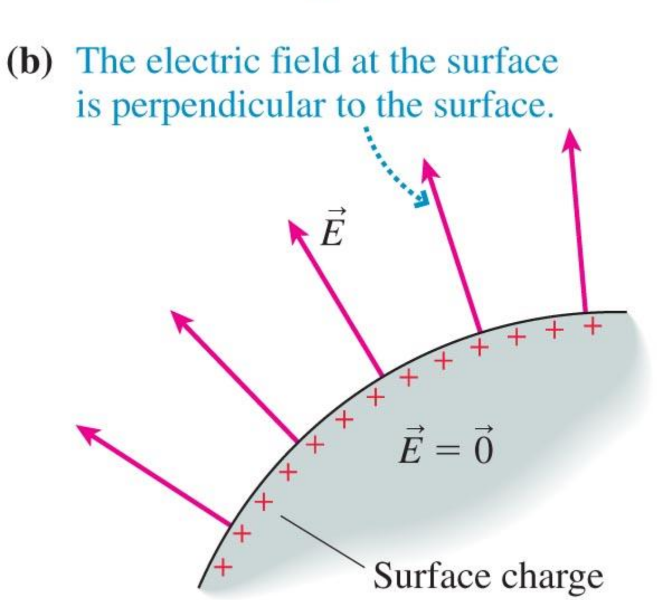
- Chapter 23.5 and 23.5 

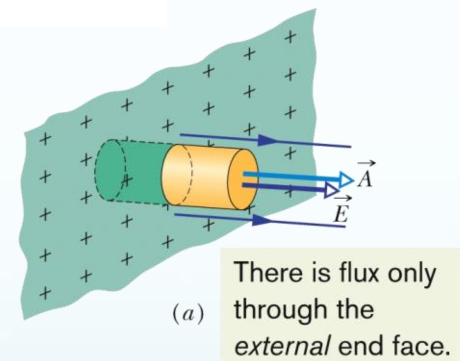
Summary of Conductors and Electric Fields

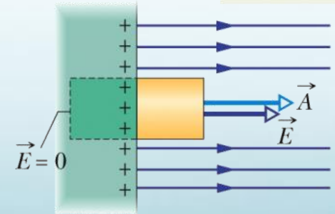












$$E = \frac{\sigma}{\varepsilon_0} \quad \text{(conducting surface).}$$

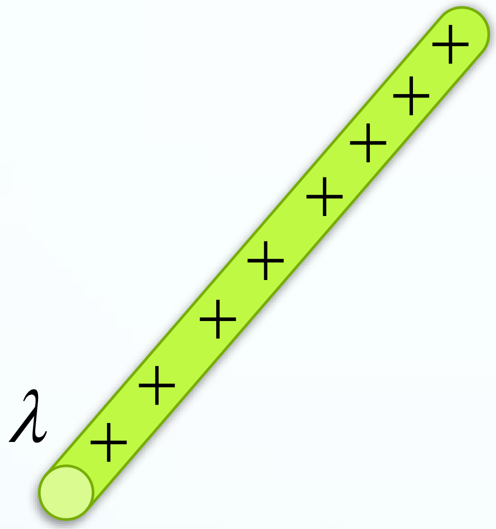
23-4 to 23-6

23-4: Electric field of a long, charged wire

Infinitely long plastic wire

$$\Phi_e = \oint \vec{E}.d\vec{A} = \frac{Q_{in}}{\varepsilon_0}$$

L

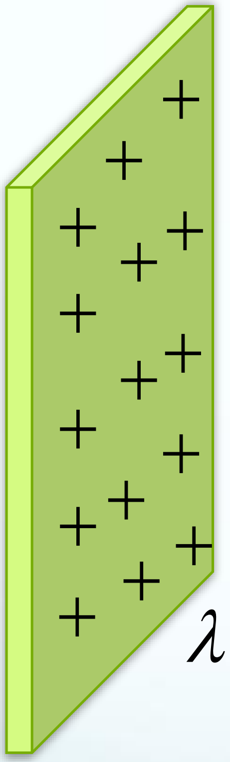


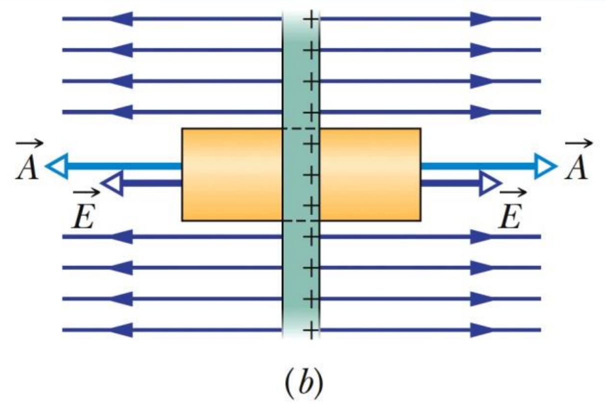
$$E_{wire} = \frac{\lambda}{2\pi\varepsilon_0 r}$$

23-5: Electric field of a plane of charge

Nonconduction infinite sheet

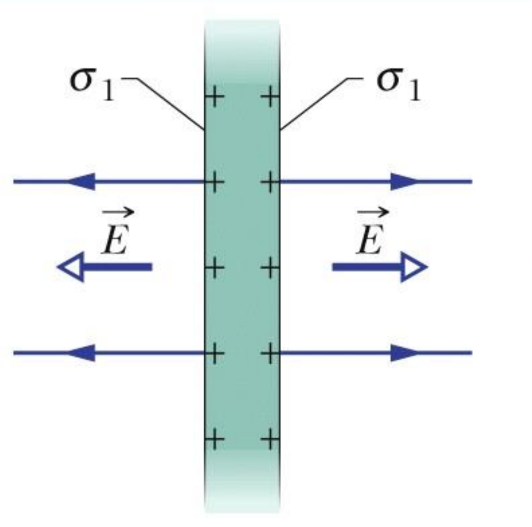
$$\Phi_e = \oint \vec{E}.d\vec{A} = \frac{Q_{in}}{\varepsilon_0}$$

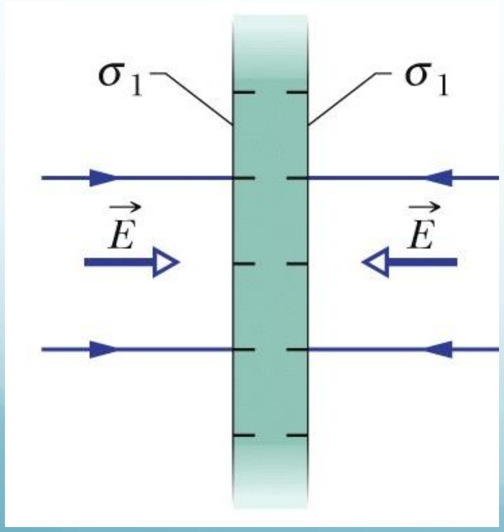


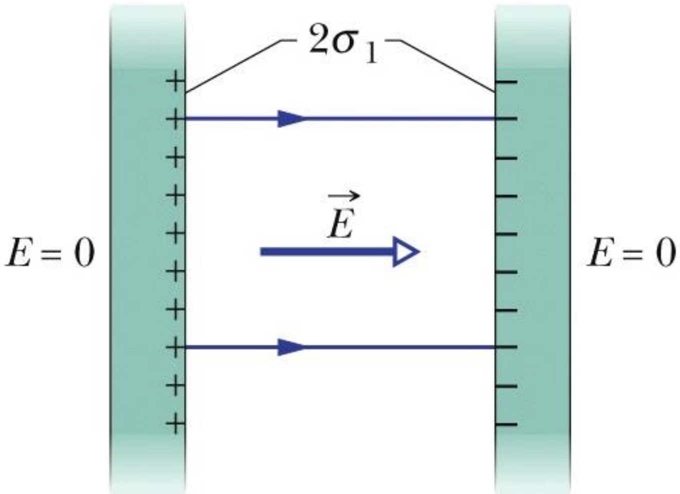


$$E_{plane} = \frac{\sigma}{2\varepsilon_0}$$

Two conducting Plates





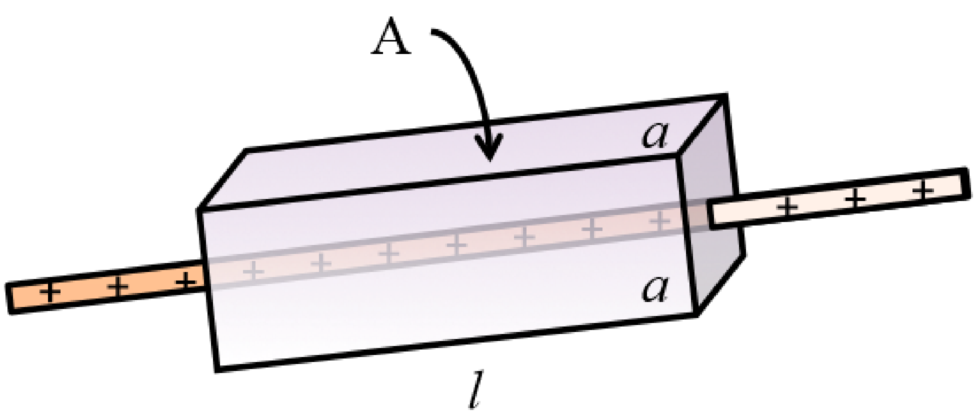


(c)

$$E = \frac{2\sigma_1}{\varepsilon_0} = \frac{\sigma}{\varepsilon_0}.$$

Field of a line charge

Consider an infinitely long, positively charged rod of linear charge density λ. How large is the flux through side A of the box? Suppose the values for l, a and λ are given.



Field of a line charge

– Consider an infinitely long, positively charged rod of linear charge density λ. How large is the flux through side A of the box? Suppose the values for l, a and λ are given.

– Gauss' law tells us that the total electric flux only depends on the enclosed charge – not the shape of the (closed) Gaussian surface:

$$\Phi_{tot} = Q_{encl}/\varepsilon_0 = \lambda l/\varepsilon_0$$