

Electricity and Magnetism

- Physics 259 – L02
 - Lecture 18




UNIVERSITY OF
CALGARY


Chapter 23



Last time

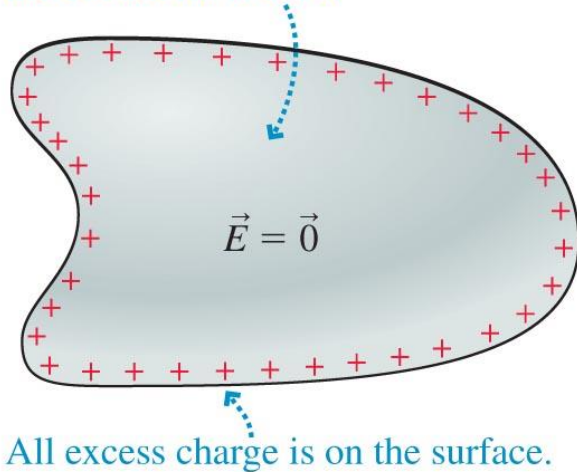
- Chapter 23.2 and 23.3 

This time

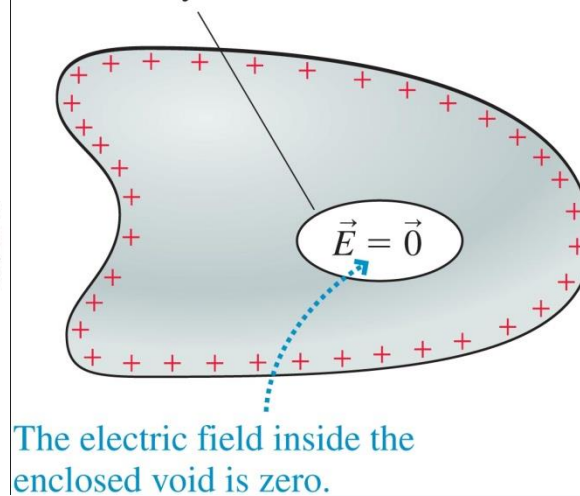
- Chapter 23.5 and 23.5 

Summary of Conductors and Electric Fields

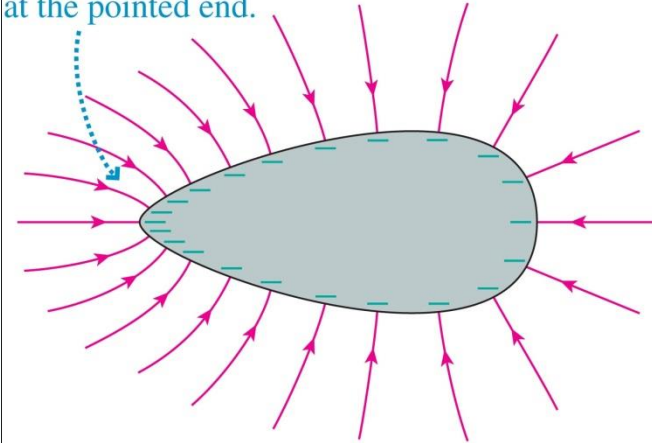
- (a) The electric field inside the conductor is zero.



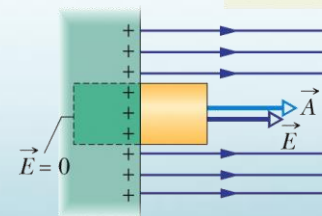
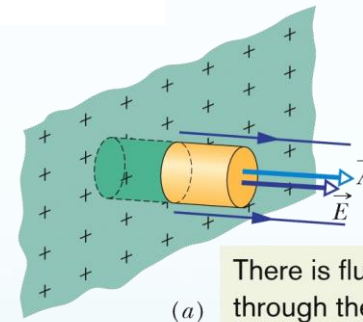
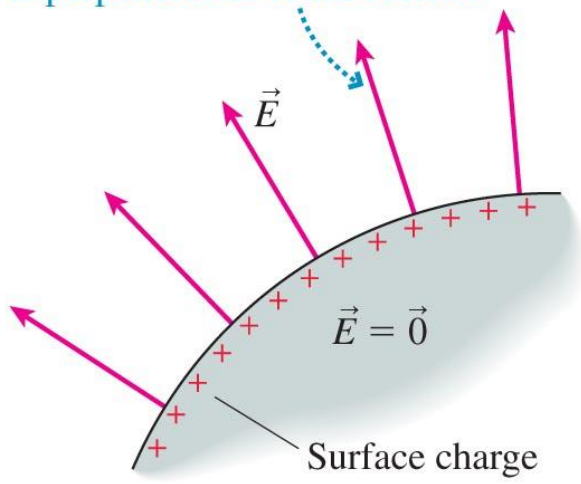
A void completely enclosed by the conductor



The charges are closer together and the electric field is strongest at the pointed end.



- (b) The electric field at the surface is perpendicular to the surface.



$$E = \frac{\sigma}{\epsilon_0} \quad (\text{conducting surface}).$$

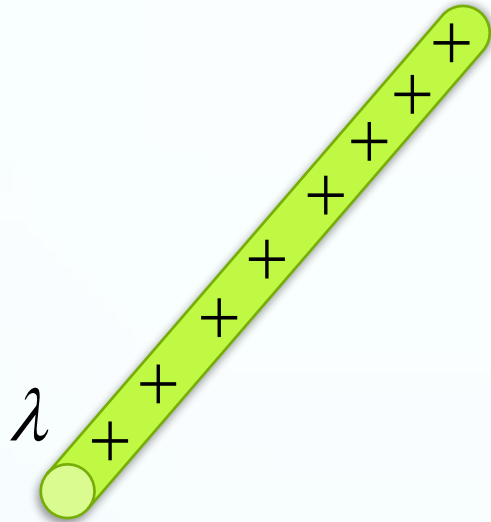
23-4 to 23-6



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

Infinitely long plastic wire

L



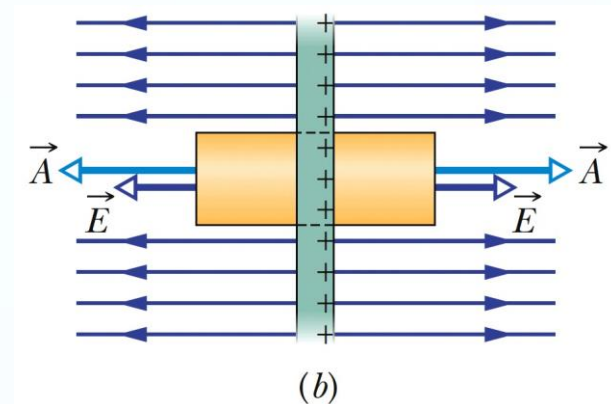
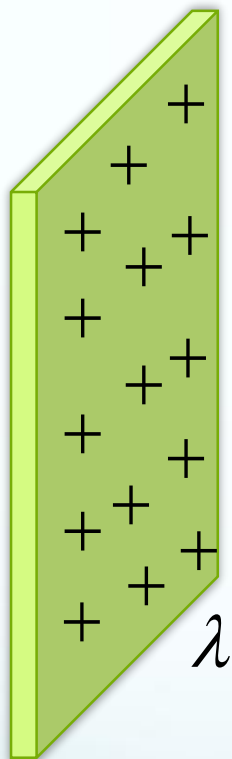
$$\Phi_e = \oint \vec{E} \cdot d\vec{A} = \frac{Q_{in}}{\epsilon_0}$$

$$E_{wire} = \frac{\lambda}{2\pi\epsilon_0 r}$$

23-5: Electric field of a plane of charge

Nonconduction infinite sheet

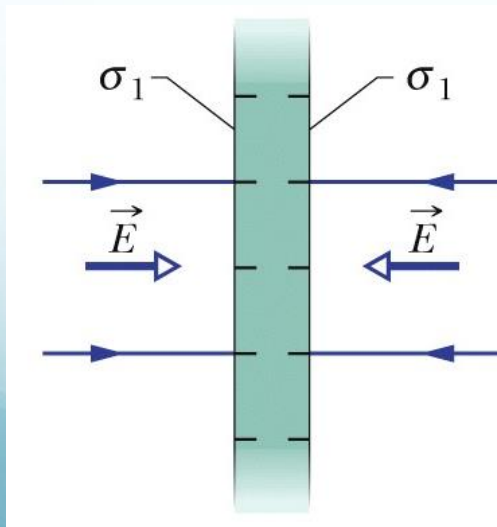
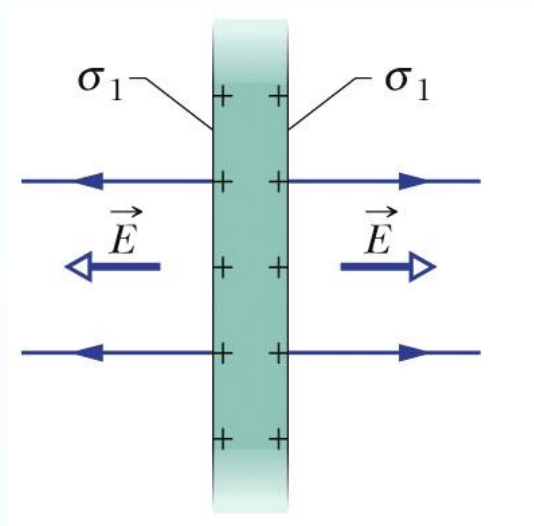
$$\Phi_e = \oint \vec{E} \cdot d\vec{A} = \frac{Q_{in}}{\epsilon_0}$$

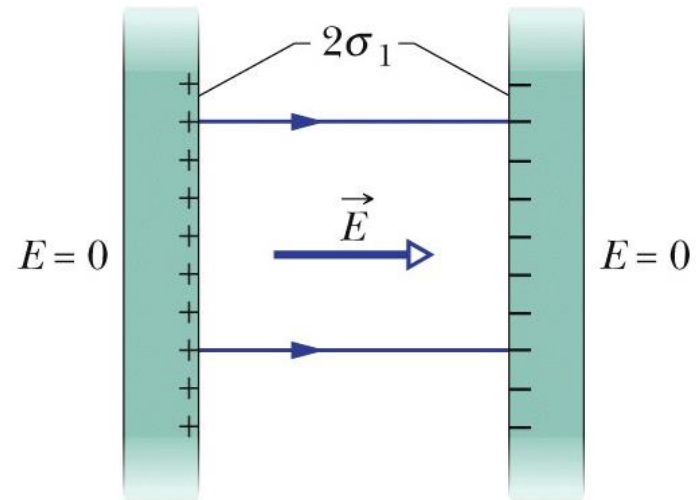


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$$E_{plane} = \frac{\sigma}{2\epsilon_0}$$

Two conducting Plates



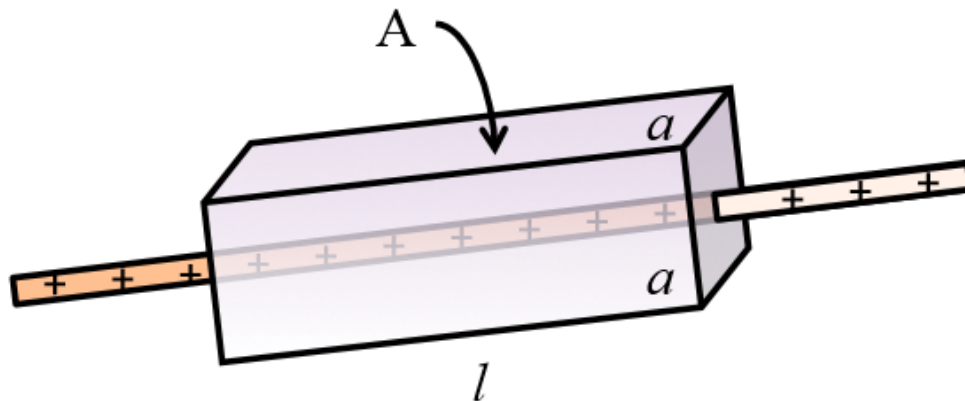


(c)

$$E = \frac{2\sigma_1}{\epsilon_0} = \frac{\sigma}{\epsilon_0}.$$

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:

$$\Phi_{\text{tot}} = Q_{\text{encl}}/\epsilon_0 = \lambda l/\epsilon_0$$

