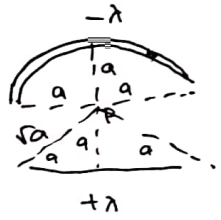
Nama : Alicia Bernadine P.
NRP : 5010201170
Kode dep : 5010
kelas : Fisika II

① 

Batang
$\ell = 2a$
$\lambda = +\lambda$

$\frac{1}{2}$ Cincin
$r = a$
$\lambda = -\lambda$

a) $\bar{E}$ di P

$\bar{E}_P = \bar{E}_1 + \bar{E}_2$

$=$

$\bar{E}_1 = \bar{E}$ cincin $\quad \cos\theta_A = 270° \quad \cos\theta_B = 90°$

$= \frac{-\lambda}{4\pi\varepsilon_0 r}\left[(\cos\theta_B - \cos\theta_A)\hat{i} - (\sin\theta_B - \sin\theta_A)\hat{j}\right]$

$= \frac{-\lambda}{4\pi\varepsilon_0 A}\left[(\cos 90° - \cos 270°)\hat{i} + (\sin 90° - \sin 270°)\hat{j}\right)$

$= \frac{-\lambda}{4\pi\varepsilon_0}\left((0-0)i - (1--1)\right.$

$= \frac{-\lambda}{4\pi\varepsilon_0} -2$

$\bar{E}_1 = \frac{\lambda}{2\pi\varepsilon_0 a}\hat{j}$

$\bar{E}_2 = \bar{E}$ batang

$= \frac{\lambda}{4\pi\varepsilon_0}\left(\cos\theta_D - \cos\theta_C\right)i + (\sin\theta_D - \sin\theta_C)\hat{j}]$

$= \frac{\lambda}{4\pi\varepsilon_0}\left(\cos 45° - \cos 315°\right)\hat{j} + (\sin 45° - \sin 315°)\hat{i}\ )$

$= \frac{\lambda}{4\pi\varepsilon_0 a}\sqrt{2}\hat{j}$

$\bar{E}_P = \frac{\lambda}{2\pi\varepsilon_0 a}\hat{j} + \frac{\sqrt{2}\cdot\lambda}{4\pi\varepsilon_0}\hat{j}$

$\bar{E}_P = \frac{(2+\sqrt{2})\lambda}{4\pi\varepsilon_0 a}\hat{j}$

$|\bar{E}_1| = \sqrt{E_P}$

$= \left(\frac{2+\sqrt{2}\lambda}{4\pi\varepsilon_0 a}\right)$ N/C

b) $F = E.q$

$= \frac{(2+\sqrt{2})\lambda}{4\pi\varepsilon_0 a}\left(1{,}6\ 10^{-19}\right)$

$= \frac{(0{,}8 + 0{,}1\sqrt{2})\,10^{-19}\,\lambda}{\pi\varepsilon_0 A}$ N

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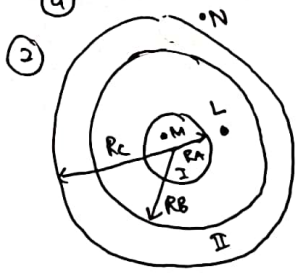
(a)



(2)

$R_A = 0{,}02\,m$
$R_B = 0{,}04\,m$
$R_C = 0{,}06\,m$

Konduktor I $= +2q$
Konduktor II $= -3Q$

- di L, $R_A < r < R_B$

$$\oint \bar{E}\,dA = \frac{\Sigma Q_{enc}}{\varepsilon_0} \rightarrow Q_{enc} = +2q$$

$$\bar{E}.A = \frac{2Q}{\varepsilon_0}$$

$$\bar{E}\,4\pi r^2 = \frac{2Q}{\varepsilon_0}$$

$$\bar{E} = \frac{2Q}{4\pi\varepsilon_0 r^2}$$

$$E = \frac{2KQ}{r^2}\ N/C$$

- di M $r < R_A$

E di M $= 0\ N/C$
karena bola konduktor

- di N, $r > R_C$

$$Q_{enc} = Q_{iso} + Q_{kon} = +2q - 3q = -q$$

$$\oint \bar{E}\,dA = \frac{\Sigma Q_{enc}}{\varepsilon_0}$$

$$\bar{E}.4\pi r^2 = \frac{-Q}{\varepsilon_0}$$

$$E = \frac{-Q}{4\pi\varepsilon_0 r^2} = -\frac{KQ}{r^2}\ N/C$$

(b) Potensial listrik di $r_L = 3\,cm$ dan $r_M = 1\,cm$

- $r_L = 3\,cm = 0{,}03\,m$

$$V_{r_L} = -\int_{\infty}^{R_C} \bar{E}_{r>R_C} - \int_{R_C}^{R_B} \bar{E}_{R_B<r<R_C} - \int_{R_B}^{r_L} \bar{E}_{R_A<r<R_B}$$

$$= -\left[-Kq\int_{\infty}^{R_C} \frac{1}{r}\right] - 0 - 2Kq\left[-\frac{1}{r}\right]_{R_B}^{r_L}$$

$$= -\frac{Kq}{R_C} + \frac{2Kq}{r_L} - \frac{2Kq}{R_B}$$

$$= Kq\left[\frac{2}{r_L} - \frac{1}{R_C} - \frac{2}{R_B}\right]$$

$$= Kq\left[\frac{2}{3} - \frac{1}{6} - \frac{2}{9}\right]$$

$= 0$ volt

- $R_M = 0{,}01\,m$

$$V_{R_B} = V_{r_L} - \int_{R_A}^{R_M} E_{r<R_A}$$

$= 0 - 0$
$= 0$ Volt

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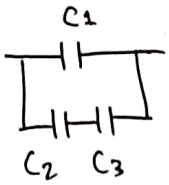
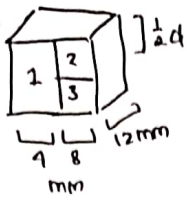
Fisika II

③ ⓐ



$A = 1{,}2 \times 1{,}2$ cm



$d = 2mm = 2.10^{-3}$

$k_1 = 4$
$k_2 = 6$
$k_3 = 2$

ⓑ $C_1 = \frac{k\varepsilon_0 A}{d}$

$= \frac{4 \cdot \varepsilon_0 \cdot 4.10^{-3} \cdot 12.10^{-3}}{2.10^{-3}}$

$= 0{,}096\ \varepsilon_0 F$

$C_2 = \frac{k\varepsilon_0 A}{d}$

$= \frac{6 \cdot \varepsilon_0 \cdot 8.10^{-3} \cdot 12.10^{-3}}{10^{-3}}$

$= 0{,}576\ \varepsilon_0 F$

$C_3 = \frac{k\varepsilon_0 . A}{d}$

$= \frac{2 . \varepsilon_0 . 4.10^{-12} 12.10^{-3}}{10^{-3}}$

$= 0{,}192\ \varepsilon_0 F$

ⓒ $\frac{1}{C_{seri}} = \frac{1}{C_2} + \frac{1}{C_3}$

$= \frac{C_3 + C_2}{C_2 C_3}$

$C_{seri} = \frac{C_2 C_3}{C_3 + C_2}$

$C_T = C_1 + \frac{C_2 C_3}{C_3 + C_2}$

$= \frac{0{,}096\ \varepsilon_0 + 0{,}576\ \varepsilon_0 \cdot 0{,}192\ \varepsilon_0}{0{,}576\ \varepsilon_0 + 0{,}192\ \varepsilon_0}$

$= 0{,}129\ \varepsilon_0 F$

$= 8{,}129 . 10^{-12} F$

3 ⓒ $U = \frac{1}{2} C V^2$

$= \frac{1}{2}\ 2{,}129 . 10^{-12} . 5^2$

$= 5{,}31 . 10^{-12} J$

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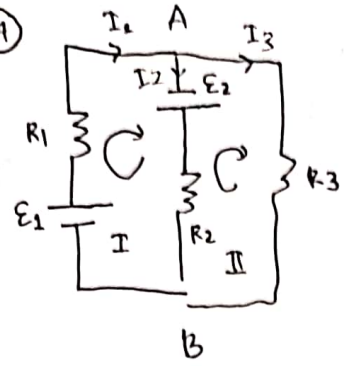
(a)



• $I_1 = I_2 + I_3 \rightarrow I_2 = I_1 - I_3$

$\varepsilon_1 = 12V$
$\varepsilon_2 = 9V$
$R_1 = 10\Omega$
$R_2 = 5\Omega$
$R_3 = 10\Omega$

•> Loop I

$\Sigma\varepsilon + \Sigma IR = 0$

$-\varepsilon_1 + I_1 R_1 - \varepsilon_2 + I_2 R_2 = 0$

$-12 + 10I_1 - 9 + 5I_2 = 0$

$10I_1 + 5(I_1 - I_3) = 21$

$15I_1 - 5I_3 = 21$

— eliminasi —

$15I_1 - 5I_3 = 21$

$-15I_1 + 45I_3 = -36$ +

$40I_3 = -15$

$I_3 = \frac{-3}{8}$ (arah berkebalikan gambar)

•> Loop 2

$\Sigma\varepsilon + \Sigma IR = 0$

$\varepsilon_2 - I_2 R_2 + R_3 I_3 = 0$

$12 - 5I_2 + 10I_3 = 0$

$-5(I_1 - I_3) + 10I_3 = -12$

$-5I_1 + 15I_3 = -12$

$15I_1 - 5\left(\frac{-3}{8}\right) = 21$

$I_1 = \frac{51}{40}$

$I_2 = I_1 - I_3$

$= \frac{51}{40} + \frac{15}{40}$

$= \frac{66}{40}$

(a) Jadi,

$I_1 = \frac{51}{40}$ A (arah searah jarum jam)

$I_2 = \frac{66}{40}$ (arah ke bawah)

$I_3 = \frac{3}{8}$ (arah berlawanan jarum jam)

(b) Beda potensial

$V = -I_3 R_3$

$= \frac{-3}{8} \cdot 10 = \frac{-30}{8}$ V (negatif karena arah berkebalikan)