

## Experiment No.8

### Norton's Theorems

#### Object

To prove Norton's theorem practically.

#### Theory

Norton's theorem states the following: "Any two terminal linear D.C network can be replaced by any equivalent circuit consisting of a constant current source ( $I_N$ ) and a parallel resistance ( $R_N$ ), as shown in Fig.1(a).

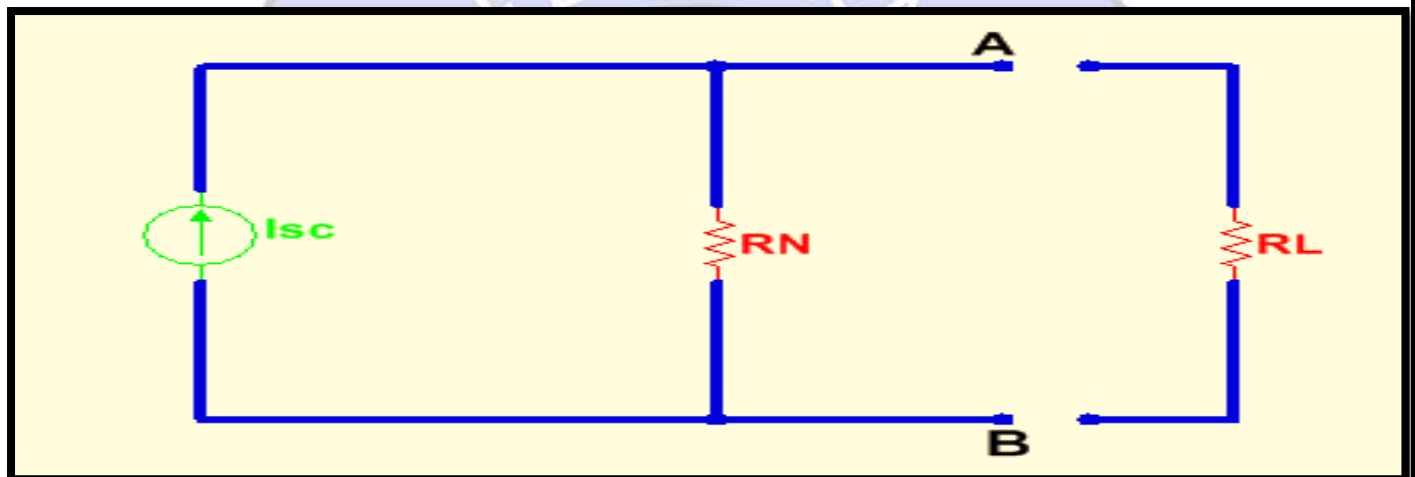


Fig.1(a) Equivalent circuit according to Norton theorem

The constant current is equal to the current which would flow in a short circuit placed across the terminals A and B as shown in Fig.1(b), and is called ( $I_{SC} = I_N$ ).

Where:

$I_{SC}$ : is the short circuit current.

$I_N$ : is the Norton current.

The parallel resistance is the resistance of the network when viewed from A-B open terminals after all voltage and current has been removed and replaced by short or open circuits respectively, as shown in Fig.2

Then according to Fig.2, the current through  $R_L$  (when  $R_L$  is connected to Norton equivalent circuit) will be:

$$I_L = I_N * R_N / (R_N + R_L)$$

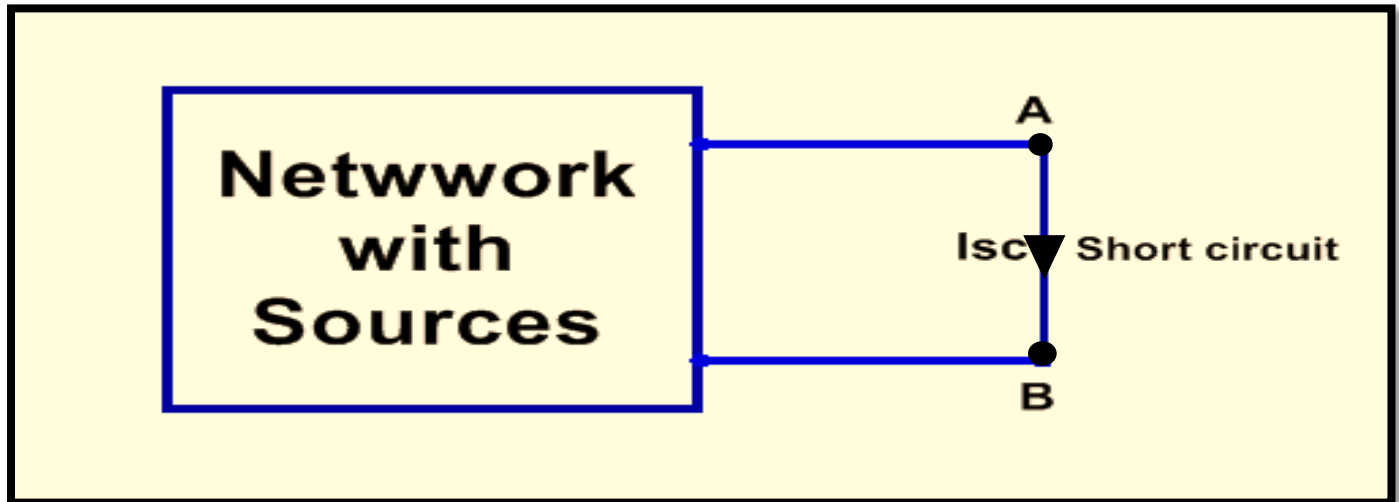


Fig.1(b) Calculating the constant current source  $I_{SC} = I_N$

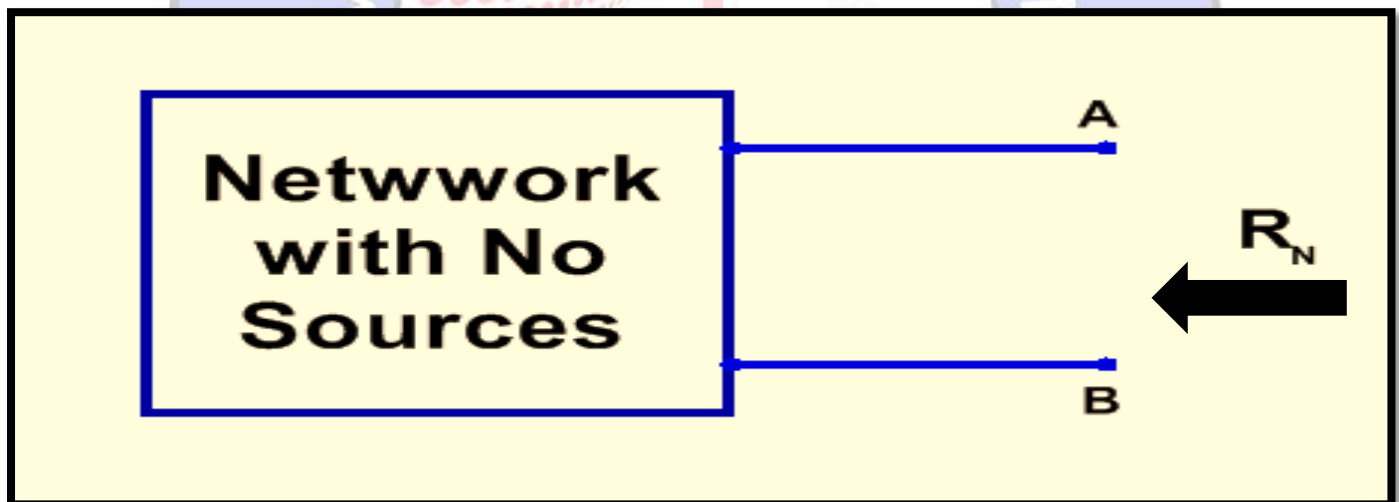


Fig.1(c) Calculating the equivalent parallel resistance  $R_N$

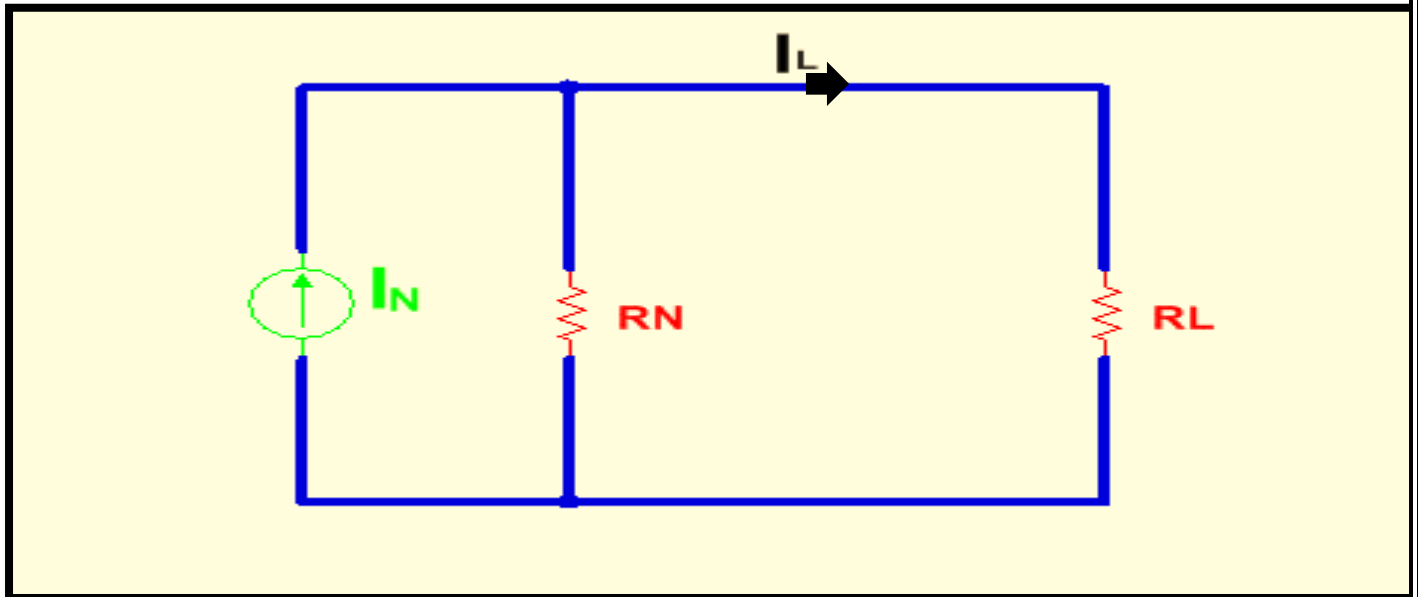


Fig.2 The equivalent Norton circuit with  $R_L$

### Apparatus

1. Power supply
2. AVO meter
3. Four resistors

### Procedure

1. Connect the circuit as shown in Fig.3

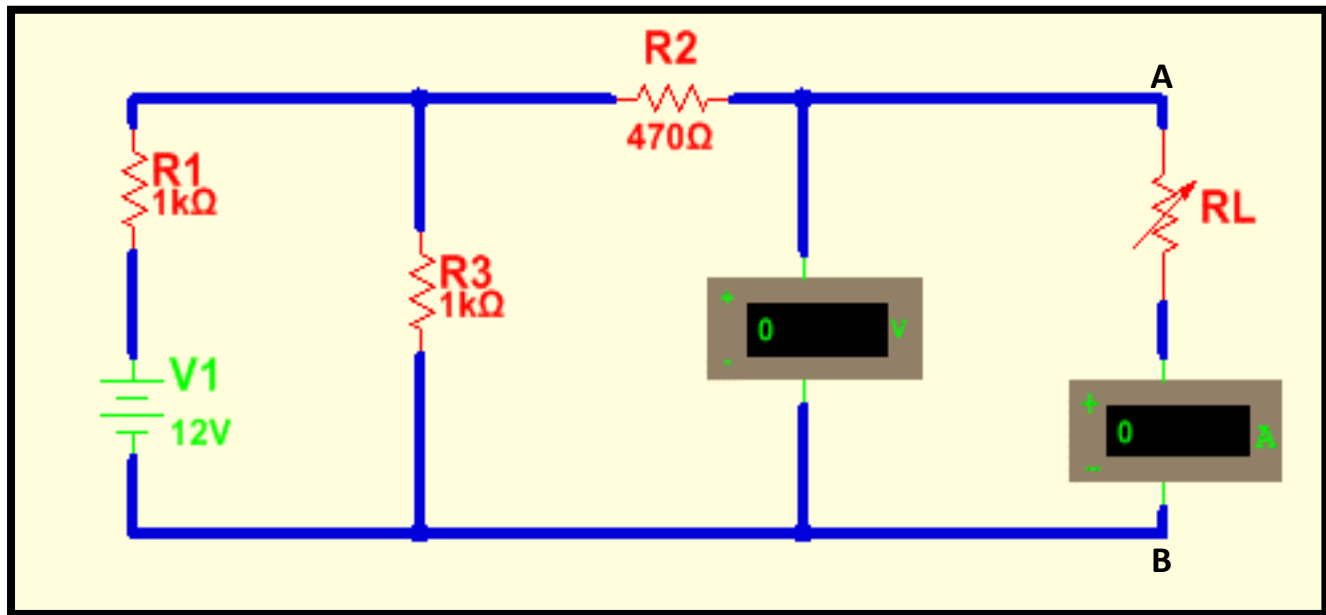


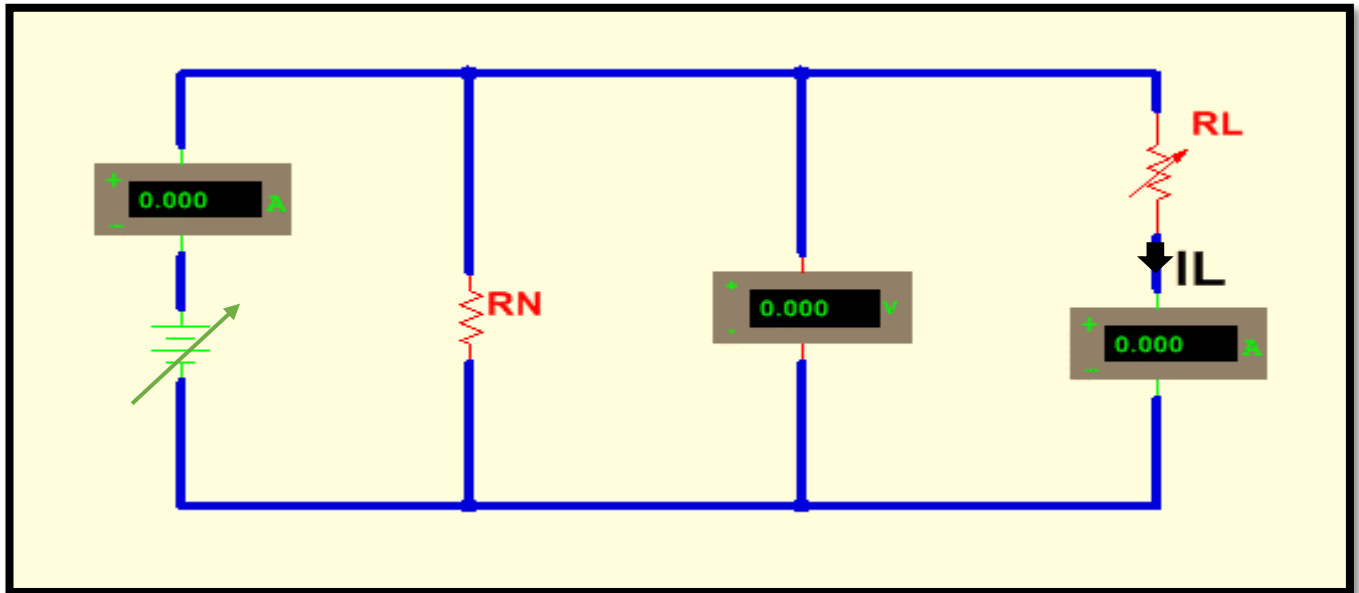
Fig.3

2. Vary  $R_L$  resistance as shown in Table (1), measured  $I_L$  and  $V_L$  in each step, Record your results in the second and third column of Table (1).

$R_L$ $\Omega$	Fig.3		Fig.4	
	$I_L$ (mA)	$V_L$ (Volt)	$I_L$ (mA)	$V_L$ (Volt)
400				
500				
600				
700				
800				

Table.1 Practical Result

3. Disconnect  $R_L$ , then measure the short circuit current ( $I_{SC}$ ) between A and B terminals.
4. Calculate  $R_N$  theoretically and connect Norton equivalent circuit as shown in Fig.4. Make sure that the constant current source is remains constant in each step of varying  $R_L$ , by means of varying the D.C power supply.



5. Repeat step (2) and record your results in the fourth and fifth column of Table (1).

$R_L$ $\Omega$	Fig.3		Fig.4	
	$I_L$ (mA)	$V_L$ (Volt)	$I_L$ (mA)	$V_L$ (Volt)
400				
500				
600				
700				
800				

Table.2 Theoretical Result

### Discussion

1. Calculate  $I_t$  and  $V_i$  theoretically from Fig.3 and Fig.4, then record your results in Table (2)
2. Compare briefly between the practical and theoretical results.



3. Find the voltage between the open terminals A and B for the network shown in Fig.5 using Norton theorem. And the value of  $R_L$  is one half the value of  $R_N$ , find the current through  $R_L$

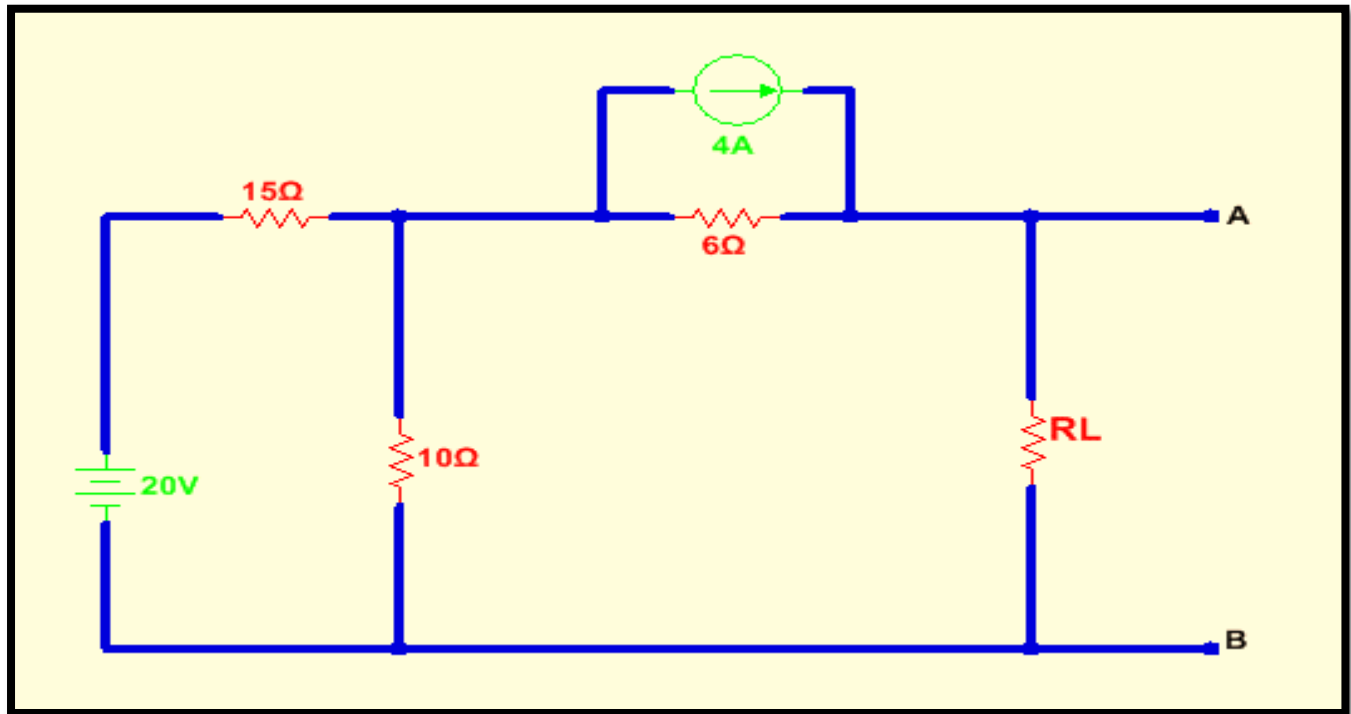


Fig.5