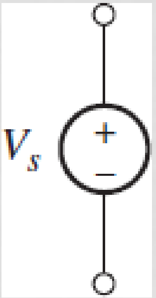
BASIC ELECTRONIC CIRCUITS

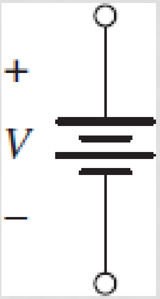
INSTITUTE CORE

INDEPENDENT SOURCES

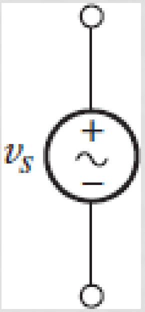
- Voltage source



Dc voltage

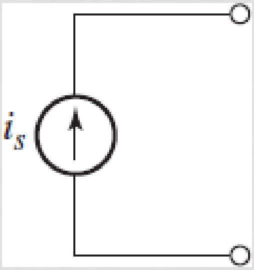


Battery

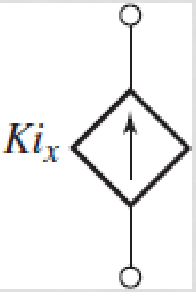


AC voltage

- Current Source

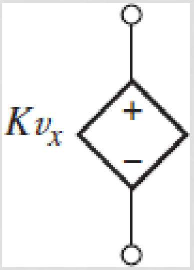


DEPENDENT SOURCES

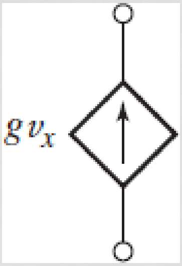


Current controlled current source

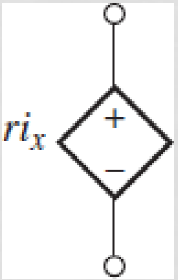
K is a dimensionless scaling factor



Voltage controlled voltage source



Voltage controlled current source

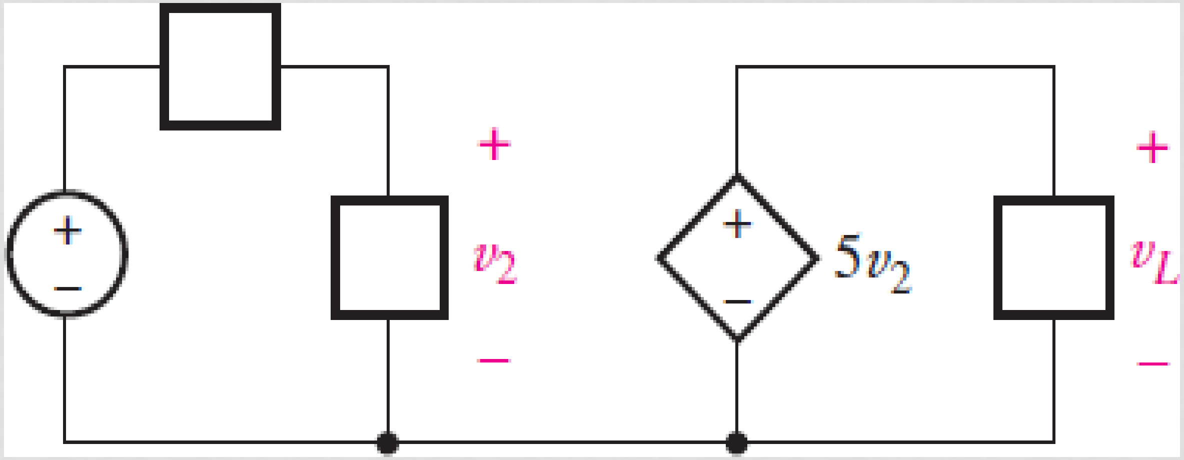


Current controlled voltage source

g, r are the scaling factor with units A/V and V/A respectively.

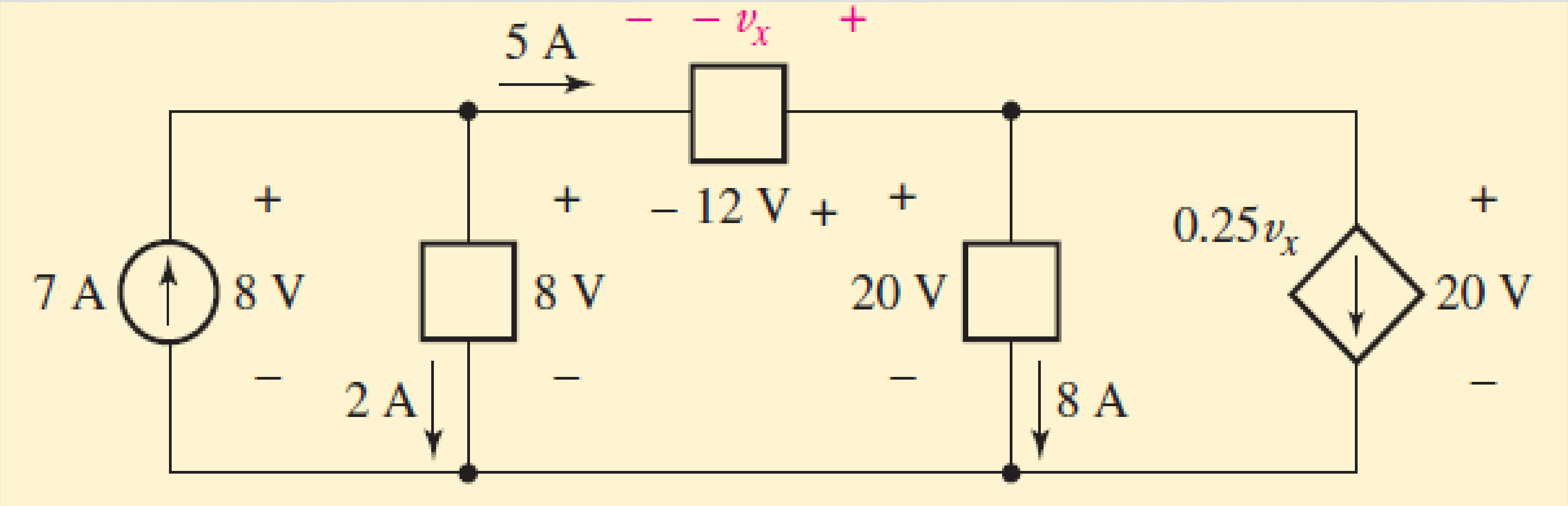
EXAMPLES

- If v_2 = 3 V, determine v_L.



- Ans: V_L = 15 V.

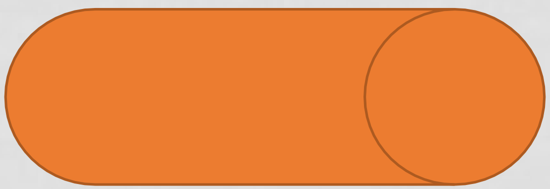
- **Find the power absorbed by each element**



Ans: (left to right) −56 W; 16 W; −60 W; 160 W

OHM'S LAW

- **Statement:** The voltage across "conducting" material is directly proportional to the current flowing through the material



Aluminium bar

Wooden bar

$$V = IR$$

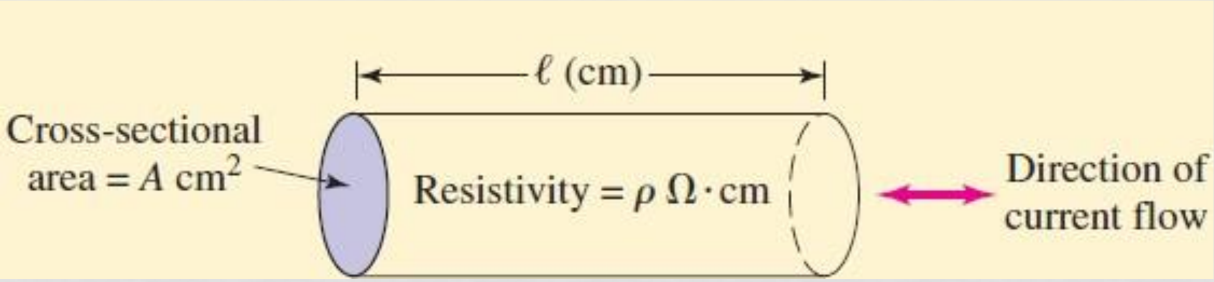
Where : R – constant of proportionality,

Unit : Ohm (Ω)

- Power absorption, $P = VI = I^2R = V^2/R$

RESISTANCE AND RESISTIVITY

- Resistance = Resistivity * length of the bar/Cross-sectional area of the bar



- R = ρl/A
- Conductivity=1/resistivity; σ = 1/ρ

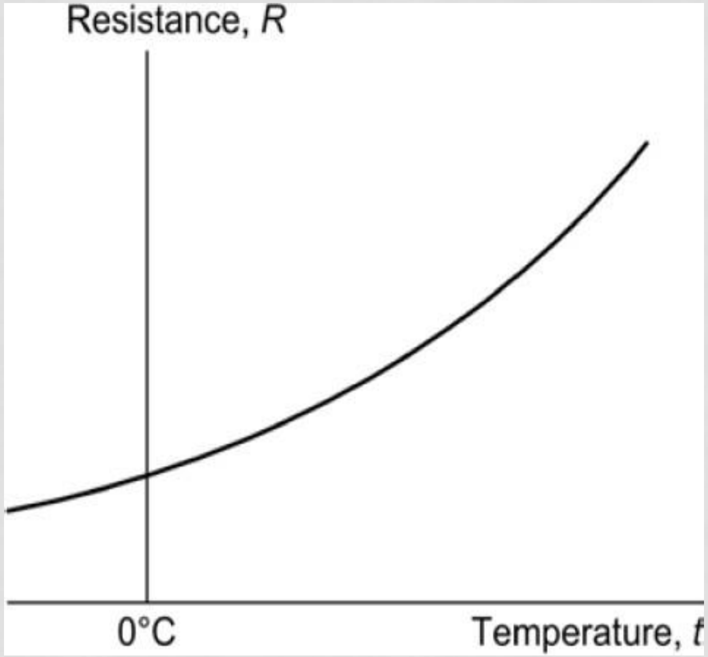
DEPENDENCY ON:

- Temperature: with increase in temp. resistivity increases.

$$R_t = R_0(1 + \alpha\, t)$$

- α is called temperature coefficient (/°C)

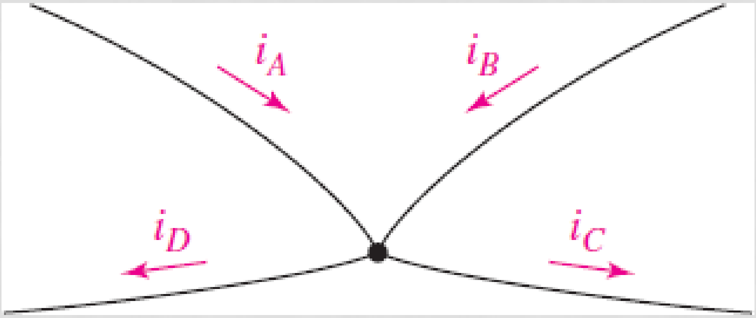
- Ex: A resistor has a temperature coefficient of 0.001 /°C. if the resistor has a resistance of 1.5 KΩ at 0°C, determine the resistance at 80°C?



KIRCHHOFF'S LAWS: KCL

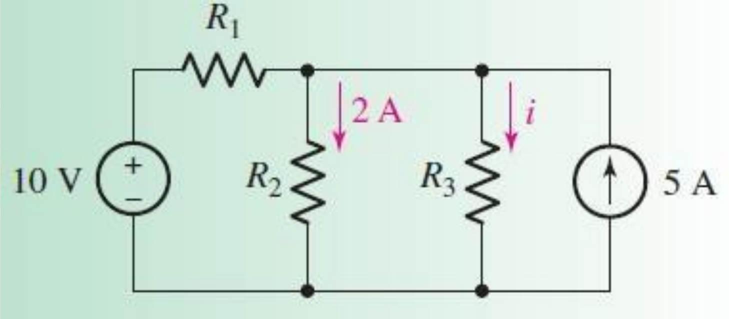
- Algebraic sum of currents entering the node is zero.

$$\sum_{n=1}^{N} i_n = 0$$

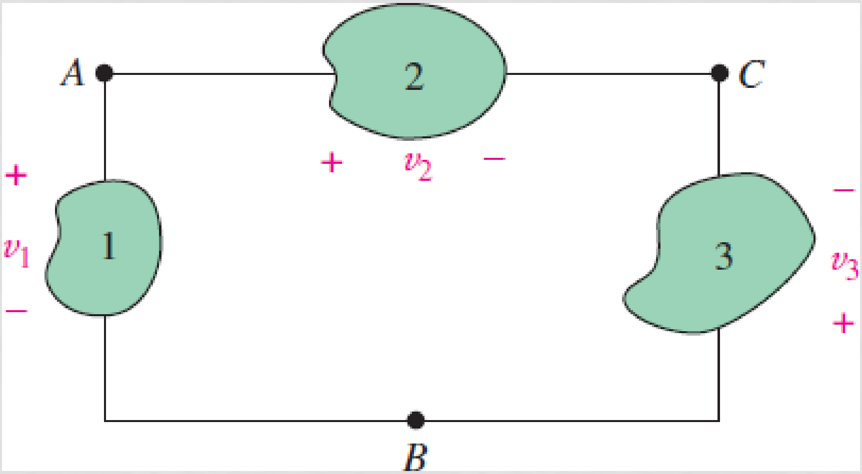


$$i_A + i_B + (-i_C) + (-i_D) = 0$$

- Ex 1: if the voltage source produces a current 3A, determine i?



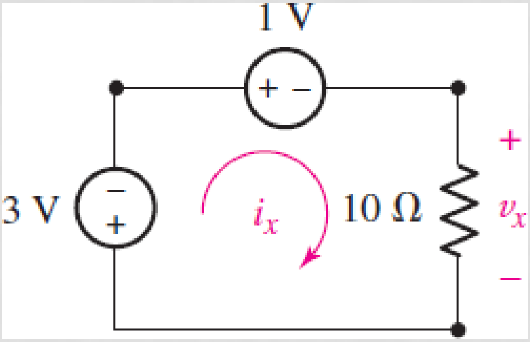
KVL



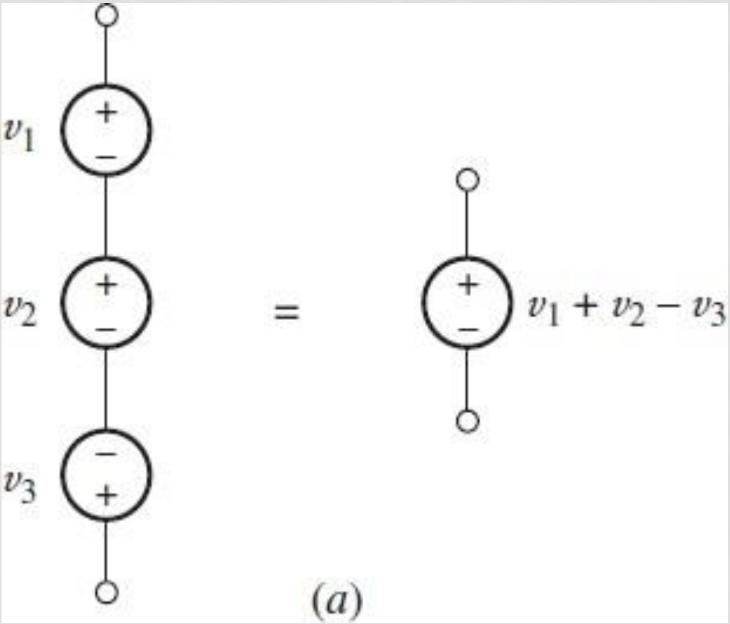
- The algebraic sum of voltages around any closed path is zero.

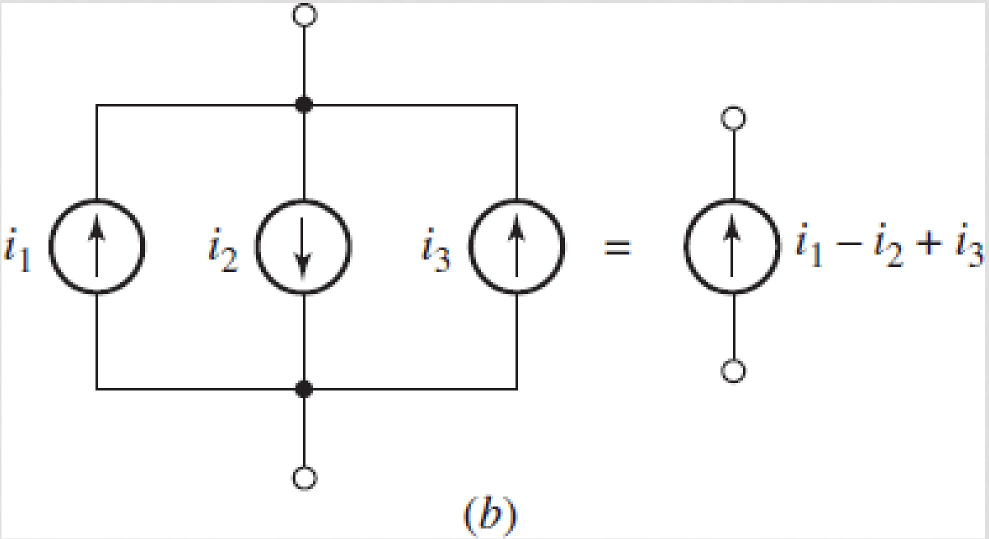
$$\sum_{n=1}^{N} v_n = 0 \qquad -v_1 + v_2 - v_3 = 0$$

- Ex 2: Determine v_x and i_x
- Ans: v_x = -4 V and i_x = -400 mV.

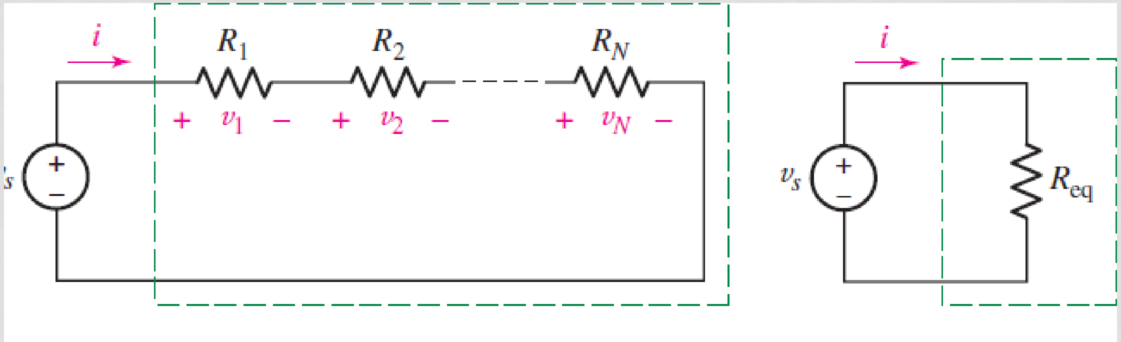


SERIES AND PARALLEL CONNECTED SOURCES





RESISTORS IN SERIES



(a) (b)

$$v_s = R_1 i + R_2 i + \cdots + R_N i = (R_1 + R_2 + \cdots + R_N)i$$

$$v_s = R_{eq} i$$

$$\boxed{R_{eq} = R_1 + R_2 + \cdots + R_N}$$

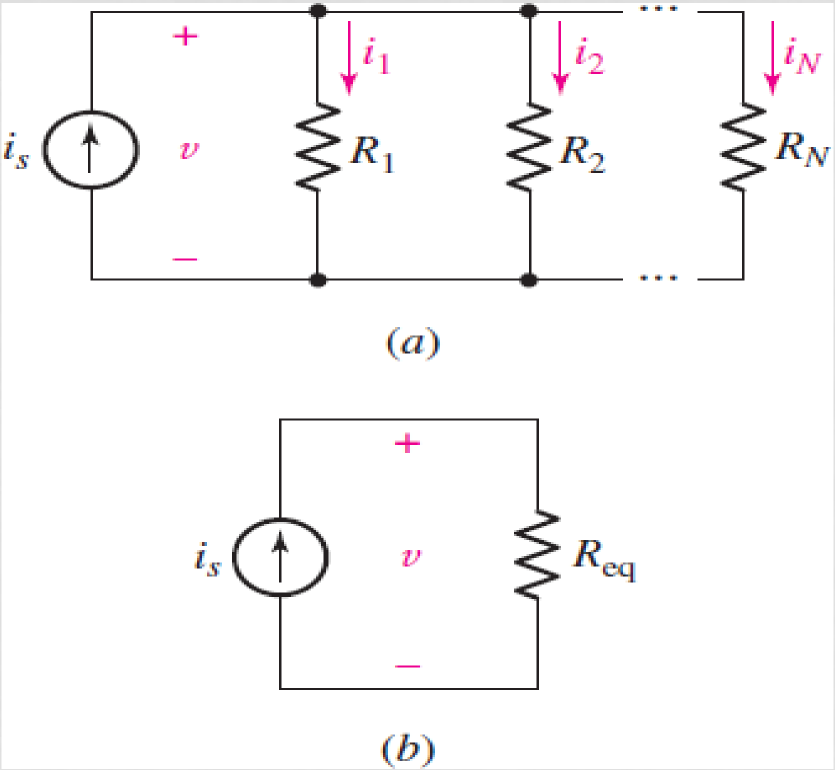
RESISTORS IN PARALLEL

$$i_s = i_1 + i_2 + \cdots + i_N$$

$$i_s = \frac{v}{R_1} + \frac{v}{R_2} + \cdots + \frac{v}{R_N}$$

$$= \frac{v}{R_{eq}}$$

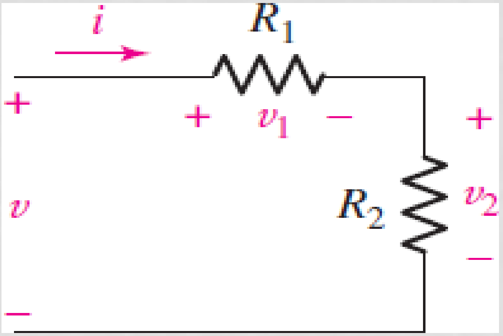
$$\boxed{\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_N}}$$



VOLTAGE DIVISION

$$v = v_1 + v_2 = iR_1 + iR_2 = i(R_1 + R_2)$$

$$i = \frac{v}{R_1 + R_2}$$

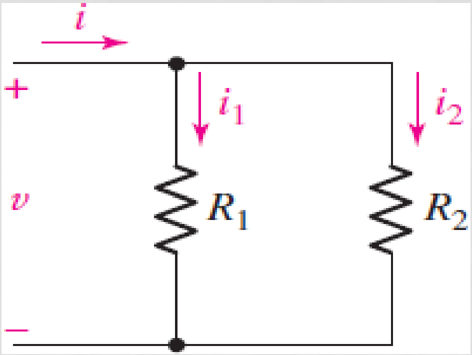


$$v_1 = \frac{R_1}{R_1 + R_2} v \qquad v_2 = \frac{R_2}{R_1 + R_2} v$$

$$\boxed{v_k = \frac{R_k}{R_1 + R_2 + \cdots + R_N} v}$$

Current division

$$i_2 = \frac{v}{R_2} = \frac{i(R_1 \| R_2)}{R_2} = \frac{i}{R_2} \frac{R_1 R_2}{R_1 + R_2}$$



$$\boxed{i_2 = i \frac{R_1}{R_1 + R_2}} \qquad \boxed{i_1 = i \frac{R_2}{R_1 + R_2}} \qquad \boxed{i_k = i \frac{\dfrac{1}{R_k}}{\dfrac{1}{R_1} + \dfrac{1}{R_2} + \cdots + \dfrac{1}{R_N}}}$$

THANK YOU