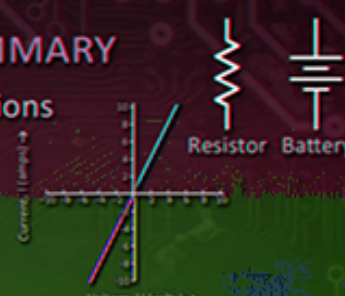


# Electronics (Great Courses)

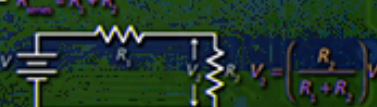
## Lecture 2

**LECTURE 2 SUMMARY**

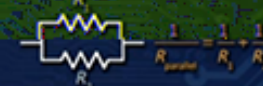
- Electronic circuits are interconnections of components
  - Components can be described by their  $V$ - $I$  characteristics
- Components may be connected in series or parallel
  - Series resistors add
  - Series resistors form a voltage divider
  - Parallel resistors add reciprocally



$R_{\text{series}} = R_1 + R_2$



$V_2 = \left( \frac{R_2}{R_1 + R_2} \right) V$



$\frac{1}{R_{\text{parallel}}} = \frac{1}{R_1} + \frac{1}{R_2}$

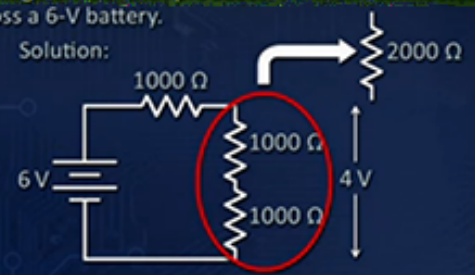
THE GREAT COURSES

## Project

**PROJECT SOLUTIONS**

1) Using only  $1000\text{-}\Omega$  resistors (as many as you want), design a voltage divider that produces  $4\text{ V}$  when connected across a  $6\text{-V}$  battery.

Solution:



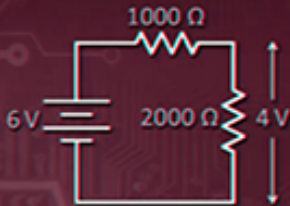
$2000\text{ }\Omega$

$4\text{ V}$

THE GREAT COURSES

**PROJECT SOLUTIONS**

1) Using only 1000-Ω resistors (as many as you want), design a voltage divider that produces 4 V when connected across a 6-V battery.



Voltage divider equation:

$$V_2 = \left( \frac{R_2}{R_1 + R_2} \right) V$$


$$= \left( \frac{2000 \, \Omega}{3000 \, \Omega} \right) (6 \, \text{V})$$

$$= \left( \frac{2}{3} \right) (6 \, \text{V}) = 4 \, \text{V}$$

GREAT COURSES

**PROJECT SOLUTIONS**

2) Suppose you connect a 10,000-Ω resistor (10 kΩ) across your voltage divider, between the points where you're supposed to have 4 V. Will the voltage across this resistor be exactly 4 V? If so, explain why. If not, explain why not and determine what the actual voltage will be.



Parallel resistors

$$\frac{1}{R_{\text{parallel}}} = \frac{1}{R_1} + \frac{1}{R_2}$$

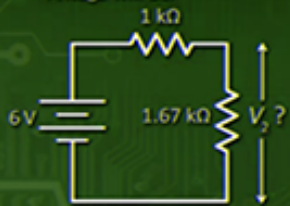
$$\frac{1}{R_{\text{parallel}}} = \frac{1}{2 \, \text{k}\Omega} + \frac{1}{10 \, \text{k}\Omega}$$

$$R_{\text{parallel}} = \frac{10}{6} \, \text{k}\Omega = 1.67 \, \text{k}\Omega$$

GREAT COURSES

**PROJECT SOLUTIONS**

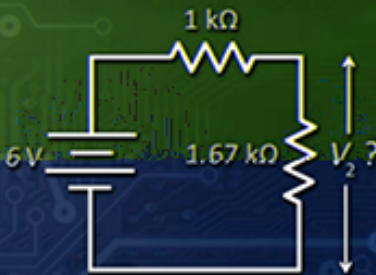
2) Suppose you connect a 10,000-Ω resistor (10 kΩ) across your voltage divider, between the points where you're supposed to have 4 V. Will the voltage across this resistor be exactly 4 V? If so, explain why. If not, explain why not and determine what the actual voltage will be.



GREAT COURSES

**PROJECT SOLUTIONS**

2) Suppose you connect a 10,000-Ω resistor (10 kΩ) across your voltage divider, between the points where you're supposed to have 4 V. Will the voltage across this resistor be exactly 4 V? If so, explain why. If not, explain why not and determine what the actual voltage will be.



Voltage divider

$$V_2 = \left( \frac{R_2}{R_1 + R_2} \right) V$$

$$= \left( \frac{1.67 \text{ k}\Omega}{2.67 \text{ k}\Omega} \right) (6 \text{ V})$$

$$= 3.75 \text{ V}$$

GREAT COURSES