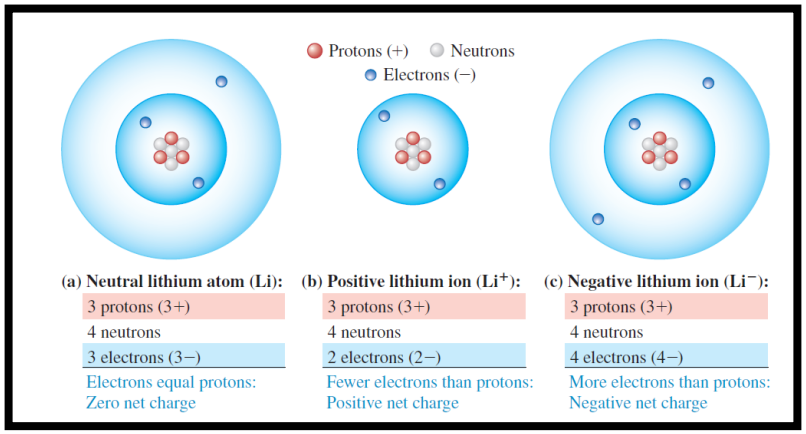
Electric charge



Coulomb's Law

The magnitude of the electric force between two point particles is directly proportional to the product of the charges and inversely proportional to the square of the distance between them.

$$F = k\frac{|Q_1 Q_2|}{r^2}$$

- Electric charge Q has unit coulomb (C)
- Electric charge is conserved
  (the sum of all electric charges in any closed system is constant)
- Two positive or two negative charges repel each other.
- A negative and a positive charge attract each other

Charles-Augustine de Coulomb, 1736-1806

Electric Current

Any flow of charge is an electric current

In a wire the current is equal to the charge that passes a cross-section per unit time.

$$I = \frac{dQ}{dt}$$

The unit of electric current is (C/s) and is named ampere (A)

André Ampère, (1775–1836)

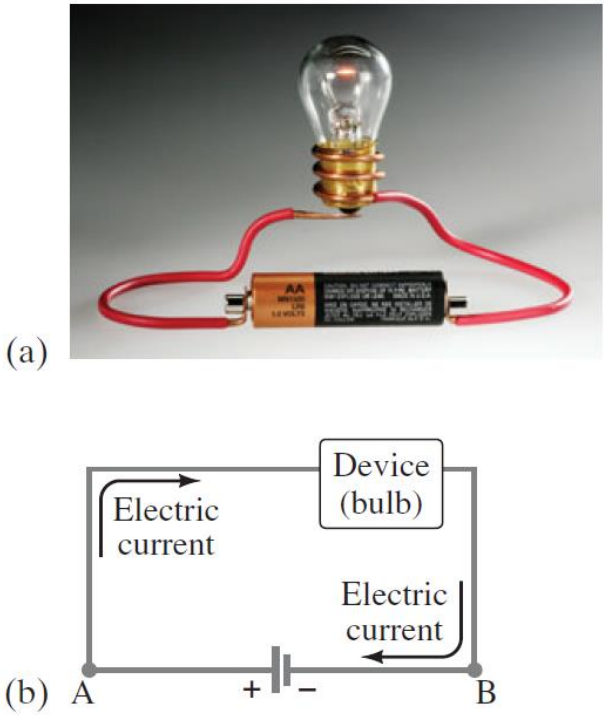


FIGURE 18–6 (a) A simple electric circuit. (b) Schematic drawing of the same circuit, consisting of a battery, connecting wires (thick gray lines), and a lightbulb or other device.

Giancoli, Physics Principles with Applications

Electric Field, Electric Potential Energy and Voltage

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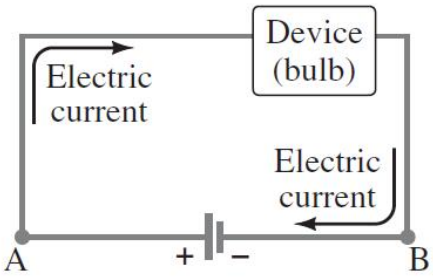

FIGURE 18–6 (a) A simple electric circuit. (b) Schematic drawing of the same circuit, consisting of a battery, connecting wires (thick gray lines), and a lightbulb or other device.

(Course IF1613 Elektromagnetism and Waves deals with electric and magnetic fields.

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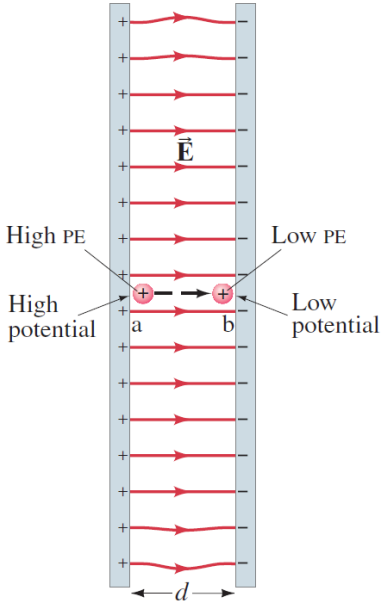

FIGURE 17–1 Work is done by the electric field $\vec{E}$ in moving the positive charge from position a to position b.

$$Work = Fd = qEd$$

$$PE_b - PE_a = -qEd$$

If a positive test charge q in an electric field has electric potential energy (PE) at some point a (relative to some zero potential energy), the **electric potential** at this point is

$$V = \frac{PE_a}{q}$$

Only difference in potential energy is physically meaningful, hence only potential difference between two points are measurable.

The unit of potential difference (J/C) is named volt (V). Potential difference is often referred to as **voltage**.

Alessandro Volta (1745–1827)

Schematic pictures from Giancoli, Physics Principles with Applications