Almustaqbal University
Engineering And Technical Engineering
Computer Techniques Engineering Department
Electrical Engineering Fundamentals
Class :- 1st

Lectuer 2

Apply Kirchhoff's law to measure current & voltage

By

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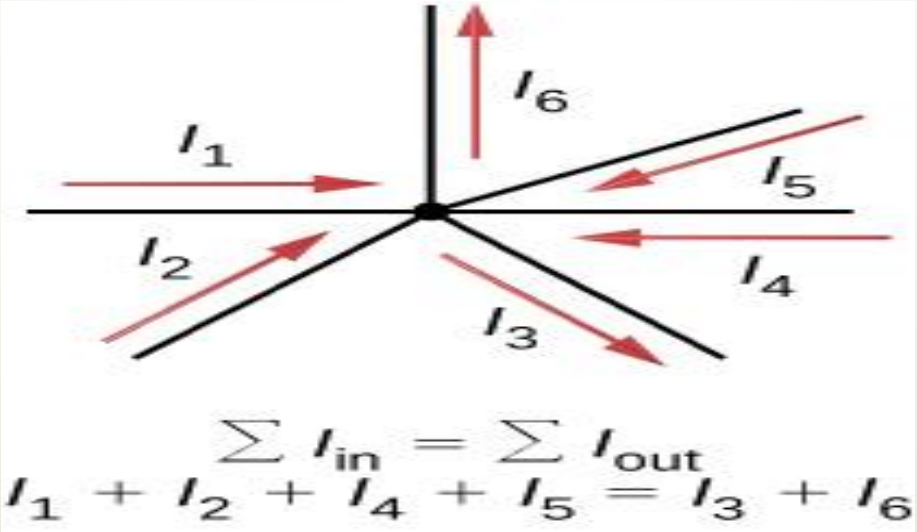
Experiment No. 2 "Apply Kirchhoff's law to measure current & voltage"

Kirchhoff's Current Law (KCL)

The sum of currents entering a junction (node) equals the sum of currents leaving the junction.

$$\sum I_{in} = \sum I_{out}$$

Charge is conserved; no accumulation at a node.



$$\sum I_{in} = \sum I_{out}$$

$$I_1 + I_2 + I_4 + I_5 = I_3 + I_6$$

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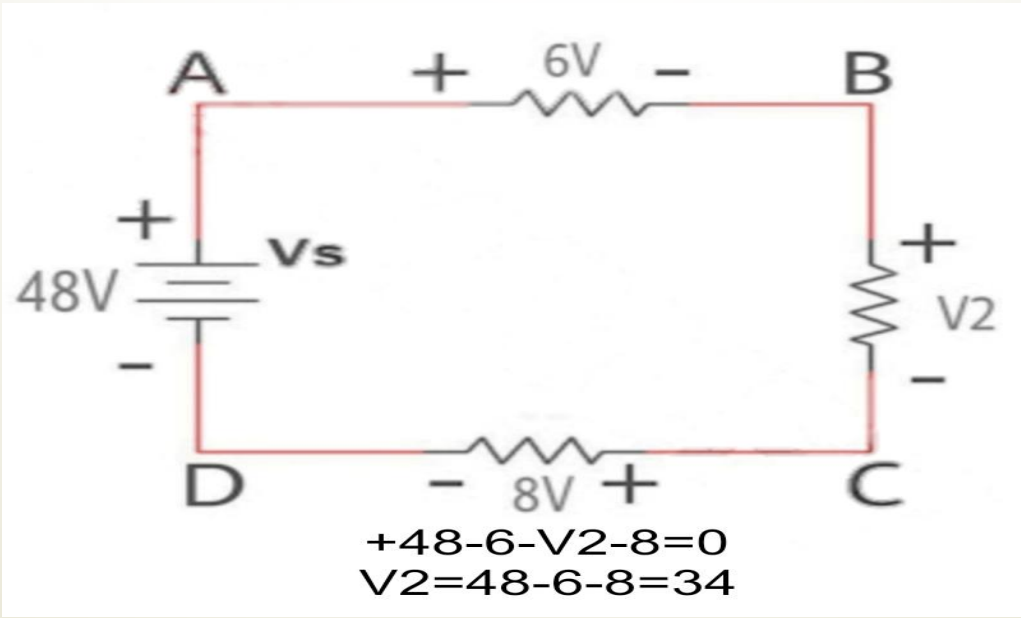
Kirchhoff's Voltage Law (KVL)

The sum of all voltage drops around any closed loop in a circuit is zero.

$$\sum V = 0$$

Energy is conserved in a closed loop.



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Why Use Kirchhoff’s Laws?

- Solve for unknown currents/voltages in circuits with multiple sources and components.
- Analyze both series and parallel configurations.
- Foundation for advanced circuit analysis (e.g., mesh and nodal analysis).
- Applicable to DC and AC circuits.

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Step-by-Step Procedure

1. Identify Nodes and Loops: Label all nodes and select independent loops.
2. Assign Current Directions: Assume directions for branch currents (correct if negative).
3. Apply KCL: Write equations for currents at each essential node.
4. Apply KVL: Write equations for voltage drops around each loop.
5. Solve the System: Use algebra or matrix methods to find unknown values.

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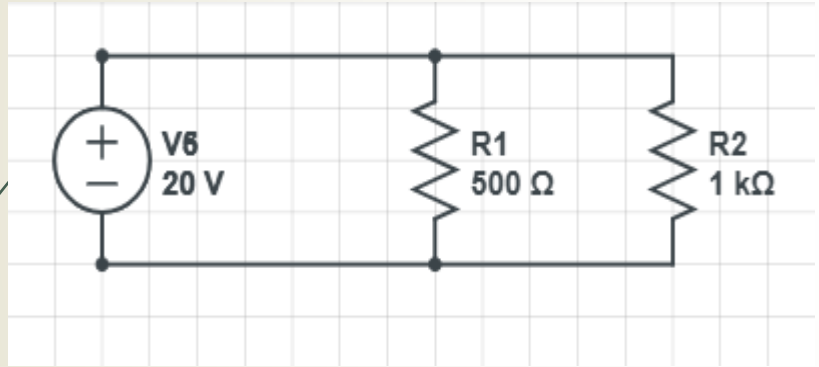
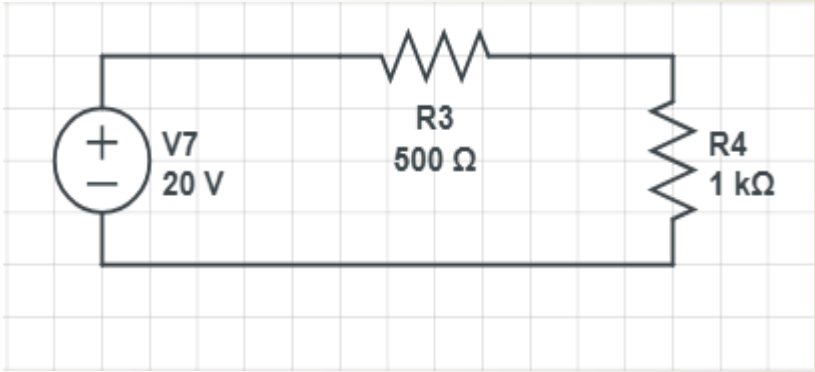
Example Circuit



Prove KCL



Prove KVL

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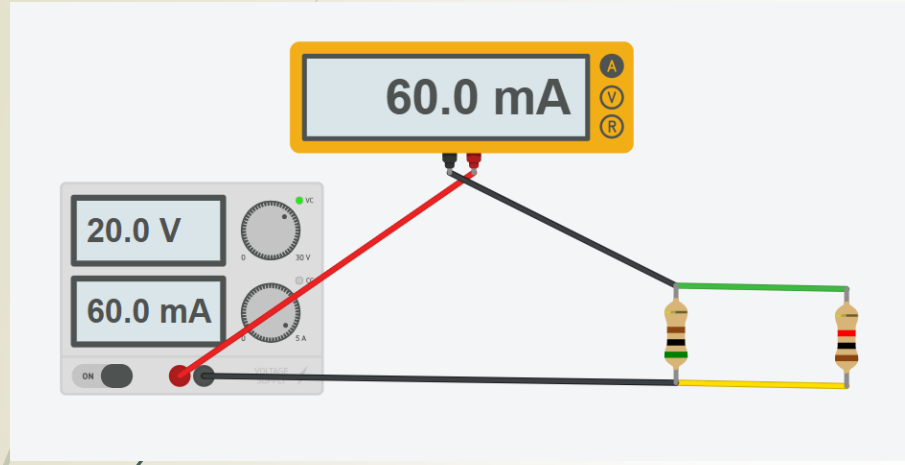
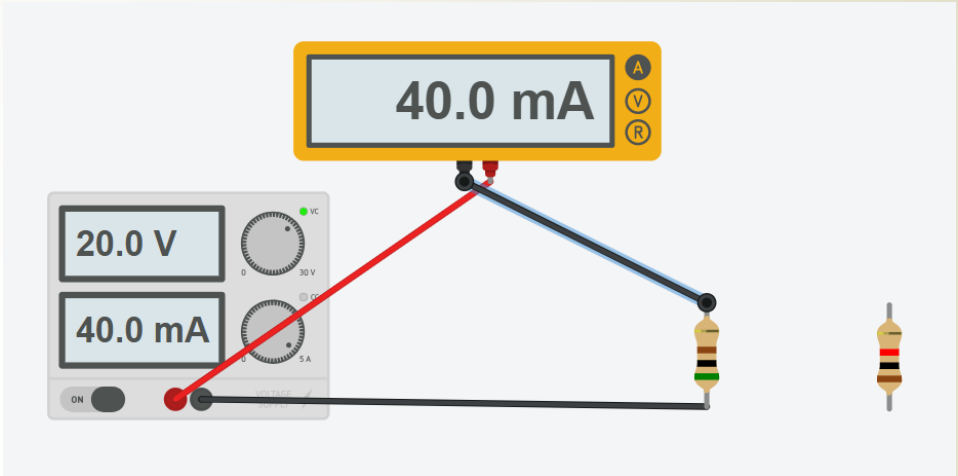
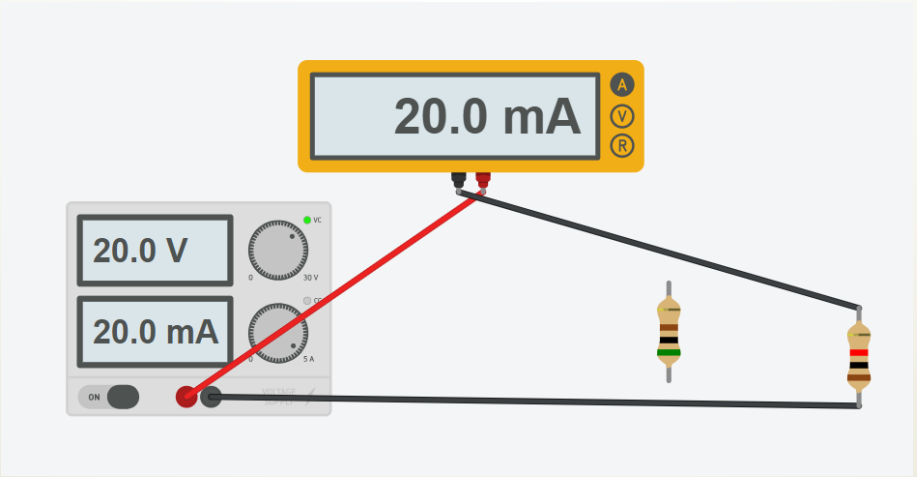


I total

The prove of KCL



I R1



I R2

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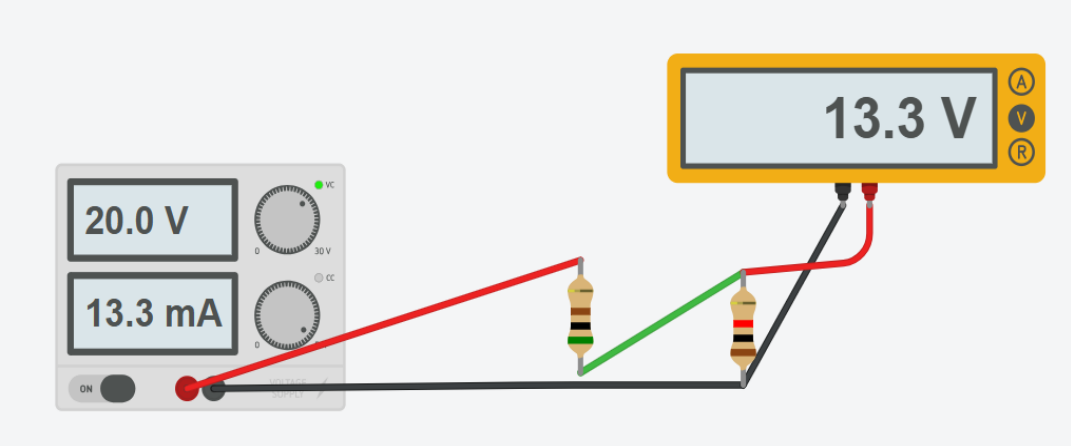
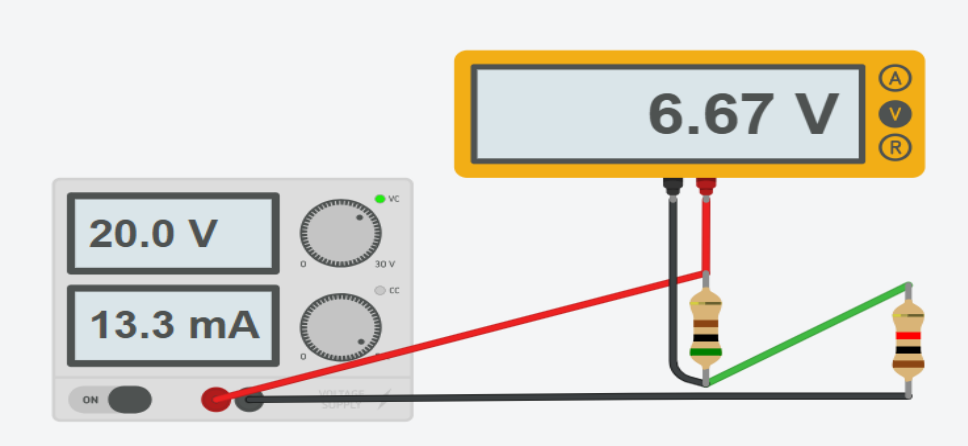


The prove Of KVL



V total = 20V
VR1= 6.7V
VR2= 13.3V

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Law	Key Idea	Real-World Uses
KCL	Sum of currents entering a node = sum leaving	Power grids, PCB design, EV battery management, signal processing
KVL	Sum of voltages around a loop = 0	Voltage regulation, circuit analysis, amplifier feedback, renewable energy systems