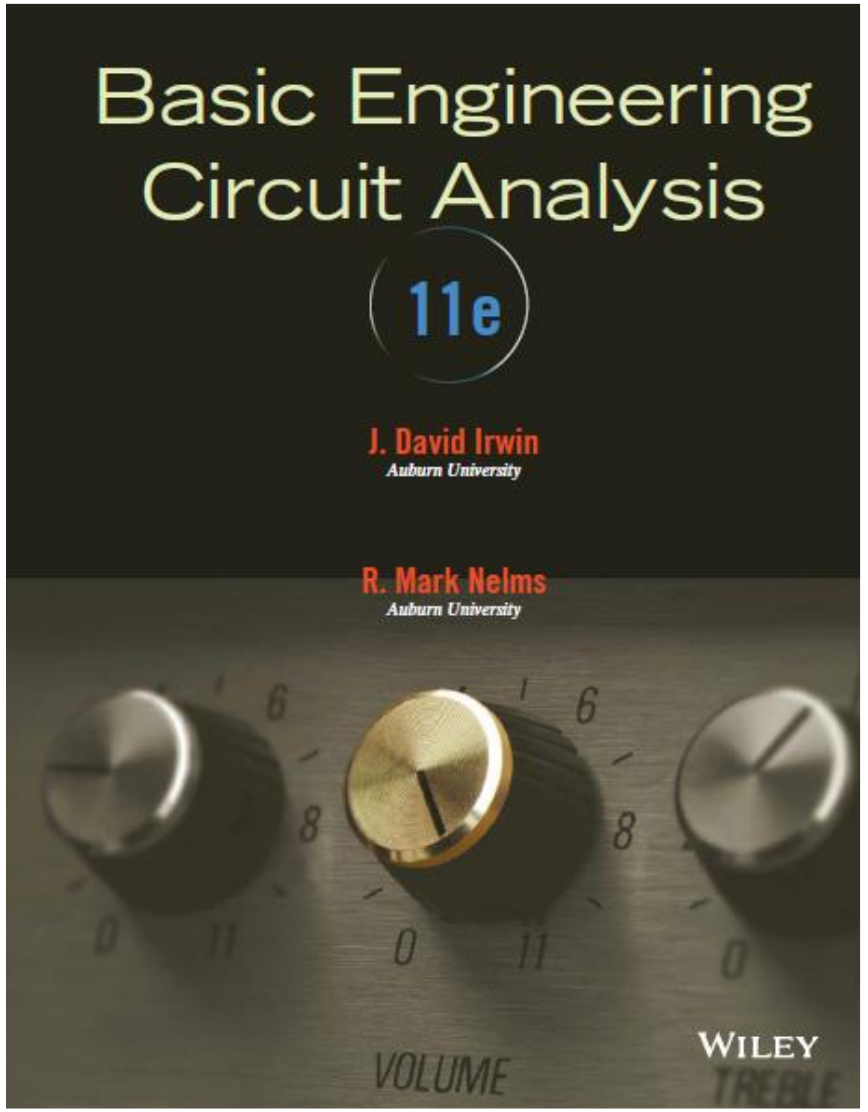
Objetivos del Curso

Desarrollar el conocimiento, las destrezas y las técnicas fundamentales para el análisis DC y AC de circuitos eléctricos sencillos. Estudiar y analizar circuitos con elementos básicos, tales como transformadores, amplificadores operacionales, resistores, inductores y capacitores, utilizando las leyes de Kirchhoff y los teoremas de simplificación eléctrica de Thevenin y Norton.



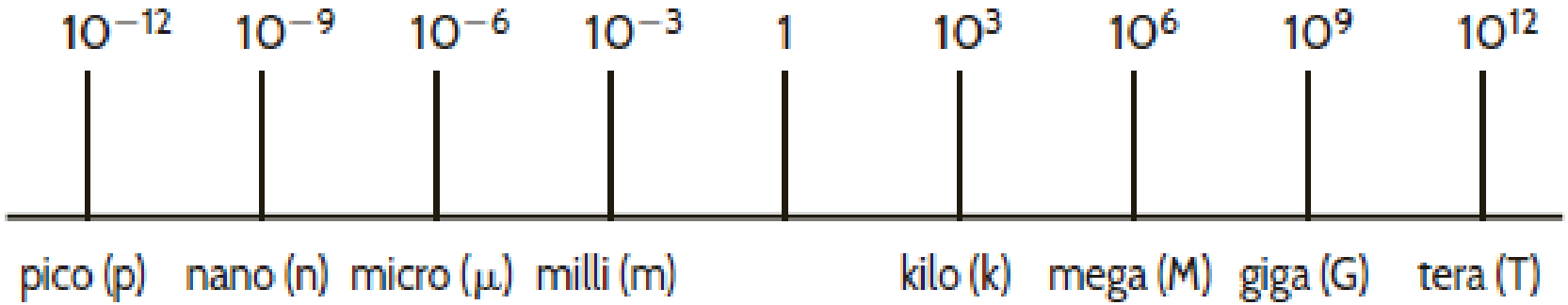
Basic Concepts → Chapter #1

- System of Units
- Basic Electrical Quantities
- Independent & Dependent Sources
- Circuit Analysis

Systeme International des Unites – SI:

- *Meter (m)*
- *Kilogram (Kg)*
- *Second (s)*
- *Ampere (A)*
- *Kelvin (K)*
- *Candela (cd)*

SI - Standard Prefixes

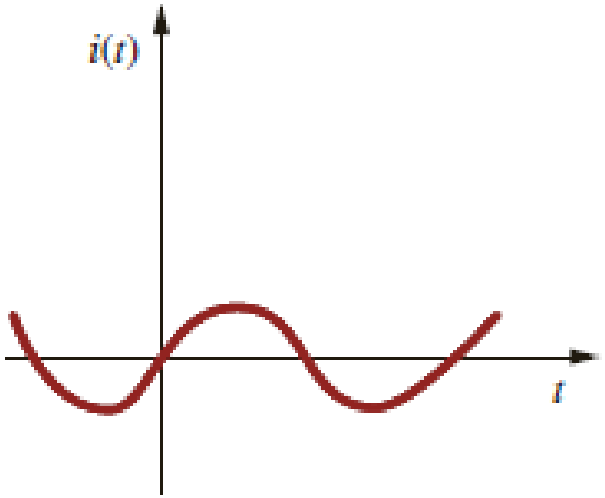


Basic Electrical Quantities → Current

Electric Current – *rate of change of charge*

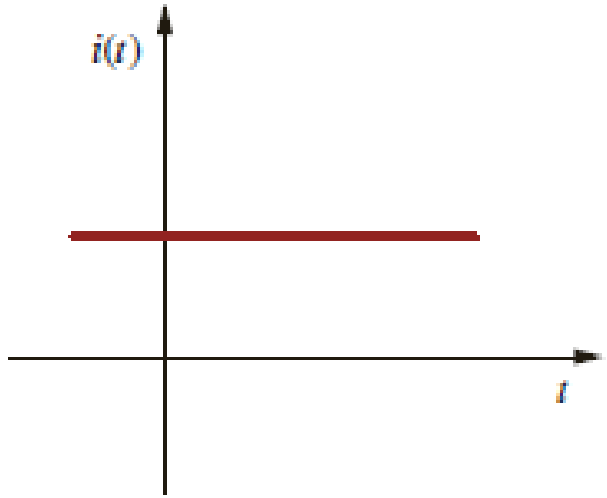
$$i(t) = \frac{dq(t)}{dt}$$ **[A = C/s]**

Alternating Current (AC)



(a)

Direct Current (DC)



(b)

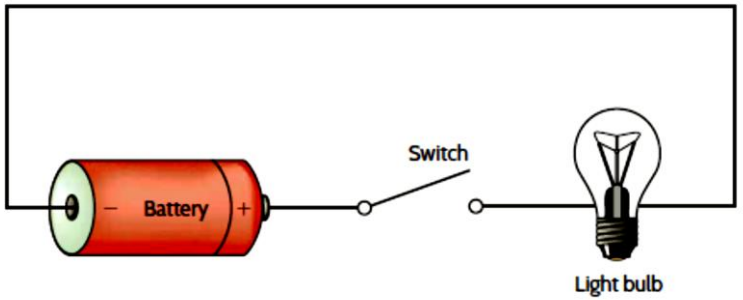
*** Convention**

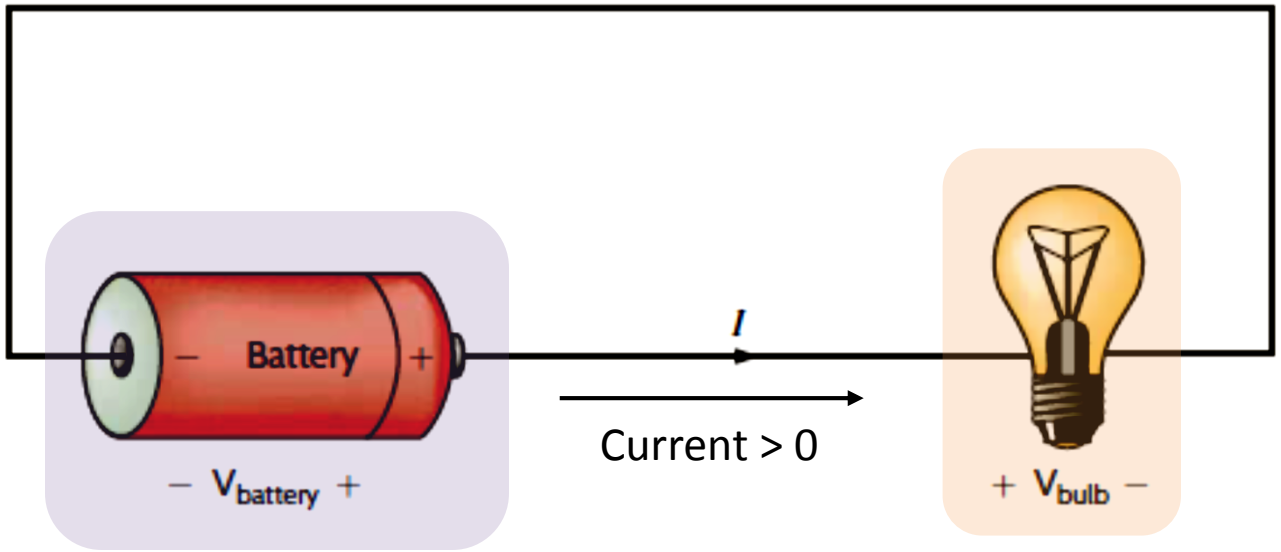
+ current → represents movement of positive charges

Basic Electrical Quantities → Energy

Energy – ***ability to do work***

$\mathbf{w}(t)$ **[J = N·m]**





Energy Supplied ***Energy Absorbed***

*** Convention:**

- **Absorbing Energy: positive current enters the positive terminal**
- **Supplying Energy: positive current enters the negative terminal**

Basic Electrical Quantities → Voltage

Voltage (potential) - $v_{AB}(t) = v_A(t) - v_B(t) = \frac{dw}{dq}$ **[V = J/C]**

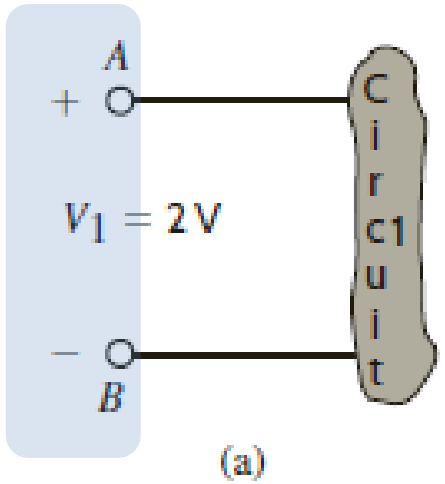
difference in energy level of a unit charge located at each of the two points

---

Voltage Representations

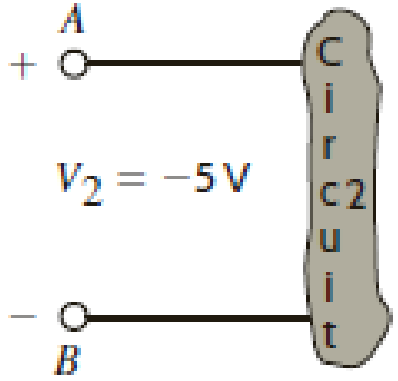
The + and – signs → define a reference

$v_{AB}(t) =$



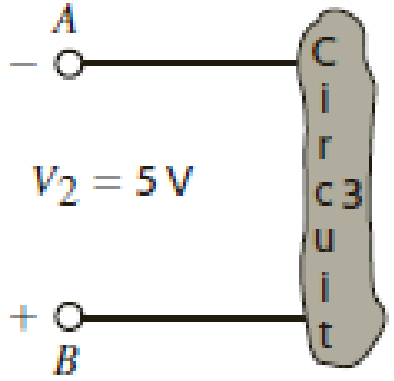
(a)

$v_{AB}(t) =$



(b)

$v_{AB}(t) =$



(c)

Basic Electrical Quantities → Power

Power (potential) –

rate of change of energy

$$p = \frac{dw}{dt} = v \cdot i \quad \text{[W = J/s]}$$

Passive Sign Convention: ***the variable for the voltage v(t) is defined as the voltage across the element with the positive reference at the same terminal that the current variable i(t) is entering***

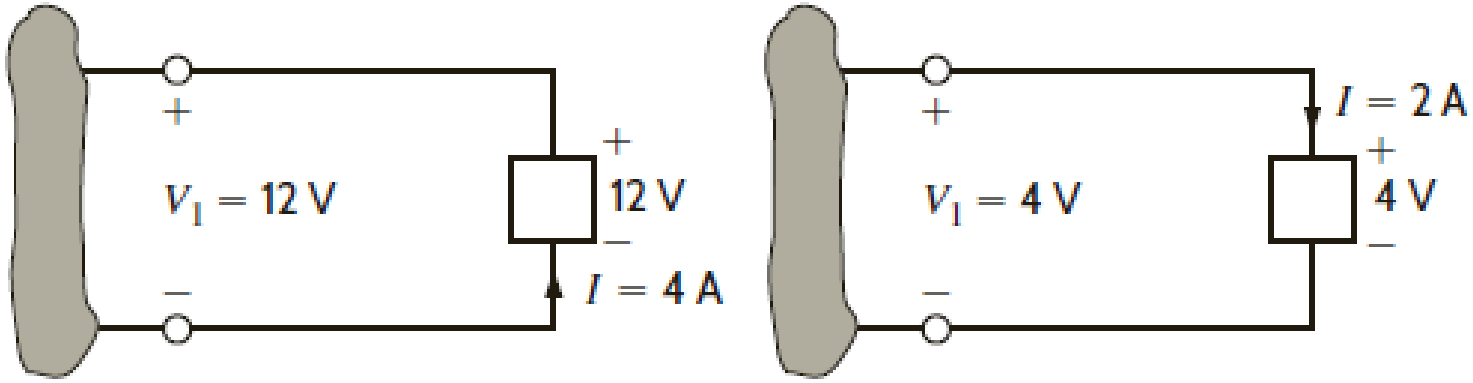
- ***Power positive – power being absorbed***
- ***Power negative – power being supplied***

Tellegen's Theorem: ***the sum of the powers absorbed by all elements in an electrical network is zero!***

$$\sum P_{absorbed} = 0$$

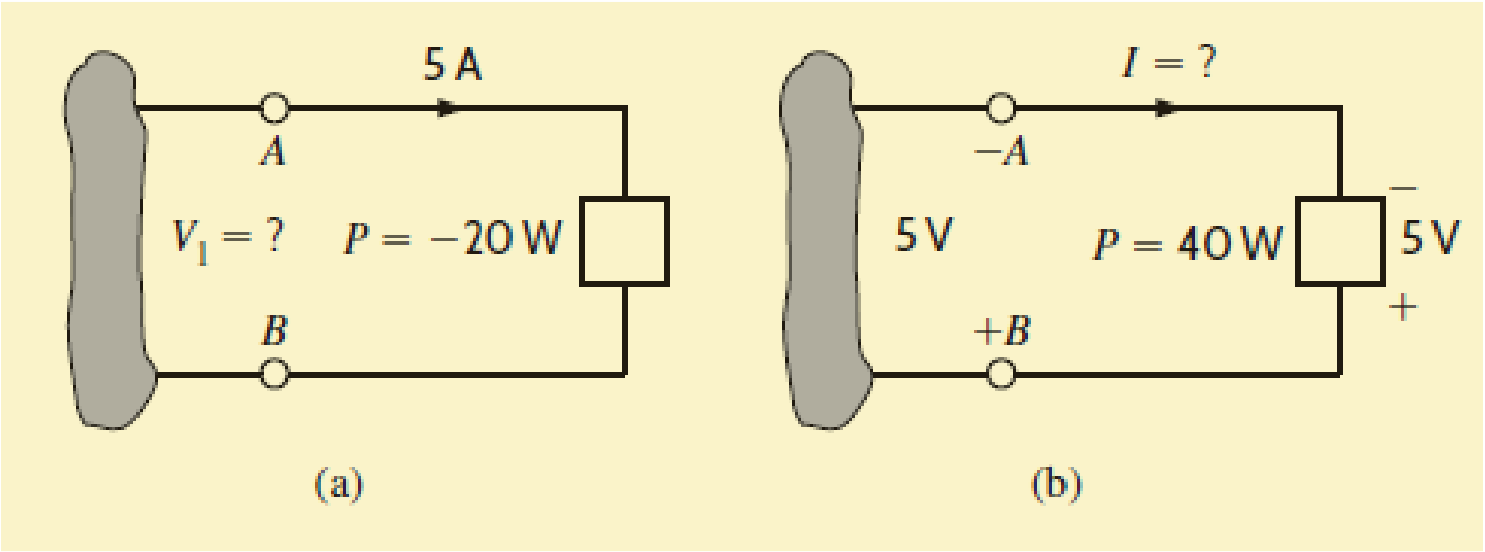
Learning Assessment E1.1

Determine the amount of power absorbed or supplied by the elements.



Example 1.3

Determine the unknown voltage or current.



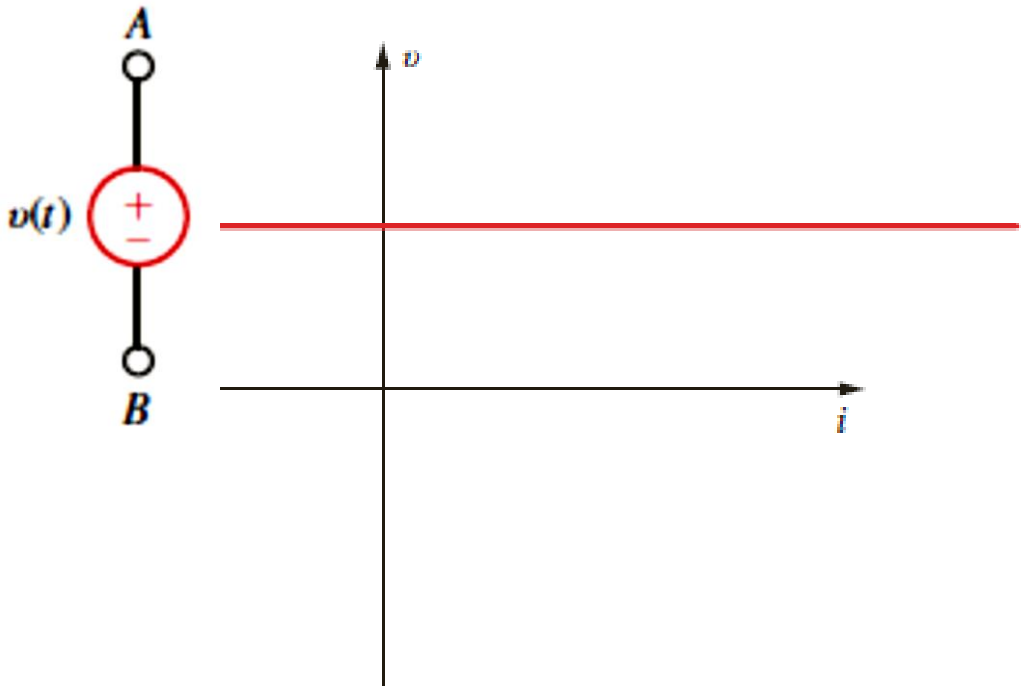
Problem

How much energy (in kW·Hr) does a 100 W electric bulb consume in two hours? Assuming the energy cost is 0.20 $/kW·Hr, how much will it cost to operate the bulb 8 hours per day for one year?

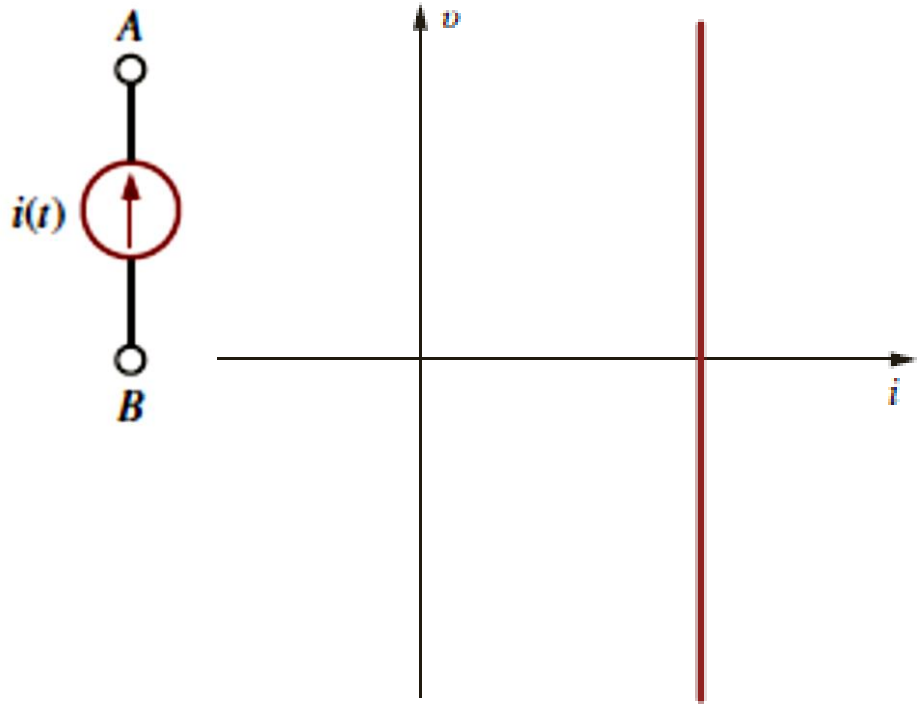
Independent Sources

A two-terminal element that maintains a specified voltage/current between it terminals regardless of the current through it.

- **Voltage Source**

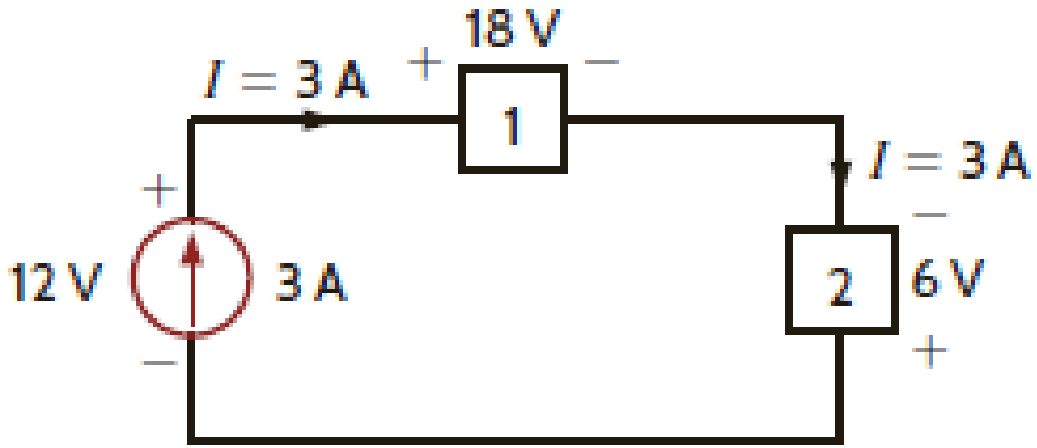


- **Current Source**



Learning Assessment E1.1

Find the power that is absorbed or supplied by the elements.



Problem 1.13

Assuming the power absorbed by the BOX is given by $2 \cdot e^{-2t}$ W, calculate the amount of charge that enters the BOX between 0.1 and 0.4 seconds.