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Pertemuan : 10

No

Date 29 Apr' 24

Arus listrik

→ Elektrodinamika

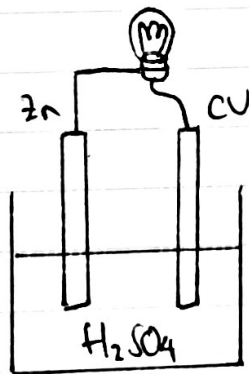
1. Hukum Ohm
2. Rangkaian listrik

→ Pembahasan :

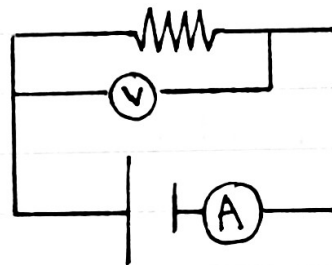
1. Hukum Ohm

$$J = 0 \text{ E} \rightarrow \text{DC}$$

$$V = IR \rightarrow \text{AC}$$



Gambar 1

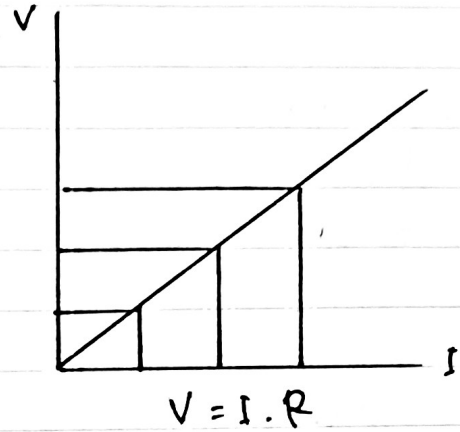
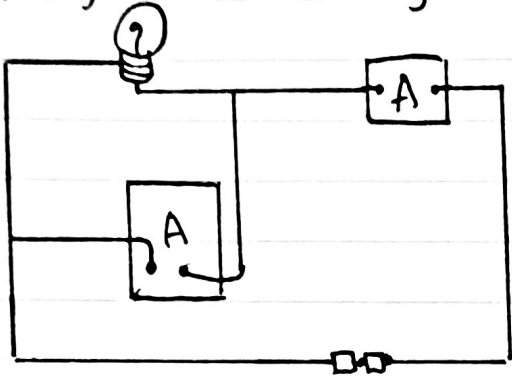


Gambar 2

Dari gambar 1 dapat dituliskan

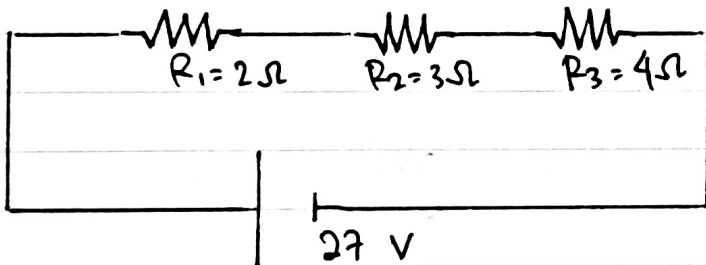
1. H_2 berupa gas.
2. Jadi SO_4 mengalir menuju Cu lalu menhidupkan lampu lalu ke Zn, terus seperti itu.
3. Hal ini menempel pada Zn yang menghambat pergerakan dari SO_4 , sehingga membuat lampu mati.

Dari gambar 2 menjadi:



→ Contoh :

1. Rangkaian listrik. Seri



$$\bullet R_t = 9\Omega$$

$$I = \frac{27}{9} = 3A$$

$$\bullet R_t = 2 + 3 + 4 = 9\Omega$$

$$I = \frac{V}{R}$$

$$= \frac{27}{9} = 3A.$$

→ Pada rangkaian seri, $I = \text{konstan}$ ($I = 3A$).

Mencari V :

$$\bullet R_1 :$$

$$V = R_1 \times I$$

$$= 2 \cdot 3$$

$$= 6V$$

$$\bullet R_3 :$$

$$V = R_3 \times I$$

$$= 4 \cdot 3$$

$$= 12A.$$

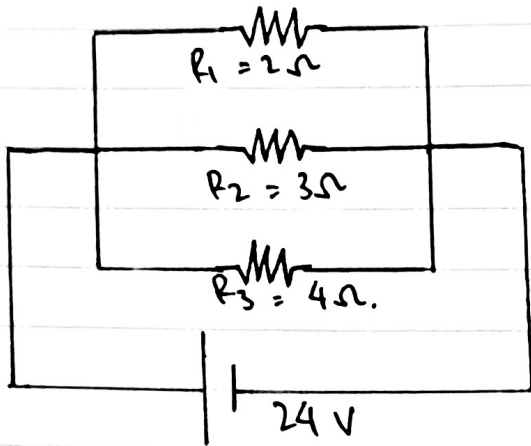
$$\bullet R_2 :$$

$$V = R_2 \times I$$

$$= 3 \cdot 3$$

$$= 9V$$

2. Rangkaian listrik paralel.



→ Pada rangkaian paralel $V = \text{konstan}$ ($V = 24 \text{ V}$).

$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_t} = \frac{1}{2} + \frac{1}{3} + \frac{1}{4}$$

$$\frac{1}{R_t} = \frac{12 + 8 + 6}{24}$$

$$\frac{1}{R_t} = \frac{26}{24} \Rightarrow R_t = \frac{24}{26}$$

$$I_{\text{total}} = \frac{V}{R_{\text{total}}}$$

$$= \frac{24}{24/26}$$

$$= \frac{24}{1} \times \frac{26}{24}$$

$$I_t = 26 \text{ A.}$$

> Mencari I :

• R_1 :

$$I = \frac{V}{R_1}$$

$$= \frac{24}{2} = 12 \text{ A.}$$

• R_2 :

$$I = \frac{V}{R_2}$$

$$= \frac{24}{3} = 8 \text{ A}$$

• R_3 :

$$I = \frac{V}{R_3}$$

$$= \frac{24}{4} = 6 \text{ A}$$

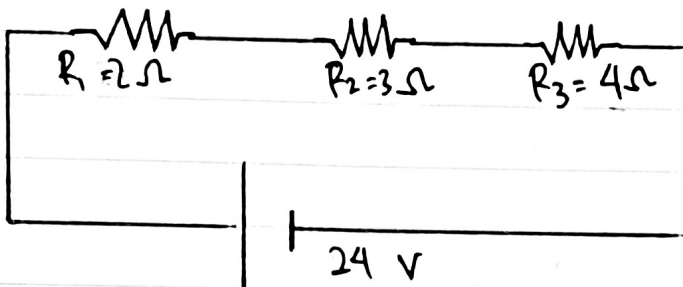
7 Mencari Daya :

$$\begin{aligned} \bullet P_1 &= I \cdot V \\ &= 12 \cdot 24 \\ &= 288 \text{ W} \end{aligned}$$

$$\begin{aligned} \bullet P_2 &= I \cdot V \\ &= 8 \cdot 24 \\ &= 192 \text{ W} \end{aligned}$$

$$\begin{aligned} \bullet P_3 &= I \cdot V \\ &= 6 \cdot 24 \\ &= 144 \text{ W} \end{aligned}$$

3. Rangkaian listrik seri:



$$\begin{aligned} \bullet R_t &= R_1 + R_2 + R_3 \\ &= 2 + 3 + 4 \\ &= 9 \Omega \end{aligned}$$

$$\begin{aligned} \bullet I &= \frac{V}{R} \\ &= \frac{24}{9} = 2,67 \text{ A} \end{aligned}$$

$$\begin{aligned} \bullet V_1 &= R_1 \cdot I \\ &= 2 \cdot 2,67 \\ &= 5,34 \text{ V} \end{aligned}$$

$$\begin{aligned} \bullet V_2 &= R_2 \cdot I \\ &= 3 \cdot 2,67 \\ &= 8,01 \text{ V} \end{aligned}$$

$$\begin{aligned} \bullet V_3 &= R_3 \cdot I \\ &= 4 \cdot 2,67 \\ &= 10,68 \text{ V} \end{aligned}$$

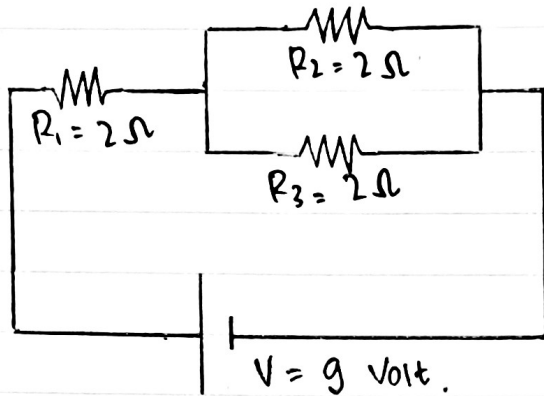
$$\begin{aligned} \bullet P_1 &= I \cdot V_1 \\ &= 2,67 \times 5,34 \\ &= 14,25 \text{ W} \end{aligned}$$

$$\begin{aligned} \bullet P_2 &= I \times V_2 \\ &= 2,67 \times 8,01 \\ &= 21,38 \text{ W} \end{aligned}$$

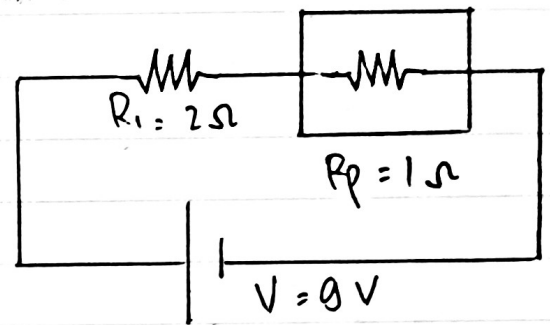
$$\begin{aligned} \bullet P_3 &= I \times V_3 \\ &= 2,67 \times 10,68 \\ &= 28,51 \text{ W} \end{aligned}$$

→ Campuran seri dan paralel

1.



menjadi



$$\begin{aligned} \bullet R_p &= \frac{1}{\frac{1}{R_2} + \frac{1}{R_3}} \\ &= \frac{1}{\frac{1}{2} + \frac{1}{2}} \\ &= 1\Omega \end{aligned}$$

$$\begin{aligned} \bullet R_t &= R_1 + R_p \\ &= 2 + 1 \\ &= 3\Omega \end{aligned}$$

$$\begin{aligned} \bullet I &= \frac{V}{R_t} \\ &= \frac{9}{3} = 3A \end{aligned}$$

$$\begin{aligned} \bullet V_1 &= R_1 \times I \\ &= 2 \times 3 \\ &= 6V \end{aligned}$$

$$\begin{aligned} \bullet V_p &= R_p \times I \\ &= 1 \times 3 \\ &= 3V. \end{aligned}$$

$$V_p = V_2 = V_3$$

$$\bullet V_2 = 3 \text{ V}$$

$$\bullet V_3 = 3 \text{ V}$$

• I di R_2 :

$$I = \frac{V_2}{R_2}$$

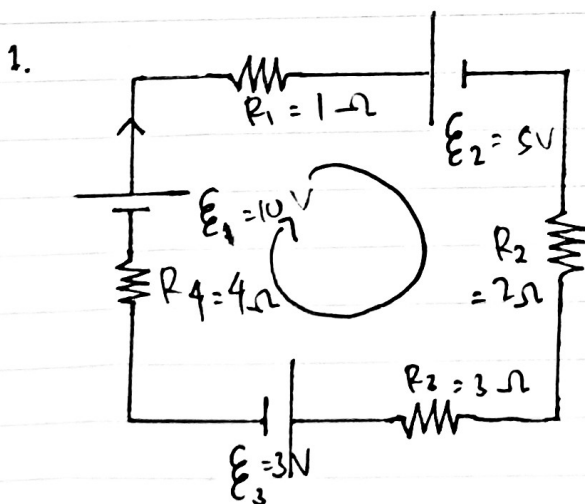
$$= \frac{3}{2} = 1,5 \text{ A}$$

• I di R_3

$$I = \frac{V_3}{R_3}$$

$$= \frac{3}{2} = 1,5 \text{ A}$$

→ Rangkaian listrik kompleks. 1 loop



$$E_1 > E_2 > E_3$$

1. Gambar arah arus sesuai dengan besarnya E
2. Gambar loop sesuai hati
3. Jika arah arus searah dengan arah loop, maka positif.

$$\begin{aligned}\sum \mathcal{E} + \sum IR &= 0 \\ -\mathcal{E}_1 + \mathcal{E}_2 + \mathcal{E}_3 + I(R_1 + R_2 + R_3 + R_4) &= 0 \\ -10 + 5V + 3V + I(1 + 2 + 3 + 4) &= 0 \\ -2 + I(10) &= 0\end{aligned}$$

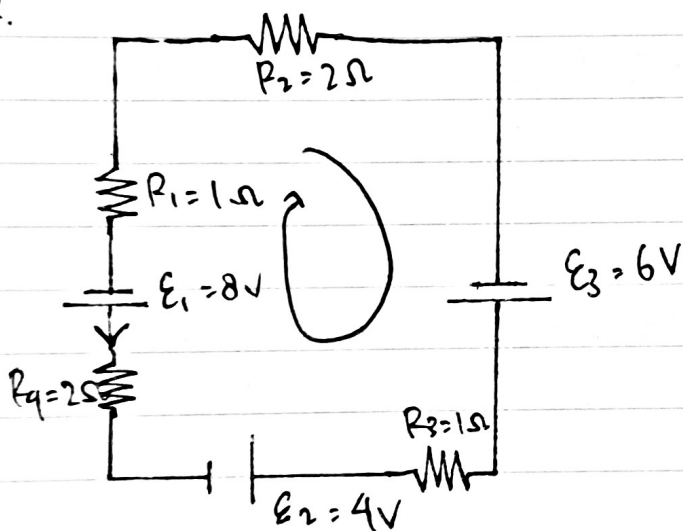
$\mathcal{E}_1$ = Minus karena pergerakannya menabrak tanda (-) yang pendek ($\overline{-}$)

$$10I = 2$$

$$I = \frac{2}{10} = \frac{1}{5}$$

$$I = 0,2 \text{ A}$$

2.



$$\sum \mathcal{E} + \sum I \cdot R = 0$$

$$\mathcal{E}_1 - \mathcal{E}_3 + \mathcal{E}_2 - I(R_1 + R_2 + R_3 + R_4) = 0$$

$$8 - 6 + 4 - I(1 + 2 + 1 + 2) = 0$$

$$6 - I(6) = 0$$

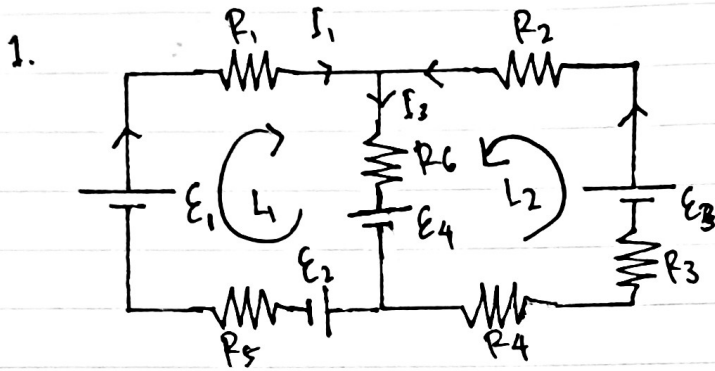
$$6I = 6$$

$$I = \frac{6}{6}$$

$$I = 1 \text{ A}$$

karena arus berlawanan dengan arah loop, maka I nya minus (-)

→ Rangkaian listrik kompleks 2 loop.



Loop I =

$$\sum \mathcal{E} + \sum IR = 0$$

$$- \mathcal{E}_1 + \mathcal{E}_4 + \mathcal{E}_2 + I_1 (R_1 + R_5) + I_3 R_6 = 0$$

Loop II =

$$\sum \mathcal{E} + \sum IR = 0$$

$$- \mathcal{E}_3 + \mathcal{E}_4 + I_2 (R_2 + R_3 + R_4) + I_3 R_6 = 0$$