



Linear Circuits

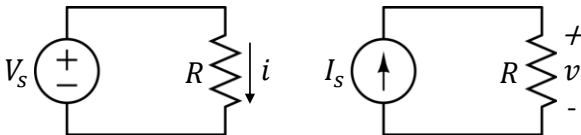
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Overview



By the end of this module you should be able to analyze simple electronic circuits

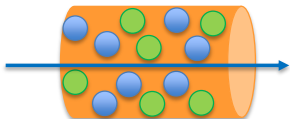


Current and Charge

Objective: By the end of this lesson, you should be able to describe and quantify electric charge and current.

Electric Current

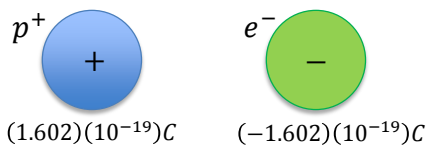
- Electric current is the rate at which electric charge flows through a substance.



- Therefore, to understand electric current, examine electric charge.
 - What is electric charge?
 - Why does electric charge flow?

What is electric charge?

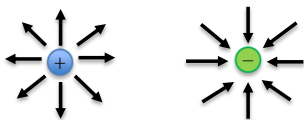
- A physical property of all matter
- Quantized into integer multiples of e
- Two types:



- Unit: Coulombs (C)
- Variable: q, Q

Why does electric charge flow?

- Charged particles exert a force on other charged particles.
- This force per unit charge is called an electric field.
- The electric field points away from a positive charge and towards a negative charge

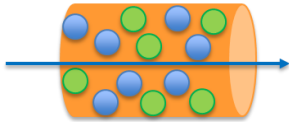


- Therefore, charges flow because their electric fields exert forces that push each other.

Define electric current



- Electric current (I) is the quantity of charge (Q) that passes through a given area in a specified time (t).



- The current as a function of time is

$$i(t) = \frac{dQ(t)}{dt}$$

- For constant current,

$$I = \frac{Q}{t}$$

- Variable: i, I
- Units: $\frac{C}{s}$, *Amperes*

Calculate electric current



Quiz: A 1mm cross section of copper wire is isolated and $50C$ of charge flow through it in 2 seconds . How much current flowed through the wire during that time?

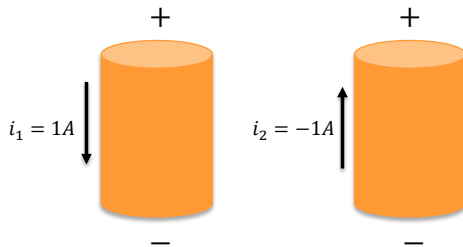
Quiz: A 1mm cross section of copper wire is isolated. The charge that flows through the cross section is

$$Q(t) = 4t^2 + 5$$

How much current flows through the wire in 6 seconds ?

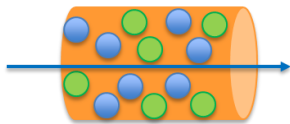
What are the reference directions for the flow of electric current?

- Positive current flows from high (+) to low (−).
- Negative current flows from low (−) to high (+).



Key Concepts

Electric current (I) is the quantity of charge (Q) that passes through a given area in a specified time (t).



$$i(t) = \frac{dQ(t)}{dt}$$

$$I = \frac{Q}{t}$$

