

Electric Field: Examples

- Electric field determines the electric force acting on a charge q :

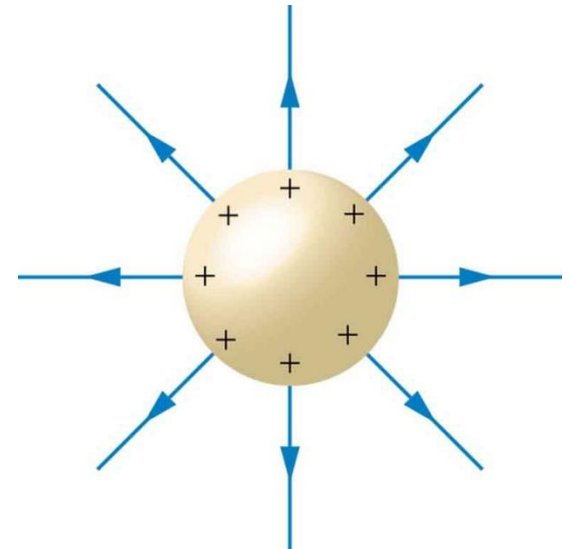
$$\vec{F}_{elect} = q\vec{E}$$

- Electric field of a point charge Q or a sphere with the same charge (**outside**), at distance R :

$$E = \frac{kQ}{R^2}$$

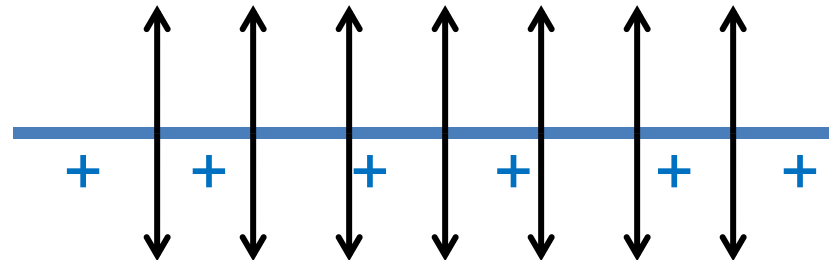
- Electric field **inside** the **hollow** charged sphere is ZERO!

$$E = 0$$



- Electric field of a plate with total charge Q , and area A :

$$E = \frac{2\pi kQ}{A}$$



Electrostatic Potential

- Reminder: **Electric Field** = electric force acting on a probe charge q , divided by q :

$$\vec{E} = \frac{\vec{F}_{elect}}{q}$$

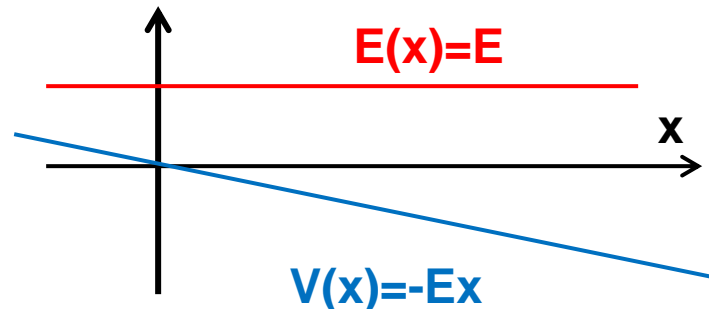
- Similarly, **Electrostatic Potential** = electrostatic potential energy divided by charge. It is also known as Voltage, since SI unit of potential is Volt (V):

$$V = \frac{U_{elect}}{q}$$

- **Example.** Consider constant electric field $E(x)=E$, (as inside a capacitor). Potential energy change = - Work:

$$\Delta U_{elect} = -F_{elect} \Delta x = -Eq \Delta x$$

$$V(x) = \frac{U_{elect}}{q} = -Ex$$



Homework 17

A capacitor is made of two parallel metallic plates separated by distance **$h=1\text{mm}$** . Area of each plate is $A=1\text{cm}$. The capacitor is attached to a 3 Volt battery as shown below. Find the charge Q at each of the plates.

Note: electric field inside a capacitor is $4\pi kQ/A$.

