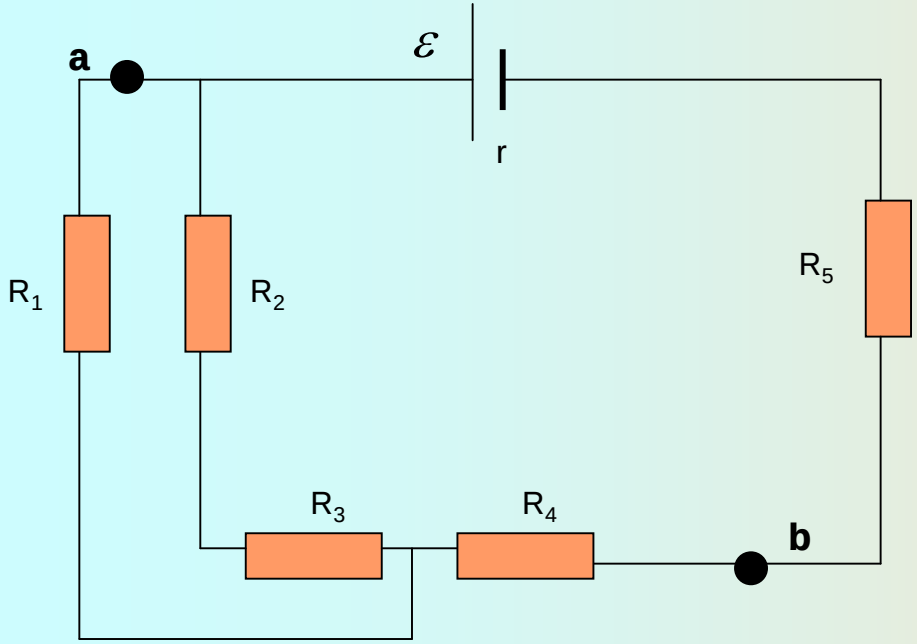
Electric Circuit

Rafa Muñoa
Lizardi Institutua
Zarautz



In this electric circuit, find:

a) the equivalent resistance
b) the intensities of the current
c) the potential difference Va - Vb

$\varepsilon = 50$ V

$r = 2\ \Omega$

$R_1 = 10\ \Omega$

$R_2 = 5\ \Omega$

$R_3 = 8\ \Omega$

$R_4 = 4\ \Omega$

$R_5 = 6\ \Omega$

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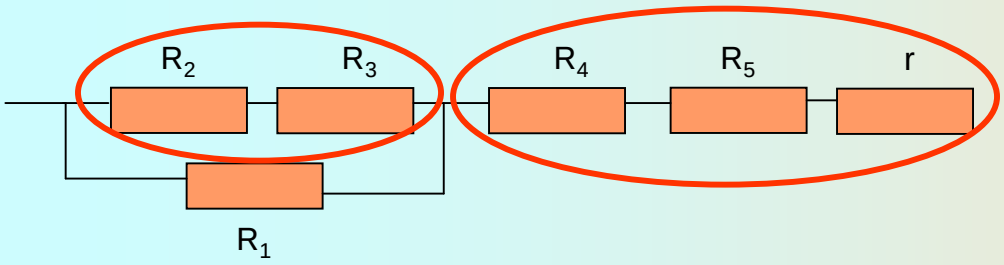

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$R_2 = 5\ \Omega$

$R_3 = 8\ \Omega$

$R_4 = 4\ \Omega$

$R_5 = 6\ \Omega$

In this electric circuit, find:

a) the equivalent resistance

The resistors R_2 and R_3 are connected in series. Therefore, the resistance equivalent to both is:

$$R_{23} = R_2 + R_3 = 5\ \Omega + 8\ \Omega = 13\ \Omega$$

The resistors R_4 and R_4 are also connected in series. Therefore, the resistance equivalent to both is:

$$R_{45r} = R_4 + R_5 = 4\ \Omega + 6\ \Omega + 2\ \Omega =$$

$$= 12\ \Omega$$

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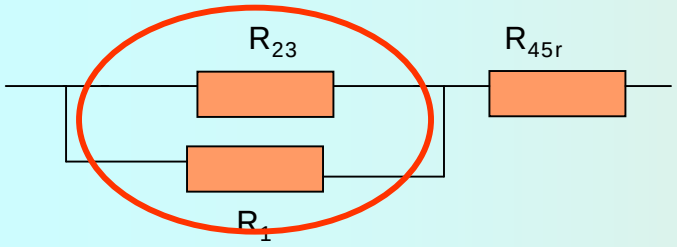


$\varepsilon = 50\ V$ $\quad R_{23} = 13\ \Omega$

$R_1 = 10\ \Omega$ $\quad R_{45r} = 12\ \Omega$

In this electric circuit, find:

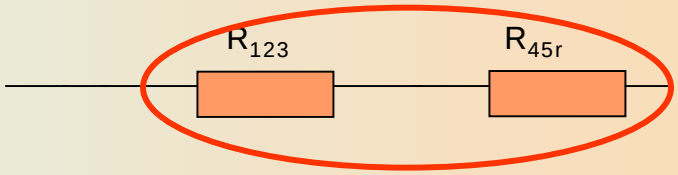
a) the equivalent resistance

The resistors R_{23} and R_1 are connected in parallel. The expression to determine the equivalent resistance is:

$$\frac{1}{R_{123}} = \frac{1}{R_1} + \frac{1}{R_{23}}$$

$$\frac{1}{R_{123}} = \frac{1}{10\ \Omega} + \frac{1}{13\ \Omega} = \frac{13 + 10}{130\ \Omega} = \frac{23}{130\ \Omega}$$

$$R_{123} = \frac{130\ \Omega}{23} = 5.65\ \Omega$$



The resistors R_{123} and R_{45r} are connected in series. Therefore, the resistance equivalent to both is:

$$R_{equiv} = R_{123} + R_{45r} =$$
$$= 5.65\ \Omega + 12\ \Omega =$$
$$= 17.65\ \Omega$$

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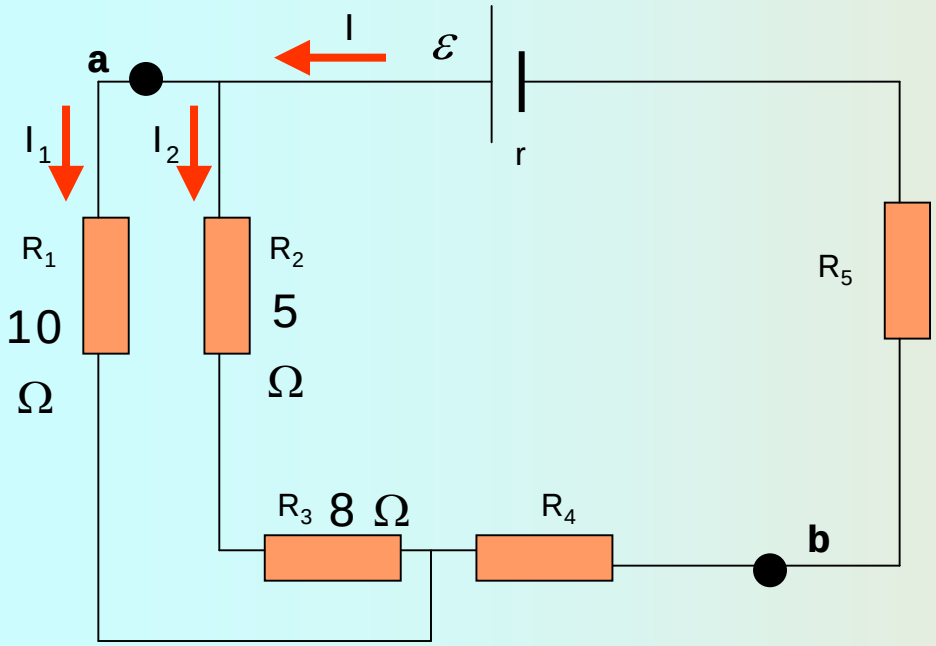

In this electric circuit, find:

b) the intensities of the current

The total current can be calculated applying Ohm's Law:

$$I = \frac{\varepsilon}{R_{equiv}} = \frac{50\ V}{17.65\ \Omega} = 2.83\ A$$

The current in each branch can be calculated by solving this system:

$$\varepsilon = 50\ V$$

$$R_{equiv} = 17.65\ \Omega$$

$$\begin{cases} i_{1st\ branch} + i_{2nd\ branch} = I \\ i_{1st\ branch} * R_{1st\ branch} = i_{2nd\ branch} * R_{2nd\ branch} \end{cases}$$

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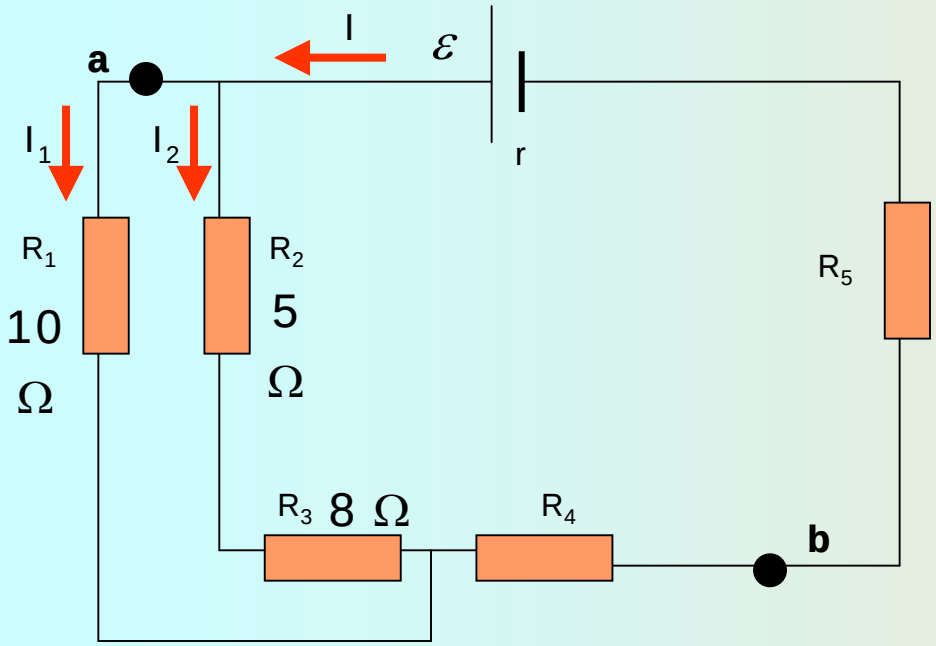

$\varepsilon = 50$ V

$R_{equiv} = 17.65\ \Omega$

In this electric circuit, find:

b) the intensities of the current

In our case:

$$\begin{cases} i_1 + i_2 = 2.83\ A \\ i_1 * 10\ \Omega = i_2 * 13\ \Omega \end{cases}$$

By substitution:

$$i_2 = 2.83 - i_1 \rightarrow i_1 * 10 = (2.83 - i_1) * 13$$

$$\rightarrow 10\ i_1 = 36.8 - 13\ i_1 \rightarrow 23\ i_1 = 36.8$$

$$\rightarrow i_1 = \frac{36.8}{23} = 1.6\ A \rightarrow i_2 = 2.83\ A - 1.6\ A = 1.23\ A$$

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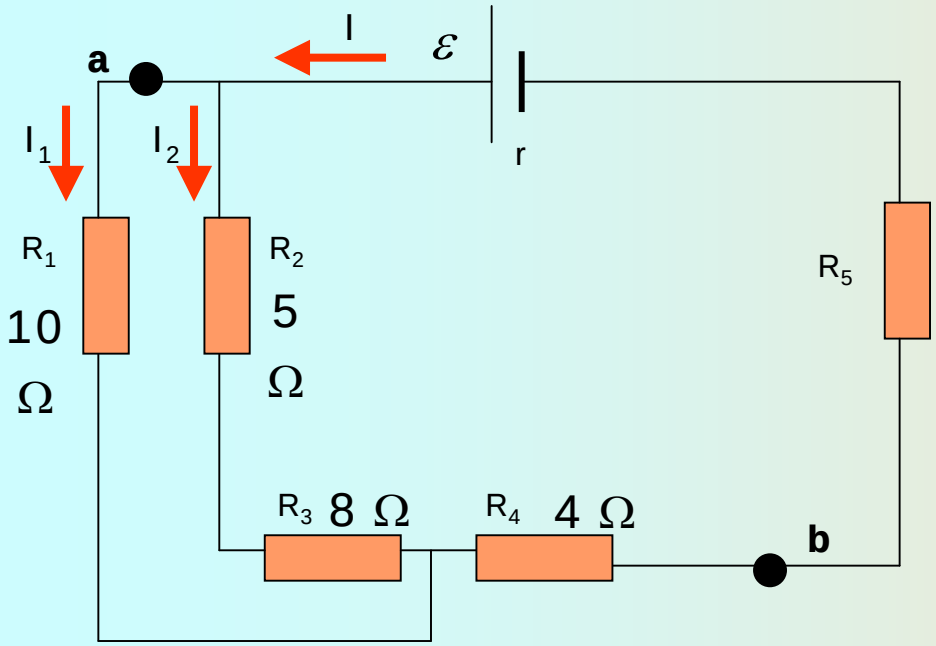

$\varepsilon = 50$ V

$R_{equiv} = 17.65\ \Omega$

In this electric circuit, find:

c) the potential difference Va - Vb

$$Va - Vb = \begin{cases} = 1.6\ A * 10\ \Omega + 2.83\ A * 4\ \Omega \\ = 1.23\ A * 13\ \Omega + 2.83\ A * 4\ \Omega \\ = 2.83\ A * 5.65\ \Omega + 2.83\ A * 4\ \Omega \end{cases} \rightarrow = 27.3\ V$$