	UNIVERSIDAD DE SAN CARLOS DE GUATEMALA	FÍSICA 2 C	NOTA:
	FACULTAD DE INGENIERÍA		
	ESCUELA DE CIENCIAS	1S2023	
	DEPARTAMENTO DE FÍSICA		
	INGA. CLAUDIA CECILIA CONTRERAS FOLGAR DE ALFARO	AUX. ANGEL QUIM	

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HT 3
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HT3

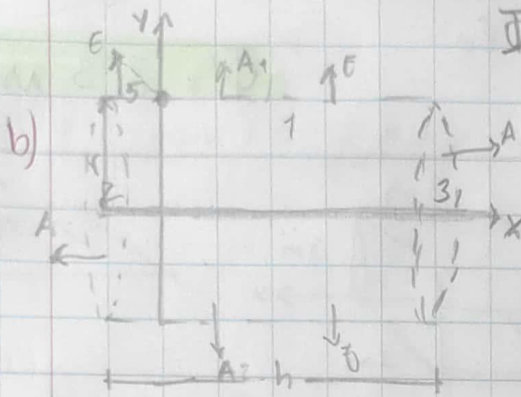
Problema 1:

a)  $\lambda = 6.00 \text{ nC/m}$   
 $r = 0.04 \text{ m}$

$$\Phi = \frac{2a}{\epsilon_0} = \frac{(6 \times 10^{-9})(2(0.04))}{8.8542 \times 10^{-12}}$$

$$\Phi = 54.21 \text{ Nm}^2/\text{C}$$

$$\Phi = 54.2 \text{ Nm}^2/\text{C}$$



$r = 0.05 \text{ m}$   
 $\lambda = 6.00 \text{ nC/m}$

$$\oint \vec{E} \cdot d\vec{A}_1 \cos 0^\circ + \oint \vec{E} \cdot d\vec{A}_2 \cos 0^\circ + \oint \vec{E} \cdot d\vec{A}_3 \cos 90^\circ = \frac{q_{\text{enc}}}{\epsilon_0}$$

$$\oint \vec{E} \cdot d\vec{A} \cos 90^\circ = \frac{q_{\text{enc}}}{\epsilon_0}$$

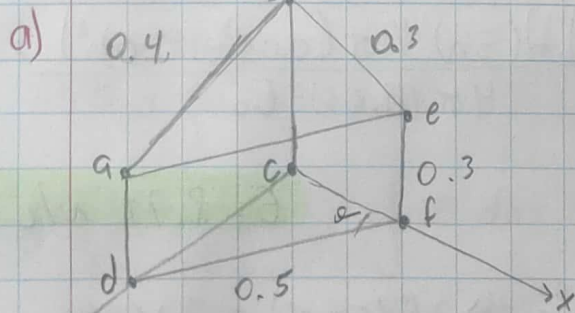
$$\oint \vec{E} \cdot d\vec{A} = \frac{q_{\text{enc}}}{\epsilon_0} \Rightarrow E(2\pi rh) = \frac{q_{\text{enc}}}{\epsilon_0}$$

$$E = \frac{q_{\text{enc}}}{2\pi rh\epsilon_0} = \frac{\lambda h}{2\pi h\epsilon_0} = \frac{\lambda}{2\pi\epsilon_0 r} = \frac{(6 \times 10^{-9})}{2\pi(0.05)\epsilon_0} = 2157 \text{ N/C}$$

$$E = 2.16 \text{ kN/C}$$

Problema

$$\vec{E} = 2.5 \times 10^3 \text{ N/C} \quad (+k)$$

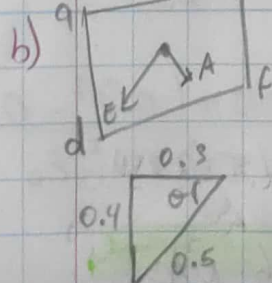


$$\Phi = EA \cos \theta$$

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

$$\Phi = -225 \text{ Nm}^2/\text{C}$$

$$\Phi = -225 \text{ Nm}^2/\text{C}$$



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

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

$$\Phi = E(0.15) \sin(36.87^\circ)$$

$$\Phi = 225 \text{ Nm}^2/\text{C}$$

$$\Phi = 225 \text{ Nm}^2/\text{C}$$

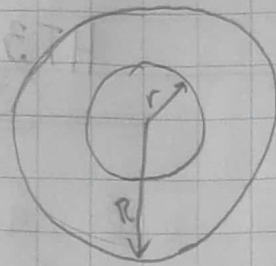
$$\theta = \cos^{-1}\left(\frac{0.3}{0.5}\right) = 53.13^\circ \Rightarrow 90 - 53.13 = 36.87$$

### Problema 3.

$$r = 0.02 \text{ m}$$

$$\lambda = 4 \text{ nC/m}^2$$

$$R = 0.04$$

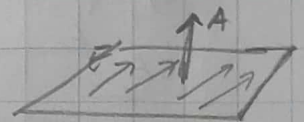
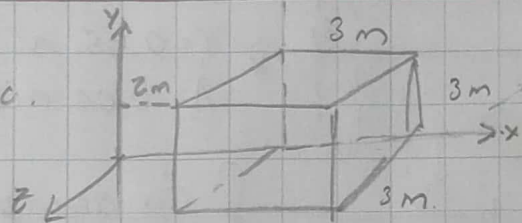


$$\Phi = \frac{q_{\text{enc}}}{\epsilon_0} = \frac{\lambda A}{\epsilon_0} = \frac{\lambda (4\pi (0.02)^2)}{\epsilon_0} = 2.27 \text{ Nm}^2/\text{C}$$

$$\Phi = 2.3 \text{ Nm}^2/\text{C}$$

### Problema 4:

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



$$\Phi = EA$$

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

$$\Phi = E_x A_x + E_y A_y + E_z A_z$$

$$\Phi = 54 \frac{\text{Nm}^2}{\text{C}}$$

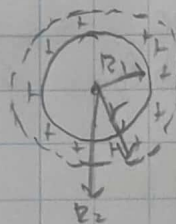
### Problema 5:

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

$$R_1 = 0.06 \text{ m}$$

$$R_2 = 0.1 \text{ m}$$

$$E = r = 0.08 \text{ m}$$



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

$$\oint E dA = \frac{q_{\text{enc}}}{\epsilon_0} \Rightarrow EA = \frac{q_{\text{enc}}}{\epsilon_0}$$

$$E = \frac{\rho V}{A \epsilon_0} = \frac{\rho \frac{4}{3} \pi (r^3 - R_1^3)}{4 \pi r^2 \epsilon_0} = \frac{(5 \text{ n}) \frac{4}{3} \pi (0.08^3 - 0.06^3)}{4 \pi (0.08)^2 \epsilon_0}$$

$$E = 8.7058 \text{ N/C}$$

$$E = 8.71 \text{ N/C}$$

b)  $E = r = 0.15$

$$\oint E dA = \frac{q_{\text{enc}}}{\epsilon_0} \Rightarrow E(4\pi r^2) = \frac{\rho V}{\epsilon_0}$$



$$E = \frac{\rho \frac{4}{3} \pi (R_2^3 - R_1^3)}{4 \pi r^2 \epsilon_0} = \frac{(5 \text{ n}) \frac{4}{3} \pi (0.1^3 - 0.06^3)}{4 \pi (0.15)^2 \epsilon_0}$$

$$E = 6.5589 \text{ N/C}$$

$$E = 6.56 \text{ N/C}$$



Problema 6:

$$R = 12 \text{ cm} \rightarrow 0.12 \text{ m}$$

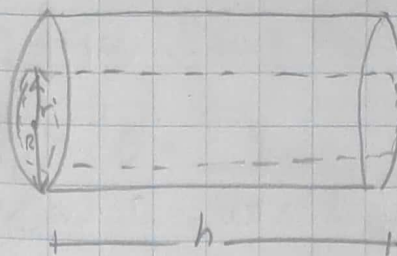
$$\rho = 5 \text{ nC/m}^3$$

$$r = 0.05 \text{ m}$$

$$\oint E dA = \frac{q_{\text{enc}}}{\epsilon_0}$$

$$\rightarrow q_{\text{enc}} = \rho V$$

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



$$E (2\pi r h) = \frac{\rho \pi r^2 h}{\epsilon_0} \Rightarrow \frac{E (2\pi r h)}{2\epsilon_0} = \frac{\rho \pi r^2 h}{2\epsilon_0} = \frac{(5 \text{ n})(0.05)}{2\epsilon_0} = 14.12 \frac{\text{N}}{\text{C}}$$

$$E = 14 \text{ N/C}$$

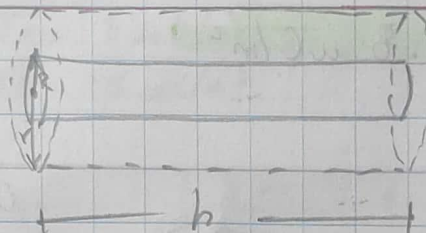
Problema 7:

$$R = 12 \text{ cm}$$

$$\rho = 5 \text{ nC/m}^3$$

$$r = 15 \text{ cm}$$

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



$$\oint E dA = \frac{q_{\text{enc}}}{\epsilon_0} \Rightarrow E (2\pi r h) = \frac{\rho \pi R^2 h}{\epsilon_0} \Rightarrow \frac{E (2\pi r h)}{2\epsilon_0} = \frac{\rho \pi R^2 h}{2\epsilon_0}$$

$$E = \frac{(5 \text{ n})(0.12)^2}{2(0.15)\epsilon_0} = 27.10 \text{ N/C}$$

$$E = 27 \text{ N/C}$$

Problema 8: D.C. Styrofoam

$$m = 10 \text{ g}$$

$$Q = -0.700 \text{ mC}$$

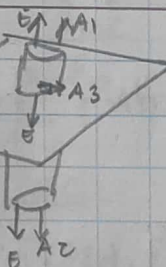


$$\sum F_y = mg$$

$$F_e = mg$$

$$qE = mg$$

$$\oint E dA_1 + \oint E dA_2 + \oint E dA_3 = \frac{q_{\text{enc}}}{\epsilon_0}$$



$$A_1 = A_2 = A_3$$

$$EA_1 + EA_2 = \frac{q_{\text{enc}}}{\epsilon_0}$$

$$q \left( \frac{\sigma}{\epsilon_0} \right) = mg$$

$$\sigma = -2.48 \text{ nC/m}^2$$

$$E = \frac{q_{\text{enc}}}{2A\epsilon_0} = \frac{\sigma A}{2A\epsilon_0} = \frac{\sigma}{2\epsilon_0} \quad \sigma = \frac{2mg\epsilon_0}{q}$$

$$\sigma = \frac{2(10 \times 10^{-3})(9.8)\epsilon_0}{0.7 \times 10^{-3}} = 2.48 \text{ nC/m}^2$$

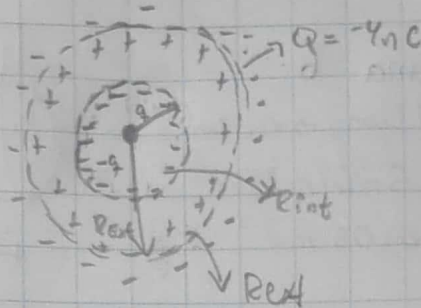
Problema 9:

$$q = 6 \text{ nC}$$

$$R_{\text{int}} = 0.01 \text{ m}$$

$$R_{\text{ext}} = 0.02 \text{ m}$$

$$Q = -4 \text{ nC}$$



$$q_{\text{enc}} = 6 \text{ nC} \Rightarrow$$

$$q_{\text{int}} = -6 \text{ nC}$$

$$q_{\text{ext}} = 2 \text{ nC}$$

$$Q_{\text{r}} = -4 \text{ nC}$$

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

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

$$\sigma = \frac{-6 \times 10^{-9}}{4\pi (0.01)^2} = -4.77 \text{ nC/m}^2$$

$$\sigma = -4.8 \text{ nC/m}^2$$

$$Q_{\text{r}} = q_{\text{int}} + q_{\text{ext}}$$

$$Q_{\text{r}} - q_{\text{int}} = q_{\text{ext}}$$

$$-4 + 6 = q_{\text{ext}}$$

$$2 = q_{\text{ext}}$$

Problema 10:

No Conductor

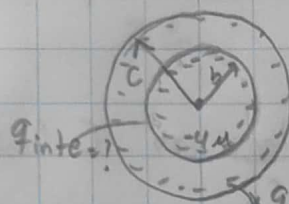
$$q = 4 \text{ nC}$$

$$a = 0.05 \text{ m}$$

$$q_a = +4 \text{ nC}$$



Conductora



$$R_{\text{int}} = 0.08 \text{ m}$$

$$R_{\text{ext}} = 0.1 \text{ m}$$

$$Q = -6 \text{ nC}$$

$$q_{\text{ext}} = -2 \text{ nC}$$

a)  $E(r = 0.03 \text{ m})$

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

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

$$\oint E dA = \frac{q_{\text{enc}}}{\epsilon_0} \Rightarrow E(4\pi r^2) = \frac{\rho(4/3\pi r^3)}{\epsilon_0} = \frac{\rho r}{3\epsilon_0}$$

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

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

b)  $E(r = 0.09 \text{ m})$

$$q_{\text{enc}} = 4 \text{ n} + (-4 \text{ n}) = 0$$

$$\oint E dA = \frac{q_{\text{enc}}}{\epsilon_0} \Rightarrow E = 0 \text{ N/C}$$

$$E = 0$$



c)  $E(r=0.12\text{ m})$

$q_{\text{enc}} = 4\mu - 6\mu = -2\mu$

$\oint E dA = \frac{q_{\text{enc}}}{\epsilon_0}$

$E = \frac{q_{\text{enc}}}{4\pi r^2 \epsilon_0}$

$E(4\pi r^2) = \frac{q_{\text{enc}}}{\epsilon_0}$

$E = \frac{-2\mu}{4\pi(0.12)^2 \epsilon_0} = -1.248 \times 10^6 \text{ N/C}$

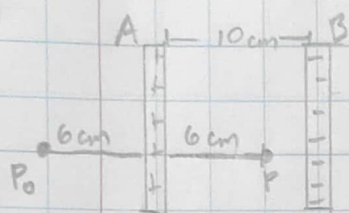
$E(r=0.12\text{ m}) = -1.25 \text{ kN/C}$

d)  $Q_T = -6\mu$   
 $q_{\text{int}} = -4\mu$   
 $q_{\text{ext}} = -2\mu$

Superficie Interna =  $-4\mu\text{ C}$

Superficie Externa =  $-2\mu\text{ C}$

Problema 11



$\sigma_A = 3 \mu\text{C/m}^2$

$\sigma_B = -5 \mu\text{C/m}^2$

a)  $E = \frac{\sigma}{2\epsilon_0} = \frac{3 \times 10^{-6}}{2\epsilon_0} + \frac{5 \times 10^{-6}}{2\epsilon_0}$

$E = 452 \text{ kN/C}$

$E = 452 \text{ kN/C}$

b)  $\frac{-(3 \times 10^{-6})}{2\epsilon_0} + \frac{(5 \times 10^{-6})}{2\epsilon_0} = 113 \text{ kN/C}$

$E = 113 \text{ kN/C}$

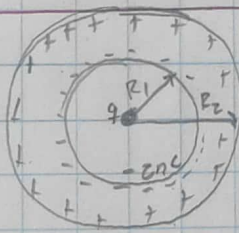
Problema 12:

$R_{\text{int}} = 0.1\text{ m}$

$R_{\text{ext}} = 0.2\text{ m}$

$E = 750 \text{ N/C}$

$q = 2\text{ nC}$



$T = q_i$

a)  $\oint E dA = \frac{q_{\text{enc}}}{\epsilon_0}$

$r = 0.3\text{ m}$

$E A = \frac{q_{\text{enc}}}{\epsilon_0}$

$E(4\pi r^2) \epsilon_0 = q_{\text{enc}}$

$q_{\text{enc}} = (750)(4\pi(0.3)^2) \epsilon_0 = 7.51 \times 10^{-9}\text{ C}$

$q = 7.5 \text{ nC}$

b)  $Q_T = 7.5$   
 $q_{\text{int}} = -2$   
 $q_{\text{ext}} = Q_T - q_{\text{int}}$   
 $q_{\text{ext}} = 7.5 + 2 = 9.5\text{ nC}$

$q_{\text{ext}} = 9.5 \text{ nC}$

c)  $\Phi = \frac{q_{\text{enc}}}{\epsilon_0} = \frac{2 \times 10^{-9}}{8.8547 \times 10^{-12}} = 225.8$

$\Phi = 226 \text{ N/C}$