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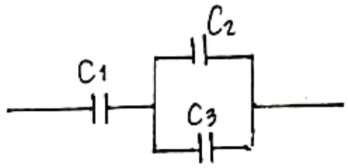
ETS FISIKA 2 - 32

3) a)



b) Kapasitansi total.

$$C_1 = \frac{\varepsilon_0 K_1 A}{\frac{1}{4}d} = \frac{4\varepsilon_0 K_1 A}{d} \text{ F}$$

$$C_2 = \frac{\varepsilon_0 K_2 \cdot \frac{A}{2}}{\frac{3}{4}d} = \frac{2\varepsilon_0 K_2 A}{3d} \text{ F}$$

$$C_3 = \frac{\varepsilon_0 K_3 \frac{A}{2}}{3/4\, d} = \frac{2\varepsilon_0 K_3 A}{3d} \text{ F}$$

Cparalel $= C_2 + C_3$

$$= \frac{2\varepsilon_0 K_2 A}{3d} + \frac{2\varepsilon_0 K_3 A}{3d}$$

$$= \frac{2\varepsilon_0 A}{3d}(K_2 + K_3)$$

Cseri / Ctotal

$$\frac{1}{C_{seri}} = \frac{1}{C_1} + \frac{1}{C_{par}}$$

$$\frac{1}{C_{seri}} = \frac{d}{4\varepsilon_0 K_1 A} + \frac{3d}{2\varepsilon_0 A(K_2+K_3)}$$

$$\frac{1}{C_{seri}} = \frac{d}{2\varepsilon_0 A}\left(\frac{1}{2K_1} + \frac{3}{(K_2+K_3)}\right)$$

$$C_{seri} = \frac{2\varepsilon_0 A}{d}\left(\frac{(K_2+K_3)\,2K_1}{K_2+K_3+6K_1}\right)$$

c) Energi yang tersimpan.

$$W = \frac{1}{2} C_{total} \cdot V^2$$

$$= \frac{1}{2} \cdot \frac{2\varepsilon_0 A}{d}\left(\frac{2K_1(K_2+K_3)}{K_2+K_3+6K_1}\right) V^2$$

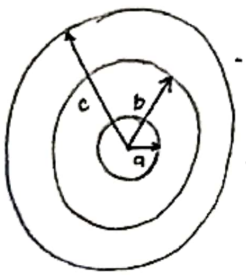
$$= \frac{\varepsilon_0 A}{d}\left(\frac{2K_1(K_2+K_3)}{K_2+K_3+6K_1}\right) V^2$$

muatan

$$Q_{total} = C_{total} \cdot V$$

$$= \frac{2\varepsilon_0 A}{d}\left(\frac{(K_2+K_3)\,2K_1}{K_2+K_3+6K_1}\right) \cdot V$$

2)



- silinder isolator jari-jari a dg muatan +q
- silinder konduktor berongga dg muatan -q

Ditanya : Medan listrik dan potensial listrik ?

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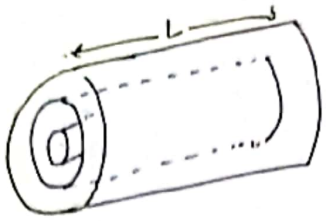
a) $r < a$

$$\oint E\,A = \frac{Q_{in}}{\varepsilon_0}$$

$$E \cdot 2\pi a L = \frac{Q}{\varepsilon_0}$$

$$E = \frac{Q}{2\pi a L \varepsilon_0}$$



b) $a < r < b$

$$\oint E\,A = \frac{Q_{in}}{\varepsilon_0}$$

$$E\,2\pi r L = \frac{Q}{\varepsilon_0}$$

$$E = \frac{Q}{2\pi r L \varepsilon_0}$$

c) $b < r < c$

$E = 0$

karena berada di kulit berupa konduktor.

d) $r > c$

$$\oint E\,A = \frac{Q_{in}}{\varepsilon_0}$$

$$E \cdot 2\pi r L = \frac{+Q - Q}{\varepsilon_0}$$

$$E = 0$$

Potensial Listrik.

a) $r < a$

$$V_r = -\int_{\infty}^{r} E\,dr$$

$$= -\int_{\infty}^{c} E\,dr - \int_{c}^{b} E\,dr - \int_{b}^{a} E\,dr - \int_{a}^{r} E\,dr.$$

$$= -0 - 0 - \int_{b}^{a} \frac{Q}{2\pi r L \varepsilon_0}\,dr - \int_{a}^{r} \frac{Q}{2\pi r L \varepsilon_0}\,dr$$

$$= \frac{Q}{2\pi L \varepsilon_0} \int_{b}^{a} \frac{1}{r}\,dr - \frac{Q}{2\pi L \varepsilon_0} \int_{a}^{r} \frac{1}{r}\,dr.$$

$$= \frac{-Q}{2\pi L \varepsilon_0}\left[\ln|a| - \ln|b|\right] - \frac{Q}{2\pi L \varepsilon_0}\left[\ln|r| - \ln|a|\right] \text{ volt}$$

b) $a < r < b$

$$V_r = -\int_{\infty}^{c} E\,dr - \int_{c}^{b} E\,dr - \int_{b}^{r} E\,dr.$$

$$= -\frac{Q}{2\pi L \varepsilon_0} \int_{b}^{r} \frac{1}{r}\,dr$$

$$= -\frac{Q}{2\pi L \varepsilon_0}\left[\ln|r| - \ln|b|\right] \text{ volt.}$$

c) $b < r < c$

$$V_r = -\int_{\infty}^{c} E\,dr - \int_{c}^{r} E\,dr$$

$V = 0$ volt

d) $r > c$

$$V_r = -\int_{\infty}^{r} E\,dr$$

$= 0$ volt.

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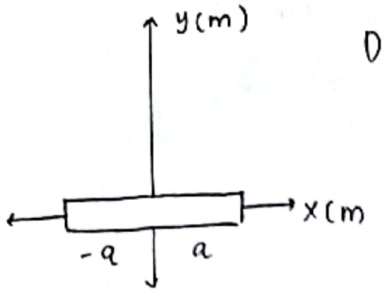
1)



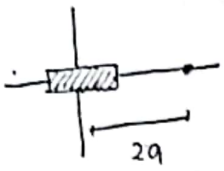
Diketahui : panjang = $2a = \ell$

$Q = Q$

Ditanya : a) E di $(2a, 0)$

b) F di (a, a)

a)



$E = \int dE \qquad dE = \frac{K}{r^2} dq$

$\lambda = \frac{Q}{\ell}$

$dE = K \frac{\lambda \, dx}{(\ell + a - x)^2}$

$E = K\lambda \int_{-a}^{a} \frac{dx}{(3a-x)^2}$

$= K\lambda \left[\frac{1}{3a-x} \right]_{-a}^{a}$

$= K\lambda \left(\frac{1}{2a} - \frac{1}{4a} \right) = \frac{K\lambda}{4a} \rightarrow \lambda = \frac{Q}{2a}$

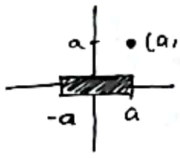
$E = \frac{KQ}{8a^2}$

b) $F = q \cdot E$

$= Q \cdot 0{,}3825 \cdot \frac{KQ}{a^2}$

$= 0{,}3825 \frac{KQ^2}{a^2}$ N.

* mencari E di (a, a)



$\theta_B = 0°, \; \theta_A = 315°$

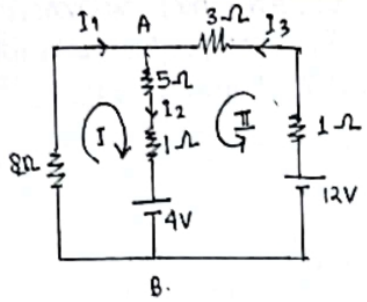
$E = \frac{K\lambda}{a} \left[(\cos\theta_B - \cos\theta_A)\hat{i} + (\sin\theta_B - \sin\theta_A)\hat{j} \right]$

$E = \frac{KQ}{2a^2} \left[(1 - \frac{1}{2}\sqrt{2})\hat{i} + \frac{1}{2}\sqrt{2}\hat{j} \right]$

$E = \frac{KQ}{2a^2} \cdot 0{,}765$

$E = 0{,}3825 \cdot \frac{KQ}{a^2}$

4)



a) arus yang mengalir pada resistor 8Ω dan 3Ω

pada loop 1

$\Sigma \varepsilon - \Sigma IR = 0$

$4 - (I_1 \cdot 8 + I_2 5 + I_2 \cdot 1) = 0$

$4 - 8I_1 - 6I_2 = 0 \quad \ldots ①$

pada loop 2

$\Sigma \varepsilon - \Sigma IR = 0$

$4 - 12 - (I_2 5 + I_2 \cdot 1 + I_3 \cdot 1 + I_3 \cdot 3) = 0$

$-8 - 6I_2 - 4I_3 = 0 \quad \ldots ②$

$I_2 = I_1 + I_3$

$I_1 = I_2 - I_3$.

Berdasarkan ①

$4 - 8(I_2 - I_3) - 6I_2 = 0$

$4 - 8I_2 + 8I_3 - 6I_2 = 0$

$4 = 14I_2 - 8I_3 \quad \ldots ③ \quad | \times 1$

$-8 = 6I_2 + 4I_3 \quad \ldots ④ \quad | \times 2$

$4 = 14I_2 - 8I_3$

$-16 = 12I_2 + 8I_3$ +

$-12 = 26I_2$

$I_2 = -\frac{12}{26} = -\frac{6}{13}$ A. (arah berkebalikan seperti gambar)

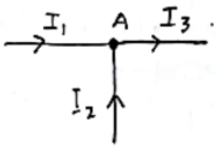
subsitusi ke ②

$-8 = 6I_2 + 4I_3$

$-8 = 6\left(-\frac{12}{26}\right) + 4I_3$

$I_3 = -\frac{17}{13}$ A (arah berkebalikan seperti gambar)

sehingga jika digambar ulang



arus pada 8Ω = I_1

$I_1 = I_3 - I_2 = \frac{17}{13} - \frac{6}{13} = \frac{11}{13}$ A.

arus pada 3Ω = $I_3 = \frac{17}{13}$ A.

b) V_{AB}.

$V = I_2 \cdot 5\Omega + I_2 \cdot 1\Omega + \varepsilon_1$

$= \frac{6}{13} \cdot 5 + \frac{6}{13} \cdot 1 + 4 = \frac{88}{13} = 6{,}76$ volt.