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Pemecahan Kasus Muatan Listrik

1. Seorang remaja putri menggunakan cincin yang terbuat dari perak ($^{107,9}_{47}\text{Ag}$) dan dilapisi emas ($^{197}_{79}\text{Au}$) 0,8 gram, masa cincin tersebut 5 gram. Berapa jumlah elektron dalam cincin remaja putri tersebut.

Jawaban:

Jumlah atom = N

$$N = \frac{N_A \times \text{massa (gr)}}{M_r}$$

$$\begin{aligned} N_{\text{total}} &= \frac{N_A \times \text{massa Ag}}{M_r \text{ Ag}} + \frac{N_A \times \text{massa Au}}{M_r \text{ Au}} \\ &= \frac{6,02 \cdot 10^{23} \cdot 4,2}{107,9} + \frac{6,02 \cdot 10^{23} \cdot 0,8}{197} \\ &= 2,34 \cdot 10^{22} + 2,44 \cdot 10^{21} \\ &= 2,58 \cdot 10^{22} \end{aligned}$$

Muatan total (Q)

Karena Ag punya 47 elektron dan Au 79 elektron maka jumlah elektron atom tersebut 126 elektron

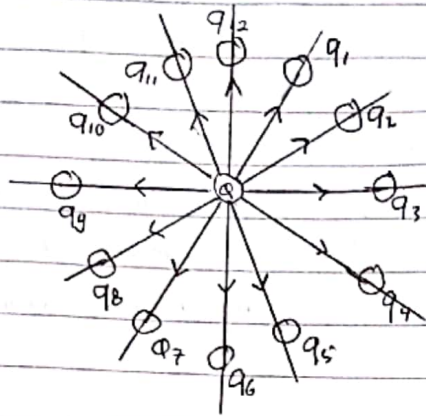
$$\begin{aligned} Q &= N \times \text{jumlah elektron} \times e \\ &= 2,58 \cdot 10^{22} \times 126 \times 1,6 \cdot 10^{-19} \\ &= 5,2 \cdot 10^5 \text{ C} \end{aligned}$$

Jadi, untuk massa cincin 5 gram mempunyai muatan $5,2 \cdot 10^5 \text{ C}$ hal ini berarti dalam massa cincin 5 gram terdapat

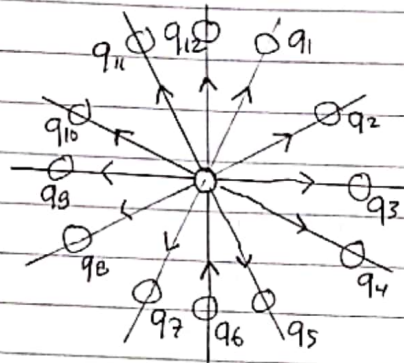
$$\frac{5,2 \cdot 10^5}{1,6 \cdot 10^{-19}} = 3,25 \cdot 10^{24} \text{ elektron}$$

Kasus gaya listrik

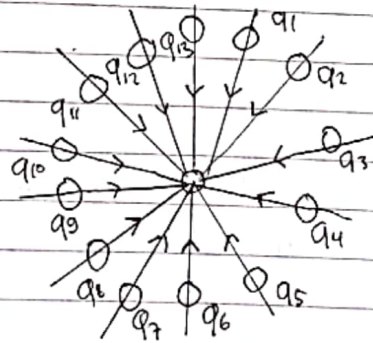
a)



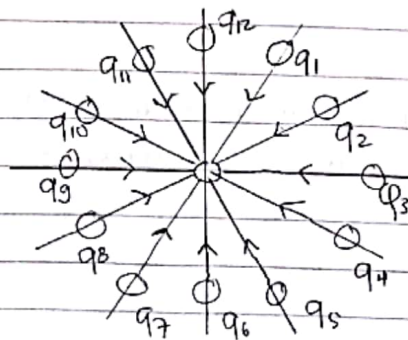
b)



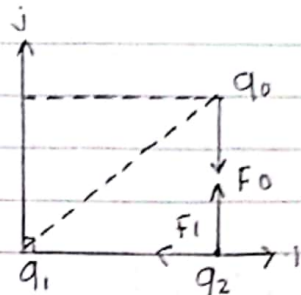
c)



d)



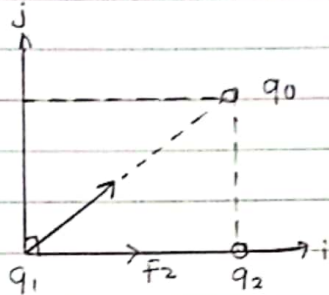
e) $q_1 = 25 \text{ } \mu\text{C} \rightarrow (0,0) \text{ m}$
 $q_2 = -10 \text{ } \mu\text{C} \rightarrow (4,0) \text{ m}$
 $q_0 = 10 \text{ } \mu\text{C} \rightarrow (4,3) \text{ m}$



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

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

f) $q_1 = 25 \text{ } \mu\text{C} \rightarrow (0,0)$
 $q_2 = -15 \text{ } \mu\text{C} \rightarrow (4,0)$
 $q_0 = 20 \text{ } \mu\text{C} \rightarrow (4,3)$

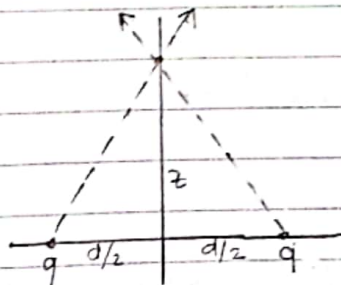


$$\vec{F} = q_0 k \left\{ \frac{q_1}{r_{q_1}^2} \hat{r}_{q_1} + \frac{q_2}{r_{q_2}^2} \hat{r}_{q_2} \right\}$$

$$= 20 \cdot 9 \times 10^9 \left\{ \frac{25}{16} + \frac{(-15)}{16} (1) \right\}$$

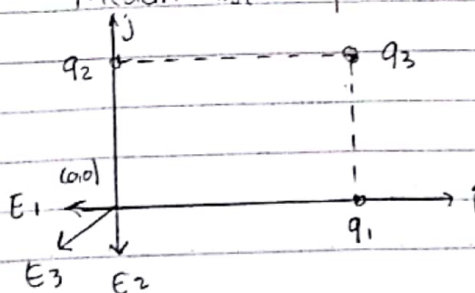
Kasus Medan Listrik

a)



b) $q_1 (4,0) = 2 \text{ C}$
 $q_2 (0,3) = 5 \text{ C}$
 $q_3 (4,3) = 10 \text{ C}$

Medan listrik posisi (0,0)



$$\vec{E} = \frac{1}{4\pi\epsilon_0} \frac{2}{16} \vec{j}$$

$$\text{medan oleh } q_2 \vec{E}_2 = \frac{1}{4\pi\epsilon_0} \frac{5}{9} \vec{a}_1$$

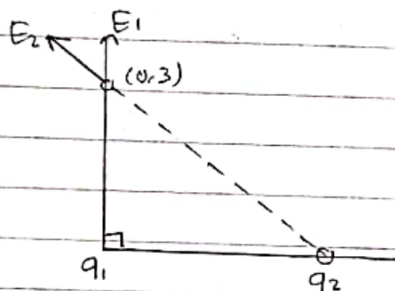
$$\begin{aligned} \text{medan oleh } q_3 \vec{E}_3 &= \frac{1}{4\pi\epsilon_0} \frac{10}{25} \left(\frac{4\vec{i} + 3\vec{j}}{5} \right) \\ &= \frac{1}{4\pi\epsilon_0} \left(\frac{40\vec{i}}{125} + \frac{30\vec{j}}{125} \right) \end{aligned}$$

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

$$E = \frac{1}{4\pi\epsilon_0} \sqrt{(0,47)^2 + (0,8)^2} = 8,35 \times 10^3 \text{ N/C}$$

c) $q_1 = -5 \text{ } \mu\text{C} \rightarrow (0,0)$

$q_2 = 10 \text{ } \mu\text{C} \rightarrow (4,0)$



$$\text{Medan oleh } q_1 \vec{E}_1 = \frac{1}{4\pi\epsilon_0} \frac{5}{25} \left(\frac{4\vec{i} + 3\vec{j}}{5} \right)$$

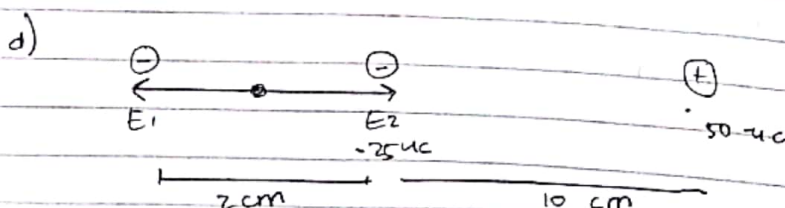
$$= \frac{1}{4\pi\epsilon_0} \left(\frac{20}{125} \vec{i} + \frac{15}{125} \vec{j} \right)$$

$$\text{oleh } q_2 \vec{E}_2 = \frac{1}{4\pi\epsilon_0} \frac{10}{16} \vec{j}$$

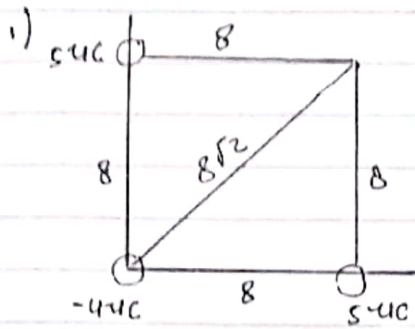
$$\text{total } \vec{E} = \frac{1}{4\pi\epsilon_0} \left[\left(\frac{20}{125} \right) \vec{i} + \left(\frac{10}{16} + \frac{15}{125} \right) \vec{j} \right]$$

$$= \frac{1}{4\pi\epsilon_0} \sqrt{(0,16)^2 + (0,74)^2}$$

$$= \frac{1}{4\pi\epsilon_0} \sqrt{0,5732}$$



Potensial Listrik



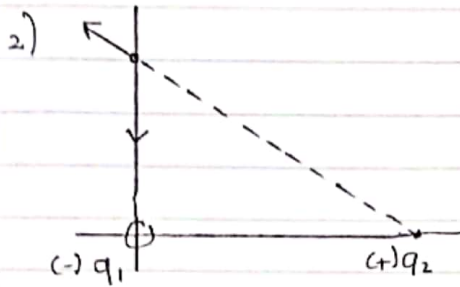
$$V_{\text{tot}} = \sum k \frac{q}{r}$$

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

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

$$= 17,6 \cdot 10^3$$

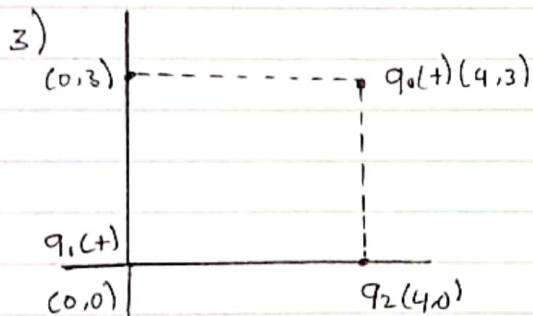
$$= 1,76 \cdot 10^4 \text{ Volt}$$



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

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

$$= 3,75 \cdot 10^7 \frac{\text{dyne cm}}{\mu\text{C}}$$



$$q_1(0,0) = 25 \mu\text{C}$$

$$q_2(4,0) = -15 \mu\text{C}$$

$$q_0(4,3) = 20 \mu\text{C}$$

Carilah titik (0,3)