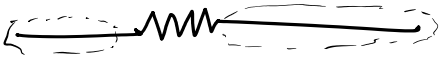
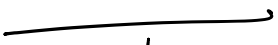
Lecture 4

Monday, February 14, 2022 9:40 AM

Circuit Symbols





Wire

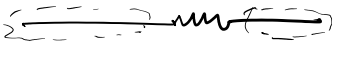
$R = 0$

$G = \frac{1}{R}$

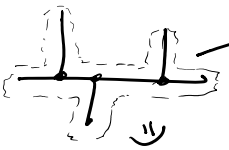
$= \frac{1}{0} = \infty$

$\Delta V = 0\ V$

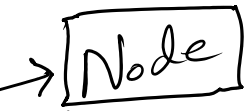
Continious Piece of Wire → Node



Discontinious



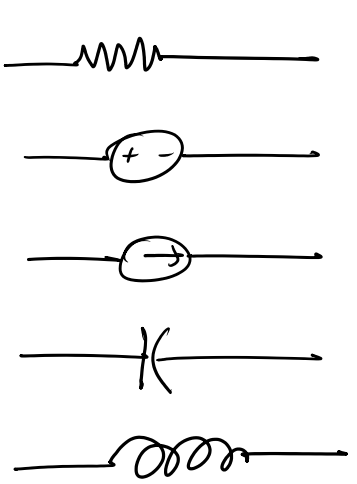
Continious



Rules

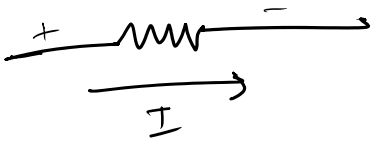
1. 1 Node ⟶ 1 voltage
2. 1 circuit component ⟶ 1 current flow.

Circuit component

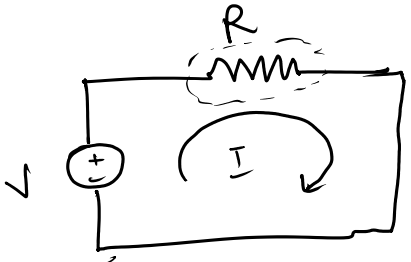


2 terminal

3 terminal

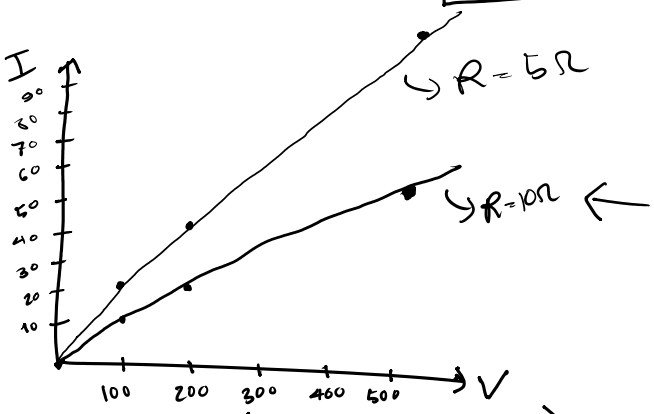


I-V Characteristics → Important Property of Circuit elements

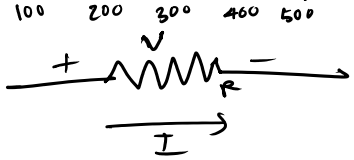


$V = IR$
$\Rightarrow I = \frac{V}{R}$

$V = 0 \Rightarrow I = 0$ A



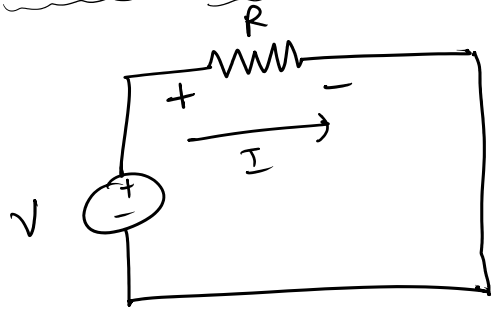
R	V	I
10 Ω	100 V	10 A
10 Ω	200 V	20 A
10 Ω	500 V	50 A
5 Ω	100 V	20 A
5 Ω	200 V	40 A
5 Ω	500 V	100 A

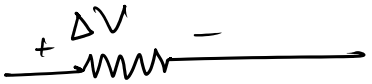


→ I-V Characteristics of Resistance

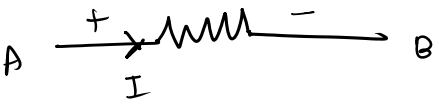
Bottom line
- I changes proportionately with V
- Slope increases with decreasing R

Passive Sign Convention



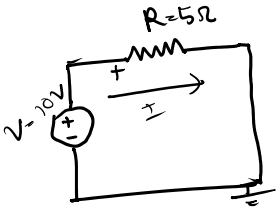


$\Delta V = V_+ - V_-$ → Always Voltage (positive terminal) − Voltage (negative terminal)

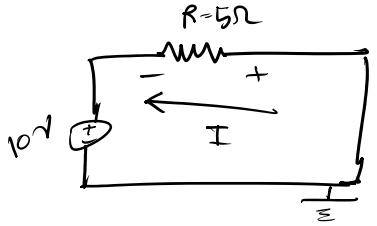


$I_{(+ \longrightarrow -)}$

H.W → Passive sign convention in Power

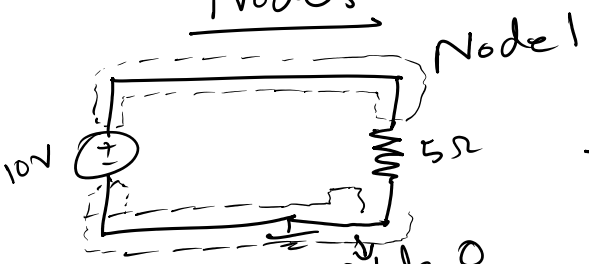


$\Delta V = V_+ - V_-$
$= 10 - 0$
$= 10\ V$
$I = \frac{\Delta V}{R} = \frac{10}{5}$
$= 2\ A$

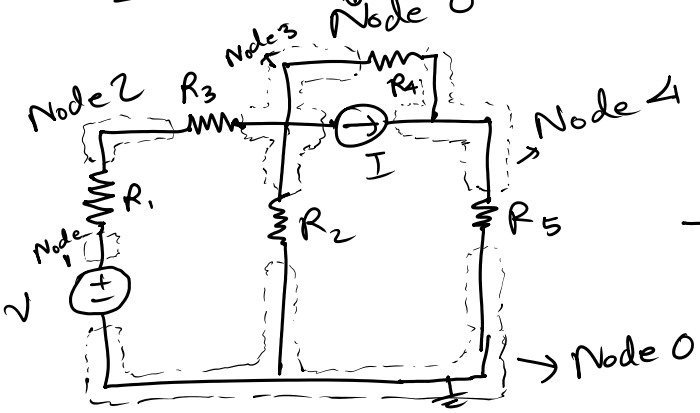


$\Delta V = V_+ - V_-$
$= 0 - 10$
$= -10\ V$
$I = \frac{\Delta V}{R} = \frac{-10}{5}$
$= -2\ A$

Nodes →



→ 2 nodes



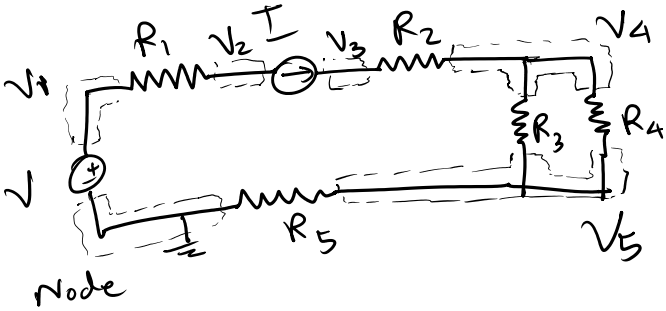
→ 5 nodes

↓

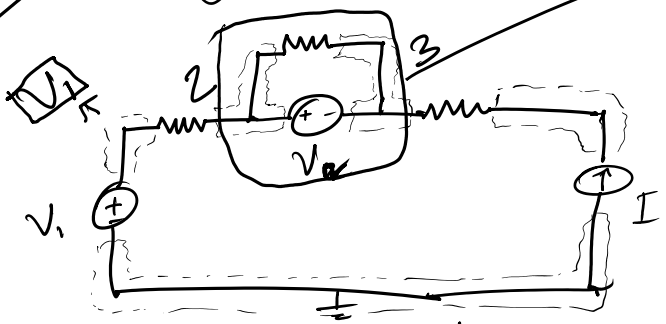
5 voltages

V_0 Ground = 0 V

V_1, V_2, V_3, V_4 → To be calculated



→ 6 Nodes



→ 3 supernode
2 & 3

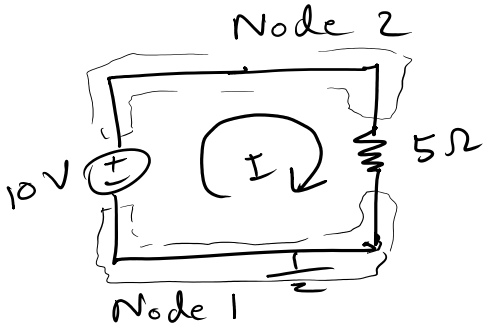
$V_o = 0\,V$

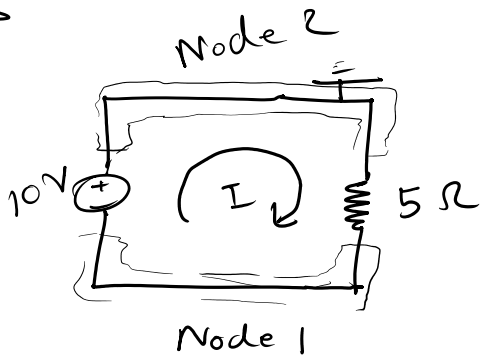
A Voltage Source that is not connected to ground directly

→ The two nodes that it's connected with

Supernodes

Ground





V_1 , V_2

N_1 N_2

$V_2 - V_1 = 10\,V$ — (i)

$V_1 = 0\,V$

$V_2 = 10\,V$

$I = \frac{V_2 - V_1}{R}$

$= \frac{10\,V}{5\,\Omega}$

$= 2A$

$V_2 - V_1 = 10\,V$ — (i)

$V_2 = 0\,V$

$-V_1 = 10\,V$

$\Rightarrow V_1 = -10\,V$

$I = \frac{V_2 - V_1}{R}$

$= \frac{10\,V}{5\,\Omega}$

$= 2A$

∴ We work with differences of voltages, not absolute values.

So, we need a reference

Ground