



## Chapter 1

The basic electrical quantities are:

- Electric Charge.
- Electric Current.
- Electric Potential Difference or Voltage.
- Energy and Power.

### Electric Charge (Q or q)

- Charge is the most fundamental quantity of electric circuits.
- There are two types of the electric charges:
  - 1) Negative charge (Electron), which is  $-1.602 \times 10^{-19}$  C
  - 2) Positive charge (Proton), which is  $1.602 \times 10^{-19}$  C

Measuring units: Coulomb (C)

### Electric Current (I or i)

- Electrical current is the time rate of flow of electrical charge through a conductor or circuit element.

$$i = \frac{dq}{dt}$$

- $i$  = current flow (ampere)
- $q$  = charge (coulomb)
- $t$  = time (second)

- The unit is Ampere (A), which is equivalent to coulombs per second (C/Sec).

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## Electric Potential Difference or Voltage ( $v$ )

- The voltage across an element is the work (energy) required to move a unit charge from one point to the other.

$$v = \frac{dw}{dq}$$

- $v$  = voltage (volt)
- $q$  = charge (coulomb)
- $w$  = Energy (joule)

- The unit of voltage is volt (V), which are equivalent to joules per coulomb (J/C).

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## Energy ( $w$ ) and Power ( $p$ ).

- Energy is the capacity to do work, measured in joules ( J).
- Power is defined as the time rate of change of doing work, measured in watt (W).

$$p = \frac{dw}{dt}$$

- $p$  = power (watt)
- $w$  = Energy (joule)

$$p = \frac{dw}{dt} = \frac{dw}{dq} * \frac{dq}{dt} = v * i$$

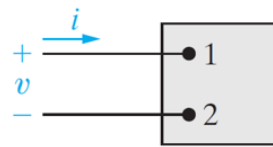
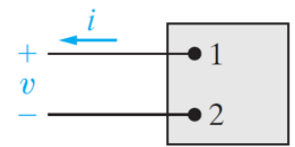
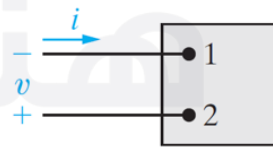
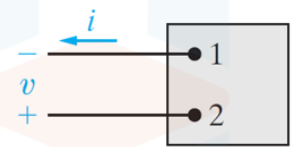
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## Power Balancing.

- For any electric circuit, the power may be supplied (delivered or developed) or dissipated absorbed or consumed).
- The amount that is supplied must be equal to the amount that is absorbed.

$$\sum p_{\text{supplied}} = \sum p_{\text{dissipated}}$$

(a)  $p = vi$ (b)  $p = -vi$ (c)  $p = -vi$ (d)  $p = vi$ 