Lecture
6

Guass' Law

What is the electric flux through (a) and (b) in and electric field E?

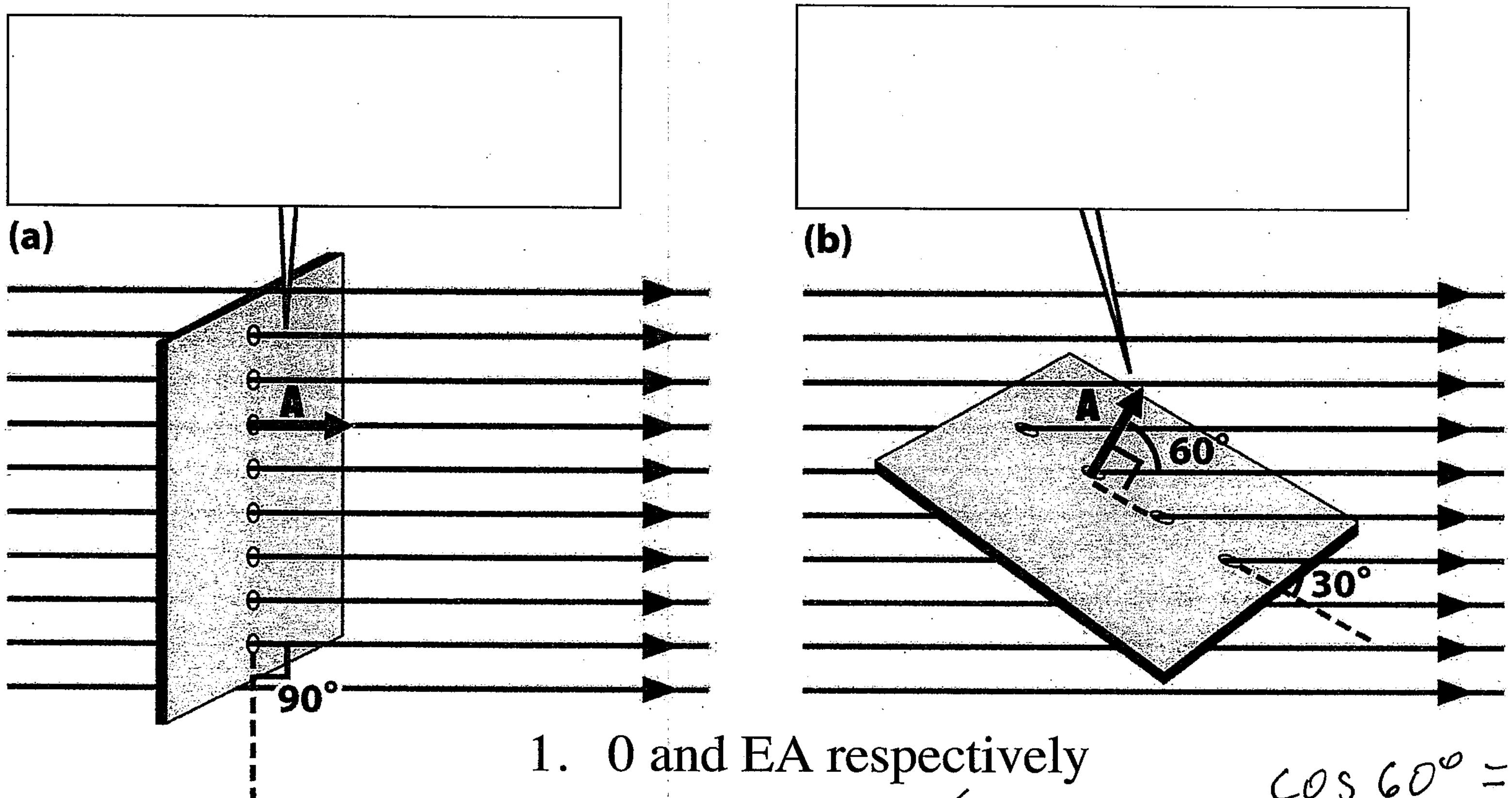


Figure 24-5 Physics for Engineers and Scientists 3/e

1. 0 and EA respectively
2. EA and EA/2 ✓
3. EA and √3EA/2
4. 0 and EA/2
5. 0 and √3EA/2

$\cos 60° = 1/2$

Point Ch in Cent of sphere

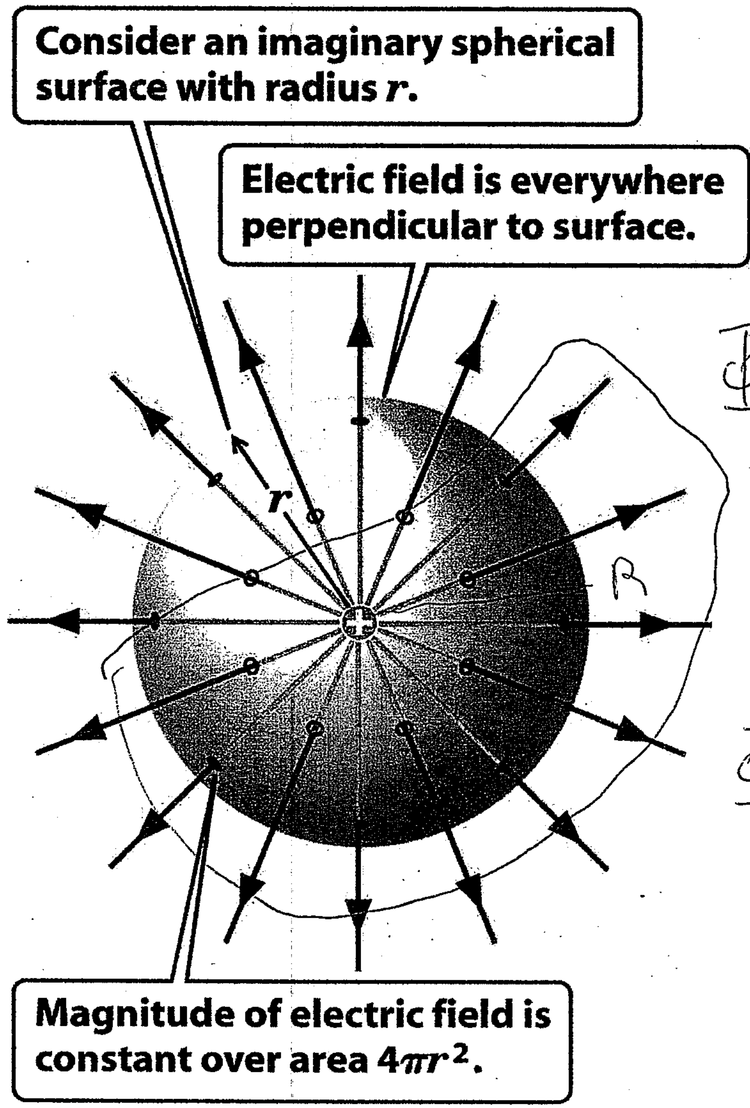


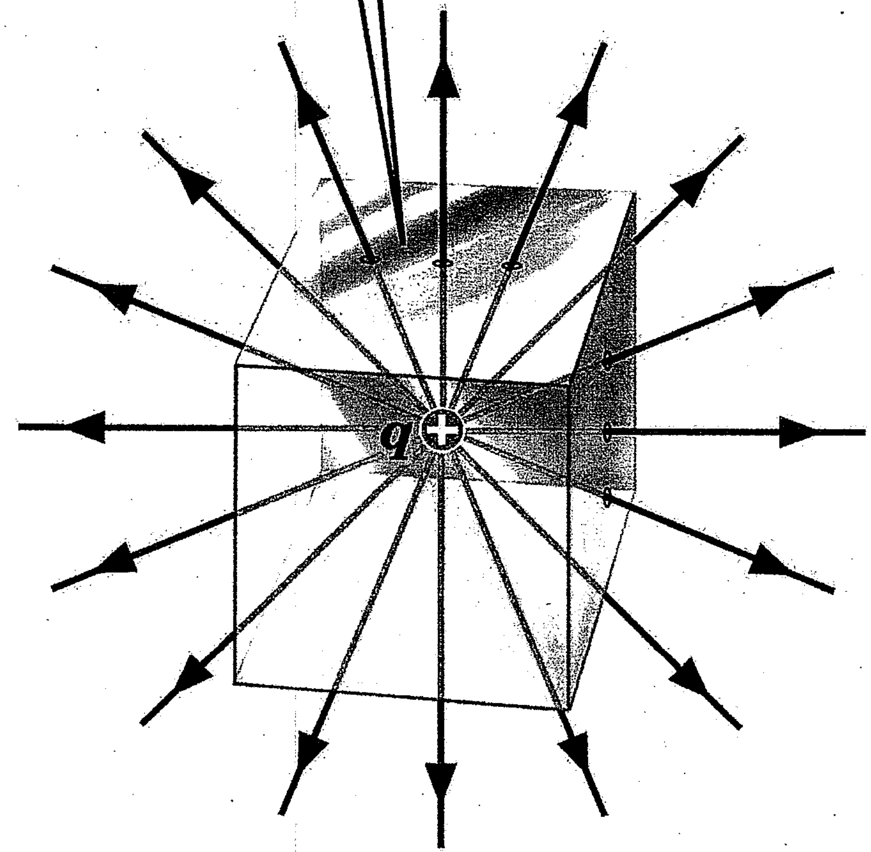
Figure 24-6 Physics for Engineers and Scientists 3/e

$$\Phi_E = E(r)\,A$$

$$E(r) = \frac{Q}{4\pi\epsilon_0 r^2}, \quad A = 4\pi r^2$$

$$\Phi_E = \frac{Q}{\epsilon_0}$$

The sphere of Example 2 has been replaced by a cube. Does the flux change?



$$\Phi_E = \frac{Q}{\epsilon_0}$$

Figure 24-8 Physics for Engineers and Scientists 3/e

a. 0
b. q/ε_0
c. Indeterminate

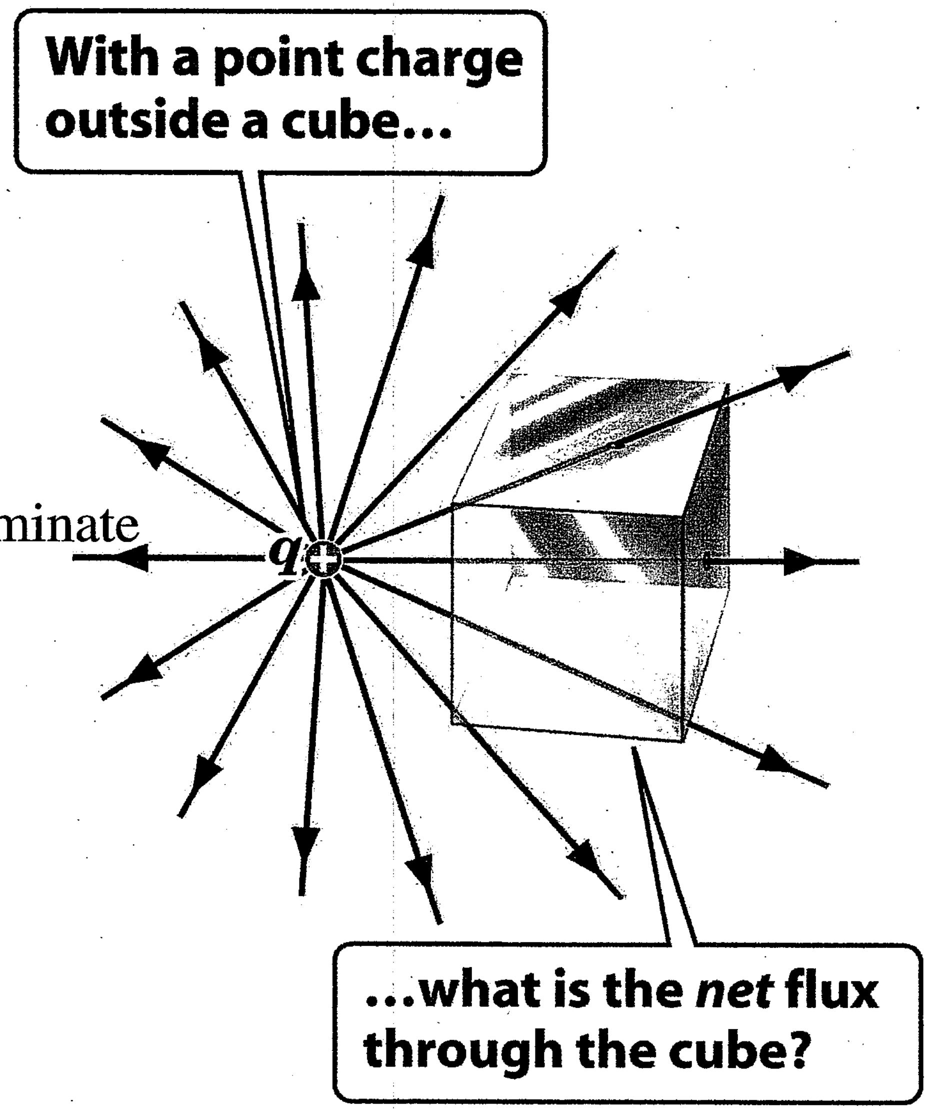


Figure 24-9 Physics for Engineers and Scientists 3/e

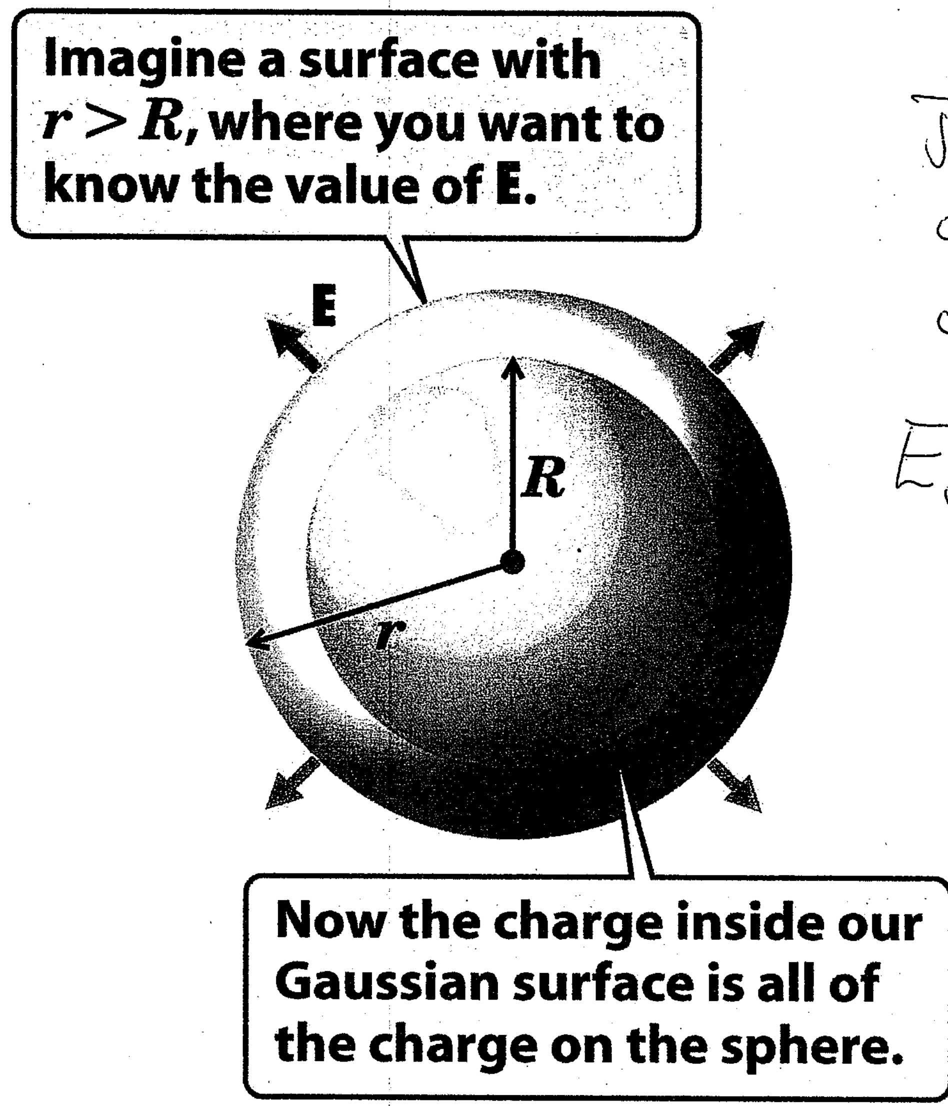


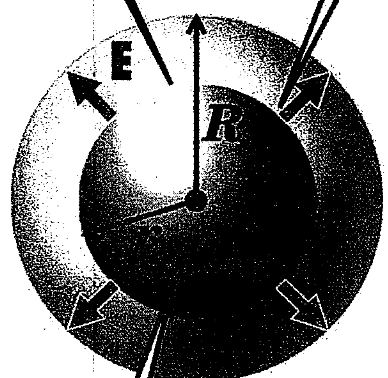
Figure 24-12b Physics for Engineers and Scientists 3/e

Just like a point charge

$$E_r = \frac{Q}{4\pi\epsilon_0 r^2}$$

To apply Gauss' Law, imagine a spherical surface with radius $r < R$, where you want to know the value of **E**.

Electric field is radial and perpendicular to surface of area $4\pi r^2$.



We then determine the amount of charge inside our imaginary surface, $Q_{inside} = \rho V_{inside}$.

$$E_r = \frac{Q \quad r}{4\pi \epsilon_0 R^3}$$

Figure 24-12a Physics for Engineers and Scientists 3/e

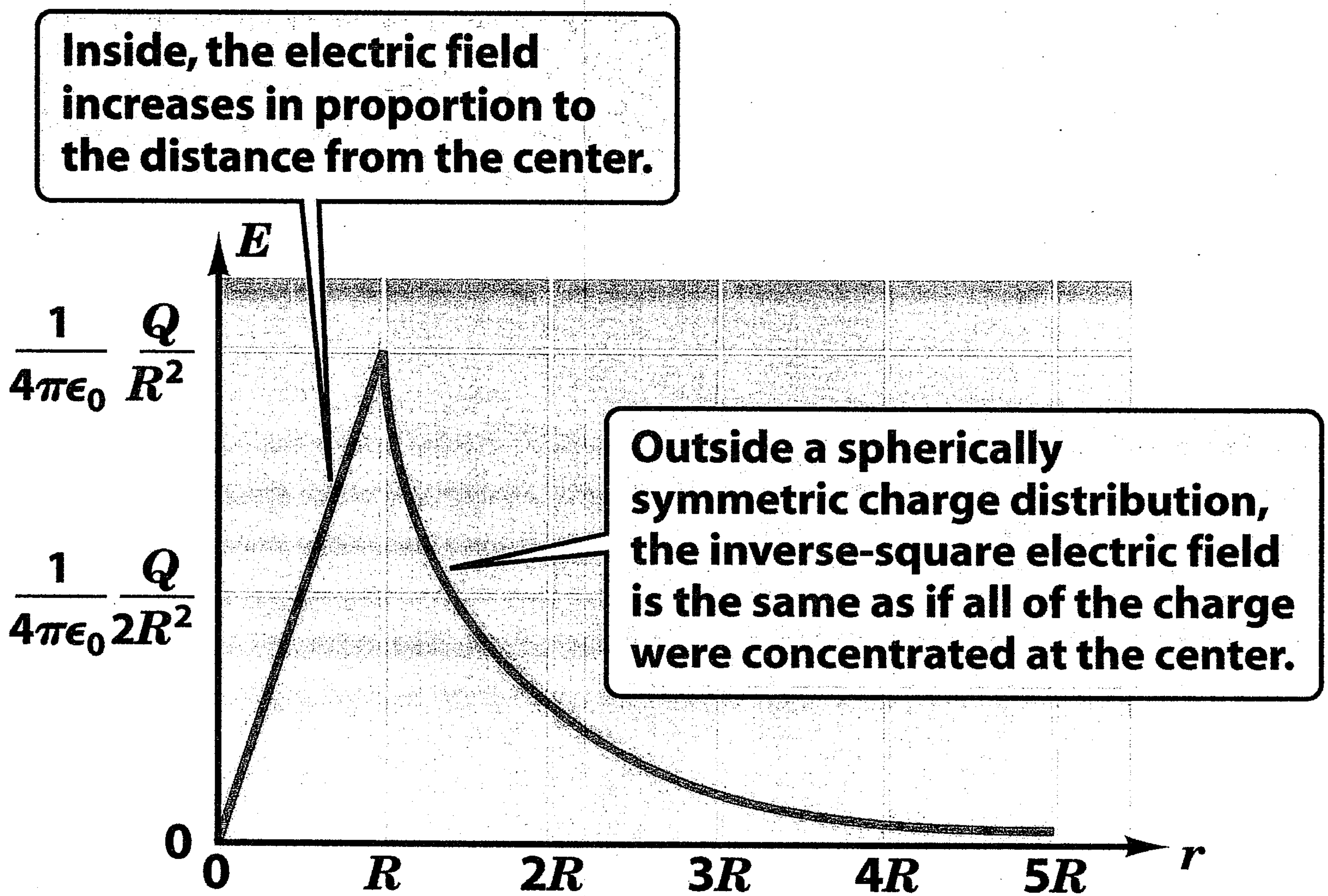


Figure 24-13 Physics for Engineers and Scientists 3/e

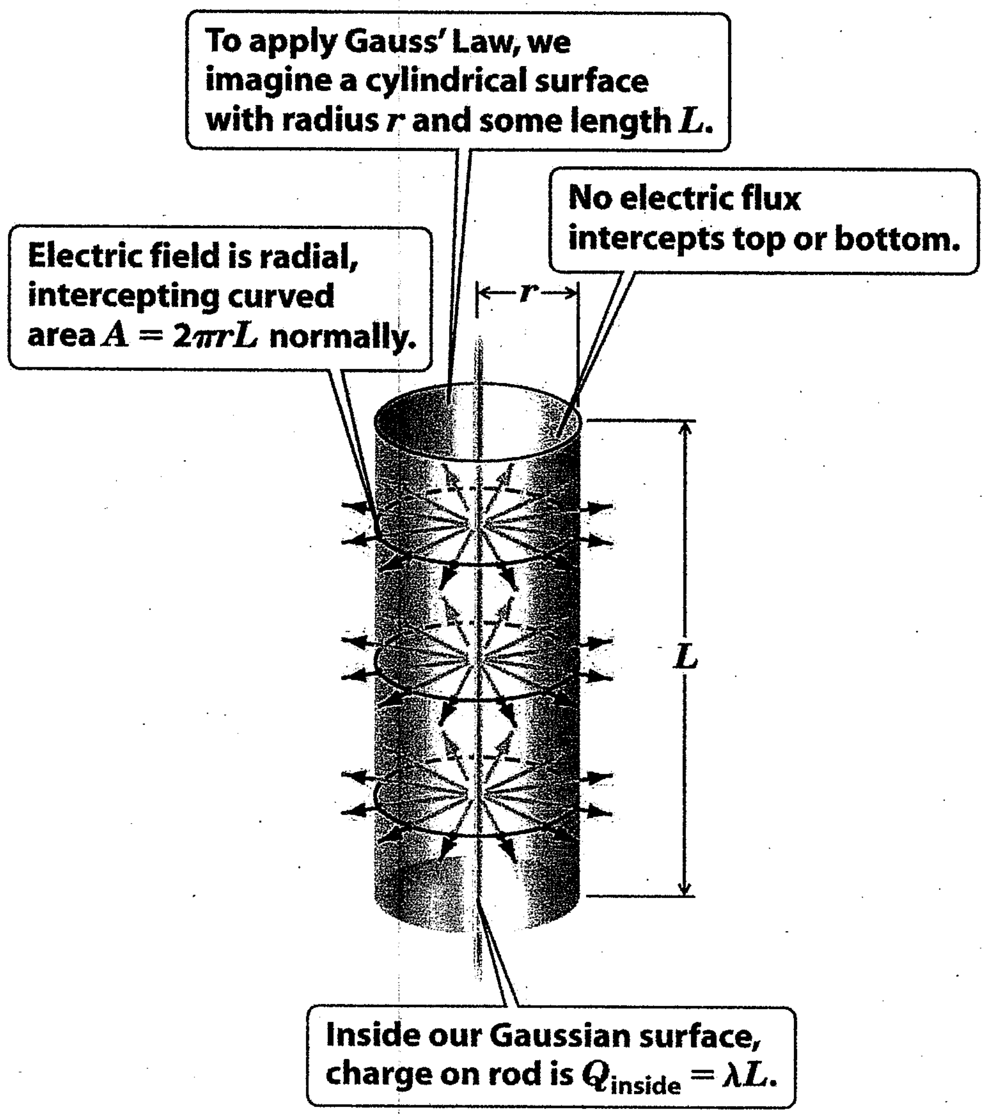


Figure 24-14 Physics for Engineers and Scientists 3/e

$r \leq a$

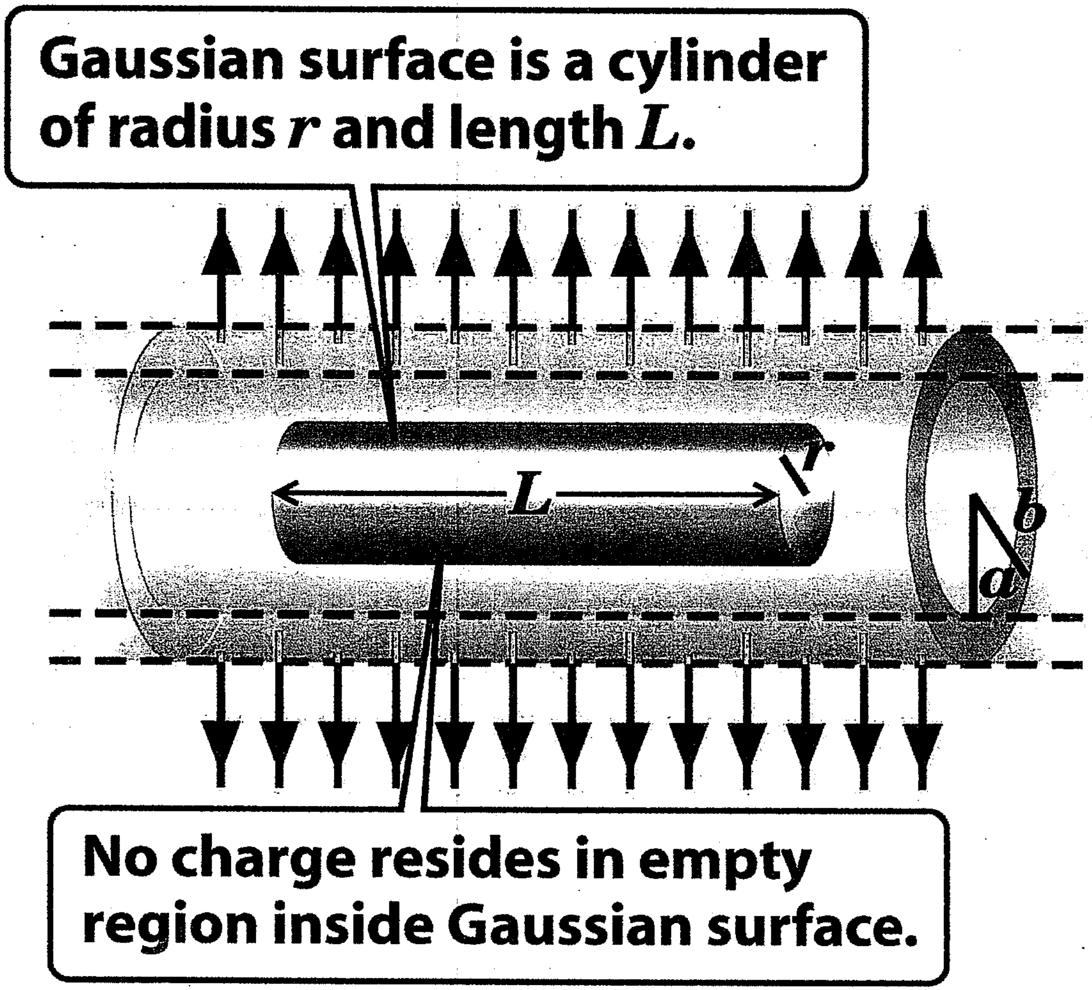


Figure 24-15a Physics for Engineers and Scientists 3/e

$a \leq r \leq b$

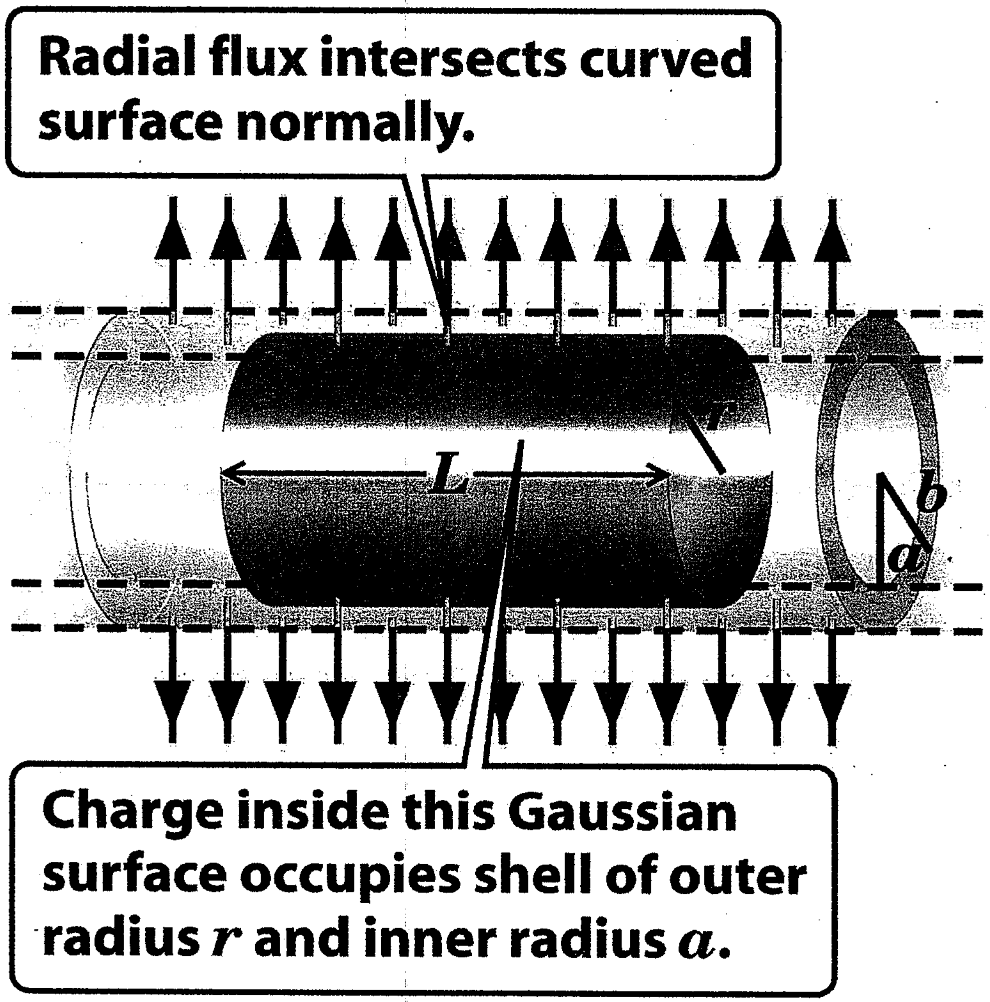
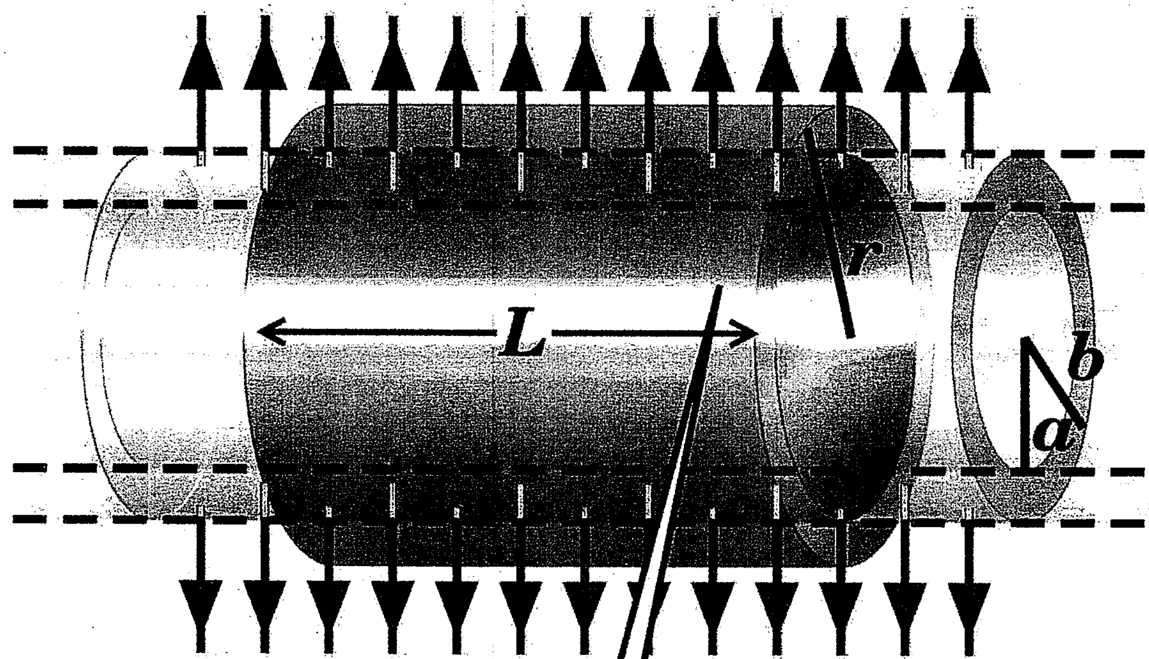


Figure 24-15b Physics for Engineers and Scientists 3/e

$r \geq b$



Charge inside this Gaussian surface is entire charge on length L of shell.

Figure 24-15c Physics for Engineers and Scientists 3/e

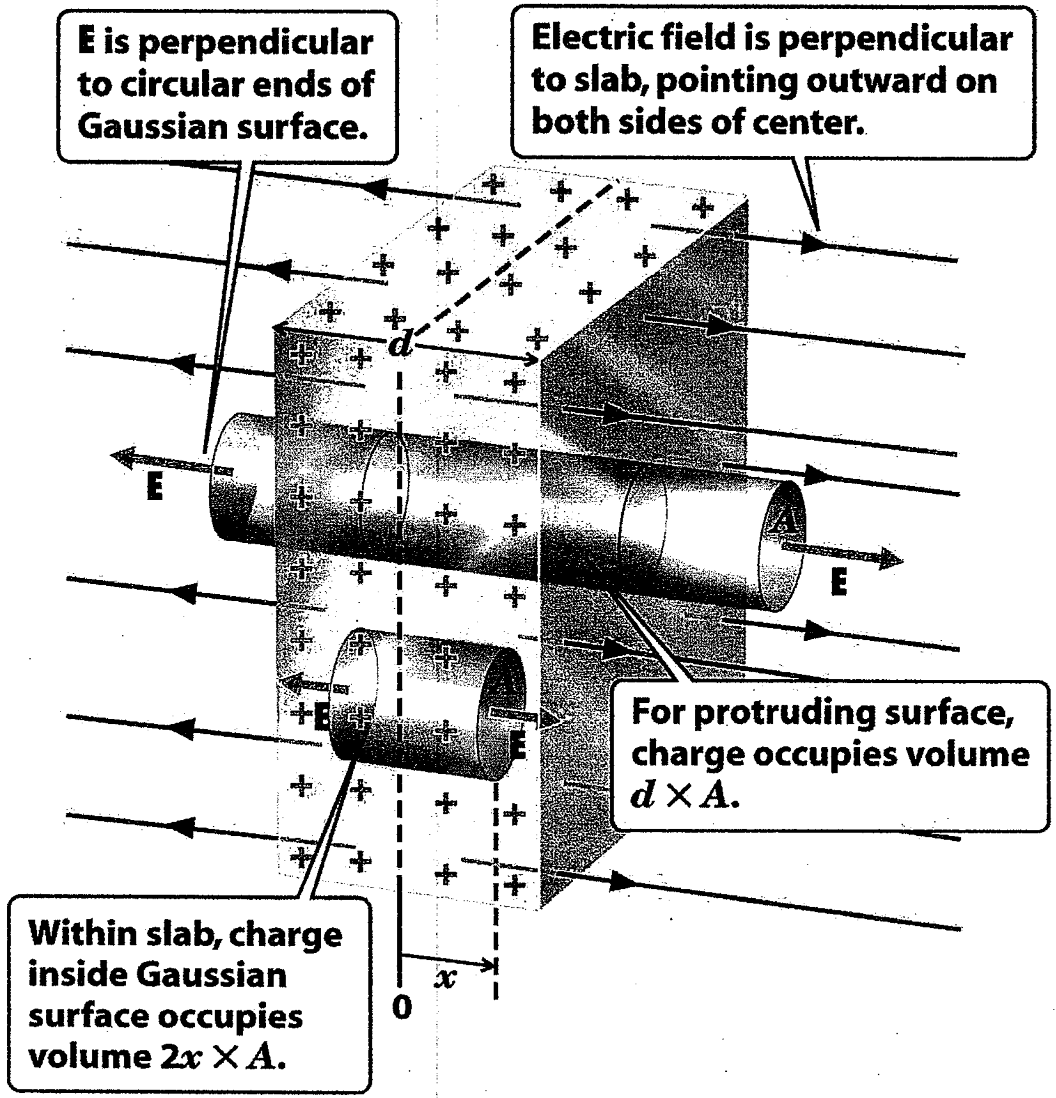


Figure 24-17 Physics for Engineers and Scientists 3/e

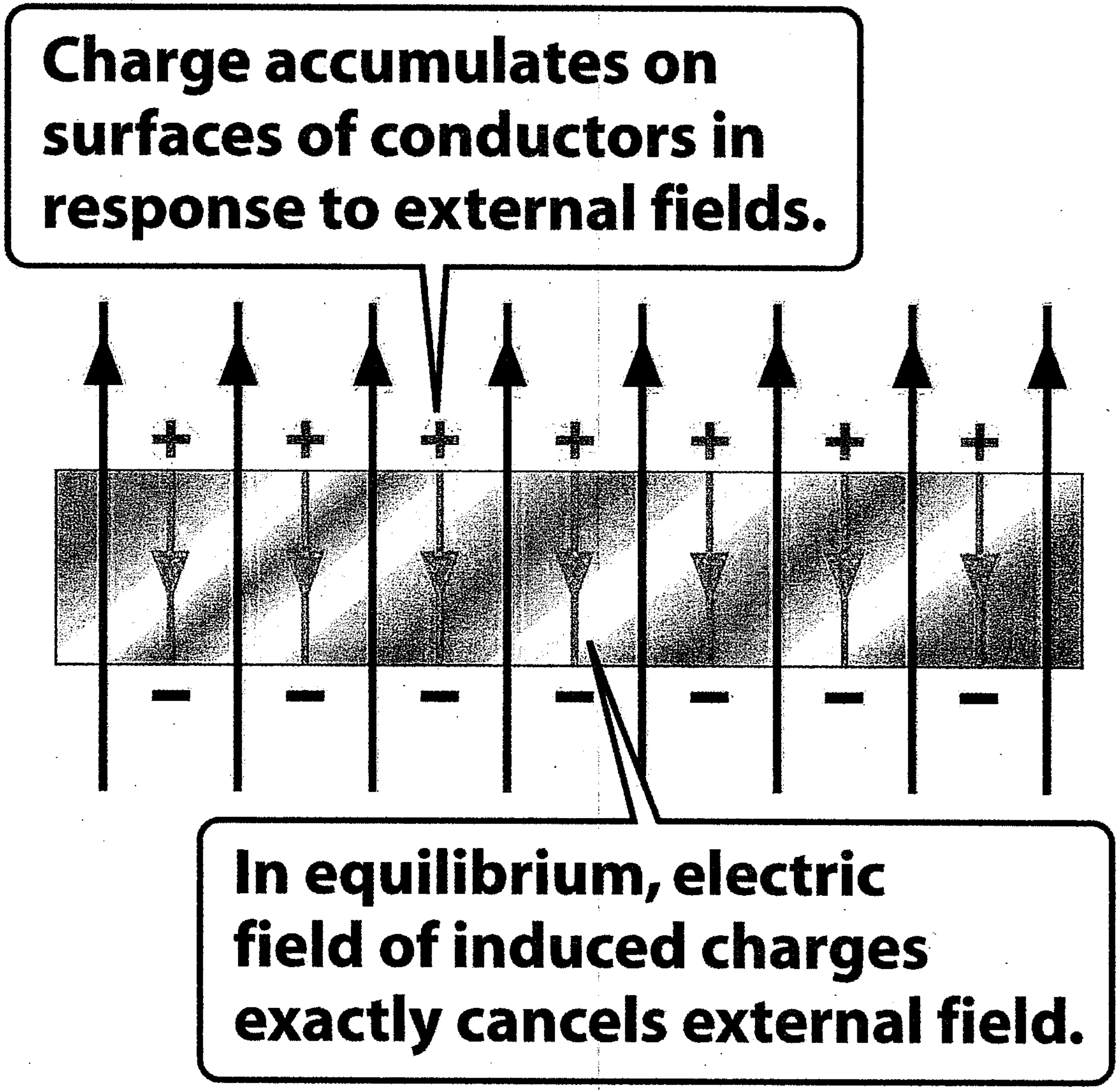


Figure 24-20 Physics for Engineers and Scientists 3/e

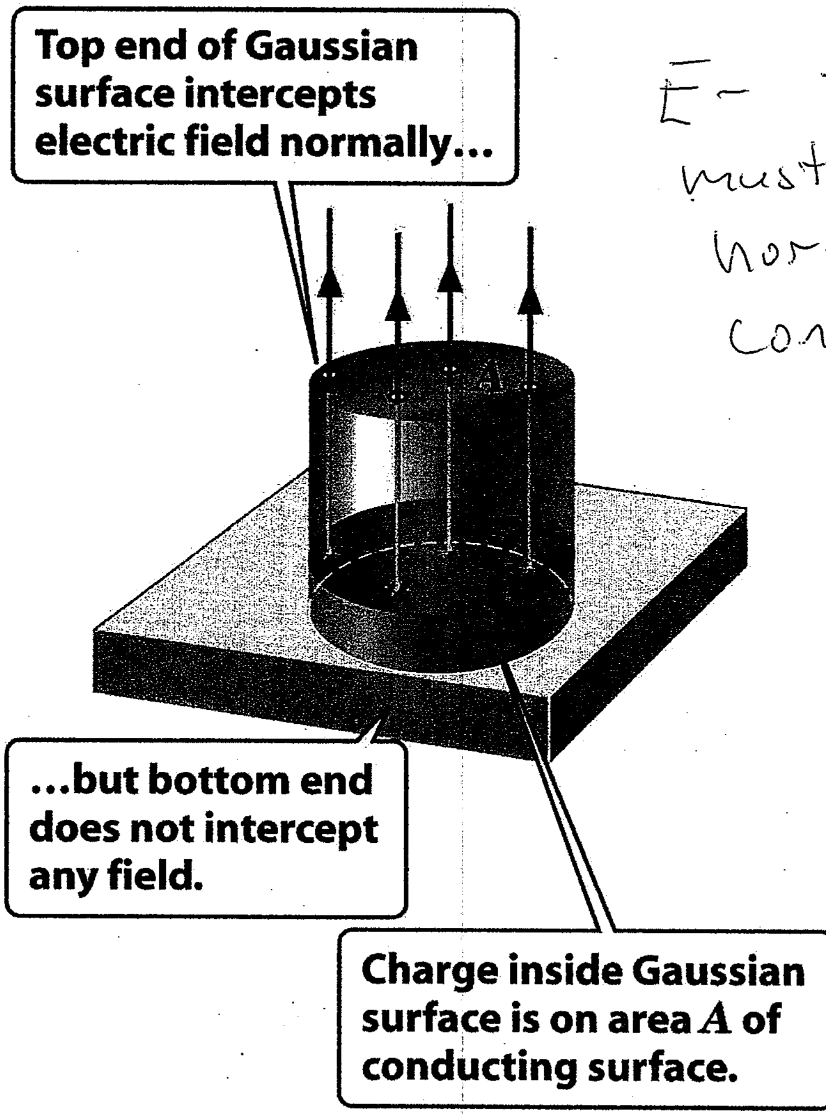


Figure 24-23b Physics for Engineers and Scientists 3/e

E-fields must be normal to conductor!

$$E = \frac{\sigma}{\epsilon_0}$$

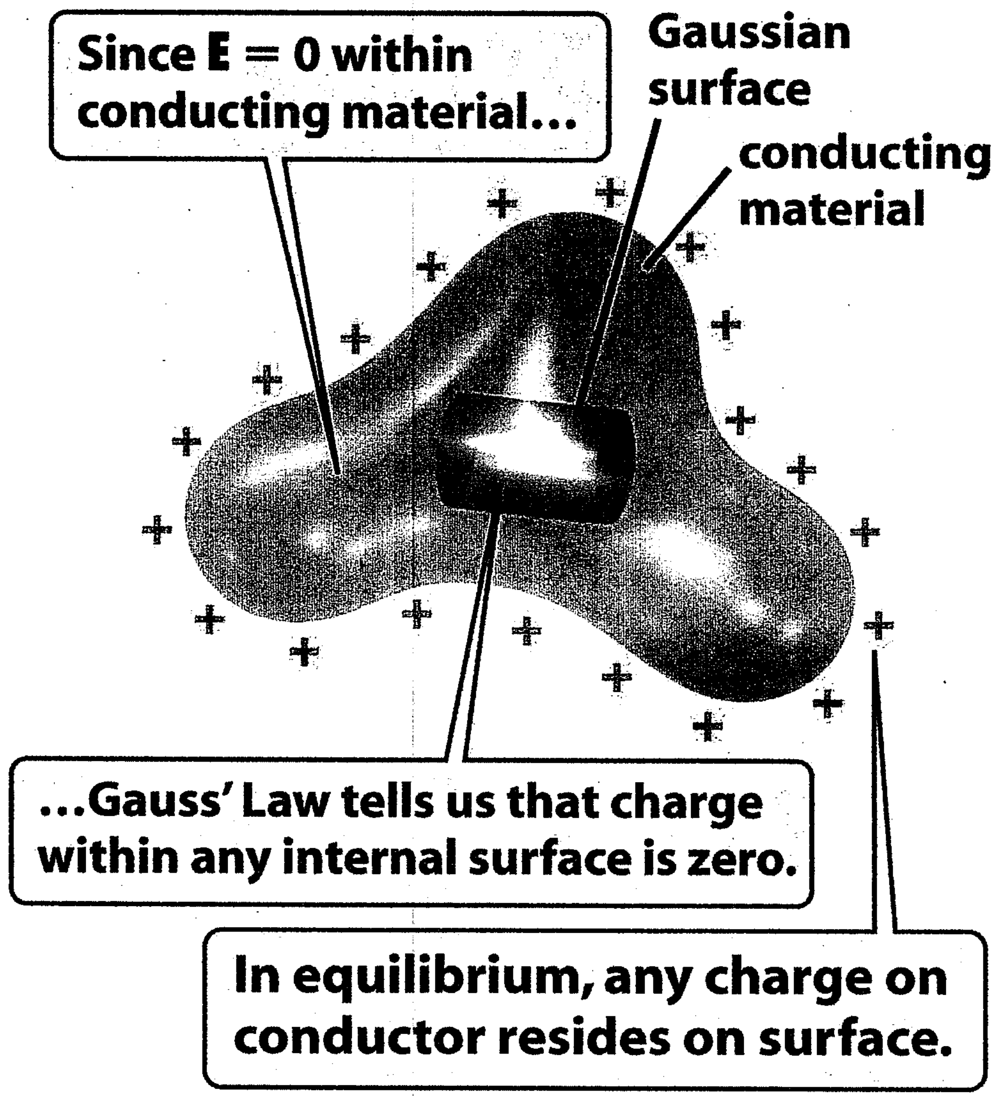


Figure 24-21 Physics for Engineers and Scientists 3/e