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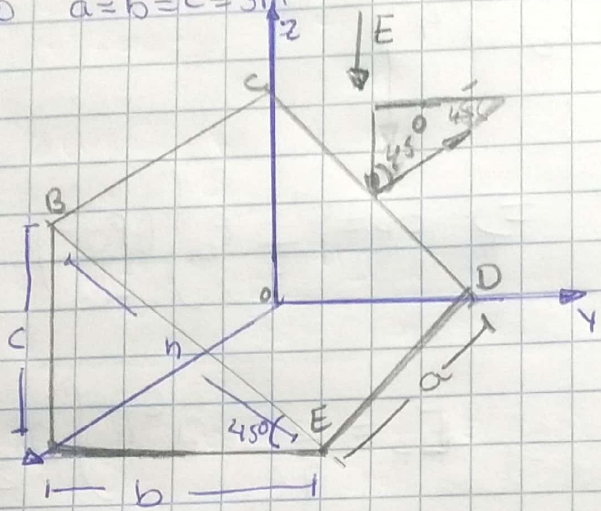
Problemas 02

1.- Las componentes en $\frac{N}{C}$ del campo electrico de la fig son $E_x = 0$; $E_y = 100y^2$ y $E_z = 0$ calcule el flujo ϕ que atravieza el rectangulo BCDE siendo $a = b = c = 3m$



$h = \sqrt{c^2 + b^2}$

$h = \sqrt{9 + 9}$

$h = 3\sqrt{2}$

$area = h \times a$

$= 3\sqrt{2} \times 3$

$area = 9\sqrt{2}$

$\theta = 45°$

$\phi = E A \cos\theta$

$= 100 \quad 9\sqrt{2} \quad \frac{\sqrt{2}}{2}$

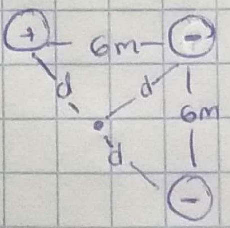
$\phi = 900 \frac{Nm}{c}$

2.- En 3 vertices de un cuadrado de 6m de lado se colocan las siguientes cargas puntuales $3\mu C$, $-5\mu C$ y $2\mu C$ calcula?

a) el punto medio de cuadrado

b) En el Vertice sin carga

c) calcula el trabajo de mover una carga $1\mu C$ entre A y B



$d = \frac{\sqrt{2d^2}}{2}$

$=$

$d = 3\sqrt{2}m$

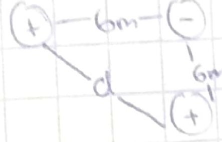
$V_1 = \frac{kQ_1}{d} = 9 \times 10^9 \frac{Nm^2}{C^2} \frac{3 \times 10^{-6}}{3\sqrt{2}} = 9\sqrt{2} \times 10^3 V$

$V_2 = \frac{kQ_2}{d} = 9 \times 10^9 \frac{Nm^2}{C^2} \frac{-5 \times 10^{-6}}{3\sqrt{2}} = -15\sqrt{2} \times 10^3 V$

$V_3 = \frac{kQ_3}{d} = 9 \times 10^9 \frac{Nm^2}{C^2} \frac{2 \times 10^{-6}}{3\sqrt{2}} = 3\sqrt{2} \times 10^3 V$

$V_{total} = V_1 + V_2 + V_3 = \left(\frac{9\sqrt{2}}{2} - \frac{15\sqrt{2}}{2} + 6\sqrt{2}\right) \times 10^3 = \left(\frac{15\sqrt{2} - 15\sqrt{2}}{}\right) \times 10^3 V$

b) en el vertice sin carga



$d = 6\sqrt{2}\,m$

$$V_1 = \frac{9\times10^9(3\times10^{-6})}{6} = \frac{9}{2}\times10^3 V$$

$$V_2 = \frac{9\times10^9(-5\times10^{-6})}{6\sqrt{2}} = -\frac{15\sqrt{2}}{4}\times10^3 V$$

$$V_3 = \frac{9\times10^9(2\times10^{-6})}{6} = 3\times10^3 V$$

$$V_{total} = V_1 + V_2 + V_3 = \left(\frac{9}{2}\times10^3 - \frac{15\sqrt{2}}{4}\times10^3 + 3\times10^3\right) V$$

$$V_{total} = \left(\frac{9}{2} - \frac{15}{4}\sqrt{2} + 3\right)\times10^3 V = 2.19\times10^3 V$$

c) $\Delta V = V_A - V_B = 0 - 2.14\times10^3 V$

$\Delta V = -2.19\times10^3 V$

D) $q = 1\times10^{-6}$

de $A \rightarrow B$

$W_{AB} = q(V_A - V_B) = 1\times(-2.19\times10^3)$

$= 2.19\times10^{-3}\,J$

③ $\lambda = ?$ $\quad R = 0.15\,m$

$V = 200V$

$\lambda = \frac{Q}{V} = \lambda = \frac{dq}{dr}$

$v = \int dv = \frac{1}{4\pi\varepsilon_0} \int \frac{\lambda\, dv}{r} \Rightarrow \frac{1}{4\pi\varepsilon_0} \lambda \int 4\pi r\, dr$

$V = 4\pi R^3$

$dv = \frac{4}{3}\pi r^3$

$\Rightarrow \frac{1}{4\pi\varepsilon_0} 4\pi\lambda \left(\frac{r^2}{2}\right)$

$dv = 4\pi r^2 dr$

$V = \frac{\lambda r^2}{2}$

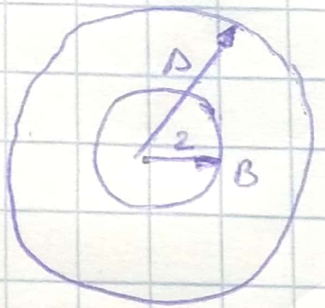
$V = 200$

$200 = \frac{\lambda}{\varepsilon_0} \frac{(0.15)^2}{2}$ $\rightarrow$ $\frac{400\varepsilon_0}{0.0225} = \lambda$

$\lambda = \frac{4 \cdot 10^2 \times 8.85 \times 10^{-12}}{2.25 \times 10^{-2}}$

$\lambda = 15733 \times 10^{-12} = \lambda = 1{,}573 \times 10^{-7}$ ✗

4)



$q_2 = 12 \times 10^{-9}$

$q_4 = 20 \times 10^{-9}$

$$\phi = \frac{Q_{encerrada}}{\varepsilon_0}$$

a) $V = ?$

$d = 3\,cm$

$V_t = V_2 + V_4$

$$V_t = V_R(2cm) + V_R(4cm)$$

$$= \frac{kQ}{R(2cm)} + \frac{kQ}{R(4cm)}$$

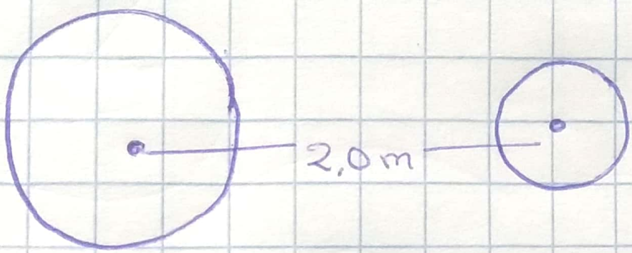
$$V_t = \frac{kQ}{r} = \frac{9 \cdot 10^{9} \cdot 12 \cdot 10^{-9}}{3 \cdot 10^{-2}} = 3{,}6 \cdot 10^{3}\,V$$

$$V_c = \frac{kQ}{r} = \frac{20 \cdot 10^{-9} \cdot 9 \cdot 10^{9}}{4 \cdot 10^{-2}} = 4{,}5 \cdot 10^{3}\,V$$

$$V_t = 8{,}1 \cdot 10^{3}\,V$$

6)

$q_1 = 4 \times 10^{-8}$ $\qquad$ $q_2 = -3 \times 10^{-8}$



$V_T = V_1 + V_2$

$$\frac{kq_1}{r_1} + \frac{kq_2}{r_2} = 9 \cdot 10^9 (4 \times 10^{-8}, -3 \times 10^{-8})$$

$$= -18V$$

b) V_1 y V_2 deven ser iguales

$q_1 + q_2 = q_T$

$-2 \times 10^{-8} = Q_T$

$Q = -1 \times 10^{-8}$

$Q_2 = -1 \times 10^{-8}$

$V_1 = \frac{kQ_1}{r_1} = 9 \times 10^7 \cdot -1 \times 10^{-8} = -90V$

$V_2 = kQ_2 = 9 \cdot 10^9 \cdot -1 \times 10^{-8} = -90V$

cuyo potencial eléctrico es ...

7) $\nabla^2 \phi = 0$

$\phi(\rho = a) = V_0$

$\phi(\rho = b) = 0$

$$E = E_{u\rho} = \frac{\partial \phi}{\partial \rho} - \frac{u\partial \phi}{\rho \partial \varphi} u\varphi - \frac{\partial \phi}{\partial z} u$$

donde $\frac{\partial \phi}{\partial \varphi} = 0$ $\frac{\partial \phi}{\partial z} = 0$

$\frac{1d}{\rho d\theta}$

8) Calcula el campo de un dipolo en un punto arbitrario $p(x, y, z)$ a partir del potencial considerando que el momento dipolar es $p = qa$

Datos:

$$V_p = k \frac{\bar{p} \cdot \bar{r}}{r^3}$$

$$r_1^2 = r^2 + \left(\frac{a}{2}\right)^2 - 2r\left(\frac{a}{2}\right)\cos\theta$$

$$E_r = ? \qquad E_\theta = ?$$

$$r >> a$$

$$\frac{\partial V}{\partial r} = -E_r \Rightarrow \frac{\partial}{\partial r}\left(\frac{k_e \cdot p \cdot \cos\theta}{r^2}\right) = -E$$

$$\frac{1}{r_1} = \frac{1}{r}\left(1 + \frac{a}{2r}\cos\theta\right)$$

$$\frac{1}{r_2} = \frac{1}{r}\left(1 - \frac{a}{2r}\cos\theta\right)$$

$r >>> a$ y $p = qa$

$$\frac{\partial V}{\partial r} = kp\cos\theta\left(\frac{-2}{r^3}\right) = -\int \frac{kp\cos\theta\, r}{r^2} = -E_r$$

$$E_\theta = \frac{\partial V}{\partial \theta}$$

$$E_\theta = \frac{kp \cdot \operatorname{sen}\theta}{r^2}\,\hat{\theta}$$

Karibeña

a) Cual es el campo electrico en el punto (1, 1, 1) en metros si el potencial electrico en todo el espacio esta dado por

$$V_{(x,y,z)} = \frac{300}{(x^2+y^2+z^2)^{1/2}} \text{ voltios}$$

$$\frac{\partial V}{\partial x} = \frac{-300x}{(x^2+y^2+z^2)^{1/2}} = E\hat{i}$$

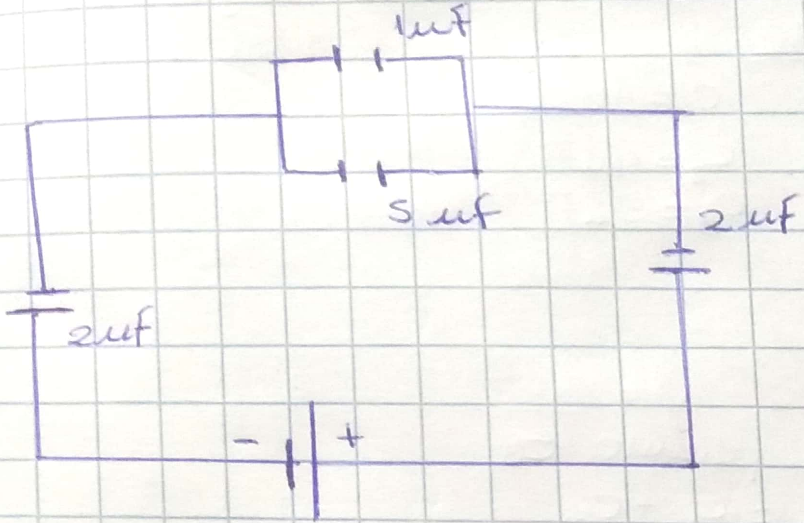
$$\frac{\partial V}{\partial y} = \frac{-300y}{(x^2+y^2+z^2)^{1/2}} = E\hat{j}$$

$$\frac{\partial V}{\partial z} = \frac{-300z}{(x^2+y^2+z^2)^{1/2}} = -E\hat{k}$$

$$\frac{-300}{\sqrt{(3)^3}} = \frac{-300}{3\sqrt{3}} = \frac{-100}{\sqrt{3}} = -E\hat{i}$$

$$\overline{E} = \left(\frac{100}{\sqrt{3}}, \frac{100}{\sqrt{3}}, \frac{100}{\sqrt{3}}\right)$$

10) En la figura el condensador de 1 uF tiene una carga de 2uF calcular el voltage V de la bateria en voltios



en paralelo

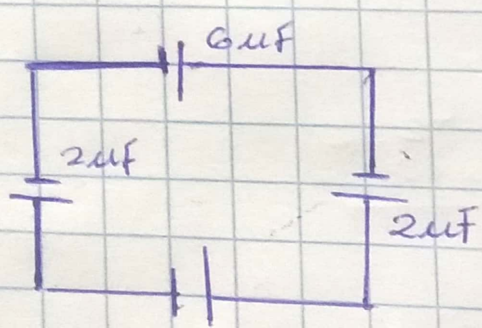
$V_1 = V_2$

$\boxed{Q = CV}$

$$\frac{Q_1}{C_1} = \frac{Q_2}{C_2}$$

$$\frac{2}{1} = \frac{Q_2}{5}$$

$Q = 10\,\mu C$



en serie

$Q_1 = Q_2 = Q_3$

$10\,\mu C = Q_1 = Q_2 = Q_3$

$10 = 2 \cdot V_1$

$V_1 = 5$

$10 = 2 \cdot V_3$

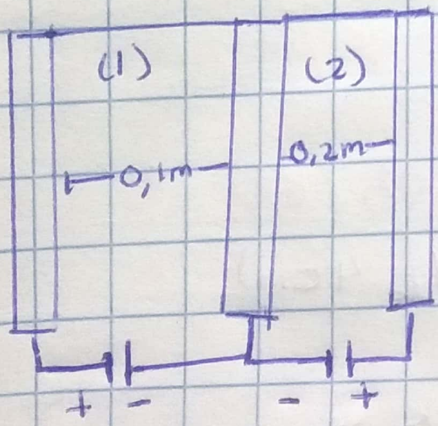
$V_3 = 5$

$V_T = V_1 + V_2 + V_3$

$V_T = 5 + 5 + 2$

$\boxed{V_T = 12V}$

11)



$E_1 = ?$

$E_2 = ?$

$C = \frac{\sigma A}{\varepsilon d}$

$E = \frac{\sigma}{\varepsilon_0}$

$C_1 = \frac{\sigma A}{\varepsilon_1 d_1}$

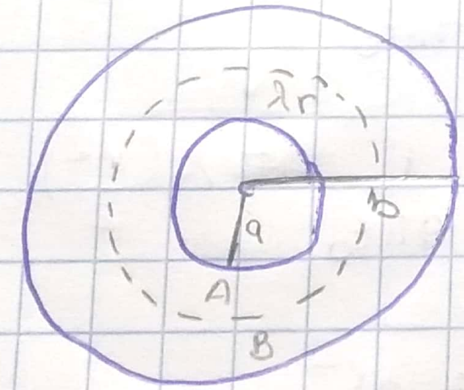
$\sigma = \frac{q}{A}$

$C_2 = \frac{\sigma A}{\varepsilon_2 d_2}$

$$\frac{C_1}{C_2} = \frac{\varepsilon_2 (0.2)}{\varepsilon_1 (0.1)}$$

$$\frac{\varepsilon_1}{\varepsilon_2} = \frac{C_2 (0.2)}{C_1 (0.1)}$$

12) Hallar la capacidad de un par de cilindros metalicos coaxiales de radios "a" y "b" y longitud "L" como se muestra.



$$\text{flujo} = -\int_a^b F\, dS$$

$$EA = \frac{Q}{\varepsilon_0} \qquad E = \frac{\lambda l}{2\pi r \cdot \varepsilon_0}$$

$$E = \frac{2k\lambda}{r}$$

$$\Delta V = -\int_a^b E\, dr = -\int_a^b 2k\lambda \frac{dr}{r}$$

$$= -2k\lambda \int_a^b \frac{dr}{r} = 2k\lambda \ln\left(\frac{b}{a}\right) = \frac{Q}{2\pi\varepsilon_0 l} \ln\left(\frac{b}{a}\right)$$

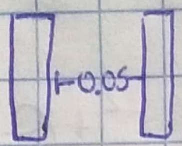
$$C = \frac{Q}{\Delta V} = \frac{2\pi\varepsilon_0 L}{\ln \frac{b}{a}}$$

(13) $c = \frac{k \varepsilon_0 A}{d}$ k = vacío

$V = 3000 V$

$\rho = 1 \times 10^{-2}$

$c = \frac{\varepsilon_0 A}{d}$



V_0 y $V_f = ?$

$V = \frac{1}{2} c v^2$

$c_0 = \frac{8.25 \times 10^{-12} \cdot 10^{-2}}{2 \times 10^{-2}}$

$c_0 = 4.425 \times 10^{-12}$

$c_f = \frac{8.85 \times 10^{-12} \times 10^{-2}}{5 \times 10^{-2}} = 1.77 \times 10^{-12}$

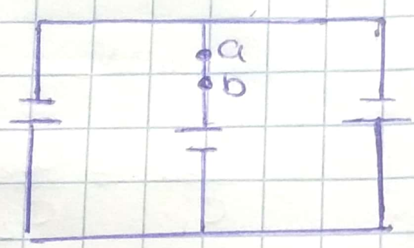
$V_0 = \frac{1}{2} \cdot 4,425 \times 10^{-12} \cdot 9 \times 10^{6}$

$V_0 = 19,91 \times 10^{-6}$

$V_f = \frac{1}{2} (1,77) \times 10^{-12} \cdot 9 \times 10^{6}$

$V_F = 7.97 \times 10^{-6}$

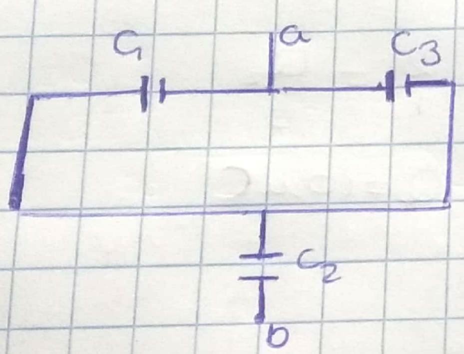
15) En la figura encontrar la capacidad equivalente a esta conexion sabiendo que $C_1 = 10\mu F$, $C_2 = 4\mu F$, $C_3 = 5\mu F$ y la diferencia de potencial entre el punto a y b es 100 v



$C_1 = 10\mu F$

$C_2 = 4\mu F$

$C_3 = 5\mu F$



C_1 paralelo C_3

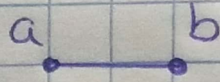
$C_{eq} = C_1 + C_3$

$C_{eq} = 15\mu F$

$(C_1 + C_3)$ serie C_2

$C_{eq} = \frac{1}{15} + \frac{1}{4}$

$C_{eq} = \frac{60}{19}$



$C = \frac{60}{19}$

$V_{AB} = \frac{q_{eq}}{C_{eq}}$

$100 = \frac{q_{eq}}{60/19}$ $\qquad q_{eq} = \frac{6000}{19}$