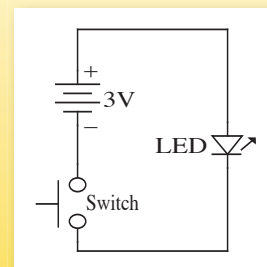
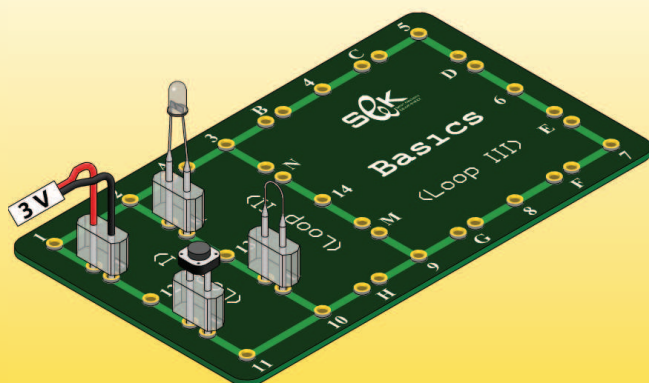


Experiment No. (26) Light Emitting Diode (LED)



Objectives:

1. The student will investigate the Light Emitting Diode (LED).
2. The student will differentiate between the terminals of the LED.
3. The student will investigate the working voltage of the LED and the maximum current allowed to flow through it.

Apparatus:

- | | | | |
|---------------------------------|-------------------------|-----------|-------|
| • Basics Board | • Connection Wire | • Jumpers | • DMM |
| • Voltage Source (PSB Board) | • Mini Screw Driver | • Switch | • LED |
| • Variable Resistor 1K Ω | • Resistor 330 Ω | | |

Procedure and Conclusions:

1. Insert LED at the pair (K).
2. Turn the selection dial of the DMM to the Diode Test mode, use its probes to identify the LED terminals by inserting the red probe at the point (2) and black probe at the point (13), if the LED emits light then the red probe is connected to the positive terminal (Anode) of the LED, otherwise the red probe is connected to the negative terminal (Cathode) of the LED.
3. Use Loop I on the Basics Board to set up a circuit by inserting a switch at the pair (I), LED at the pair (K) in a way that its positive terminal will be towards the point (2), a jumper at the pair (L).

4. Connect (3 volt) from PSB board to the pair (J) using a connection wire in a way that the positive terminal (red wire) will be towards the point (1).
5. Press the switch button for few seconds to close the circuit while watching the LED.
 - When you close the circuit the LED ... emits / doesn't emit ... light.
6. Reverse the LED at the pair (K) in a way that its positive terminal will be towards the point (13), press the switch button while watching the LED.
 - In this case, the LED ... emits / doesn't emit ... light.

Notes:



- That LED allows light to pass current through it in one direction and blocks the current in the opposite direction.
- LED must be forward biased to allow current to pass through it.

7. Again, reverse the LED at the pair (K) in a way that its positive terminal will be towards the point (2).
8. Turn the selection dial of the DMM to DCA mode (range 200mA), insert the probes at the pair (L) instead of the jumper.
9. Press the switch button for few seconds, record the Ammeter reading for the current and compare this result with the maximum allowed current to pass through the LED (i.e. 20mA).
 - The current passes through the LED ismA, this value is ... larger / smaller ... than the allowed value (20mA).

Notes:



- Most LEDs can pass 20 milliamps, this is the maximum amount of current that can flow through the particular LED before it burns out.

10. Insert a variable resistor $1K\Omega$ at the pair (I) instead of the switch, turn its wiper clockwise and anticlockwise using a mini screw driver to bring Ammeter reading to $20mA$.
11. Insert a switch at the pair (L) instead of the DMM probes; turn the selection dial of the DMM to DCV mode (range $20V$), insert red probe at the point (2) and the black probe at the point (13) to measure the voltage drop across the LED.
12. Press the switch button and record the voltage drop across the LED (Voltmeter reading).
 - The voltage drop across the LED is volt, and this is the working voltage of the LED.
13. To use a LED in a circuit with voltage source $6V$ (taking into consideration that the working voltage is $1.8V$, and the maximum current allowed to pass through it is $20mA$), we should use a dropping resistor in series with the LED to limit the current passes through the LED, we can calculate the required resistor using the following formula:
$$R = (V_{\text{source}} - V_{\text{LED}}) / I_{\text{LED}}$$
$$= ((6-1.8)/20)*1000 = 210\Omega.$$
14. Use the resistor 220Ω since its value is very close to the calculated one; insert the resistor 220Ω at the pair (I) instead of the variable resistor.
15. Take the connection wire off the outlet socket $3V$ and insert it in the outlet socket $6V$ on the PSB Board to get $6V$, press the switch button to close the circuit. Using the Voltmeter, measure the voltage across the voltage source terminals, LED and resistor 220Ω .
 - Voltage across the voltage source terminals is volt, voltage across the LED is volt, voltage across the resistor is volt.

16. Remove the DMM probes, turn the selection dial of the DMM to DCA mode (range 500mA), insert its probes at the pair (L) instead of the switch to measure the current passes through the LED and compare it with maximum current allowed to pass through the LED.
- The current passes through the LED is mA.

Notes:



- The most commonly available colors for LED's are red, green, amber, yellow, blue and white. The red, green, yellow and amber have a working voltage of approximately 1.8 volts.
- LED's are used in many electronic devices as indicator lamps.



Discussion

1. Discuss the Solar-powered LED Lights.