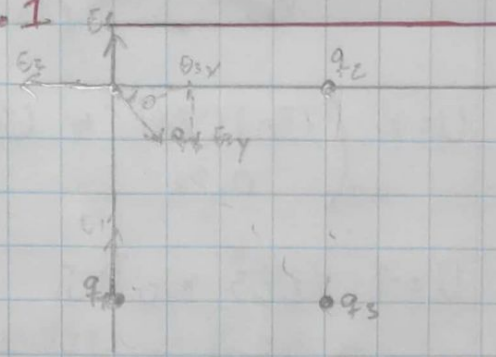
T2

P. 1

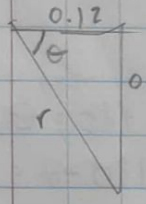
$q_1 = 3\,nC \quad (0, -12)\,cm$
$q_2 = 2\,nC \quad (12, 0)\,cm$
$q_3 = -4\,nC \quad (12, -12)\,cm$



a) $E_R = E_1 + E_2 + E_3$

$$E_1 = \frac{k q_1}{r_1^2}(\hat{j}) = \frac{k(3n)}{(0.12)^2} = 1875\ N/C\ (+\hat{j})$$

$$E_2 = \frac{k q_2}{r_2^2}(-\hat{i}) = \frac{k(2n)}{(0.12)^2} = 1250\ N/C\ (-\hat{i})$$



$r^2 = (0.12)^2 + (0.12)^2$
$r^2 = 0.0288\ m$
$r = 0.17\ m$

$\cos\theta = \frac{0.12}{0.17} = \operatorname{sen}\theta$

$$E_{3x} = \frac{k q_3}{r_3^2}\cos\theta = \frac{k(4n)}{(0.0288)}\left(\frac{0.12}{0.17}\right) = 882.35\ N/C\ (\hat{i})$$

$$E_{3y} = \frac{k q_3}{r_3^2}\operatorname{sen}\theta = \frac{k(4n)}{(0.0288)}\left(\frac{0.12}{0.17}\right) = 882.35\ N/C\ (-\hat{j})$$

$E_{Rx} = -1250 + 882.35 = -367.65\ N/C\ (-\hat{i})$
$E_{Ry} = 1875 - 882.35 = 992.65\ N/C\ (+\hat{j})$

$$|E_R| = \sqrt{(367.65)^2 + (992.65)^2} = 1058.5\ N/C$$

b) $V_R = V_1 + V_2 + V_3$

$$V_1 = \frac{k q_1}{r_1} = \frac{k(3n)}{0.12} = 225\ V$$

$$V_2 = \frac{k q_2}{r_2} = \frac{k(2n)}{0.12} = 150\ V$$

$$V_3 = \frac{k q_3}{r_3} = \frac{k(-4n)}{0.17} = -211.8\ V$$

$V_R = 225 + 150 - 211.8$
$V_R = 163.2\ V.$

$V_R = 163\ V.$

$E = 1058\ N/C$

c) $U = \frac{k q_1 q_2}{r_{12}} + \frac{k q_1 q_3}{r_{13}} + \frac{k q_2 q_3}{r_{23}}$

$U = k\left(\frac{(3n)(2n)}{0.17} + \frac{(3n)(-4n)}{0.12} + \frac{(2n)(-4n)}{0.12}\right)$

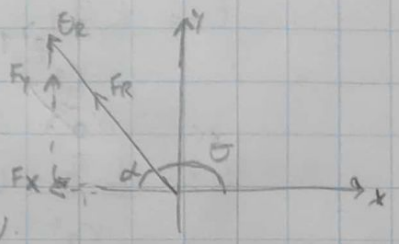
$U = -1.1823 \times 10^{-6}\ J$

$U = -1182 \times 10^{-9}\ J$

d) $Q = 5nC$

$\vec{F} = \vec{E} q \rightarrow F_{ex} = E_{ex} q$

$F_{ey} = E_{ey} q$



$F_{ex} = (-367.65)(5n) = -1.838 \times 10^{-6}\ N$

$F_{ey} = (992.65)(5n) = 4.963 \times 10^{-6}\ N$

$\alpha = \tan^{-1}\left(\frac{4.963}{1.838}\right) = 69.678° \rightarrow$

$180 = \theta + \alpha$

$180 - \alpha = \theta$

$\theta = 180 - 69.68$

$\theta = 110.3°$

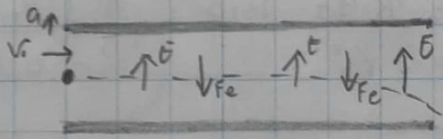
$\theta = 110°$

P. 2

$m = 10.0mg = 10 \times 10^{-6}\ g$

$q = -4.00\ \mu C$

$v = 20\ m/s$ (↑)



a) $E = 50.0\ N/C$ (↓)

$\sum F = ma$

$Fe = ma$

$a = \frac{Fe}{m}$

$Fe = Eq$

$Fe = (50)(-4\mu)$

$Fe = -2 \times 10^{-4}\ N$

$a = \frac{-2 \times 10^{-4}}{10 \times 10^{-6}} = -20\ m/s^2$

$a = 20\ m/s^2$

b) $t = 1.50s$

$v_x = at = 20 m/s$

$v = \sqrt{v_x^2 + v_y^2}$

$v_y = \cancel{v_0}^{0} + at = (-20)(1.5) = -30 m/s$

$|v| = \sqrt{(20)^2 + (-30)^2} = 36.1\ m/s$

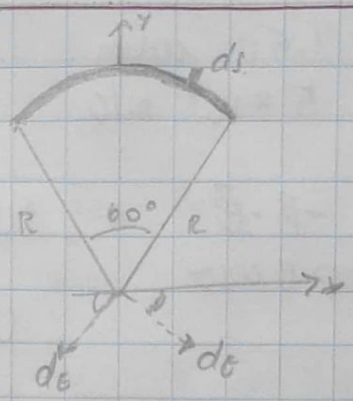
$v = 36.1\ m/s$

P. 3

$q = 0.471\ nC$

$\theta = 60°$

$R = 18.0\ cm$



$E_x = 0$ → Por simetría

$E_y = ?$

$dq = \lambda ds \qquad \lambda = \frac{q}{R\theta} = \frac{0.471}{0.18\theta} = 2.50\ nC/m$

$dq = \lambda R d\theta$

$r = R$

$dE = 2E_y \Rightarrow E_y = \frac{k\lambda R d\theta}{R^2} \operatorname{Sen}\theta = \frac{2k\lambda}{R}\int_{\pi/3}^{\pi/2} \operatorname{Sen}\theta\, d\theta$

$E_y = \frac{2k\lambda}{R}\left(-\cos\theta\Big|_{\pi/3}^{\pi/2}\right) = \frac{2k\lambda}{R}\left(-\cos\frac{\pi}{2} + \cos\frac{\pi}{3}\right)$

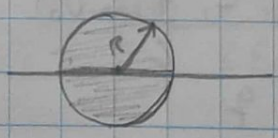
$E_y = \frac{2k\lambda}{R}\left(\frac{1}{2}\right) = \frac{2(9*10^9)(2.50)}{0.18}\left(\frac{1}{2}\right) = 125$

$E = 125\ N/C$

P. 4

$\lambda = 9\ nC/m$

$R = 0.08\ m$



$\oint \vec{E}\, d\vec{A} = \frac{q_{enc}}{\varepsilon_0}$

$\Phi = \frac{q_{enc}}{\varepsilon_0} \qquad q_{enc} = \lambda \ell$

$q_{enc} = (9n)(2r)$

$\lambda = \frac{q_{enc}}{\ell} \qquad q_{enc} = (9n)(2*0.08)$

$q_{enc} = 1.44*10^{-9}\ C$

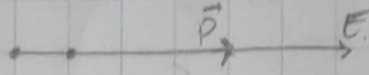
$\Phi = \frac{1.44*10^{-9}}{\varepsilon_0} = 162.6\ N m^2/C$

$\Phi = 163\ N m^2/C$

P. 5

$p = 4.50\ \mu Cm$

$\vec{E} = 5 \times 10^7\ N/C$



a)

$U = -\vec{p} \cdot \vec{E} \Rightarrow |U| = -(4.5\ \mu)(5 \times 10^7)\cos 0^2$

$U = -p E \cos\theta$

$U = -225$

$U = -225\ J$

b) $W = -\Delta U = U_f - U_0$

$U_f = -(4.5\ \mu)(5 \times 10^7)\cos 90° = 0$

$U_0 = -225$

$W = 0 - (-225) = 225\ J.$

$W = 225\ J.$

P. 6

En A: $v = 50\ Km/s$

En B: $v = 80\ Km/s$

$\Delta V_{A-B} = V_{0A} - V_{fB}$

$W_{FE} = q V_{AB} \Rightarrow \frac{K_f - K_0}{q} = V_{AB}$

$W_{FE} = \Delta K \rightarrow K_f - K_0$

$$V_{AB} = \frac{\frac{1}{2} m v_f^2 - \frac{1}{2} m v_0^2}{q} = \frac{1}{2}\frac{(1.6726 \times 10^{-27})[(80 \times 10^3)^2 - (50 \times 10^3)^2]}{(1.6022 \times 10^{-19})}$$

$V_{AB} = 20.35\ V.$

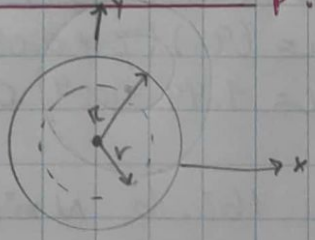
$V_A - V_B = 20.4\ V.$

P. 7

a) $Q = 5.00\ nC$

$R = 10.0\ cm$

$r = R/2$



$\int EA = \frac{q_{enc}}{\varepsilon_0}$

$E(4\pi r^2) = \frac{r^3 Q}{\varepsilon_0 R^3}$

$A_{Superficie} = 4\pi r^2$

$r = 0.05\ m$

$\rho_{Total} = \rho_{enc}$

$Q/V_T = q_{enc}/V_{enc}$

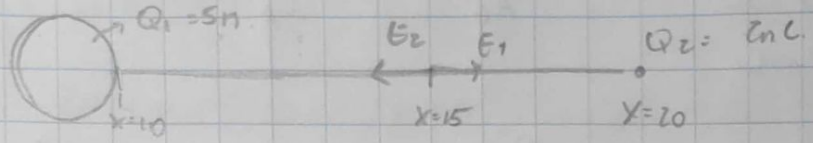
$\frac{V_{enc}\, Q}{V_T} = q_{enc}$

$q_{enc} = (r^3/R^3) Q$

$E = 2.25\ kN/C$

$E = \frac{Qr}{4\pi R^3 \varepsilon_0} = \frac{(5n)(0.05)}{4\pi (0.1)^3 \varepsilon_0} = 2246.8\ N/C$

b) $Q_2 = 2\,nC$ en $x = 0.2\,m$
E en $x = 0.15\,m$



$E_R = E_1 + E_2$ $\quad E_2 = \frac{k Q_2}{r^2} = \frac{1C\,(2n)}{(0.05)^2} = 7.20 \times 10^3\ N/C$

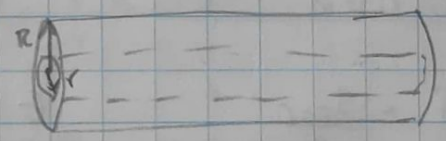
$E_1 = \frac{1C\,(5n)}{(0.15)^2} = 2 \times 10^3\ N/C$

$E_R = 2 \times 10^3 - 7.20 \times 10^3 = -5.20 \times 10^3\ N/C \quad (-\hat{i})$

$E = 5.20\ kN/C$

P. 8.

$R = 0.15\ m$.
$\rho = 2.50\ \mu C$.
$r = 0.05\ m$.



$q_{enc} = \rho V$

$\oint E\,dA = \frac{q_{enc}}{\varepsilon_0}$

$E = \frac{\rho r}{2\varepsilon_0} = \frac{(2.5\,\mu)(0.05)}{2\varepsilon_0}$

$E(2\pi r h) = \frac{\rho \pi r^2 h}{\varepsilon_0}$

$E = 7058.7\ N/C$

$E = 7.1\ kN/C$