Jan 7. 02

Element used in Electrical Engineering

1) Passive :- Resistors
Capacitors (condensers)
Inductors (coils)
chokes

2) Active (Electronic components)
1) transistors
2) Diodes
3) Operational Amplifiers
4) Vacuum tubes

Lossy and lossless components

Lossy :- Always dissipate energy (Resistor)

Lossless :- Do not dissipate energy
store energy (capacitor
Inductor)

Time invariant vs. time variant

time invariant :- Physical properties
are constant in time

Resistors

Electrical Symbol

R : Resistance in ohms (Ω)

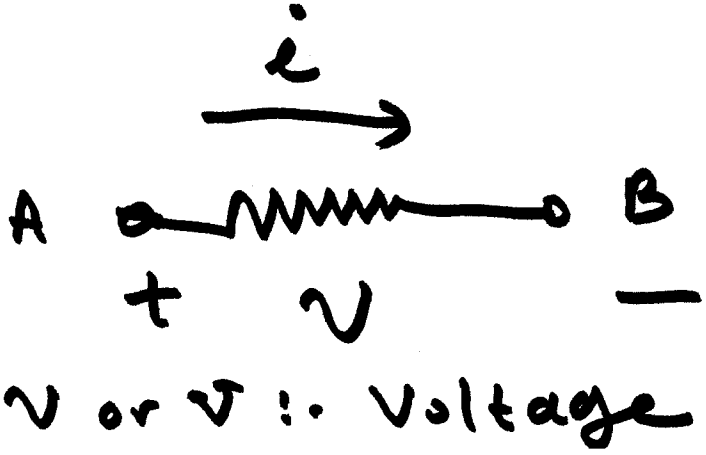
($K\Omega$) 10^3

($M\Omega$) 10^6

($m\Omega$) 10^{-3}

Electric current :. due to moving electrons

I :. Electric current
$\dot{e}$: $\Big\} = \frac{dq}{dt}$



V or v :. Voltage

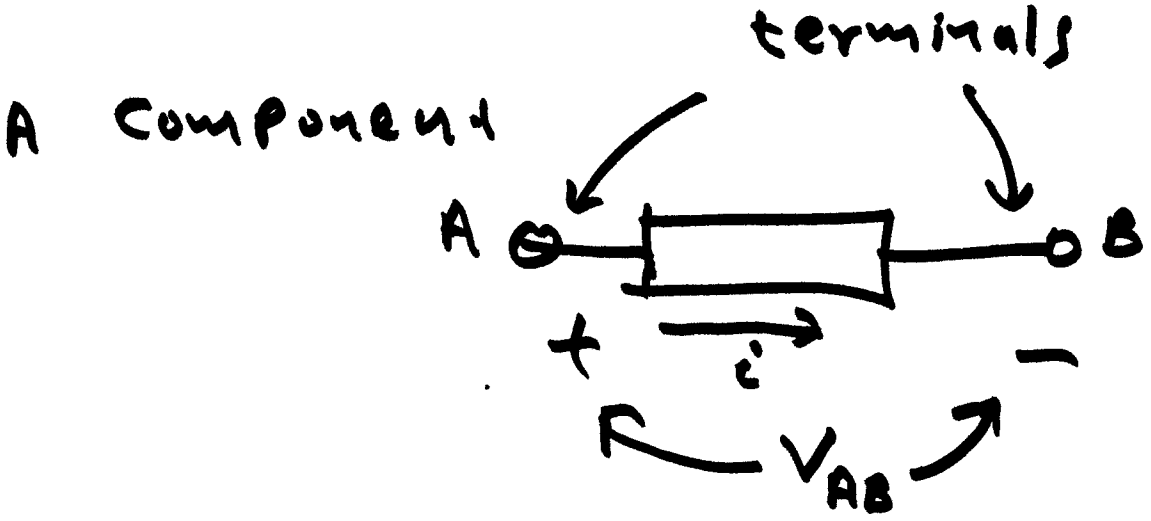
Units:- current:- Amperes (A)

mA 10^{-3} A

μA 10^{-6} A

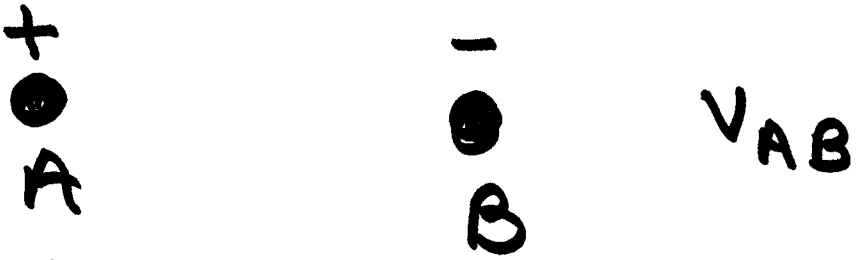
Voltage:- Volts (V) mV (10^{-3})

KV (10^{3}V)



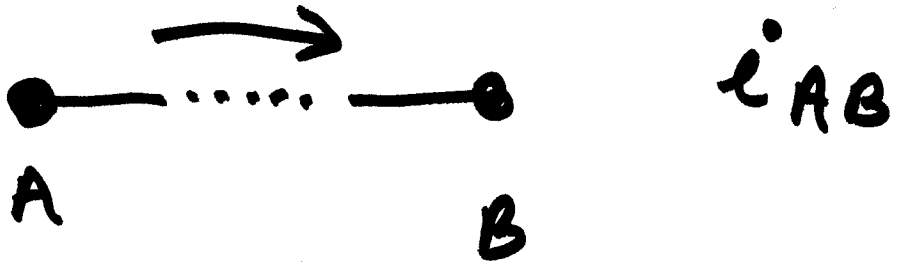
Note:- Voltage (or voltage difference) exists between two points (nodes)

Voltage has a polarity

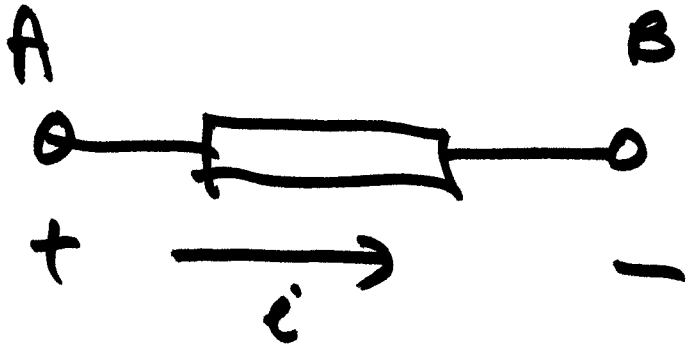


current flows in a branch (path)

current has a direction (of flow)

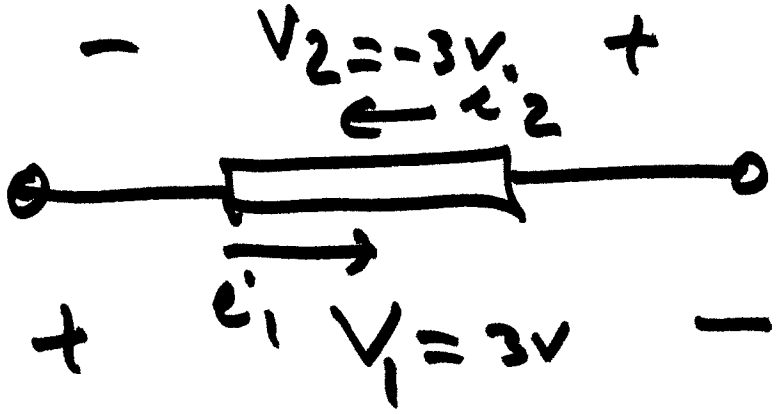


Back to the component



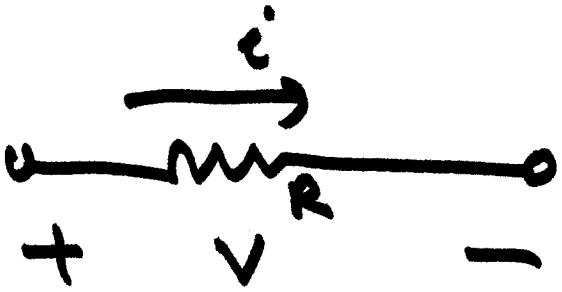
Lossy convention of polarities and directions: current flows from + to − ⇒ energy is dissipated.

since a resistor is a lossy element (component), the current flows from + to −



$$v_1 = -v_2$$
$$i_1 = -i_2$$

Back to Resistor Component



Relationship between V, i.

Ohm had discovered that

$$i \sim V$$

$$\left.\begin{aligned} i &= \frac{V}{R} \\ V &= i \cdot R \end{aligned}\right\} \text{Ohm's Law}$$