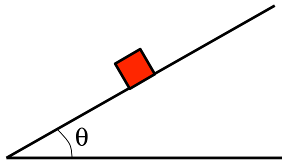
Problem 15.21

A block of mass m has charge Q on it.
It sits stationary on a frictionless incline.
a.) What electric field must exist along the incline to make this happen?



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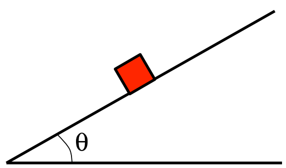
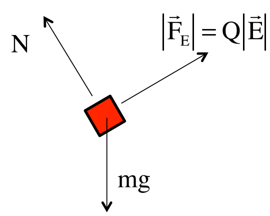


Starting with a f.b.d., where the electric force MUST be up the incline (from common sense):

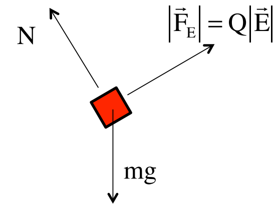


Summing the forces along the incline:

$\underline{\sum F_x:}$

$$QE - mg\sin\theta = m\cancel{a}^{=0}$$

$$\Rightarrow \quad E = \frac{mg\sin\theta}{Q}$$



b.) With m=5.4 g, $Q = -7.00\ \mu C$, and $\theta = 25.0^\circ$, determine :

$$E = \frac{mg\sin\theta}{Q}$$

$$= \frac{(5.4x10^{-3}kg)(9.8\ m/s^2)\sin 25^\circ}{7x10^{-6}C}$$

$$= 3195\ N/C$$

With the ELECTRIC FORCE up the incline, and remembering that negative charges feel FORCES *OPPOSITE* the direction of electric fields, the field must be DOWN the incline. If the +x direction is up the incline, we can write:

$$\vec{E} = -(3195\ N/C)\hat{i}$$