

2.0 - Diodes and LEDs

About diodes and LEDs (Light Emitting Diodes)

Diodes and LEDs are semiconductors – devices that can act as both conductors and insulators. Diodes and other semiconductors are known as active components because they can change their resistance depending on the operation conditions in a circuit, as opposed to passive devices with constant resistance, such as resistors.

LED activity

1. Describe the two measurements that are necessary to test a diode and explain the expected results.
2. Obtain an LED. Measure the forward and reverse LED potential drop using the multimeter's diode test function.

$V_{FWD} =$

$V_{REV} =$

3. Using your forward potential measurement, calculate the value of a series resistor that will limit the LED current to 16 mA at an applied potential of 30 V .

$V_R =$

$R =$

3. Which resistor in the E24 resistor series is the best match for the calculated value?
4. Draw a schematic diagram showing your LED in series with a 30 V power supply and the current-limiting resistor that you calculated in step 3.

5. Build the LED circuit that you drew, above, on a breadboard. Measure the actual resistance of the resistor.

Teacher Check

6. Connect a power supply to the LED circuit. Measure the potential drop across the LED and across the resistor at each of the applied potentials. Observe the brightness of the LED.

V_T	V_{LED}	V_R	I_{LED}	R_{LED}
1 V				
3 V				
6 V				
12 V				
24 V				
30 V				

7. As the power supply potential increased, explain:
- a) how the LED potential drop changed? Which potential drop is closest to that in step 2?
 - b) how the resistor potential drop changed?
 - c) how the brightness of the LED changed?

Teacher Check

LED analysis

8. For each potential in the chart, calculate the LED current from the known resistor values. How does the LED current relate to LED potential? How does it relate to LED brightness?
9. Use the LED parameters in the chart to calculate the equivalent LED resistance at each potential. How does the LED's conductivity change with the change in potential?
10. Based on your observations in steps 7 and your calculations in steps 8 and 9, explain whether you think the LED brightness is dependent on potential or current.
11. Calculate the resistor required to limit the current through your LED to 8 mA in a 5 V circuit.