Voltage divider as voltage source

Student Group

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The voltage divider shown in figure 1 is in an unloaded state, as the entire current supplied by the power supply flows through the resistors $R_{\rm 1}$ and $R_{\rm 2}$ connected in series. A resistor parallel to $R_{\rm 2}$ loads the voltage divider. Set the voltage on the power supply to $12 ~\rm V$ and measure the exact voltage with a multimeter. Set up the measuring circuit shown in figure 1. For the connected load $R_{\rm L}$ = ${\rm 10} ~{\rm k\Omega}$, the voltage divider represents a voltage source. Like any voltage source, it has a source voltage (also called the original voltage) $U_{\rm 0}$ and an internal resistance $R_{\rm i}$. The internal resistance of a voltage divider considered as a voltage source results from the parallel connection of the divider resistors $R_{\rm 1}$ and $R_{\rm 2}$:
$$ R_i = R_1 || R_2 = \frac{R_1\cdot R_2}{R_1+R_2} $$
Use the measured values of resistors $R_{\rm 1}$ and $R_{\rm 2}$ to calculate the internal resistance $R_{\rm i}$ of the voltage source:

$$ R_i = $$ $$ U_0 = $$

The power $P_{\rm 0}$ supplied by the power supply can be calculated using the following equation:
$$ P_0 = U\cdot I_1$$
The power consumed by the load resistance can be determined using the following formula: $$ P_L = R_L\cdot {I_2}^2$$

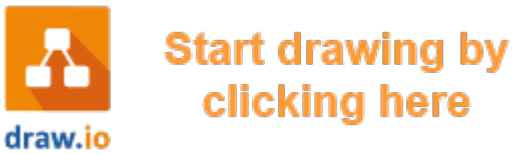

Fig. 1: Voltage divider

Draw the equivalent voltage source of the voltage divider:

What would be the value of $U_{\rm 2}$ without $R_{\rm L}$?
$$ U_{2, zero} = $$

Calculate $U_{\rm 2,L}$ and $I_{\rm 2}$ for $R_{\rm L}$ = ${\rm 10} ~{\rm k\Omega}$ using the values of the equivalent voltage source: (Provide formulas!)

$$ U_{2L} : $$

$$ I_2 : $$
Check the values by measuring:
$$ U_{2L, Meas} : $$
$$ I_{2, Meas} : $$

Check the values using Kirchhoff's rules: (Provide formulas!)
$$ U_{2L} : $$

$$ I_2 : $$