

2.2 - LEDs

About LEDs (Light Emitting Diodes)

LEDs, like diodes, are semiconductor components with the ability to act as conductors or insulators. When forward biased, or conducting, LEDs emit light. The composition of the LED determines the specific colour of light produced, and almost all LEDs (with the exception of white) are strongly monochromatic, meaning that the light is all one colour or wavelength.

LED activity

1. Obtain an LED from your kit of CHRP parts. Measure the forward and reverse voltage drops of the LED using the diode test function of the multimeter.

$$V_{\text{FWD}} =$$

$$V_{\text{REV}} =$$

2. In order to protect the LED from excessive current it needs to be connected to a series current-limiting resistor. If the 12 VAC input of the CHRP is capable of passing a pulsing 20 VDC output voltage to the LED, calculate the value of resistor required to limit the LED current to 10 mA.

$$E_{\text{T}} = 20 \text{ V}$$

$$I_{\text{R}} = 10 \text{ mA}$$

$$E_{\text{R}} =$$

$$R =$$

3. Which resistor in your kit is closest to the calculated value?
4. Draw a schematic diagram of your LED in series with the calculated current-limiting resistor and a 6 V power supply.

5. Build the LED circuit that you drew, above, on a breadboard.

Teacher Check

6. Connect the LED circuit to a power supply. Measure the potential drop across the LED as well as the resistor. Then, increase the voltage and repeat the measurements to complete the chart.

$$E_T = 6 \text{ V}$$

$$E_{LED1} =$$

$$E_{R1} =$$

$$E_T = 12 \text{ V}$$

$$E_{LED1} =$$

$$E_{R1} =$$

$$E_T = 24 \text{ V}$$

$$E_{LED1} =$$

$$E_{R1} =$$

7. As the power supply voltage doubled in step 6, analyse:

a) the amount by which the LED voltage changed

b) the amount by which the resistor voltage changed

c) the relative brightness of the LED

8. How does the LED voltage in step 6 relate to the forward voltage drop measured in step 1?

9. Using the potential measurements in step 6 as well as the actual current-limiting resistor value, calculate the LED current at each potential.

$$E_T = 6 \text{ V}$$

$$I_{LED1} =$$

$$E_T = 12 \text{ V}$$

$$I_{LED1} =$$

$$E_T = 24 \text{ V}$$

$$I_{LED1} =$$

Teacher Check

10. Install R1 and LED1 in your CHRP board, making sure that LED1 is in the correct orientation.

LED analysis

11. Based on your observations in steps 7 and 8, as well as your calculations in step 9, explain whether you think the LED brightness is dependent on potential or current. Why?

12. Calculate the value of the resistor required to limit the current through an LED connected in a circuit powered by a 5 V potential to 8 mA.