Basic Electrical Technology

Thevenin's Theorem

Definition

- Any **linear, bilateral** network may be replaced by a single voltage source (called Thevenin's equivalent voltage, $\mathbf{V_{Th}}$) in series with one resistance (called Thevenin's equivalent resistance, $\mathbf{R_{Th}}$) across the load terminals.

- Thevenin's equivalent voltage, $\mathbf{V_{Th}}$, is the open circuit voltage at the load terminals.

- Thevenin's equivalent resistance, $\mathbf{R_{Th}}$, is the equivalent resistance at the load terminals, after replacing the sources by their internal resistances.

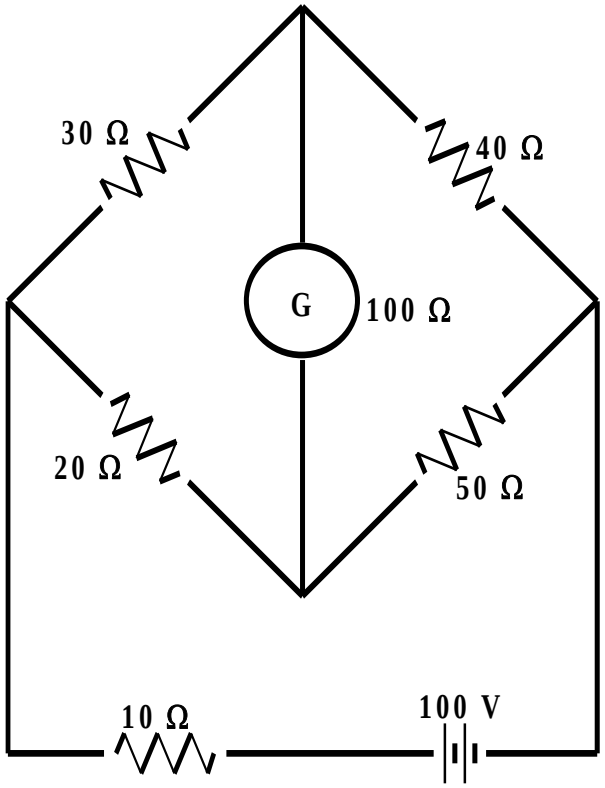
Procedure

- **To find V_{Th} :**
  - Remove the load and keep the terminals open circuited.
  - Apply mesh current / node voltage method
  - Find the voltage across the open circuited terminals.

- **To find R_{Th} :**
  - Keep the load terminals open.
  - Replace all the sources by their internal resistances.
  - Find the equivalent resistance with respect to open circuited load terminals.

Illustration 1

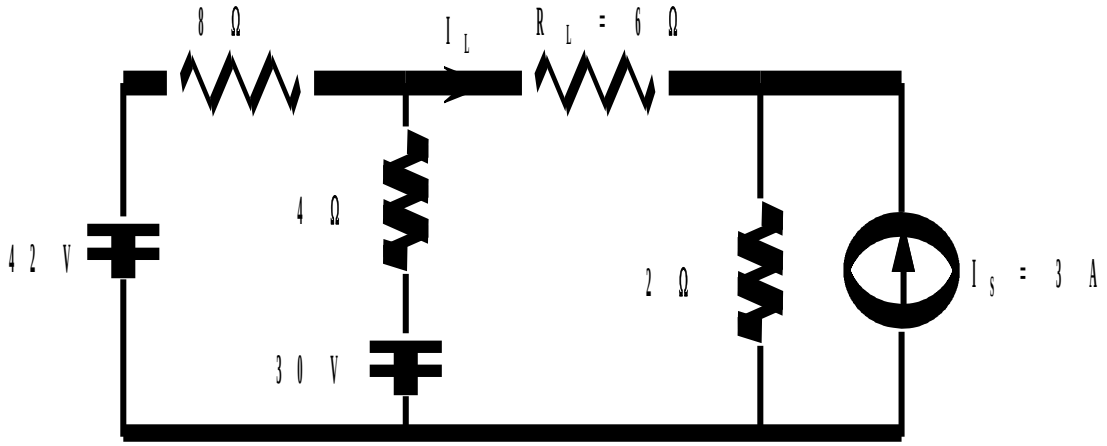
Determine the current through the galvanometer using Thevenin's Theorem



Answer : 84 mA

Illustration 2

For the circuit shown find the current I_L through 6 Ω resistor using Thevenin's theorem



Ans: I_L = 2.625 A

Illustration 3

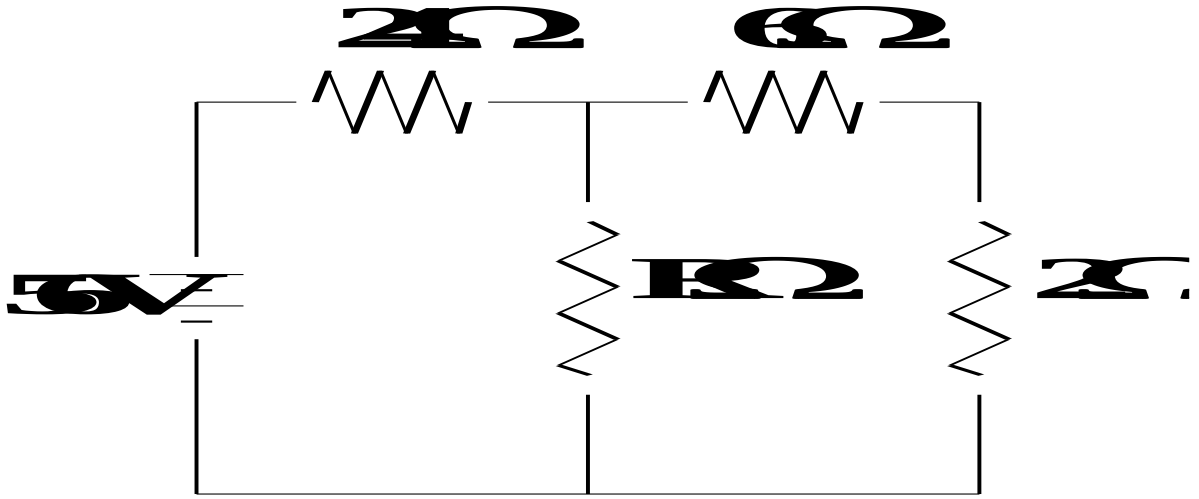
The box shown in the adjacent figure consists of independent dc sources and resistances. Measurements are taken by connecting an ammeter in series with the resistor R_L and the results are shown in the table below. Find the value of R_L for which the current is 0.6 A

R_L	I
10 Ω	2.0 A
20 Ω	1.5 A
?	0.6 A

Ans: R_L = 80 Ω

Homework 1

Using Thevenin's theorem, find the value of **R** such that the current through 2 Ω resistor is 1 A



Ans: 8 Ω