Charges in Uniform Fields:

1. $\vec{v}_0 = 0$
   $\vec{v} = 3.0\times10^{7}\ m/s$
   $t = 5.0\ s$

a. $\bar{v} = 1.5\times10^{7}\ m/s$

$d = \bar{v}t = 7.5\times10^{7}\ m$

b. $\vec{a} = \frac{\Delta\vec{v}}{t} = 6.0\times10^{6}\ m/s^2$

$\vec{F} = m\vec{a} = 1.002\times10^{-20}\ N$

$\vec{E} = \frac{\vec{F}}{q} = 0.062625\ N/C$

$E = 0.063\ N/C$

2. $\vec{v}_0 = 0$
   $\vec{v} = 3.0\times10^{7}\ m/s$
   $t = 5.0\ s$

a. $\bar{v} = 1.5\times10^{7}\ m/s$

$\vec{d} = \bar{v}t = 7.5\times10^{7}\ m$

b. $\vec{a} = \frac{\Delta\vec{v}}{t} = 6.0\times10^{6}\ m/s^2$

$\vec{F} = m\vec{a} = 5.466\times10^{-24}\ N$

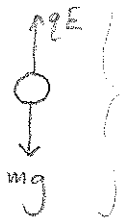
$\vec{E} = \frac{\vec{F}}{q} = 0.000034\overline{1625}\ N/C$

$E = 3.4\times10^{-5}\ N/C$

3.a. Negative

b. Top

c.



$\Sigma F = 0$

$qE = mg$

$q = \frac{mg}{E}$ → $q = 9.8\times10^{-7}\ C$

d. $N = \frac{q}{e} = \frac{9.8\times10^{-7}\ C}{1.6\times10^{-19}\ \frac{C}{e^-}} = 6.125\times10^{12}$ electrons GAINED

4. Ok, 2-D kinematics $\vec{E}$ is vertically upward ⇒ $\vec{F}_e$ is vertically upward (+ charge) ⇒ $\vec{a}$ is v.u. (↑) so $\vec{v}_x$ is constant.

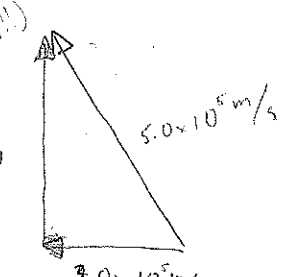
$\hat{x}$: $d_x = v_x t$

$t = \frac{d_x}{v_x} = 1.\overline{6}\times10^{-7}\ s$

$\hat{y}$: $\vec{v}_{0y} = 0$
$t = 1.\overline{6}\times10^{-7}\ s$
$\vec{v}_y = 4.0\times10^{5}\ m/s$

$\vec{a}_y = \frac{\Delta\vec{v}_y}{t} = 2.4\times10^{12}\ m/s^2$ (down)

(use pythagoras!!)



DRAWINGS HELP!!

4. $\sum \vec{F} = m\vec{a}$

$qE = m\vec{a}$

$\Rightarrow E = \frac{ma}{q} = \frac{1.67\times10^{-27}\,kg\,(2.4\times10^{12}\,m/s^2)}{1.6\times10^{-19}\,C} = 2.505\times10^{5}\,N/C$

$\vec{E} = 2.5\times10^{5}\,N/C$ up

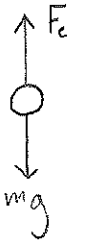
5. $W = \vec{F}\cdot\vec{d} = (qE)d = 1.6\times10^{-19}C\,(2.5\times10^{5}\,N/C)(0.02\,m) = 8.0\times10^{-16}\,J$

6. $W = \vec{F}_{\parallel}\vec{d} = (-qE)d = -8.0\times10^{-16}\,J$

7. $W = \vec{F}_{\parallel}\vec{d} = (-qE)d = -8.0\times10^{-16}\,J$

8. $W = \vec{F}_{\parallel}\vec{d} = (qE)d = 8.0\times10^{-16}\,J$

9.



$\sum \vec{F} = 0$

$F_e = mg$

$qE = mg$

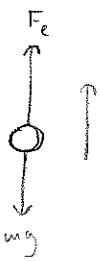
$q = \frac{mg}{E} = 6.53\times10^{-6}\,C$

but if $\vec{E}$ is down and $\vec{F}_e$ is up

q is negative!

$q = -6.5\,\mu C$

b.



$\sum \vec{F} = m\vec{a}$

$F_e - mg = ma$

$qE = ma + mg$

$E = \frac{ma + mg}{q}$

$\Rightarrow \vec{E} = 5448.979592\ldots\,N/C$ down

$\vec{E} = 5400\,N/C$ down