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⑤ Penyelesaian 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, massa cincin tersebut 5 gram. Berapa jumlah elektron dalam cincin remaja putri tersebut?

Penyelesaian :

$$\begin{aligned} N &= (5 - 0,8) \cdot \frac{6,02 \times 10^{23}}{107,9} + 0,8 \cdot \frac{6,02 \times 10^{23}}{197} \\ &= 4,2 \cdot \frac{6,02 \times 10^{23}}{107,9} + 0,8 \cdot \frac{6,02 \times 10^{23}}{197} \\ &= 23,4 \times 10^{21} + 2,4 \times 10^{21} \\ &= 25,8 \times 10^{21} \end{aligned}$$

Atom Ag mempunyai 47 elektron atom Au mempunyai 79 elektron, maka jumlah kedua atom tersebut adalah $47 + 79 = 126$ elektron.

Jadi, jumlah medan total Q yaitu :

$$\begin{aligned} Q &= (25,8 \times 10^{21} \text{ atom}) (126 \text{ elektron/atom}) (1,6 \times 10^{19} \text{ C/elektron}) \\ &= 52 \times 10^4 \text{ C} \end{aligned}$$

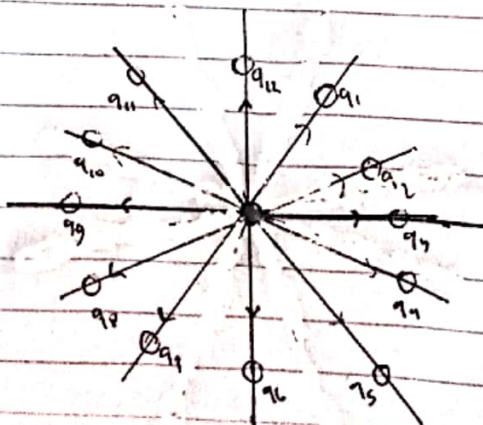
Jadi, untuk massa cincin 5 gram mempunyai muatan $52 \times 10^4 \text{ C}$.

Hal ini artinya dalam massa cincin 5 gram terdapat :

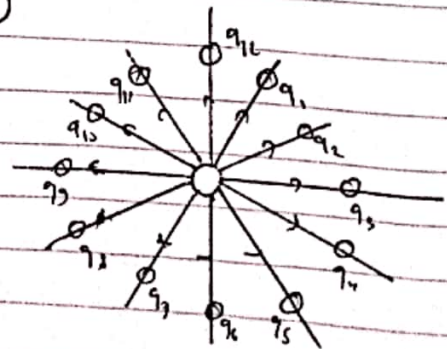
$$\Rightarrow \frac{52 \times 10^4}{1,6 \times 10^{19}} = 32,5 \times 10^{23} \text{ elektron}$$

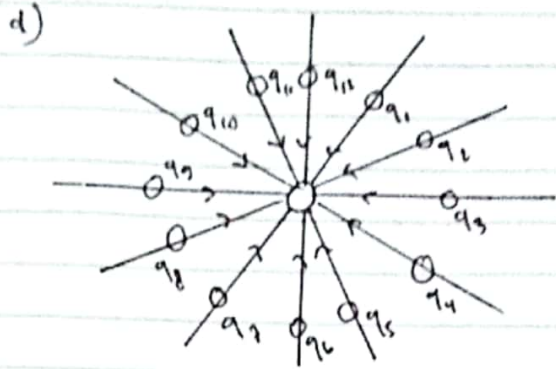
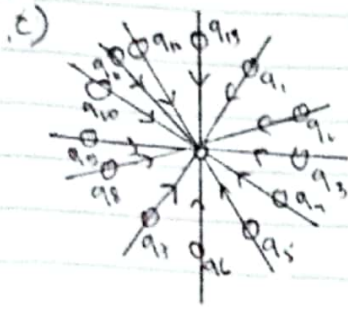
* Penyelesaian Kasus Gaya Listrik

a)

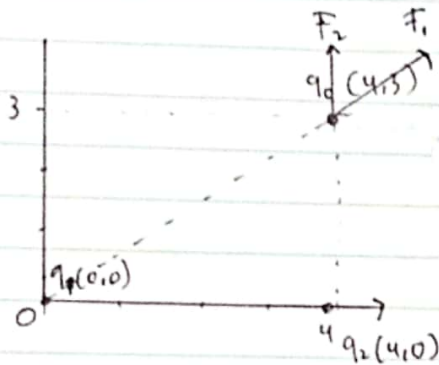


b)



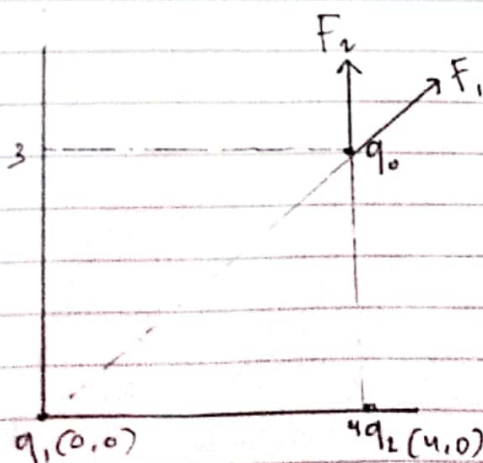


e) $q_1 = 25 \mu\text{C} \rightarrow (0,0) \text{ m}$
 $q_2 = -10 \mu\text{C} \rightarrow (4,0) \text{ m}$
 $q_0 = 10 \mu\text{C} \rightarrow (4,3) \text{ m}$



$$\begin{aligned}\vec{F} &= q_0 \cdot k \left[\frac{q_1}{r_1^2} \cdot \hat{r}_1 + \frac{q_2}{r_2^2} \cdot \hat{r}_2 \right] \\ &= 10 \cdot 9 \times 10^9 \left(\frac{25}{25} + \frac{(4i+3j)}{16} + \frac{10}{125} (i) \right) \\ &= 10 \cdot 9 \times 10^9 \left(\frac{100}{125} + \frac{10}{16} i + \frac{75}{125} j \right) \\ &= 9 \times 10^{10} (1.42 i + 0.6 j) \\ &= 9 \times 10^{10} (1.42 i + 0.6 j)^{1/2}\end{aligned}$$

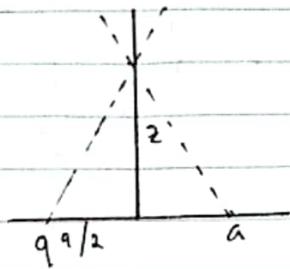
f) $q_1 = 25 \mu\text{C} \rightarrow (0,0)$
 $q_2 = -15 \mu\text{C} \rightarrow (4,0)$
 $q_0 = 20 \mu\text{C} \rightarrow (4,3)$



$$\begin{aligned}\vec{F} &= q_0 \cdot k \left(\frac{q_1}{r_1^2} \hat{r}_1 + \frac{q_2}{r_2^2} \hat{r}_2 \right) \\ &= 20 \cdot 9 \times 10^9 \left(\frac{25}{25} \left(\frac{4i+3j}{5} \right) + \frac{10}{16} (i) \right) \\ &= 20 \cdot 9 \times 10^9 \left(\frac{100}{125} + \frac{10}{16} (i) + \frac{75}{125} j \right) \\ &= (-18 \times 10^{10}) (1.42 i + 0.6 j) \\ &= 18 \times 10^{10} \left((1.42)^2 + (0.6)^2 \right)^{1/2}\end{aligned}$$

⊗ Pemecahan Kasus Medan Listrik

a) ketika $z \gg d$

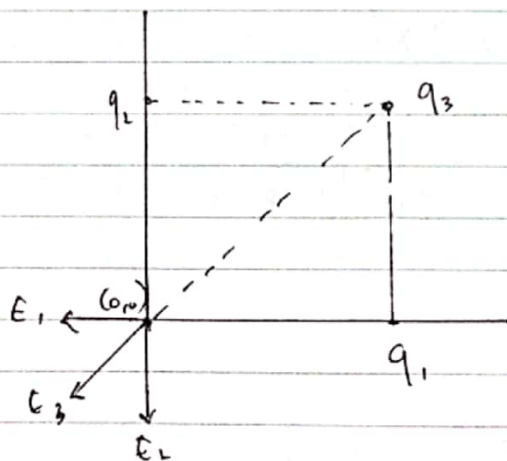


b) $q_1 (4, 0) \rightarrow 2C$

$q_2 (0, 3) \rightarrow 5C$

$q_3 (4, 3) \rightarrow 10C$

Medan listrik pada posisi $(0, 0)$



$$\bullet \text{ Medan oleh } q_1, \vec{E}_1 = \frac{1}{4\pi\epsilon_0} \frac{2}{16} \hat{j}$$

$$\bullet \text{ Medan oleh } q_2, \vec{E}_2 = \frac{1}{4\pi\epsilon_0} \frac{5}{9} \hat{i}$$

$$\bullet \text{ Medan oleh } q_3, \vec{E}_3 = \frac{1}{4\pi\epsilon_0} \frac{10}{25} (4\hat{i} + 3\hat{j})$$

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

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

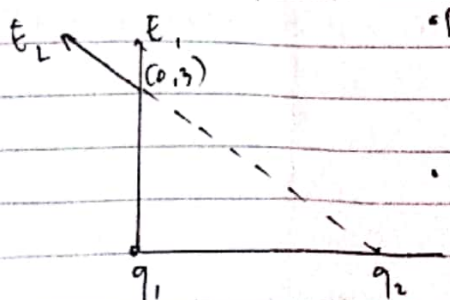
$$= \frac{1}{4\pi\epsilon_0} \sqrt{(0.44)^2 + (0.28)^2}$$

$$= 0.35 \times 10^3 \text{ N/C}$$

c) $q_1 \rightarrow (0, 0) \Rightarrow -5 \text{ nC}$

$q_2 (4, 0) \Rightarrow 10 \text{ nC}$

Medan listrik pada posisi $(0, 3)$



$$\bullet \text{ Medan oleh } q_1, \vec{E}_1 = k \frac{q_1}{r^2} \hat{r} = 9 \cdot 10^9 \cdot \frac{5}{25} \left(\frac{-4\hat{i} - 3\hat{j}}{5} \right)$$

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

$$\bullet \text{ Medan oleh } q_2, \vec{E}_2 = k \frac{q_2}{r^2} \hat{r} = 9 \cdot 10^9 \left(\frac{10}{16} \right) \left(\frac{3\hat{j}}{4} \right)$$

$$= 9 \cdot 10^9 \left(\frac{30}{64} \right) \hat{j}$$

$$\bullet \text{ Medan listrik total } = -9 \cdot 10^9 \cdot \frac{20}{125} \hat{i} + 9 \cdot 10^9 \cdot \frac{30}{64} \hat{j}$$

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