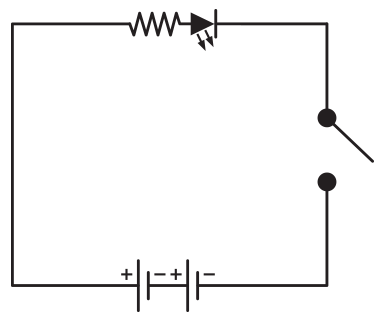
# **Investigation: LEDs**

**Essential Question: How does an LED behave in a circuit?**

LEDs are found in many electric circuits. For many years, LEDs were used primarily as indicator lights in electronic devices. In recent years, LEDs have become more common as a lighting alternative to traditional bulbs and fixtures. In this investigation, you will explore how an LED behaves in a circuit and how it differs from a common light bulb. Note that the LED module contains a 330 Ω resistor in series with the LED to protect the LED from damage.

Part 1: Lighting an LED



1. Build the circuit shown in the diagram.
2. Close the switch to light up the LED.
3. Make the following changes to your circuit and observe how it affects the LED. Reset the circuit to its original conditions after performing each experiment.
   1. Turn the battery modules upside down to reverse the direction of current.
   2. Remove one battery and replace it with a wire module to decrease the circuit voltage.
   3. Add a 100 ohm resistor in series with the LED to decrease the circuit current.
4. Replace the LED module with a light bulb and repeat the experiments.

Questions

1. What happened to the LED when the direction of current changed? The light bulb?

Answer: The LED does not light up, but the light bulb stays lit.

1. What happened to the LED when the circuit voltage was decreased? The light bulb?

Answer: The LED does not light up. The light bulb still lights up, but it is significantly dimmer.

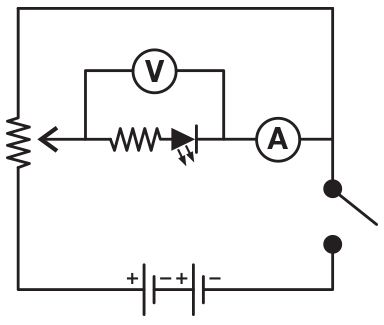
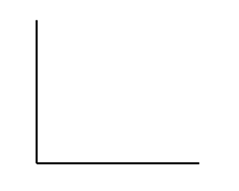
1. What happened to the LED when the circuit current was decreased? The light bulb?

Answer: The LED lights up, slightly dimmer, but it is difficult to notice. The light bulb does not light up at all.

1. Based on your observations, what conditions are necessary to light an LED? A light bulb?

Answer: To light up the LED, current must be in a specific direction and a higher voltage is required. To light up the LED, higher current is required.

Part 2: Voltage and current measurements

1. Build the circuit shown in the diagram.
2. Open the experiment file **LEDCircuit** then connect the current and voltage sensors to your software.
3. With the switch open, zero your sensors.
4. Start collecting data. Close the switch and slowly turn the potentiometer knob as far as it can go in both directions.
5. Replace the LED module with the light bulb and repeat the experiment.
6. Draw a sketch of your current versus time graph for the LED and the light bulb.

Questions

1. At what voltage did the LED turn on? The bulb?
2. At what current did the LED turned on? The bulb? What unique difference do you notice about LED current versus the bulb current as voltage increases?
3. Based on this data, why did the LED not turn on when only one battery was used in Part 1?
4. Is the LED or the bulb a more efficient light source? Explain using your collected data as evidence.