



SCHOOL OF THE WEST

Electronics

Chapter 6: Voltage divider practise

Our Circuit

Description of the problem

- We have a battery, a switch and a lightbulb.
- We want to connect the components to form a circuit so that the light bulb emits light when the switch is on.
- Our lightbulb has a smaller voltage than our battery. If we connect it directly, it will burn.
- We need to use resistors to divide the voltage.

Calculations - 1

- Our light bulb has a 1.8W power, and a 6V nominal voltage
- We can use the power formula to get its nominal current:

$$P = I * V$$

$$I = P / V$$

$$I = 1.8 / 6 = \mathbf{0.3 \text{ A}}$$

- When the light bulb is off, its resistance is virtually 0. But when it's on, it will follow Ohm's law with the nominal voltage and current:

$$R = V / I$$

$$R = 6 / 0.3 = \mathbf{20\Omega}$$

Calculations - 2

- Our battery has 9 volts. We know that we need 0.3A current for the light bulb to work.
- We can use Ohm's law to get the circuit resistance that we need:
 $R = V / I$
 $R = 9 / 0.3 = \mathbf{30\Omega}$
- We know that our light bulb will have 20Ω , so we need to add $30 - 20 = \mathbf{10\Omega}$ to our circuit to get the needed current.
- Could we use a $\mathbf{10\Omega}$ resistor? Let's check.

Calculations - 3

- A 10Ω resistor would give us the needed resistance, however, we need to calculate its power first. We know $I = 0.3$ and the voltage will be $9-6 = \mathbf{3V}$
 $P = I * V$
 $P = 0.3 * 3 = \mathbf{0.9 W}$
- Our 10Ω resistors have a **$0.5W$** maximum power. So we cannot just connect a single 10Ω resistor, it would burn.
- Using what you learned in the previous lesson, design a circuit that solves this problem, with **four 10Ω resistors**. Try to design it yourself before checking the solution!

Reminder - 4 steps rule

- **Check** that you have the components with the values you need.
- **Design** your circuit on a piece of paper and calculate all the values you need.
- **Simulate** your circuit with some software to check that everything works as expected.
- **Build** your circuit and test it.

Your turn!



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Next lesson

Chapter 7: Kirchhoff's laws