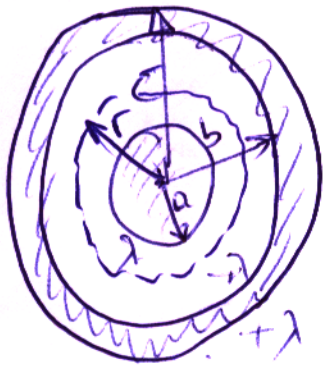
1



a) $E = \frac{2k\lambda}{r}$ //

b)

c) $-\lambda$ içeriye
$+\lambda$ dışarı yönlü

5

a) $\int \vec{E} d\vec{A} = \frac{q}{\varepsilon_0}$ (4)

$\int E dA \cos\theta = \frac{q}{\varepsilon_0} \Rightarrow \int E dA = \frac{q}{\varepsilon_0}$ $q = \lambda l$

$\theta = 0$

$E \int dA = \frac{\lambda l}{\varepsilon_0} \Rightarrow E 2\pi r l = \frac{\lambda l}{\varepsilon_0}$

$\int dA = 2\pi r l$

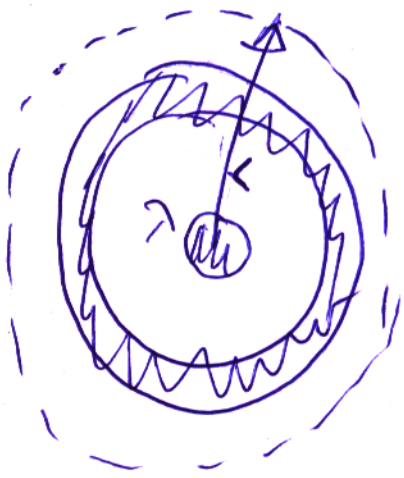
$\boxed{E = \frac{\lambda}{2\pi\varepsilon_0 r}}$ //

(8)

b) $E = \frac{\lambda}{2\pi\varepsilon_0 r}$ // $r > c$ için

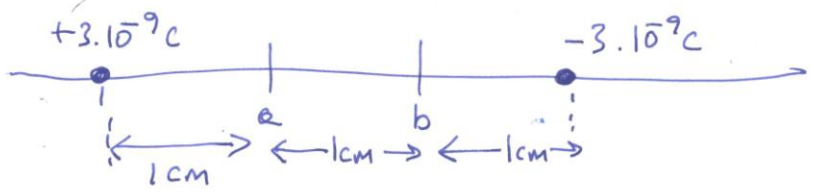
$\int E dA = \frac{q_{in}}{\varepsilon_0} \Rightarrow q_{in} = \lambda + 0$

$E = \frac{\lambda}{2\pi\varepsilon_0 r}$



(7)

2



Şekilde 5g ağırlığında ve 2.10^{-9}C (q') yüklü parçacık "a" noktasında serbest hareket bırakılıyor. Söz konusu parçacığın "b" noktasındaki hızı nedir?

$$K_a + U_a = K_b + U_b$$

$$0 + q'V_a = \frac{1}{2}mv^2 + q'V_b$$

$$v = \sqrt{\frac{2q'(V_a - V_b)}{m}}$$

$$V_a = 9.10^9 \frac{Nm^2}{C^2}\left(\frac{3.10^{-9}C}{1.10^{-2}m} + \frac{-3.10^{-9}C}{2.10^{-2}}\right) = 1350V$$

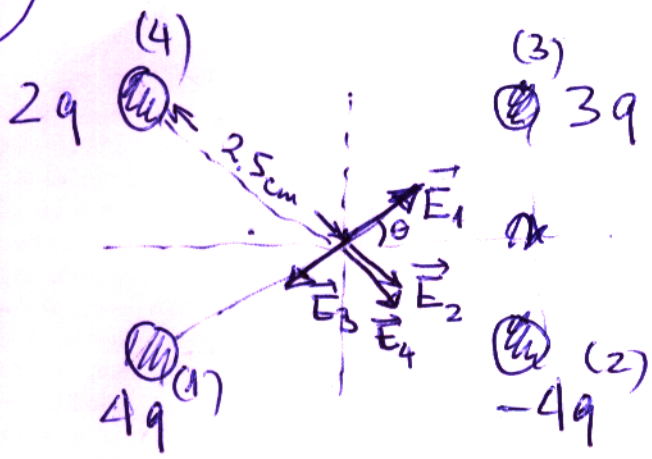
$$V_b = 9.10^9\left(\frac{3.10^{-9}C}{2.10^{-2}} + \frac{-3.10^{-9}}{1.10^{-2}}\right) = -1350V$$

$$V_a - V_b = 2700$$

$$v = \sqrt{\frac{2.2.10^{-9}\,2700}{5.10^{-3}}}$$

$$v = 4{,}65.10^{-2}\ m/s$$

(3)



$r = 2.5\ cm = 2.5\times10^{-2}\ m$

$q = 5\ \mu C = 5\times10^{-6}\ C$

$k = 9\times10^{9}\ N\,m^2/C^2$

$$E_1 = k\frac{4q}{r^2} = 9\times10^{9}\frac{4(5\times10^{-6})}{(2.5\times10^{-2})^2} = 28.8\times10^{7}\frac{N}{C}$$

$$E_2 = 28.8\times10^{7}\frac{N}{C}$$

$$E_3 = k\frac{3q}{r^2} = 9\times10^{9}\frac{3(5\times10^{-6})}{(2.5\times10^{-2})^2} = 21.6\times10^{7}\frac{N}{C}$$

$$E_4 = k\frac{2q}{r^2} = 9\times10^{9}\frac{2(5\times10^{-6})}{(2.5\times10^{-2})^2} = 14.4\times10^{7}\frac{N}{C}$$

$$\vec{E}_1 = E_1\cos\theta\,\hat{i} + E_1\sin\theta\,\hat{j} = \left[28.8\left(\frac{2.0}{2.5}\right)\hat{i} + 28.8\left(\frac{1.5}{2.5}\right)\hat{j}\right]\times10^{7}$$

$$\vec{E}_1 = 23.04\times10^{7}\,\hat{i} + 17.28\times10^{7}\,\hat{j}$$

$$\vec{E}_2 = E_2\cos\theta\,\hat{i} + E_2\sin\theta\,\hat{j} = 23.04\times10^{7}\,\hat{i} - 17.28\times10^{7}\,\hat{j}$$

$$\vec{E}_3 = \left[21.6\left(\frac{2.0}{2.5}\right)(-\hat{i}) + 21.6\times\left(\frac{1.5}{2.5}\right)(-\hat{j})\right]\times10^{7} = -17.28\times10^{7}\,\hat{i} - 12.96\times10^{7}\,\hat{j}$$

$$\vec{E}_4 = \left[14.4\left(\frac{2.0}{2.5}\right)(+\hat{i}) + 14.4\times\left(\frac{1.5}{2.5}\right)(-\hat{j})\right]\times10^{7} = 11.52\times10^{7}\,\hat{i} - 8.64\times10^{7}\,\hat{j}$$

$$\vec{E} = \vec{E}_1 + \vec{E}_2 + \vec{E}_3 + \vec{E}_4 = \left[40.32\,\hat{i} - 21.6\,\hat{j}\right]\times10^{7}$$

$$|\vec{E}| = \sqrt{(40.32)^2 + (21.6)^2} = \sqrt{2091.26} = 45.73\times10^{7}\ \frac{N}{C}$$

$$\tan\theta = \frac{-21.6}{40.32} = -0.535 \qquad \theta = 331.86$$

$E_4 + E_2 = 14.4 + 28.8 = 43.2$

$E_1 - E_3 = 28.8 - 21.6 = 7.2$

$E_2 = 43.2\left(\frac{\cancel{Q6}}{2.5}\right) + 43.2\left(\frac{2}{2.5}\right)$

$E_y = 7.2\ \frac{1.5}{2.5} = 7.2\left(\frac{2}{2.5}\right)$

$E_2 = 25.92\,\hat{i} + 34.56\,\hat{j}$

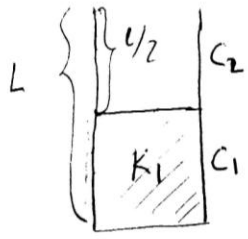
$E_2 = 4.32\,\hat{i} - 27.648$

$E = 30.24\,\hat{i} - 6.92\,\hat{j}$

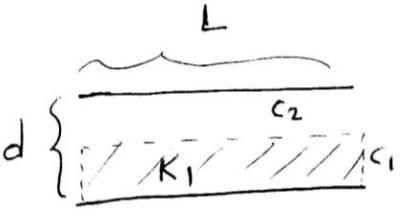
914.45

$9 - \square = 7$

t)



$K_1 = 2.0$



Sığanın değişmemesi için dielektrik malzemenin kalınlığı ne kadar olmalı.

a şıklındaki resimde $C_{eq} = C_1 + C_2$ (paralel)

$$C_{eq} = \frac{K_1 \varepsilon_0 A/2}{d} + \frac{\varepsilon_0 A/2}{d} = \frac{K+1}{2} \cdot \frac{\varepsilon_0 A}{d}$$

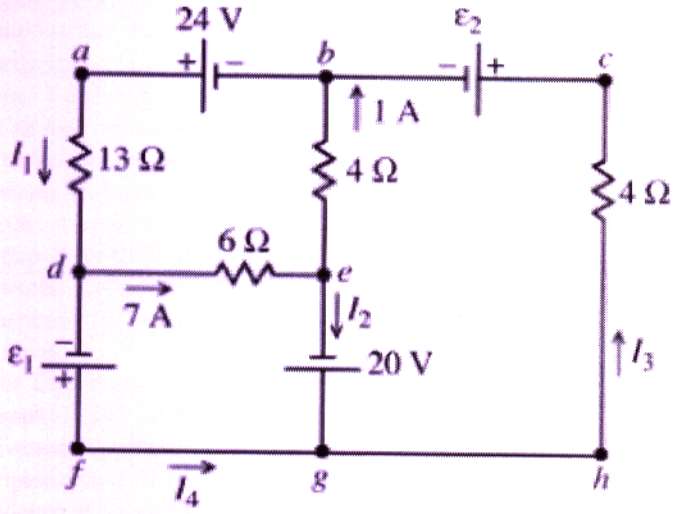
b şıklındaki resimde $\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2}$ (seri)

$$\frac{1}{C_{eq}} = \frac{1}{\frac{K_1 \varepsilon_0 A}{x}} + \frac{1}{\frac{\varepsilon_0 A}{d-x}}$$

$$\frac{2d}{(K+1)(\varepsilon_0 A)} = \frac{x}{K_1 \varepsilon_0 A} + \frac{d-x}{\varepsilon_0 A}$$

$$x = \frac{2d}{2} \quad (K_1 = 2.0 \text{ kullanıldı})$$

5. Aşağıdaki devrede I_1, I_3, I_4 akımlarını, ε_1 ve ε_2 elektromotor kuvvetlerini bulunuz. Bataryalar ideal, iç dirençleri yoktur.



Soru boyunca yönleri verildiği gibi alalım.

- e noktası için

$7A = 1A + I_2$

$I_2 = 6A$

- badeb yolu boyunca

$+24 - 13I_1 - 6\times 7 - 4\times 1 = 0$

$13I_1 = -22$

$I_1 = -\frac{22}{13} A$ (4 puan)

- d noktasında

$I_1 = 7A + I_4$

$I_4 = I_1 - 7 = -\frac{22}{13} A - 7A = -\frac{113}{13} A$ (4 puan)

negatif çıkan büyüklükler, demek ki, verilen (kabul ettiğimizin) tersi yönde imiş!

- g noktasında

$I_2 + I_4 = I_3$

$I_3 = 6A - \frac{113}{13} A = -\frac{35}{13} A$ (4 puan)

- degfd yolu boyunca

$-7\times 6 + 20 - \varepsilon_1 = 0$

$\varepsilon_1 = -42 + 20 = -22 V$ (4puan)

- begheb yolu boyunca

$4\times 1 + 20 - 4I_3 - \varepsilon_2 = 0$

$\varepsilon_2 = 4 + 20 - 4\times\left(-\frac{35}{13}\right)$

$\varepsilon_2 = 24 + \frac{140}{13} = \frac{452}{13} V$ (4puan)