HT3

Problema 1:

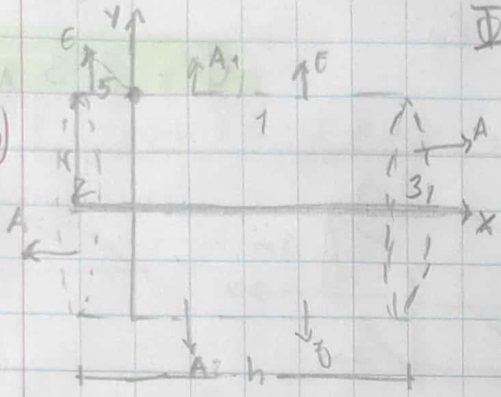
a) $\lambda = 6.00\ nC/m$

$r = 0.04\ m$

$$\Phi = \frac{\lambda a}{\varepsilon_0} = \frac{(6\times10^{-9})(2(0.04))}{8.8542\times10^{-12}}$$

$$\Phi = 54.21\ N m^2/C$$

b)



$r = 0.05\ m$

$\lambda = 6.00\ nC/m$

$$\oint \vec{E}\cdot dA_1 \cos\theta^{1} + \int E\, dA_2 \cos 0^{\circ} +$$

$$\int E\, dA \cos 90^{\circ} = \frac{q_{enc}}{\varepsilon_0}$$

$$\oint E\, dA = \frac{q_{enc}}{\varepsilon_0} \rightarrow E(2\pi r h) = \frac{q_{enc}}{\varepsilon_0}$$

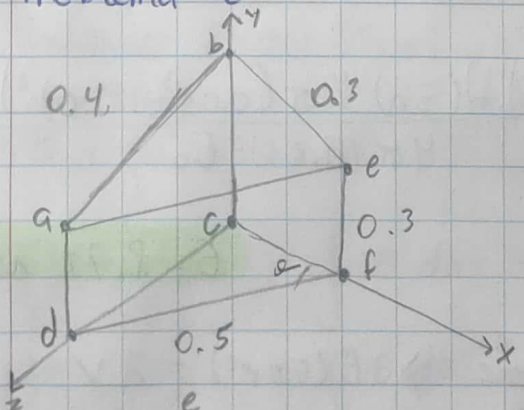
$$E = \frac{q_{enc}}{2\pi r h \varepsilon_0} = \frac{\lambda h}{2\pi r h \varepsilon_0} = \frac{\lambda}{2\pi\varepsilon_0 r} = \frac{(6\times10^{-9})}{2\pi(0.05)\varepsilon_0} = 2157\ N/C$$

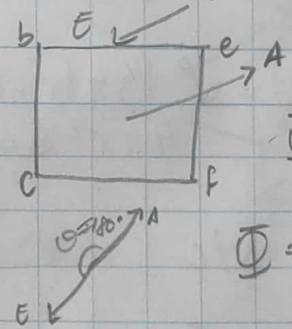
$$E = 2.16\ KN/C$$

Problema 2:

$\vec{E} = 2.5\times10^{3}\ N/C\ (+k)$

a)





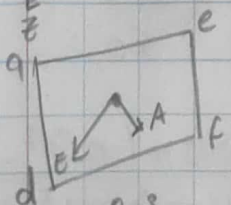
$\Phi = EA\cos\theta$

$\Phi = E(0.3)^2\cos 180^{\circ}$

$\Phi = -225\ N m^2/C$

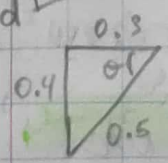
$\Phi = -225\ N m^2/C$

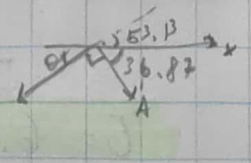
b)

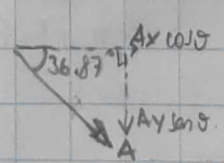


$\Phi = EA\cos 90^{\circ}$

$\Phi = E(0.5)(0.3)\cos\theta$







$\theta = \cos^{-1}\left(\frac{0.3}{0.5}\right) = 53.13^{\circ} \rightarrow 90 - 53.13 = 36.87$

$\Phi = E(0.15)\,\text{Sen}(36.87)$

$\Phi = 225\ N m^2/C$

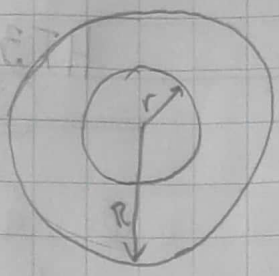
$\Phi = 225\ N m^2/C$

Problema 3.

$r = 0.02m$

$\lambda = 4nC/m^2$

$R = 0.04$

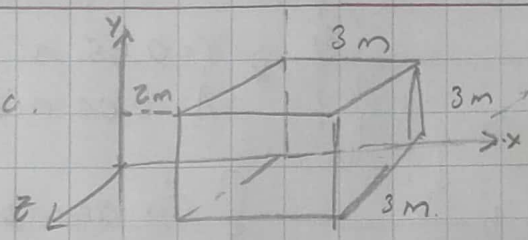


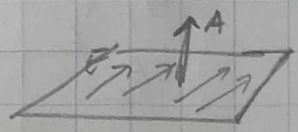
$$\Phi = \frac{q_{enc}}{\varepsilon_0} = \frac{\lambda A}{\varepsilon_0} = \frac{\lambda(4\pi(0.02)^2)}{\varepsilon_0} = 2.27\ Nm^2/C$$

$$\Phi = 2.3\ Nm^2/C$$

Problema 4:

$\vec{E} = (8\hat{i} + 2y\hat{j})\ N/C.$





$\Phi = EA.$

$$\Phi = 2(3)(3^2) = 54\ Nm^2/C$$

$\Phi = E_x \cancel{A_x^{\circ}} + E_y A_y + E_z \cancel{A_z^{\circ}}$

$$\Phi = 54\ \frac{N}{C}m^2$$

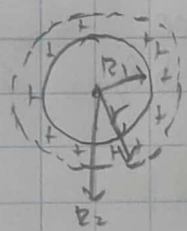
Problema 5:

a) $\rho = 5nC/m^3$

$R_1 = 0.06m$

$R_2 = 0.1m$

$E = r = 0.08\ m.$



$$V = \frac{4}{3}\pi(r^3 - R_1^3)$$

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

$$E = \frac{\rho V}{A\varepsilon_0} = \frac{\rho\, 4/3\pi(r^3 - R_1^3)}{4\pi r^2 \varepsilon_0} = \frac{(5n)\,4/3\pi(0.08^3 - 0.06^3)}{4\pi(0.08)^2\varepsilon_0} =$$

$E = 8.7058\ N/C$

$$E = 8.71\ N/C$$

b) $E = r = 0.15$

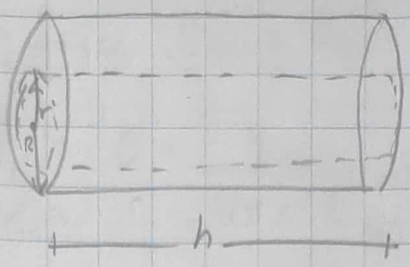
$$\oint E\,dA = \frac{q_{enc}}{\varepsilon_0} \Rightarrow E(4\pi r^2) = \frac{\lambda V}{\varepsilon_0}$$

$$E = \frac{\lambda\, 4/3\pi(R_2^3 - R_1^3)}{4\pi r^2 \varepsilon_0} = \frac{(5n)4/3\pi(0.1^3 - 0.06^3)}{4\pi(0.15)^2\varepsilon_0}$$

$E = 6.5589\ N/C$

$$E = 6.56\ N/C$$

Problema 6:



$R = 12\,cm \rightarrow 0.12\,m$

$\rho = 5\,nC/m^3$

$r = 0.05\,m$

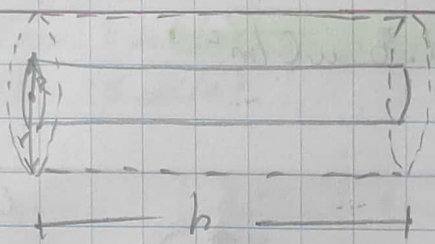
$$\oint E\,dA = \frac{q_{enc}}{\varepsilon_0} \qquad \rightarrow q_{enc} = \rho V$$

$$q_{enc} = \rho \pi r^2 h$$

$$E(2\pi r h) = \frac{\rho \pi r^2 h}{\varepsilon_0} = \frac{\rho V}{2\varepsilon_0} = \frac{(5n)(0.05)}{2\varepsilon_0} = 14.12\,\frac{N}{C}$$

$E = 14\ N/C$

Problema 7:



$R = 12\,cm$

$\rho = 5\,nC/m^3$

$r = 15\,cm$

$q_{enc} = \rho \pi R^2 h$

$$\oint E\,dA = \frac{q_{enc}}{\varepsilon_0} \Rightarrow E(2\pi r h) = \frac{\rho \pi R^2 h}{\varepsilon_0} = \frac{\rho R^2}{2r\varepsilon_0}$$

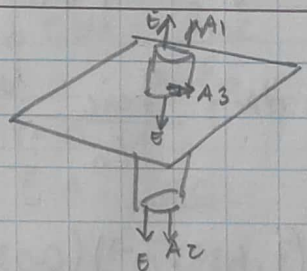
$$E = \frac{(5n)(0.12)^2}{2(0.15)\varepsilon_0} = 27.10\ N/C$$

$E = 27\ N/C$

Problema 8: DCL Styrofoam

$m = 10\,g$

$Q = -0.700\,mC$



$$\Sigma F_y = mg \qquad \oint E\,dA_1 + \oint E\,dA_2$$

$$F_e = mg \qquad + \oint E\,dA_3^{\,\rightarrow 0} = \frac{q_{enc}}{\varepsilon_0}$$

$$q_E = mg \qquad A_1 = A_2 = A_3$$

$$EA_1 + EA_2 = \frac{q_{enc}}{\varepsilon_0} \qquad \left| \quad q\left(\frac{\sigma}{2\varepsilon_0}\right) = ma \right.$$

$$E = \frac{q_{enc}}{2A\varepsilon_0} = \frac{\sigma A}{2A\varepsilon_0} = \frac{\sigma}{2\varepsilon_0} \qquad \left| \quad \sigma = \frac{2mg\varepsilon_0}{q} \right.$$

$$\sigma = \frac{2(10\times10^{-3})(9.8)\varepsilon_0}{0.7\times10^{-3}} = 2.48\,nC/m^2$$

$\sigma = -2.48\ nC/m^2$

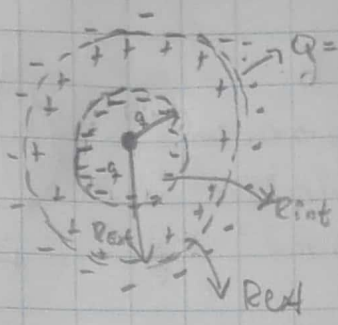
Problema 9:

$q = 6nC$

$R_{int} = 0.01m$

$R_{ext} = 0.02m$

$Q = -4nC$



$q_{enc} = 6nC \Rightarrow$ $q_{int} = -6nC$

$q_{ext} = 2nC$

$Q_T = -4nC$

$\sigma = \frac{q_{int}}{A}$

$\sigma = \frac{-6n}{4\pi r^2}$

$\sigma = \frac{-6*10^{-9}}{4\pi(0.01)^2} = -4.77\ \mu C/m^2$

$\sigma = -4.8\ \mu C/m^2$

$Q_T = q_{int} + q_{ext}$

$Q_T - q_{int} = q_{ext}$

$-4 + 6 = q_{ext}$

$2 = q_{ext}$

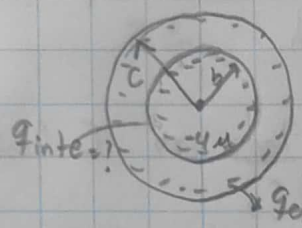
Problema 10:

No Conductora

$q = 4\mu C$ $q_a = +4\mu C$

$a = 0.05m$

Conductora



$R_{int\,b} = 0.08m$

$R_{ext\,c} = 0.1m$

$Q = -6\mu C$

a) $E\ (r = 0.03m)$

$q_{ext} = -6 + 4 = -2$

$\rho = \frac{q}{V} = \frac{3(4\mu)}{4\pi a^3} = \frac{3(4*10^{-6})}{4\pi(0.05^3} = 7.639*10^{-3}\ C/m^3$

$\oint E\,dA = \frac{q_{enc}}{\varepsilon_0} \Rightarrow E(4\pi r^2) = \frac{\rho(\frac{4}{3}\pi r^3)}{\varepsilon_0} = \frac{\rho r}{3\varepsilon_0}$

$E = \frac{(7.639*10^{-3})(0.03)}{3(8.8542*10^{-12})} = 8.627*10^6\ N/C$

$E\ (r = 0.03m) = 8.6\ \frac{KN}{C}$

b) $E\ (r = 0.09m)$ $q_{enc} = 4\mu + (-4\mu) = 0$

$\oint E\,dA = \frac{q_{enc}}{\varepsilon_0} \Rightarrow E = 0\ N/C$

$E = 0.$

c) $E\ (r = 0.12\,m)$. $\quad q_{enc} = 4\mu - 6\mu = -2\mu$

$$\oint E\,dA = \frac{q_{enc}}{\varepsilon_0} \qquad E = \frac{q_{enc}}{4\pi r^2 \varepsilon_0}$$

$$E(4\pi r^2) = \frac{q_{enc}}{\varepsilon_0} \qquad E = \frac{-2\mu}{4\pi(0.12)^2 \varepsilon_0} = -1.248 \times 10^6\ N/C$$

$E\ (r = 0.12m) = -1.25\ KN/C$

d) $Q_T = -6\mu$

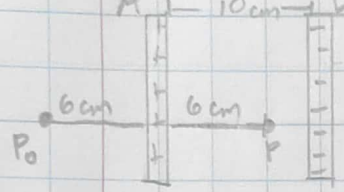
$q_{int} = -4\mu$

$q_{ext} = -2\mu$

Superficie Interna $= -4\mu C$

Superficie Externa $= -2\mu C$

Problema 11 $\quad \sigma_A = 3\,\mu C/m^2$ $\quad \sigma_B = -5\,\mu C/m^2$



a) $$E = \frac{\sigma}{2\varepsilon_0} = \frac{3\times10^{-6}}{2\varepsilon_0} + \frac{5\times10^{-6}}{2\varepsilon_0}$$

$E = 452\ KN/C$.

$E = 452\ KN/C$

b) $$\frac{-(3\times10^{-6})}{2\varepsilon_0} + \frac{(5\times10^{-6})}{2\varepsilon_0} = 113\ KN/C.$$

$E = 113\ KN/C$

Problema 12.

$R_{int} = 0.1\,m$

$R_{ext} = 0.2m$

$E = 750\ N/C$

$q = 2nC$

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

$r = 0.3\,m$.

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

$T = q_i$

$E.(4\pi(r)^2)\varepsilon_0 = q_{enc}$

$q_{enc} = (750)(4\pi(0.3)^2)\varepsilon_0 = 7.51 \times 10^{-9} C$

$q = 7.5\ nC$

b) $Q_T = 7.5$ $\quad q_{int} = -2$ $\quad q_{ext} = Q_T - q_{int}$

$q_{ext} = 7.5 + 2 = 9.5\,nC$

$q_{ext} = 9.5\ nC$

d) $$\Phi = \frac{q_{enc}}{\varepsilon_0} = \frac{2\times10^{-9}}{8.8542\times10^{-12}} = 225.8$$

$\Phi = 226\ N/C$