Wakhidatul Mukaromah
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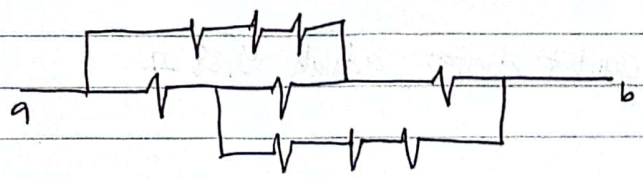
Elektrodinamika

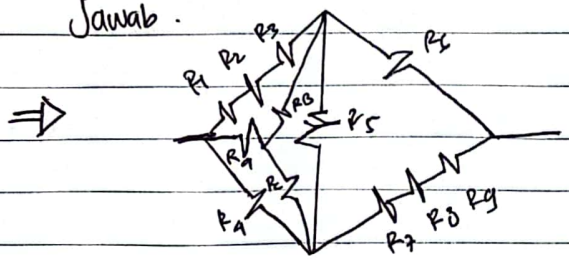
UAS

1.) Perhatikan Gambar!



Jika R = 5 ohm dan terpasang seperti gambar diatas, hitung:
a.) Hambatan penggantinya
b.) Jika V_{ab} = 10 Volt bagaimana arus pada setiap hambatan pada rangkaian diatas?

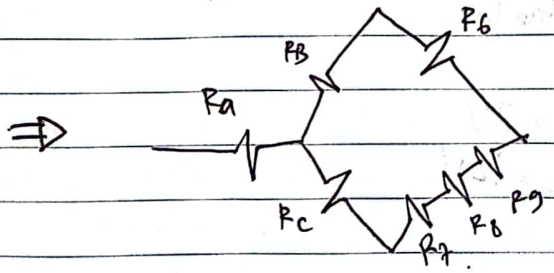
Jawab.



$R_A = \frac{(R_1+R_2+R_3)(R_4)}{R_1+R_2+R_3+R_4}$ $R_B = \frac{(R_1+R_2+R_3)(R_5)}{R_1+R_2+R_3+R_5}$ $R_C = \frac{R_4 \cdot R_5}{R_4+R_5}$

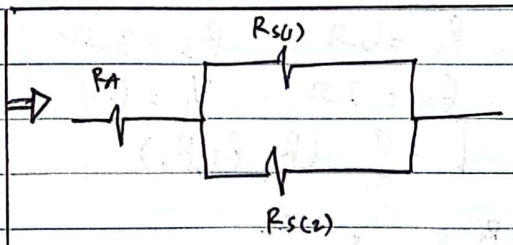
$R_A = \frac{(15)(5)}{20}$ $R_B = \frac{(15)(5)}{5+5+5}$ $= \frac{5 \cdot 5}{5+5}$

$R_A = \frac{75}{20} = 3{,}75\ \Omega$ $R_B = \frac{75}{20} = 3{,}75\ \Omega$ $= \frac{25}{10} = 2{,}5\ \Omega$



$R_{S(1)} = R_B + R_6$
$= (3{,}75) + (5)$
$= 8{,}75\ \Omega$

$R_{S(2)} = R_C + R_7 + R_8 + R_9$
$= 2{,}5 + 5 + 5 + 5$
$= 17{,}5\ \Omega$



$\frac{1}{R_P} = \frac{1}{R_{S(1)}} + \frac{1}{R_{S(2)}}$

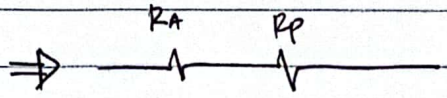
$= \frac{1}{8{,}75} + \frac{1}{17{,}5}$

$\frac{1}{R_P} = \frac{2+1}{17{,}5}$

$\frac{1}{R_P} = \frac{3}{17{,}5}$

$R_P = \frac{17{,}5}{3}$

$R_P = 5{,}83\ \Omega$



$R_s = R_A + R_p$

$R_s = 3{,}75\ \Omega + 5{,}83\ \Omega$

$R_s = 9{,}58\ \Omega$

(a.) Jadi, hambatan pengganti pada gambar diatas adalah $9{,}58\ \Omega$

(b) $R_s = 9{,}58\ \Omega$

$V_{ab} = 10$ Volt

ditanya : I ..?

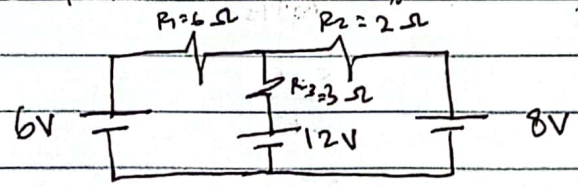
Jawab

$$I = \frac{V_{ab}}{R_s}$$

$$I = \frac{10\ V}{9{,}58\ \Omega}$$

$$I = 1{,}04\ A$$

3.) Perhatikan Gambar!



Hitung arus listrik pada setiap hambatan!

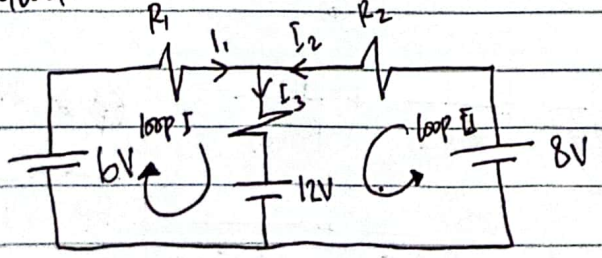
Jawab.

Diketahui : $R_1 = 6\ \Omega$ $R_3 = 3\ \Omega$ $V_3 = 8V$

$R_2 = 2\ \Omega$ $V_1 = 6V$ $V_3 = 12V$

Ditanya : I ..? (R_1, R_2, R_3)

Jawab.



$I_3 = I_1 + I_2$ ①

No.

Date :

Loop 1

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

$(-\varepsilon_1 + \varepsilon_2) + (I_1 R + I_3 R_3) = 0$

$(-6 + 12) + (I_1 6 + I_3 3) = 0$

$6 + 6I_1 + 3I_3 = 0$

$6I_1 + 3I_3 = -6$ (2)

Loop 2

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

$(-\varepsilon_3 + \varepsilon_2) + (I_3 R_3 + I_2 R_2) = 0$

$(-8 + 12) + (I_3 \cdot 3 + I_2 \cdot 2) = 0$

$4 + 3I_3 + 2I_2 = 0$

$3I_3 + 2I_2 = -4$ (3)

Masukan Persamaan I ke Persamaan 2

$6I_1 + 3I_3 = -6$

$6I_1 + 3(I_1 + I_2) = -6$

$6I_1 + 3I_1 + 3I_2 = -6$

$9I_1 + 3I_2 = -6$ (4)

Masukan Pers 1 ke Persamaan 3.

$3I_3 + 2I_2 = -4$

$3(I_1 + I_2) + 2I_2 = -4$

$3I_1 + 3I_2 + 2I_2 = -4$

$3I_1 + 5I_2 = -4$ (5)

Substitusikan Persamaan 4 dan 5

$9I_1 + 3I_2 = -6$ | x5 | $45I_1 + 15I_2 = -30$

$3I_1 + 5I_2 = -4$ | x3 | $9I_1 + 15I_2 = -12$ −

$36I_1 = -18$

$I_1 = -\frac{18}{36}$

$I_1 = -0,5$ A

Masukan I_1 ke persamaan 4.

$9I_1 + 3I_2 = -6$

$9(-0,5) + 3I_2 = -6$

$-4,5 + 3I_2 = -6$

$3I_2 = -6 + 4,5$

$3I_2 = -1,5$

$I_2 = -\frac{1,5}{3}$

$I_2 = -0,5$ A

Masukan Nilai I_1 & I_2 ke Pers 1

$I_3 = I_1 + I_2$

$I_3 = (-0,5) + (-0,5)$

$I_3 = -0,5 - 0,5$

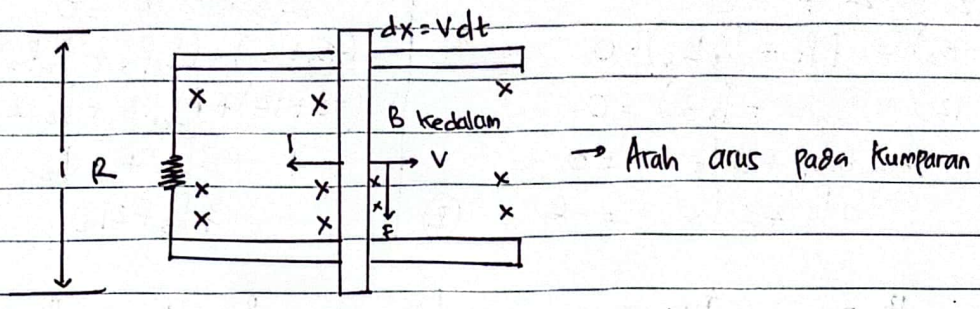
$I_3 = -1$ A

2.) Perhatikan Gambar rangkaian multisimpal dibawah ini! Bagaimana arus mengalir pada setiap simpal?

Jelaskan bagaimana arus bisa mengalir pada kumparan? Gambarkan arah arus pada kumparan tersebut! Jika medan magnet 20 tesla, kecepatan gerakan kawat 10 m/s, jauh gerakan kawat (l) = 15m, dan hambatan yang terpasang 10 ohm. Berapa besarnya arus dalam kumparan tersebut?

Date :

Jawab.



diketahui : $B = 20\ T$ $\quad d = 15\ m$ (L)

$V = 10\ m/s$ $\quad R = 10\ \Omega$

ditanya : I ...?

Jawab.

mencari nilai $\mathcal{E}$

$\mathcal{E} = BLV$

$\mathcal{E} = (20)(15)(10)$

$\mathcal{E} = 3000\ Volt$

Maka nilai arus I

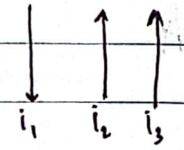
$$I = \frac{\mathcal{E}}{R}$$

$$I = \frac{3000}{10}$$

$$I = 300\ A$$

Jadi, arus yang diinduksi dalam kumparan tersebut adalah 300 A.

4.) Gambar gaya-gaya yang dialami oleh masing-masing kawat berikut ini, jika arus i dan jarak sama besar, kemana arah gerakan kawat, 1, 2 dan 3?



Jawab.