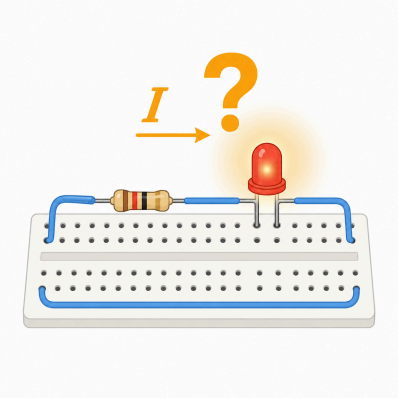
Measure the Current of a Red LED



Predict how much current flows through a red LED wired in series with a 220 ohm resistor on a 5-volt supply -- then prove your prediction with a multimeter.

STEPS

1. Gather a 5V power source, breadboard, red LED, 220 ohm resistor, jumper wires, and multimeter.
2. Predict the current: use Ohm's Law (I = V / R) with 3V (5V minus the LED's ~2V) and 220 ohms.
3. Wire the power source, resistor, and LED in one series loop on the breadboard.
4. Break the loop at one point and insert the multimeter, set to DC milliamps.
5. Power the circuit and compare the reading to your prediction.

STRETCH GOAL

Swap in a 330 ohm resistor, recalculate the predicted current, and measure again -- is the LED noticeably dimmer?

Intermediate Card

Ohm's Law

Solution

HINTS

- *Voltage is the push (volts); current is the flow it produces (amps). Ohm's Law connects them -- V = I x R.*
- *A lit LED eats a fairly fixed chunk of the supply voltage no matter what, about 2 volts for a red LED.*
- *A multimeter measuring current sits in series (inline), not in parallel like a voltage measurement.*

STEPS

1. 5V - 2V (the LED's share) = 3V left over for the resistor.
2. I = V / R = 3V / 220 ohms = about 0.0136 amps, or 13.6 milliamps.
3. Break the loop, insert the multimeter in series with jumper wires, set it to DC milliamps, and power the circuit.
4. A reading near 13.6 mA confirms the prediction.

CIRCUIT

A red LED in series with a 220 ohm resistor on a 5V supply drops about 2V across the LED, leaving 3V across the resistor. Ohm's Law (I = V / R) then predicts about 13.6 mA -- a safe, typical LED current, well under this chapter's 20 mA safety line. Measuring it for real means breaking the breadboard loop and routing current through the multimeter's DC milliamp range, in series rather than in parallel like a voltage reading. A result close to but not exactly 13.6 mA is expected, since a real LED's forward voltage varies slightly by part and brightness.

See also: Ohm's Law Current Calculator diagram (Chapter 16) -- this scenario matches the diagram's own 5V/220-ohm default settings.