



# **Student Worksheet**

# Lesson 4: LED Circuit Combination

**Objective:** The objective of this lab is to use LEDs to show the current flow through the path of a series, parallel, and combination circuit. The relationship between current flow and LED brightness will be illustrated when a constant potential difference is applied across the circuit.

#### **Materials:**

- Ammeter
- Breadboard
- Multimeter (to measure resistance and voltage)
- Power supply/battery
- Jumper wires
- LED (Holiday light bulb or regular)
- Three resistors
- Switch

#### Procedure:

- 1. Test the polarity of the LED with a battery or power supply of 3V or less.
- 2. Choose three resistors with different resistances and record their values (from the color code and measured with an ohmmeter) in Table 1.

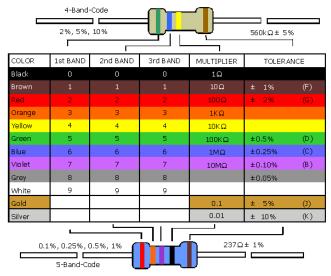


Figure 1. Resistor color code chart.

Table 1.	Resistor	data table.	
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Resistor	Color Code	Measured Resistance (🛛)	Color Coded Resistance (2)
R <sub>1</sub>			(11)
R <sub>2</sub>			
R <sub>3</sub>			

Part A: An LED in a Series Circuit

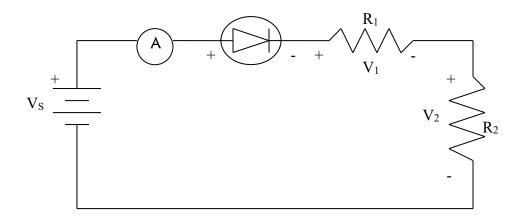


Figure 2. Series schematic circuit.

- 3. Create a series circuit with resistor one (R<sub>1</sub>) in the breadboard provided.
- 4. Add an ammeter between the battery and LED to record the current.
- 5. Attach the breadboard circuit to a 3V potential difference.
- 6. Does the LED light up? If it does not, change the polarity of the LED.
- 7. Measure the voltage across the resistor with the voltmeter or multimeter. Record the values in Table 2.
- 8. Measure and record the voltage across the LED.
- 9. Record the ammeter current (total current).
- 10. Disconnect the power supply.
- 11. Add another resistor (R<sub>2</sub>) in series and repeat steps 4 through 10, but place the values in Table 3.
- 12. Add another resistor ( $R_3$ ) in series and repeat steps 4 through 10, but place the values in Table 4.

Resistor	Resistor Value (🛛)	Resistor Voltage (V)	Current (A)
R1			
LED			

## Table 2. Data for the first series circuit.

#### Table 3. Data for the second series circuit.

Resistor	Resistor Value (᠒)	Resistor Voltage (V)	Current (A)
R1			
R <sub>2</sub>			
LED			

### Table 4. Data for the third series circuit.

Resistor	Resistor Value (᠓)	Resistor Voltage (V)	Current (A)
R1			
R <sub>2</sub>			
R <sub>3</sub>			
LED			

Part B: An LED in a Parallel Circuit

- 13. Create a parallel circuit with  $R_1$  and  $R_2$  on the breadboard.
- 14. Add an ammeter and LED in series with the battery. Look at Figure 3 for help.
- 15. Connect the breadboard circuit to a 3V power supply or battery.
- 16. Does the LED light up? If it does not, change the polarity of the LED.
- 17. Measure the voltage across the resistors with the voltmeter or multimeter. Record the values in Table 5.
- 18. Measure and record the voltage across the LED.
- 19. Record the ammeter current (total current).

- 20. Disconnect the power supply.
- 21. Add another resistor ( $R_3$ ) in parallel and repeat steps 17 through 20, but place the values in Table 6.

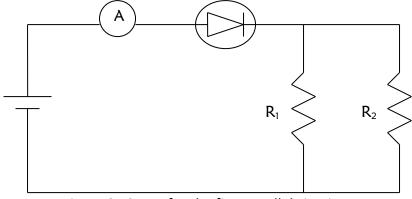


Figure 3. Setup for the first parallel circuit.

Table 5.	Data	for the	first	narallel	circuit
Table J.	Data	ior the	111.51	paraner	circuit.

Resistor	Resistor Value (᠒)	Resistor Voltage (V)	Current (A)
R <sub>1</sub>			
R <sub>2</sub>			
LED			

#### Table 6. Data for the second parallel circuit.

Resistor	Resistor Value (🛛)	Resistor Voltage (V)	Current (A)
R <sub>1</sub>			
R <sub>2</sub>			
R <sub>3</sub>			
LED			

#### Part C: An LED in a Combination Circuit

- 22. Create a combination circuit with  $R_1$ ,  $R_2$ , and  $R_3$  on the breadboard.
- 23. Add an ammeter, LED, and R<sub>1</sub> in series with the battery. Look at Figure 4 for help.
- 24. Connect the breadboard circuit to a 3V power supply or battery.
- 25. Does the LED light up? If it does not, change the polarity of the LED.

- 26. Measure the voltage across the resistors with the voltmeter or multimeter. Record the values in Table 7.
- 27. Measure and record the voltage across the LED.
- 28. Record the ammeter current (total current).
- 29. Disconnect the power supply.

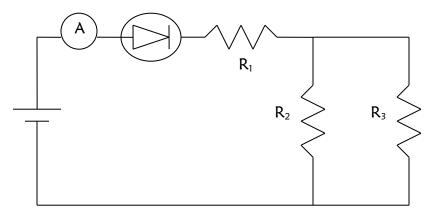


Figure 4. Setup for the first combination circuit.

Resistor	Resistor Value (?)	Resistor Voltage (V)	Current (A)
R1			
R <sub>2</sub>			
R <sub>3</sub>			
LED			

Table 7. Data for the combination c	circuit.
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#### Analysis and Conclusion:

- 1. In Part A, what happened to the LED as resistors were added?
- 2. In Part B, what happened to the LED as resistors were added?

- 3. Of all the circuits in this experiment which one caused the LED to shine the brightest? How do you know?
- 4. If there were a parallel circuit like the one shown in Figure 3. Which LED would be the brightest? Why?

