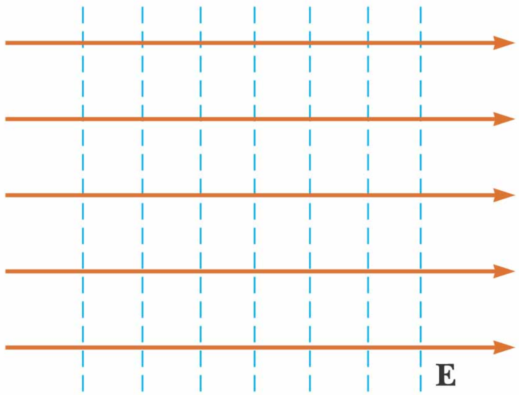
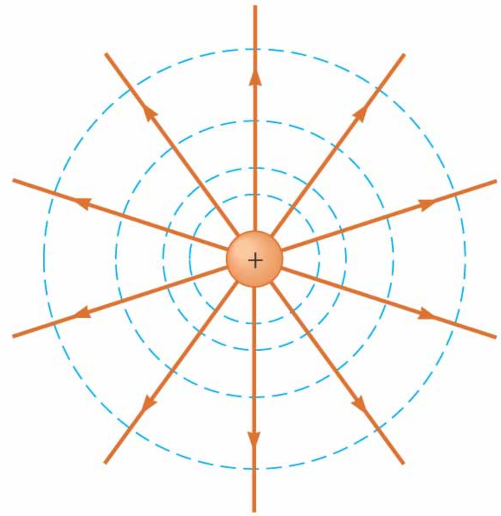
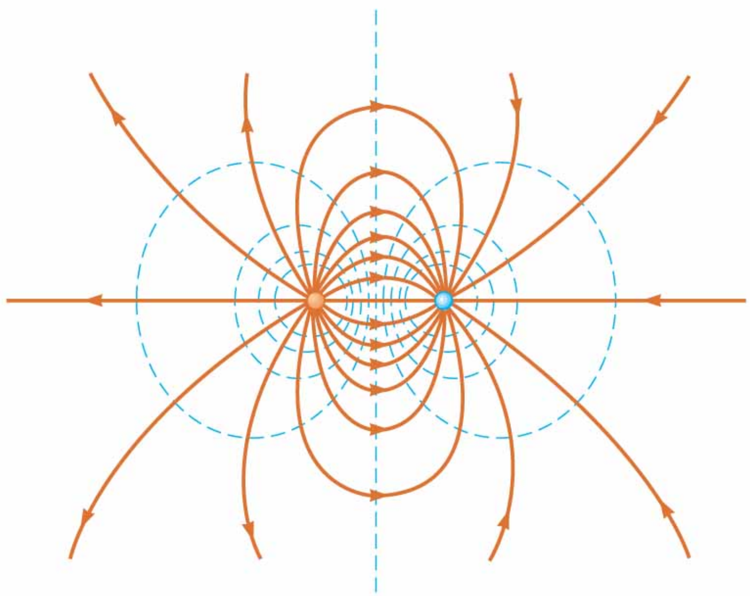
Equipotentials



(a)



(b)



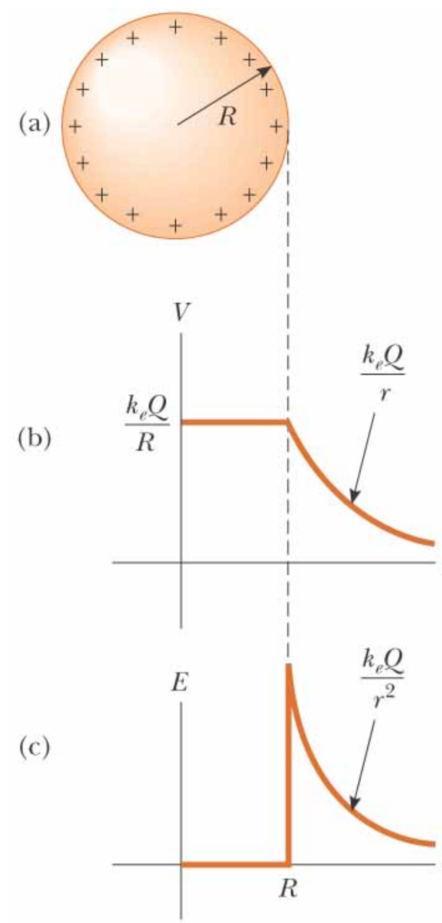
(c)

Example Problem

- The potential in a region between $x = 0$ and $x = 6.00$ m is $V(x) = a + bx$, where a = 10.0 V and b = -7.00 V/m. Determine (a) the potential at x=0, 3.00 m, and 6.00 m, and (b) the magnitude and direction of the electric field at x = 0, 3.00 m, and 6.00 m.
- Solution: (a) plot and (b) find negative gradient of the potential

Electric potential for conductors

- ❑ As discussed earlier, the electric field is zero inside a conductor in steady-state. How about the potential?



Example Problem

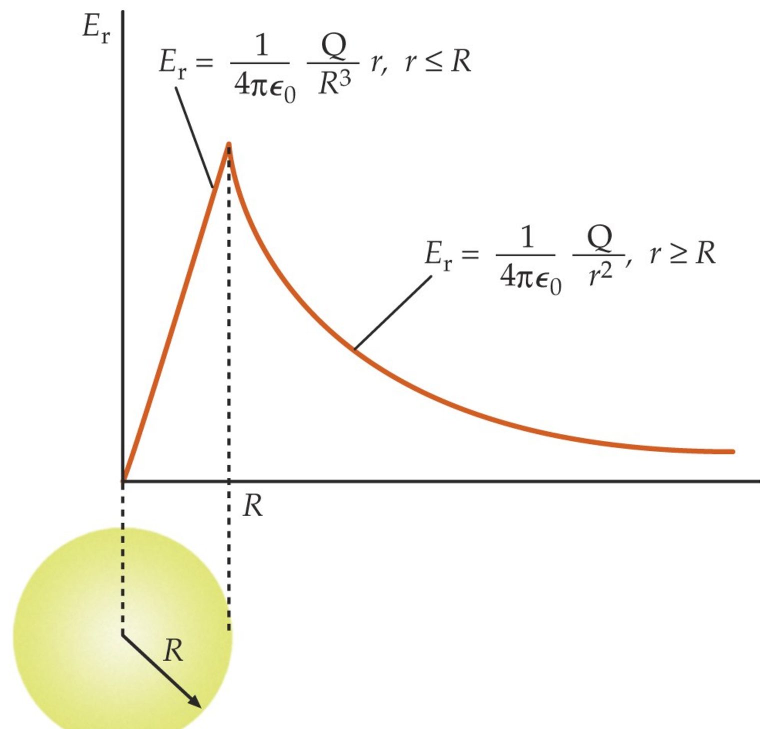
- ❑ How many electrons should be removed from an initially uncharged spherical conductor with R = 30.0 cm to produce a potential of 7.5 kV at the surface?

Example Problem

- A metal sphere of radius 15.0 cm has a net charge of 3.00×10^{-8} C. (a) What is the electric potential at the sphere's surface (if V=0 as $R \rightarrow \infty$)? (b) At what distance from the sphere's surface has the electric potential dropped by 500 V?
- Solution: apply potential difference relation for a spherical conductor

Electric potential for insulators

❑ For a spherical insulator with a uniform charge distribution throughout its volume, we previously found the electric field over all space

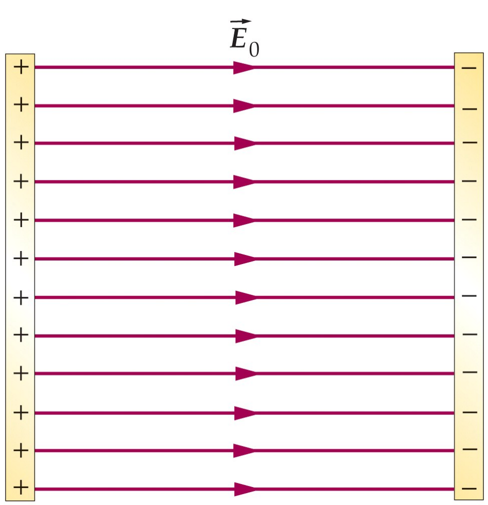


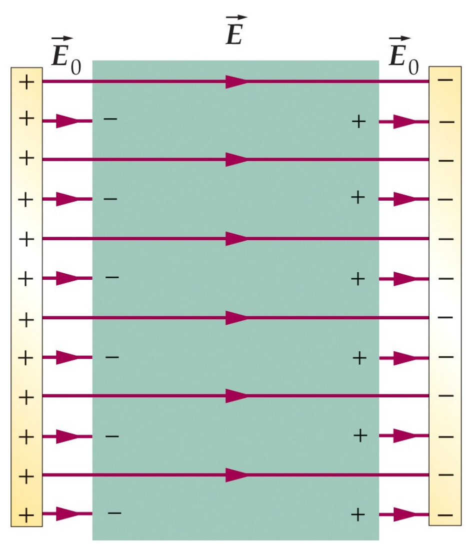
Electric potential for capacitors

- We can insert a neutral insulator between the charged plates of a capacitor with applied field $E_0 = E_{\text{applied}}$
- Molecules in insulator become polarized resulting in a reduced *E*-field

$$\vec{E}_{\text{insulator}} = \frac{\vec{E}_{\text{applied}}}{K}$$

- *K* is the dielectric constant of a given material with $K \geq 1$





$$\Delta V_{\text{insulator}} = \frac{\Delta V_{\text{vacuum}}}{K}$$