

# Loop law

## Student Group

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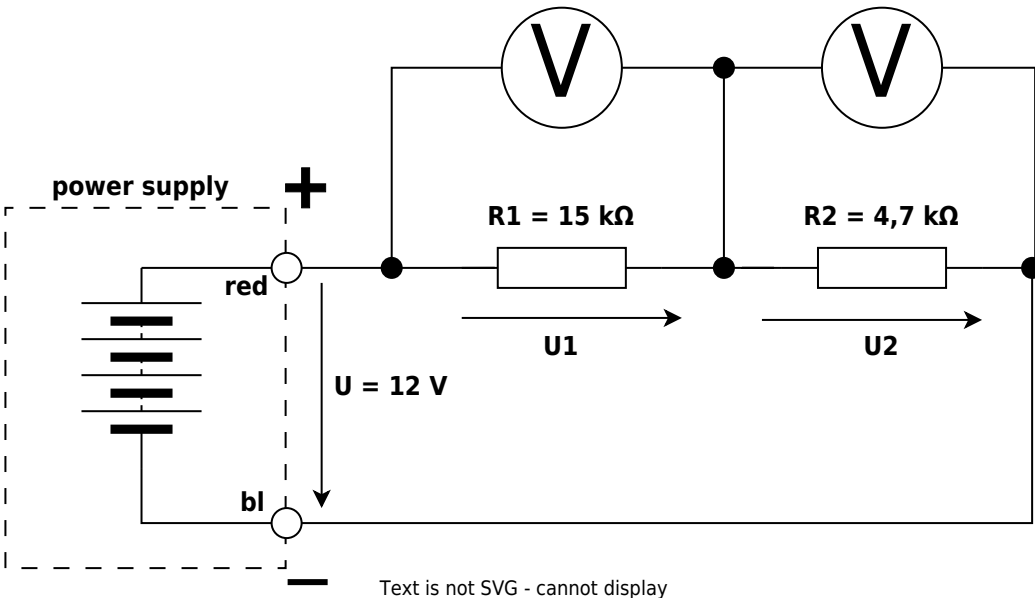
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# Loop law

**Kirchhoff's voltage law:** In every closed loop of an electrical network, the sum of all voltages is zero.

Set the voltage on the power supply to  $12 \text{ V}$  and measure this voltage accurately using a multimeter. Build the measurement circuit shown in [figure 1](#).



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Fig. 1: Verification of

Kirchhoff's voltage law

Add the voltage arrows and measure  $U$ ,  $U_{\text{1}}$  and  $U_{\text{2}}$ .

U	$U_{\text{1}}$	$U_{\text{2}}$

### Tab. 1: Voltage measurement for Kirchhoff's voltage law

What is the loop equation here?

Verify the equation using the measured values.

The resistors  $R_{\text{1}}$  and  $R_{\text{2}}$  connected in series form a voltage divider. In what ratio are the voltages  $U_{\text{1}}$  and  $U_{\text{2}}$ ?

$$\frac{U_{\text{1}}}{U_{\text{2}}} =$$

## Node law

**Kirchhoff's current law:** At every node, the sum of all currents flowing into and out of the node is zero.

Set the voltage on the power supply to  $12 \text{ V}$  and measure the voltage accurately using a multimeter. As a first step, build the measurement circuit shown in [figure 2](#).

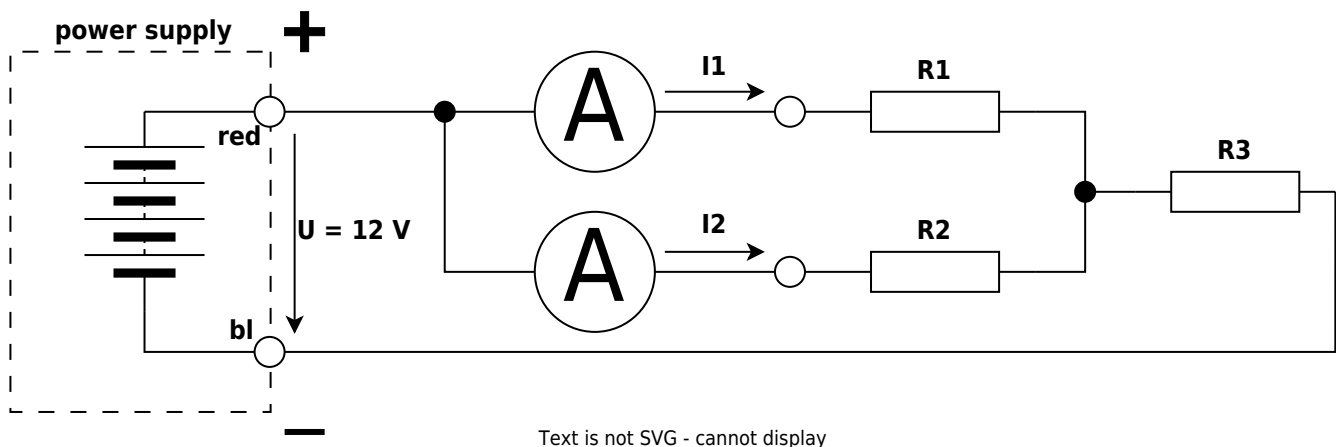
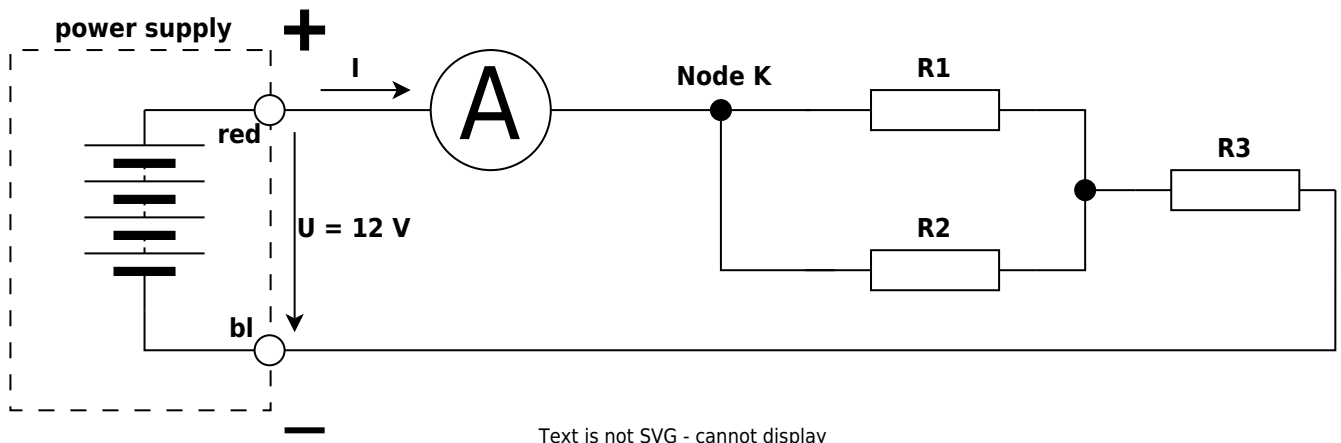


Fig. 2: Branch currents for verification of Kirchhoff's current law

Add the arrows indicating the directions of currents  $I_{\text{1}}$  and  $I_{\text{2}}$ . On both multimeters, set the DC current range and the polarity before switching on. Then measure currents  $I_{\text{1}}$  and  $I_{\text{2}}$  and enter the measured values in the table.



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Fig. 3: Total current and node \$K\$

In what ratio are currents  $I_{\text{R1}}$  and  $I_{\text{R2}}$ ?

$$\frac{I_{\text{R1}}}{I_{\text{R2}}} =$$

Switch the power supply on again and measure the current \$I\$. Enter its value in the table.

\$I\$	$I_{\text{R1}}$	$I_{\text{R2}}$

Tab. 2: Current measurement for Kirchhoff's current law

Determine the node equation for node \$K\$ and verify its validity.

Using the measured values of resistors  $R_{\text{1}}$ ,  $R_{\text{2}}$  and  $R_{\text{3}}$ , calculate the total resistance  $R_{\text{KP}}$ .

Using the calculated value of  $R_{\text{KP}}$ , verify the measured value of the total current:

$$I = \frac{U}{R_{\text{KP}}} =$$

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