



Chapter Sixteen: Electricity

- **16.1 Charge and Electric Circuits**
- **16.2 Current and Voltage**
- **16.3 Resistance and Ohm's Law**
- **16.4 Types of Circuits**



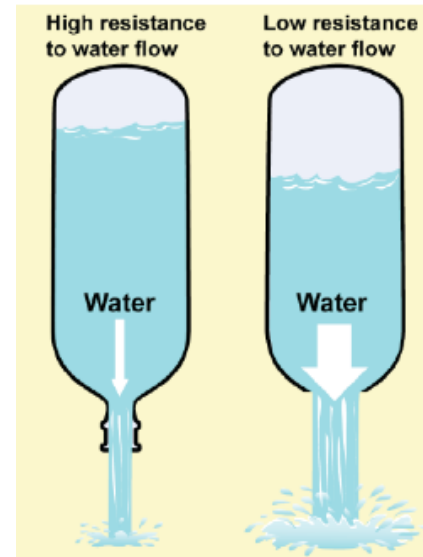
Chapter 16.3 Learning Goals

- Use Ohm's law to relate current, voltage and resistance.
- Apply Ohm's law to solve problems.
- Classify materials as conductors, insulators, and semiconductors.



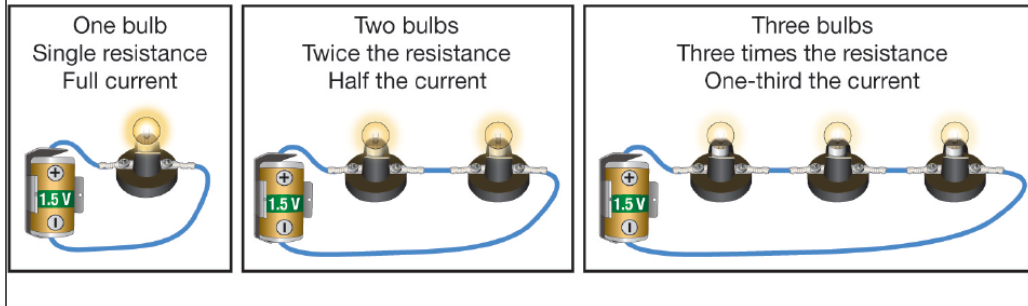
16.3 Resistance

- Resistance is the measure of how strongly an object resists current flowing through it.
- The relationship between electric current and resistance can be compared with water flowing from the open end of a bottle.



16.3 Resistance

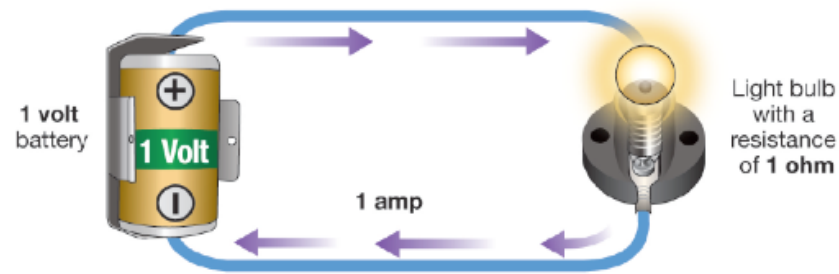
- **The total amount of resistance in a circuit determines the amount of current in the circuit for a given voltage.**



16.3 Resistance

- Electrical resistance is measured in units called **ohms**.
- This unit is abbreviated with the Greek letter **omega (Ω)**.

1 volt creates a current of 1 amp through a resistance of 1 ohm.





16.3 Ohm's Law

- The current in a circuit depends on voltage and resistance.
- Ohm's law relates current, voltage, and resistance with one formula.

| Equation | Gives you... | If you know... |
|-----------|--------------------|------------------------|
| $I = V/R$ | current (I) | voltage and resistance |
| $V = IR$ | voltage (V) | current and resistance |
| $R = V/I$ | resistance (R) | voltage and current |



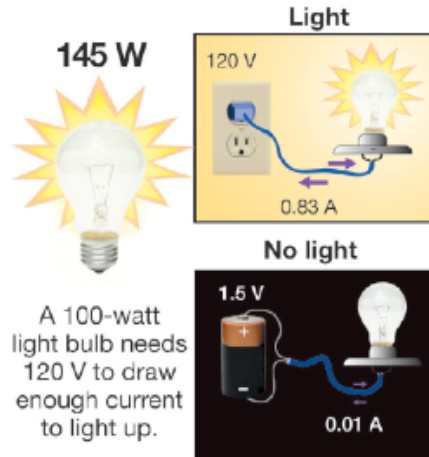
Solving Problems: Ohm's Law

OHM'S LAW

Current (amps, A) $I = \frac{V}{R}$ ***Voltage*** (volts, V)
Resistance (ohms, Ω)

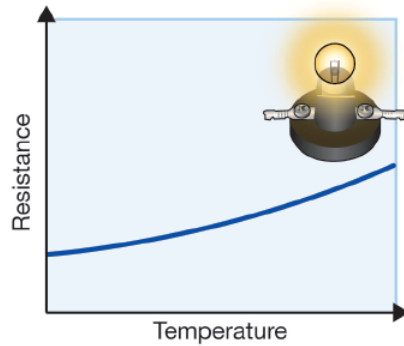
16.3 Resistance of common objects

- Every electrical device is designed with a resistor that causes the right amount of current to flow when the device is connected to voltage.





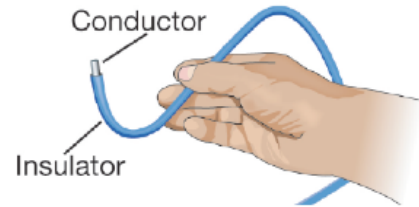
16.3 Resistance of common objects



- The resistance of many electrical devices varies with temperature and current.
- A light bulb's resistance increases when there is more current because the bulb gets hotter when more current passes through it.



16.3 Conductors and insulators

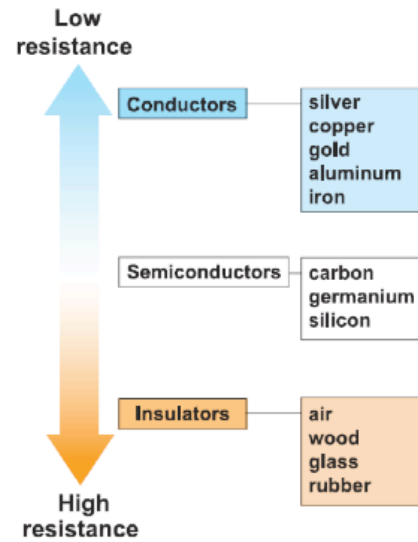


Name 20 items that require insulated wire to function...

- **Both conductors and insulators are necessary materials in technology.**
- **For example, a wire has one or more conductors on the inside and an insulator on the outside.**

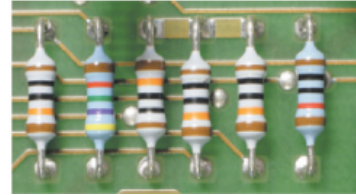


Comparing Resistance of Materials



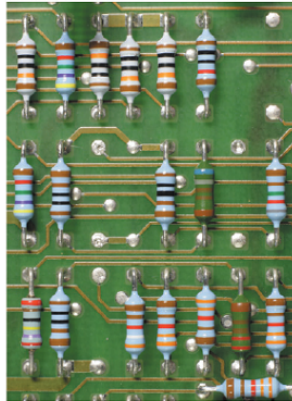
16.3 Resistors

- Resistors are used to control the current in circuits.
- There are two main types of resistors: fixed and variable.





16.3 Fixed resistors



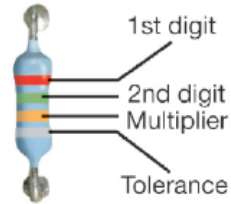
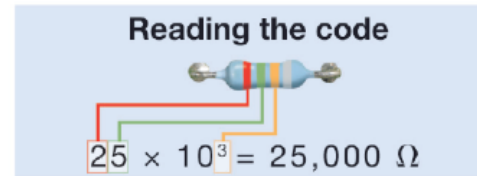
| Color | Number |
|--------|--------|
| black | 0 |
| brown | 1 |
| red | 2 |
| orange | 3 |
| yellow | 4 |
| green | 5 |
| blue | 6 |
| violet | 7 |
| grey | 8 |
| white | 9 |

- Fixed resistors have a resistance that cannot be changed.
- Because resistors are tiny, it is impossible to label each one with its resistance value.
- Instead, colored stripes tells you

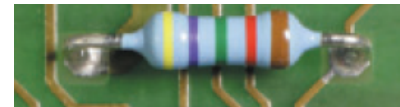
16.3 Fixed resistors

- Resistors are found in many common electronic devices such as computers, televisions, telephones, and stereos.

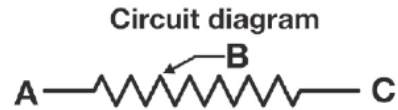
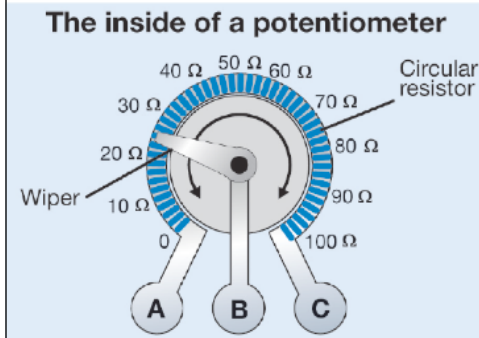
| Color | Tolerance |
|--------|-----------|
| silver | +/- 10% |
| gold | +/- 5% |
| brown | +/- 1% |

Can you read the code of this resistor?



16.3 Variable resistors



- Variable resistors, also called potentiometers, can be adjusted to have a resistance within a certain range.
- Turning the dial changes the resistance between A and B and also changes either the current or the voltage in the circuit.