① Phys 2426 2014-09-08

Homework Questions?

⊕ $q_1$ ⊕ $q_2$ ⊖ $q_3$

Forces on $q_1$

Repelled by $q_2$ $F = k\frac{q_1 q_2}{r_{12}^2}$ to the left

Attracted to $q_3$ $F = k\frac{q_1 q_3}{r_{13}^2}$ to the right

(Use magnitude)

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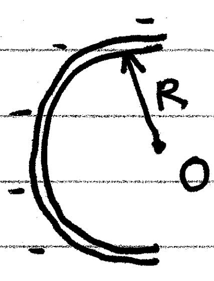


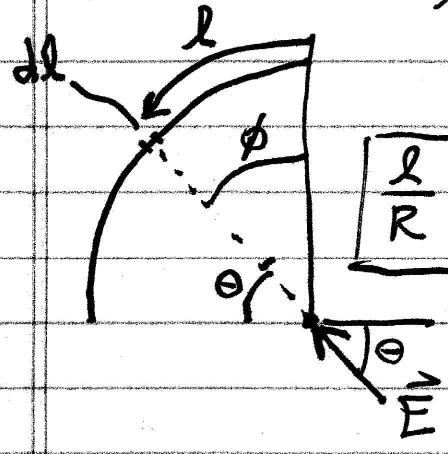

Given total charge $Q$ on the arc, Find $\vec{E}$ @ point O.

① E points to the left.

$$E_x = \int dE_x = \int \frac{k\,dq}{r^2}\cos\theta$$

$dq = \lambda\, dl$

$\cos\theta = \sin\left(\frac{l}{R}\right)$




$=$

$$\boxed{\frac{l}{R} = \phi}$$

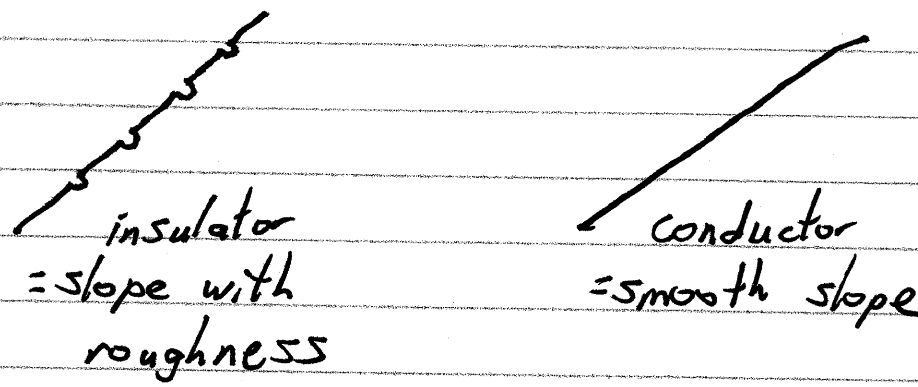
$$\boxed{\phi + \theta = \pi/2}$$

# Electric Field in a conductor

- Conductor allows charges to move freely
- E-Fields cause forces on charges.
- Any E will move charges.
- In electrostatics, charges aren't moving.
- ∴ In electrostatics, $E=0$ in a conductor.

Another analogy:

- E is like the tilt of the V surface.



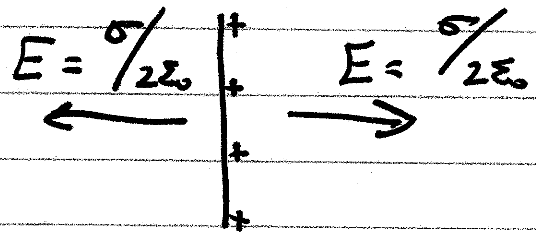

$E=0$ in a conductor.
A solid metal ball w/ charge has all of the charge on the outside surface.

Conductors can only carry net charge on their surface.

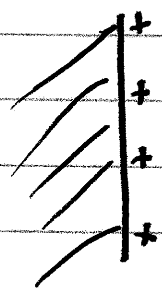
How do we reconcile?

$$E = \frac{\sigma}{2\varepsilon_0} \quad \text{vs.} \quad E = \frac{\sigma}{\varepsilon_0}$$

Single surface's contribution is $E = \sigma/2\varepsilon_0$.




With a metal surface, there is a "background E".



The background E comes from the back of the metal.

$E = 0$ $\qquad$ $E = \frac{\sigma}{\varepsilon_0}$

Two surface charges