

2.2 - LEDs

About LEDs (Light Emitting Diodes)

LEDs, like diodes, are semiconductor devices with the ability to act as conductors or insulators. When conducting (forward biased), LEDs emit light. The composition of the LED determines the specific colour of light it produces. All LEDs, with the exception of white LEDs, are strongly monochromatic, meaning that the light produced is of 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. The 12 VAC input of the CHRP is capable of passing a maximum 20 VDC output voltage to the LED. Calculate the resistor value 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 showing your LED in series with a 6V power supply and the current-limiting resistor that you calculated in step 2.

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 potential and repeat the measurement 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 potential doubled in step 6, analyse:

a) the amount by which the LED potential drop changed

b) the amount by which the resistor potential drop changed

c) the relative brightness of the LED

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

9. Using the potential measurements in step 6 and 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 to 7 mA when it is connected to a 5 V power supply.