Quiz 18.2A

A ball with a mass of 245 grams and a charge of 36.0 μC starts at rest and is dropped from a height of 133 meters. It takes the ball 6.25 seconds to reach the ground.

The only forces acting on the ball are gravity and the electric force. Determine the magnitude and direction of the uniform electric field in which the ball is immersed.

Hint: Use kinematic equations to first determine the acceleration of the ball. From there, I will leave it to you.

$v_0 = 0$

$\Delta y = 133\ m$

$t = 6.25\ s$

$\Delta y = v_0 t + \frac{1}{2} a t^2$

$133 = \frac{1}{2} a (6.25)^2$

$\Rightarrow a = 6.81\ m/s^2$

(taking down to be positive)

Since $a < 9.8\ m/s^2$, $\vec{F}_E$ must oppose gravity & point up, and since $q+$, that means $\vec{E}$ points up.

(down is positive)

$\Sigma F_y = +mg - qE = ma$

$(.245)(9.8) - (36 \times 10^{-6})E = (.245)(6.81)$

$2.40 - 1.67 = (36 \times 10^{-6})E$

$\Rightarrow \boxed{\vec{E} = 2.03 \times 10^4\ N/C,\ \uparrow}$