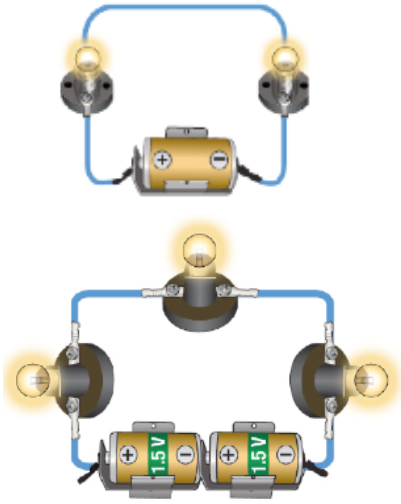
Chapter 16.4 Learning Goals

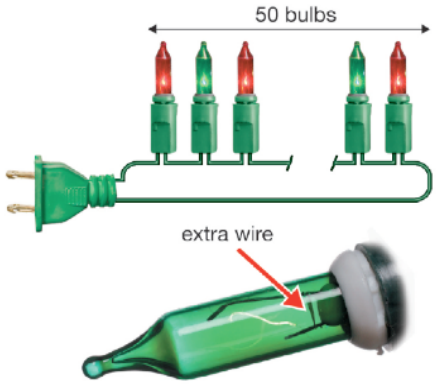
- Build and analyze series and parallel circuits.
- Apply Ohm's law to calculate the current in a circuit.
- Compare and contrast series and parallel circuits.

16.4 Types of circuits

- In a series circuit, current can only take one path, so the current is the same at all points in the circuit.



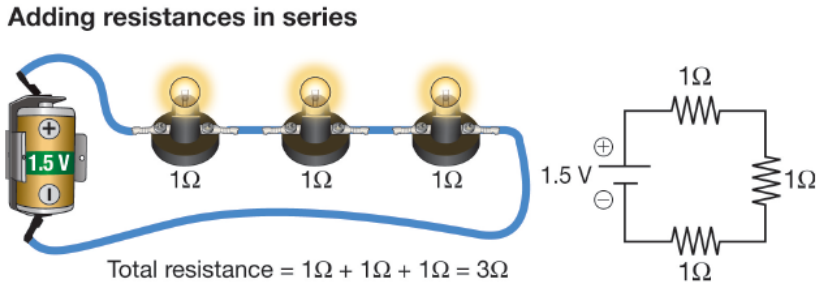
16.4 Series circuits



- Inexpensive strings of holiday lights are wired with the bulbs in series.
- If you remove one of the bulbs from its socket, the whole string of mini bulbs will go out.

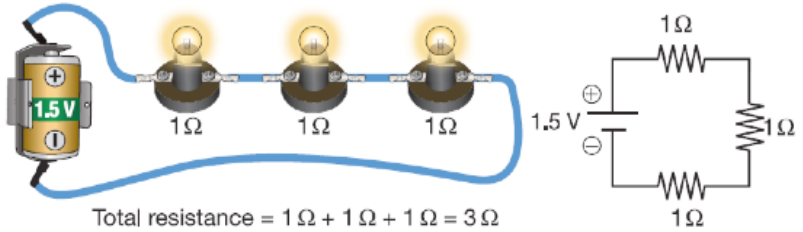
16.4 Current and resistance in series circuits

- Everything has some resistance, even wires.



16.4 Current and resistance in series circuits

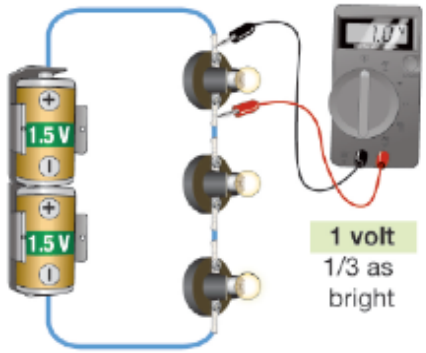
- If you know the resistance of each device, you can find the total resistance of the circuit by adding up the resistance of each device.



Total resistance = 1 Ω + 1 Ω + 1 Ω = 3 Ω

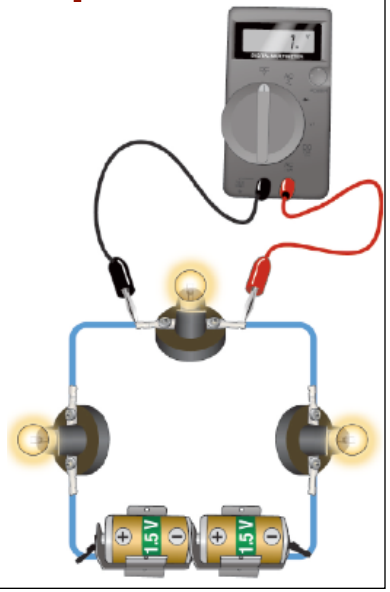
16.4 Voltage drop

- As each device in series uses power, the power carried by the current is reduced.
- As a result, the voltage is lower after each device that uses power.
- This is known as the voltage drop.



16.4 Voltage drop

- The law of conservation of energy also applies to a circuit.
- In this circuit, each bulb has a resistance of 1 ohm, so each has a voltage drop of 1 volt when 1 amp flows through the circuit.

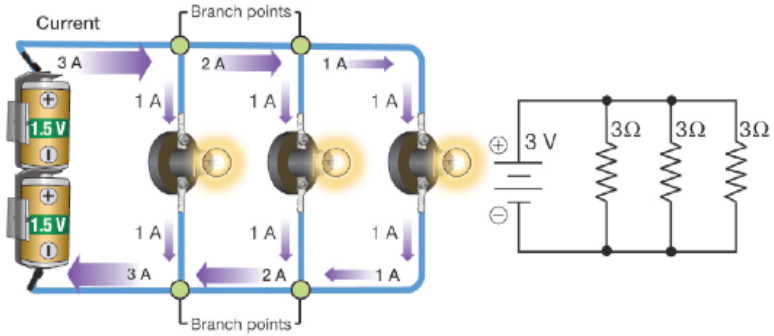


16.4 Voltage drop and Ohm's law

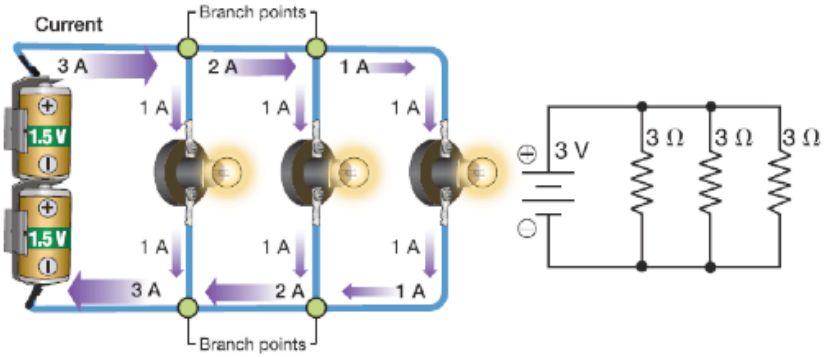
- The voltage drop across a resistance is determined by Ohm's law in the form V = IR.
- The voltage drop (V) equals the current (I) multiplied by the resistance (R) of the device.

16.4 Parallel Circuits

- In parallel circuits the current can take more than one path.

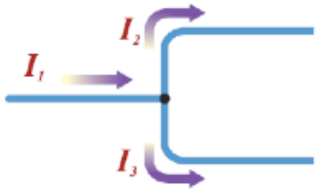


Parallel Circuits



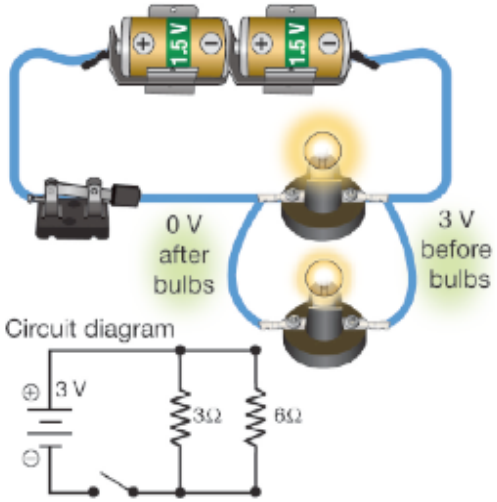
Kirchhoff's current law

All current flowing into a branch point must flow out again.



$$I_1 = I_2 + I_3$$

16.4 Voltage and parallel circuits



- If the voltage is the same along a wire, then the same voltage appears across each branch of a parallel circuit.

16.4 Voltage and parallel circuits

- **Parallel circuits have two advantages over series circuits.**

1. Each device in the circuit has a voltage drop equal to the full battery voltage.
2. Each device in the circuit may be turned off independently without stopping the current in the other devices in the circuit.

16.4 Current and parallel circuits

- Each branch works independently so the total current in a parallel circuit is the sum of the currents in each branch.