

Unit I: DC Circuits

Notes Class- 4

Concepts of Open Circuit & Short Circuit:

Open Circuit:

An open circuit is characterised by Infinite resistance and hence zero current through it. It is represented as shown below:



Voltage across the Open Circuit can be any finite value.

Short Circuit:

A short circuit is characterised by zero resistance and hence zero voltage across it. It is represented as shown below:

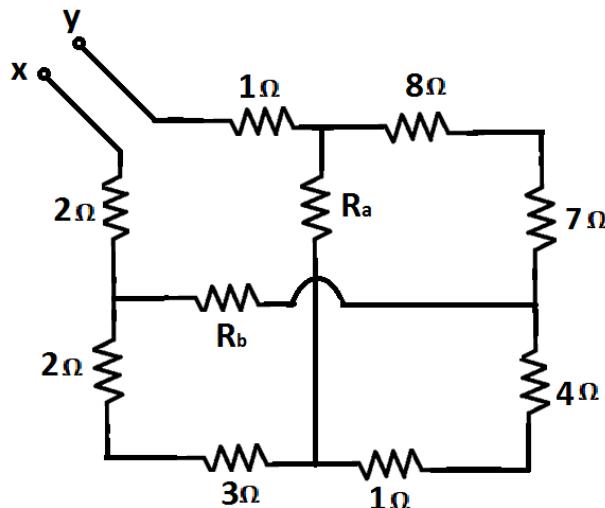


Current through a short circuit can be any finite value.

Current through a Dead Short Circuit is dangerously high.

Numerical Example: Find the equivalent resistance between X & Y if

- i) $R_a = \infty$ & $R_b = \infty$
- ii) $R_a = 0$ & $R_b = \infty$
- iii) $R_a = \infty$ & $R_b = 0$
- iv) $R_a = 0$ & $R_b = 0$

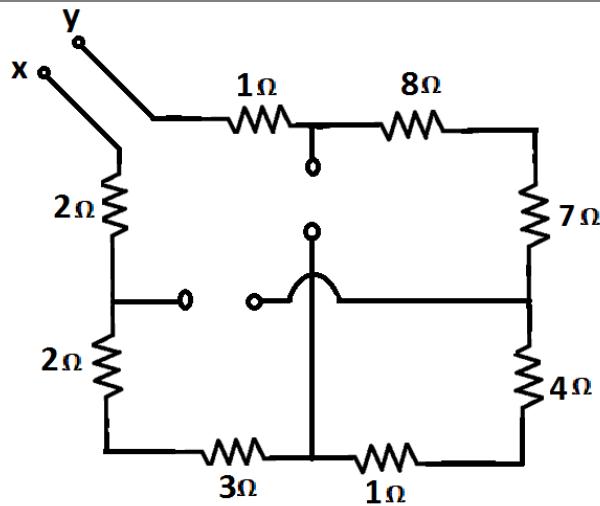


Solution:

Case i) $R_a = \infty$ & $R_b = \infty$

Here, both R_a and R_b have been replaced by infinite resistance i.e., open circuit.

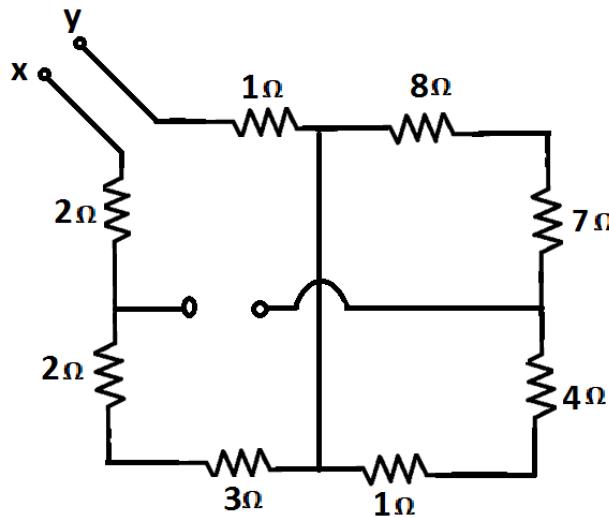
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It can be observed that all the resistors are in series. Hence, $R_{XY} = 28\Omega$.

Case ii) $R_a = 0$ & $R_b = \infty$

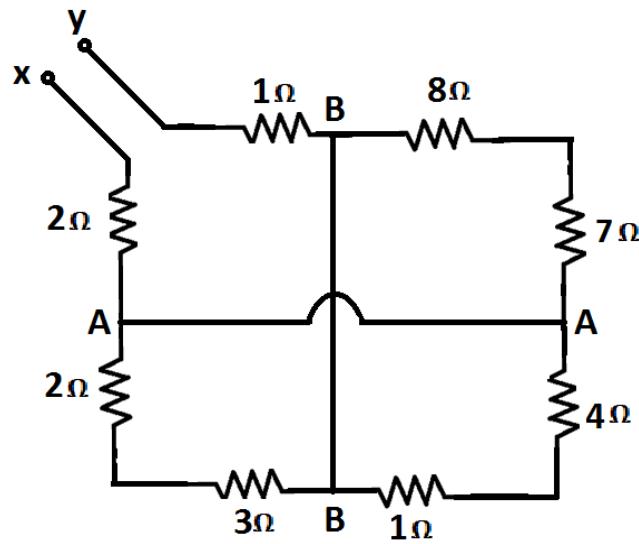
In this case, replace R_a with zero resistance i.e., short circuit and R_b with infinite resistance, i.e., open circuit.



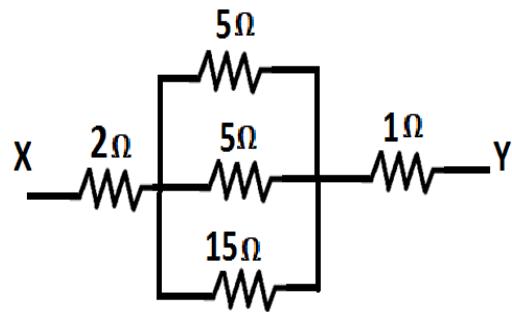
Case iii) can be solved on the similar lines as case ii). By solving, $R_{XY} = 18\Omega$.

Case iv) $R_a = 0$ & $R_b = 0$

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Rearranging this network, it looks as shown below:



$$\text{Hence, } R_{XY} = (2\Omega + (5\Omega \parallel 5\Omega \parallel 15\Omega)) + 1\Omega = 5.143\Omega.$$