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Pemecahan Kasus Muatan Listrik

1. Jumlah atom cincin yang terbuat dari perak ($^{107.9}_{47} \text{Ag}$) dan dilapisi emas ($^{197}_{79} \text{Au}$) 0.8 gram. Massa cincin 5 gram. Berapa jumlah elektron?

Penyelesaian:

$$N = 4.2 \cdot \frac{6.02 \times 10^{23}}{107.9} = 2.34 \times 10^{23} \text{ atom menjadi } 23.4 \times 10^{21} \text{ atom}$$

$$N = 0.8 \cdot \frac{6.02 \times 10^{23}}{197} = 2.44 \times 10^{23} \text{ atom}$$

$$N_{\text{tot}} = (23.4 + 2.44) \times 10^{21} \\ = 25.84 \times 10^{21} \text{ atom}$$

Elektron Perak (Ag) + elektron Au

$$47 + 79 = 126 e$$

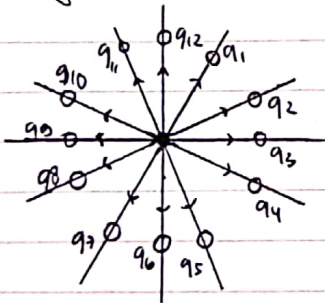
$$Q = (25.84 \times 10^{21})(126 e)(-1.60 \times 10^{-19} \text{ C/e}) \\ = 5.21 \times 10^5 \text{ C}$$

Jadi muatan cincin tersebut adalah $5.21 \times 10^5 \text{ C}$

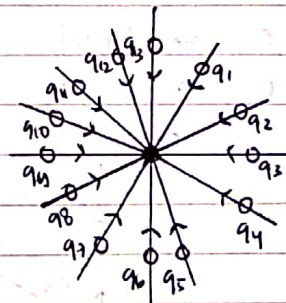
$$\rightarrow \frac{5.21 \times 10^5}{1.6 \times 10^{-19}} = 3.25 \times 10^{24} \text{ elektron}$$

Kasus Gaya Listrik

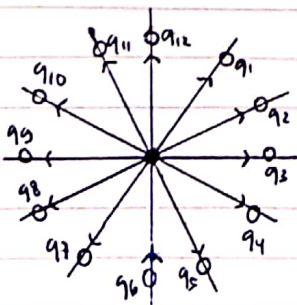
a.



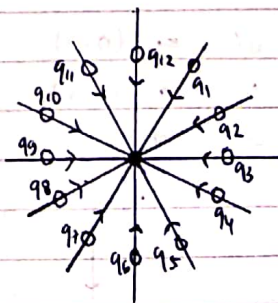
c.



b.



d.

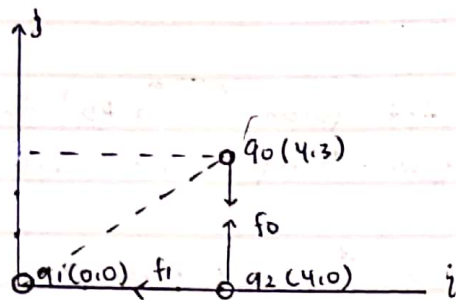


e. $q_1 = 25 \text{ MC} \Rightarrow (0,0)$

$q_2 = -10 \text{ MC} \Rightarrow (4,0)$

$q_0 = 10 \text{ MC} \Rightarrow (4,3)$

gaya total q_0 akibat q_1 dan $q_2 \dots ?$



$$\vec{F} = q_0 k \left\{ \frac{q_1}{r_{q_1}^2} \hat{r}_{a_1} + \frac{q_2}{r_{a_2}^2} \hat{r}_{a_2} \right\}$$

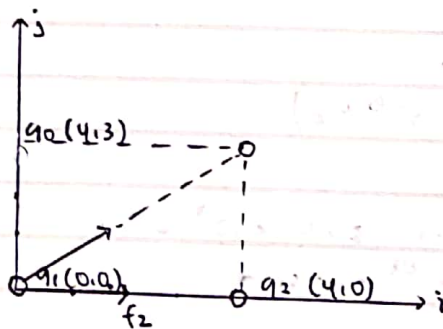
$$= 10 \cdot 9 \times 10^9 \left\{ 25 + \frac{(-10)}{16} (1) \right\}$$

f. $q_1 = +25 \text{ MC} \Rightarrow (0,0)$

$q_2 = -15 \text{ MC} \Rightarrow (4,0)$

$q_0 = +20 \text{ MC} \Rightarrow (4,3)$

q_0 pada medan listrik $\dots ?$

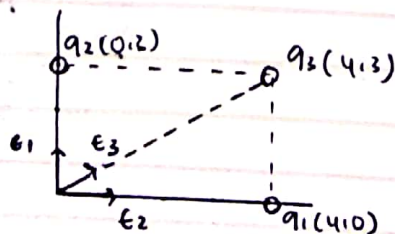


Kasus Medan Listrik

b. $q_1 = 2 \text{ C} \Rightarrow (4,0)$

$q_2 = 5 \text{ C} \Rightarrow (0,3)$

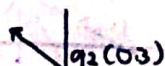
$q_3 = 10 \text{ C} \Rightarrow (4,3)$



c. $q_1 = -5 \text{ uC} \Rightarrow (0,0)$

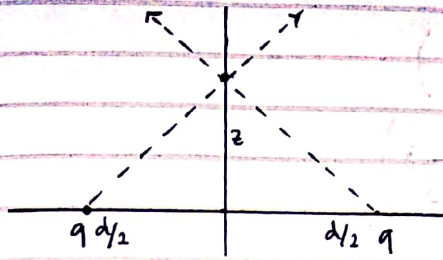
$q_2 = 5 \text{ C} \Rightarrow (0,3)$

$q_3 = 10 \text{ C} \Rightarrow (4,3)$



Kasus Medan Listrik

a.

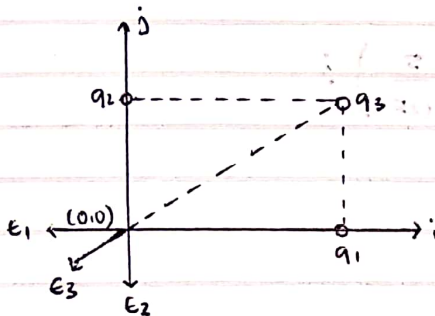


b. $q_1 = 2 \text{ C} \Rightarrow (4, 0)$

$q_2 = 5 \text{ C} \Rightarrow (0, 3)$

$q_3 = 10 \text{ C} \Rightarrow (4, 3)$

Medan listrik pada posisi $(0, 0)$..?



Medan oleh q_1 $\vec{E}_1 = \frac{1}{4\pi\epsilon_0} \frac{2}{16} (j)$

Medan oleh q_2 $\vec{E}_2 = \frac{1}{4\pi\epsilon_0} \frac{5}{9} (i)$

Medan oleh q_3 $\vec{E}_3 = \frac{1}{4\pi\epsilon_0} \frac{10}{25} \left(\frac{4i + 3j}{5} \right)$

$= \frac{1}{4\pi\epsilon_0} \left(\frac{40}{125} i + \frac{30}{125} j \right)$

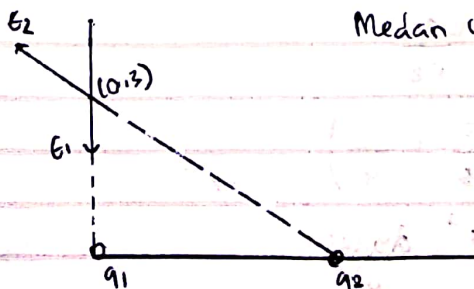
Medan total $\vec{E} = \frac{1}{4\pi\epsilon_0} \left[\left(\frac{5}{9} + \frac{40}{125} \right) (i) + \left(\frac{2}{16} + \frac{30}{125} \right) (j) \right]$

c. $q_1 = -5 \text{ uC} \Rightarrow (0, 0)$

$q_2 = 5 \text{ C} \Rightarrow (6, 3)$

$q_3 = 10 \text{ C} \Rightarrow (4, 3)$

Medan listrik pada posisi $(0, 3)$



Medan listrik oleh q_1 $\vec{E}_1 = k \cdot \frac{q_1}{r_1^2}$

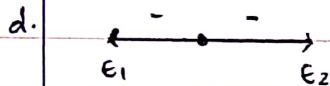
$$= 9 \cdot 10^9 \frac{5}{25} \left(\frac{-4i - 3j}{5} \right)$$

$$= 9 \cdot 10^9 \left(-\frac{20}{125} i - \frac{15}{125} j \right)$$

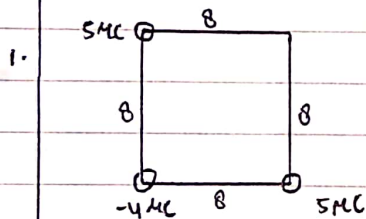
Medan listrik oleh q_2 $\vec{E}_2 = 9 \cdot 10^9 \frac{10}{16} \left(\frac{3j}{2} \right)$

$$= 9 \cdot 10^9 \left(\frac{30}{48} j \right)$$

Medan total $\vec{E} = -9 \cdot 10^9 \cdot \frac{20}{125} i + 9 \cdot 10^9 \left(\frac{30}{48} - \frac{5}{125} \right) j$



Potensial listrik



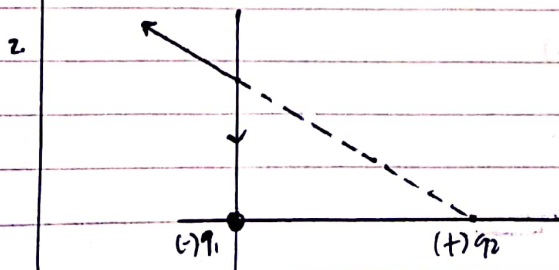
$$V_{\text{total}} = \sum k \frac{q}{r}$$

$$= 9 \cdot 10^9 \cdot \frac{5 \cdot 10^{-6}}{8} + \frac{5 \cdot 10^{-6}}{8} \cdot 9 \cdot 10^9 - \frac{4 \cdot 10^{-6} \cdot 9 \cdot 10^9}{8\sqrt{2}}$$

$$= 5,62 \cdot 10^3 + 5,62 \cdot 10^3 - 6,36 \cdot 10^2$$

$$= 17,6 \cdot 10^2$$

$$= 1,76 \cdot 10^4 \text{ volt}$$



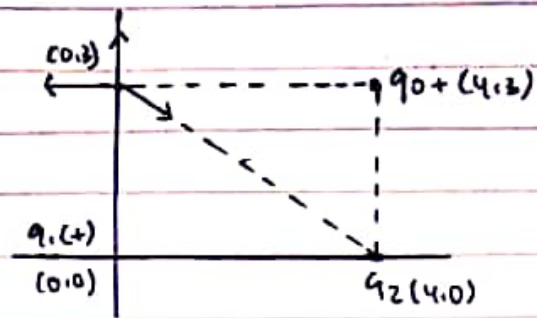
$$V = \frac{kq_1}{r_1} + \frac{kq_2}{r_2}$$

$$= 9 \cdot 10^6 \left(\frac{5}{3} + \frac{10}{4} \right)$$

$$= 3,75 \times 10^7 \text{ dynecm}$$

μC

3.



ket

$$q_1 = 25 \text{ MC} \Rightarrow (0,0)$$

$$q_2 = 15 \text{ MC} \Rightarrow (4,0)$$

$$q_0 = 20 \text{ MC} \Rightarrow (4,3)$$