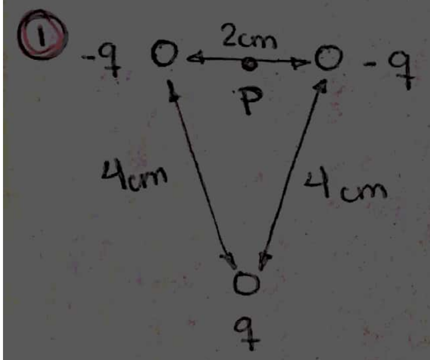
EYM 01T - Parcial 1.

Parte 1.

1. Opción c.   2. Opción b.

Parte 2.

1.



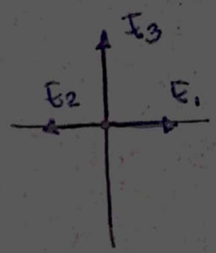
$q = 3\mu C$

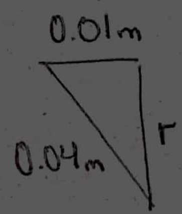
a) $\vec{E}_p = ?$

b) $q_0 = 10\,nC$

$F_{e_p} = ?$

DCL 0.5





$r = \sqrt{(0.04)^2 + (0.01)^2}$

$r^2 = 1.5\times10^{-3}$

a) $E_2 = E_1$

Por simetría

$\Sigma E_x = 0$

$E_T = \Sigma E_y = E_3$

$$E = \frac{kq}{r^2} = \frac{(9\times10^9)(3\times10^{-6})}{1.5\times10^{-3}}$$

$$\boxed{\vec{E} = 18\times10^6\ N/C\ \hat{j}}$$ 0.5

b) $\vec{F}_e = q_0\vec{E}$

$\vec{F}_e = (10\times10^{-9})(18\times10^6)$

$$\boxed{\vec{F}_e = 0.18\ N\ \hat{j}}$$ 0.5

② $\theta = 30°$

$q = 3\mu C$

$d = 2a$

$E = 500\,N/C$

$U = -13\,nJ$

ⓐ $U = -pE\cos\theta$

$U = -q\,2a\,E\cos\theta$

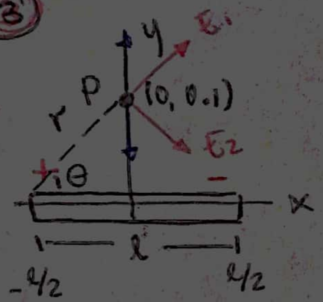
$$a = \frac{U}{-q\,2E\cos\theta} = \frac{-13\times10^{-9}}{-(3\times10^{-6})(2)(500)\cos 30°}$$

$$\boxed{a = 5\,\mu m}$$ 0.8

ⓑ $\tau = pE\,\text{Sen}\,\theta = (2)(5\times10^{-6})(3\times10^{-6})(500)\,\text{Sen}\,30° \longrightarrow \boxed{\tau = 7.5\times10^{-9}\,Nm}$

0.7

③



$l = 1m$

$\lambda = 0.2\,C/m$

$y = 0.1m$

Por simetría

$\Sigma E_y = 0 \qquad E_T = \Sigma E_x$

$\lambda = \frac{Q}{l}$

$Q = \lambda l$

$dq = \lambda dl$

$dq = \lambda dx$

$$E = \int \frac{k\,dq}{r^2}\,\hat{r} = \int_{-l/2}^{0} \frac{k\lambda\,dx}{x^2+y^2}\cdot\frac{x}{\sqrt{x^2+y^2}} = \int_{-l/2}^{0} \frac{k\lambda x\,dx}{(x^2+y^2)^{3/2}}$$ 1.0

$u = x^2+y^2$

$du = 2x\,dx$

$du/2 = x\,dx$

$$E = k\lambda\int_{-l/2}^{0}\frac{x\,dx}{(x^2+y^2)^{3/2}} = k\lambda\int_{-l/2}^{0}\frac{du}{2u^{3/2}}$$

$$E = \frac{k\lambda}{2}\int_{-l/2}^{0}\frac{du}{u^{3/2}} = \frac{k\lambda}{2}\int_{-l/2}^{0}u^{-3/2}\,du = \frac{k\lambda}{2}\cdot\frac{u^{-1/2}}{-1/2}$$

$$E = -\frac{k\lambda}{\sqrt{u}} = -\frac{k\lambda}{\sqrt{x^2+y^2}}\Bigg|_{-l/2}^{0} = -\frac{k\lambda}{y} + \frac{k\lambda}{\sqrt{(-l/2)^2+y^2}}$$

$$E = -(9\times10^{9})(0.2)\left[1/0.1 - \frac{1}{\sqrt{1/4+(0.1)^2}}\right]\times 2$$

$$\boxed{E = 2.9\times10^{10}\,N/C\ \hat{\imath}}$$ 1.0

(4) $M_e = 9.11\times10^{-31}$ kg

$\Delta x = 6cm = 0.06m$

$\Delta y = 1cm = 0.01m$

$\vec{E} = 3.8\times10^{3}$ N/C

(a) $a = \frac{qE}{m} = \frac{(1.6\times10^{-19})(3.8\times10^{3})}{9.11\times10^{-31}}$

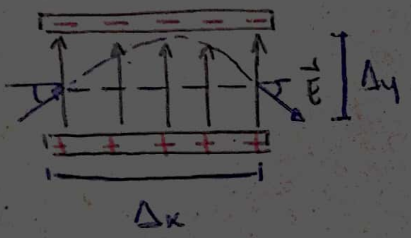
$\boxed{a = 6.7\times10^{14}\ m/s^2\ \ -\hat{\imath}}$ 0.5

(b) $\cancel{v_{fy}^{2}}^{\,0} = v_{oy}^2 + 2a\Delta y$

$-v_{oy}^2 = 2(-a)(\Delta y)$

$v_{oy} = \sqrt{(2)(6.7\times10^{14})(0.005)}$

$\boxed{v_{oy} = 2.6\times10^{6}\ m/s}$ 0.5



$\cancel{v_{fy}}^{\,0} = v_{oy} + at$

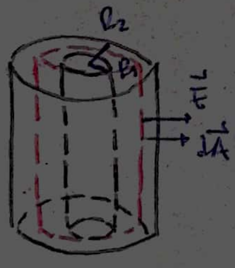
$t = \frac{-v_{oy}}{-a} = \frac{2.6\times10^{6}}{6.7\times10^{14}} = 3.8$ ns

$v_{ox} = \frac{\Delta x}{t} = \frac{0.03}{3.88\times10^{-9}}$

$\boxed{v_{ox} = 7.73\times10^{6}\ m/s}$ 0.5

$\boxed{v = (7.73\hat{\imath} + 2.6\hat{\jmath})\times10^{6}\ m/s}$

(5)



(a) $E = ?$, $r = 2cm$

0.5 $\boxed{E = 0}$ Por estar dentro del conductor

(b) $\oint \vec{E}\cdot d\vec{A} = \frac{q_{enc}}{\varepsilon_0} \rightarrow EA = \frac{q_{enc}}{\varepsilon_0} \rightarrow E = \frac{q_{enc}}{A\varepsilon_0}$

$R_1 = 3cm$

$R_2 = 5cm$

$\sigma_1 = 1\ mC/m^2$

$\sigma_2 = 2.5\ mC/m^2$

$\sigma = \frac{q}{A}$

0.5 $E = \frac{\sigma_1 A_{enc}}{A_c \varepsilon_0} = \frac{\sigma_1 \cancel{2\pi} R_1 \cancel{L}}{\cancel{2\pi} R \cancel{L} \varepsilon_0} = \frac{\sigma_1 R_1}{R\varepsilon_0} = \frac{(1\times10^{-3})(3)}{4\varepsilon_0}$

$\boxed{E = 84.7\times10^{6}\ N/C}$ 0.5