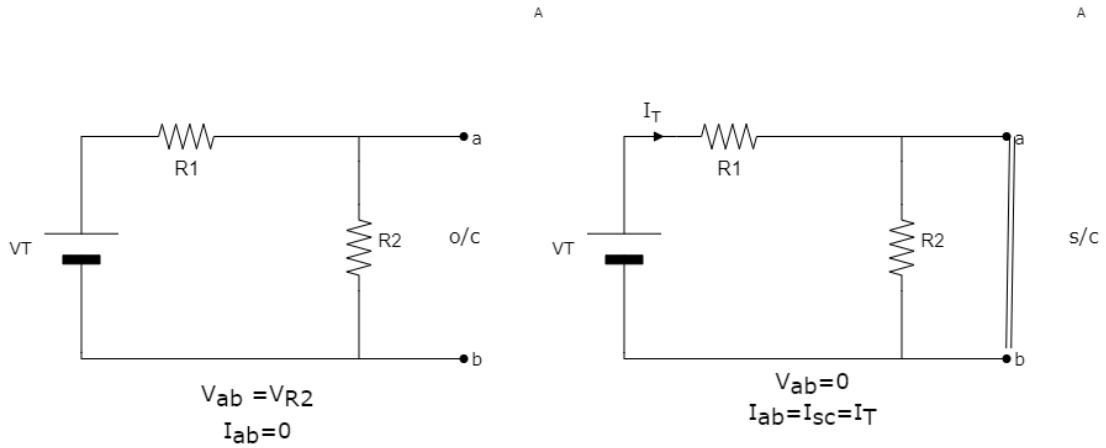
18: Open circuit and short circuit



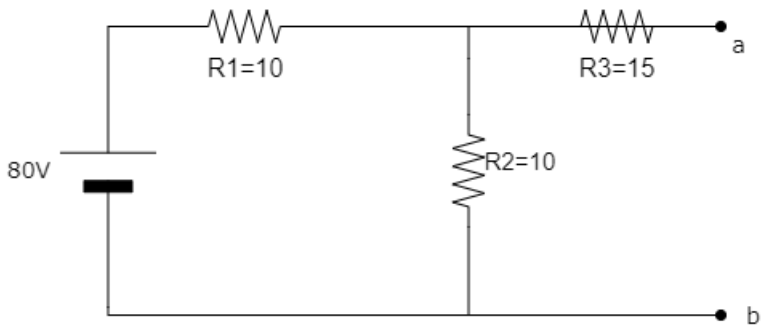
For o/c there will be a voltage but no current.

For s/c there will be a current but no voltage.

EX.1: for the circuit shown below find:-

1-the open circuit voltage between points (a) and (b)

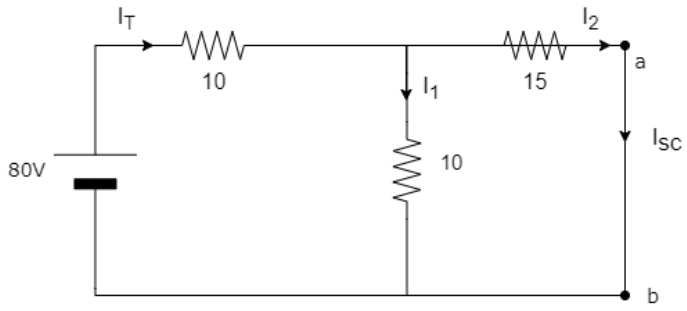
2-if the points (a) and (b) are short circuited, find the short circuit current.



Solution:-

1-when ab are open :$V_{ab} = V_{R2} = 80 * \frac{10}{10+10} = 40V$

2-when ab are short circuited, then



$$R_T = \frac{R_2.R_3}{R_2+R_3} + R_1$$

$$= \frac{15 * 10}{15 + 10} + 10 = 16\Omega$$

$$I_T = \frac{V_T}{R_T} = \frac{80}{16} = 5A$$

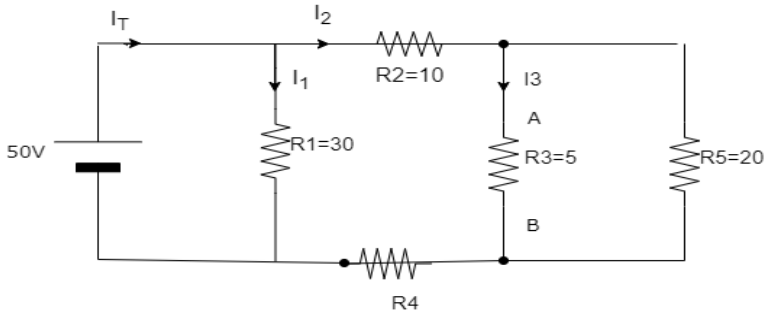
$$I_{sc} = I_2 = I_T \frac{R_2}{R_2 + R_3} = 5\frac{10}{10 + 15} = 2A$$

H.W: for the circuit shown below:-

1-find $V_{AB}\ and\ I_2$.

2- -find $V_{AB}\ and\ I_2\ \ when\ points\ AB\ are\ opend.$

3- -find $V_{AB}\ and\ I_2\ when\ points\ AB\ are\ shorted$.



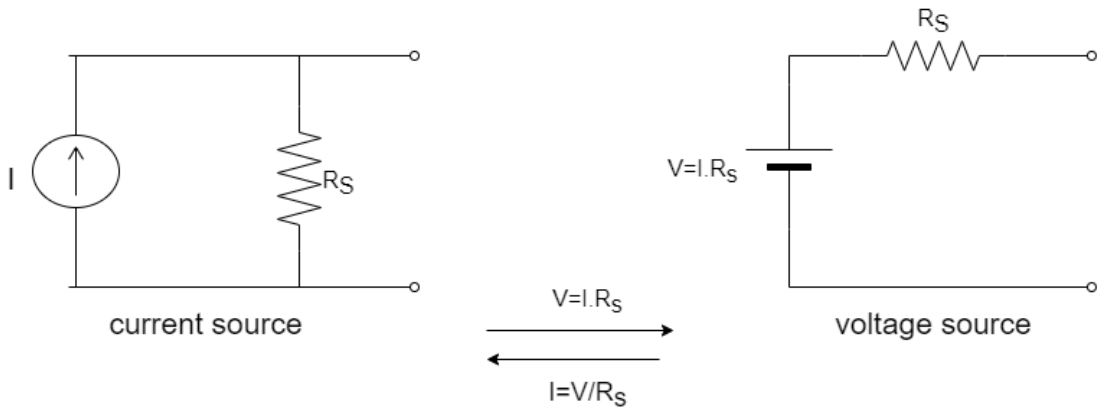
1-$V_{AB} = 5.88\ V\ , I_2 = 1.47\ A$

2-$V_{AB} = 20\ V, I_2 = 1\ A$

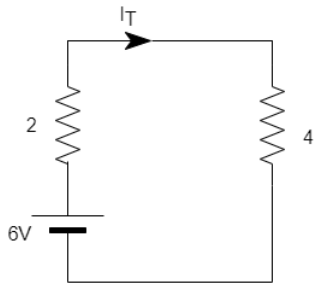
3-$V_{AB} = 0\ V, I_2 = 1.666\ A$

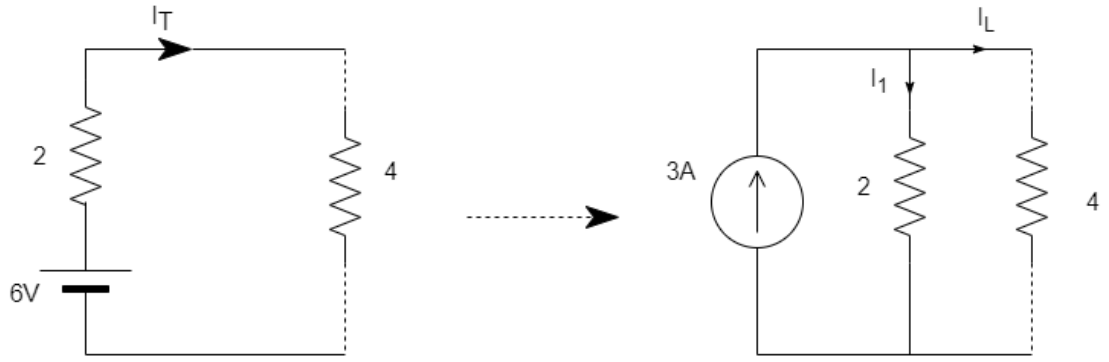
19: conversion of energy sources

A current source having a current (I) and a source resistance (R_s) can be replaced by a voltage source with a voltage of ($I.R_s$) and a source resistance (R_s)



EX: convert the voltage source shown below to a current source and calculate the current through the 4Ω load resistance for each source.





$I_L = \frac{6V}{2+4} = 1A$

$I_L = 3 * \frac{2}{2+4} = 1A$

Example 4.6

★ **Use source transformation to find v_o in the circuit in Fig 4.17.**

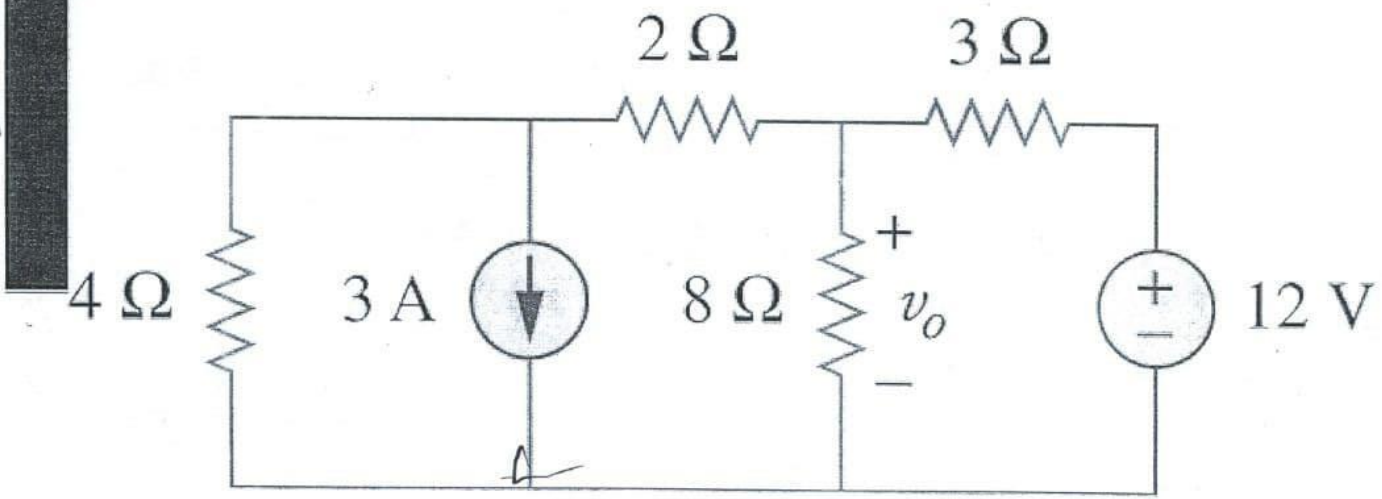
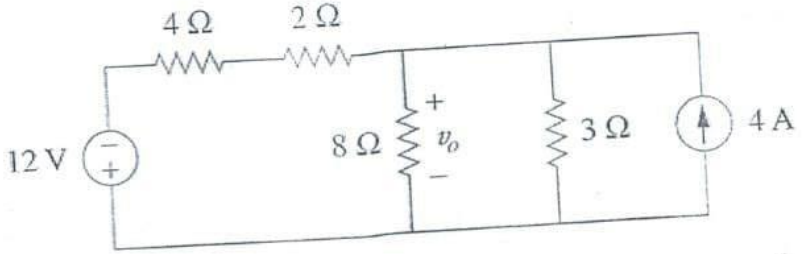


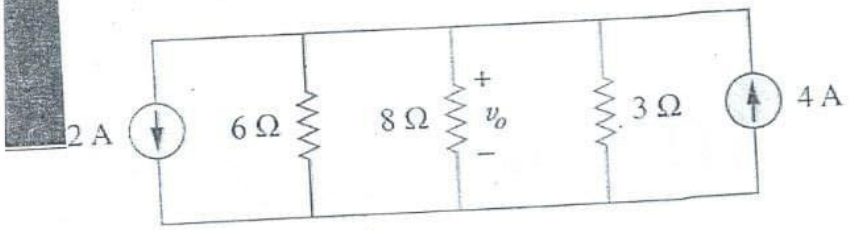
Fig (4.17)

Example 4.6

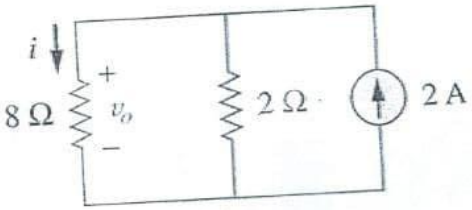
Fig 4.18



(a)



(b)



(c)

$i = 2A \times \frac{2}{2+8} = 0.4A$

$\therefore V_o = 0.4 \times 8 = 3.2\ V$

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Example 4.6

we use current division in Fig.4.18(c) to get

$$i = \frac{2}{2+8}(2) = 0.4\text{A}$$

and

$$v_o = 8i = 8(0.4) = 3.2\text{V}$$