TOPICS TO BE DISCUSSED

Star-Delta Transformation.

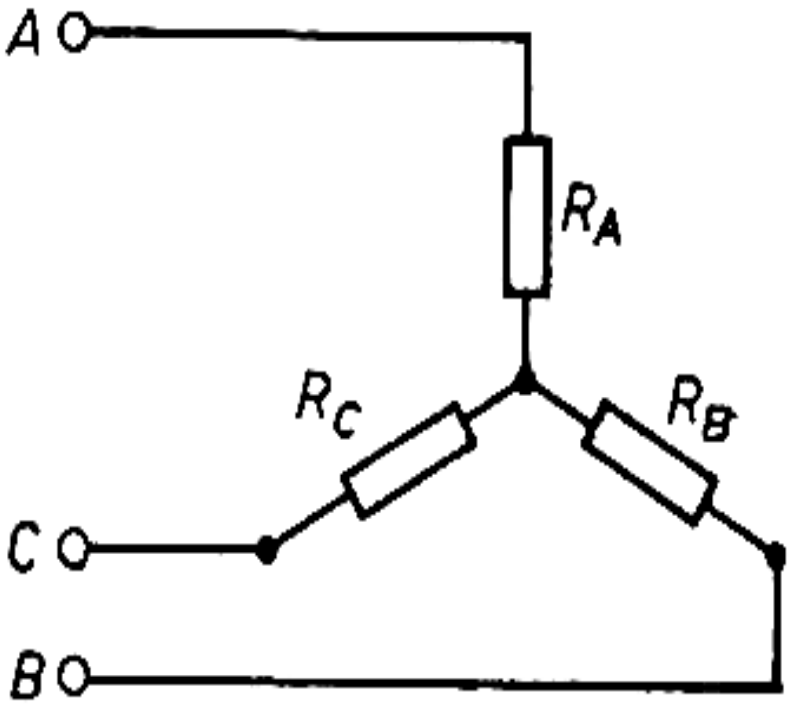
Equivalence STAR to DELTA.

DELTA to STAR.

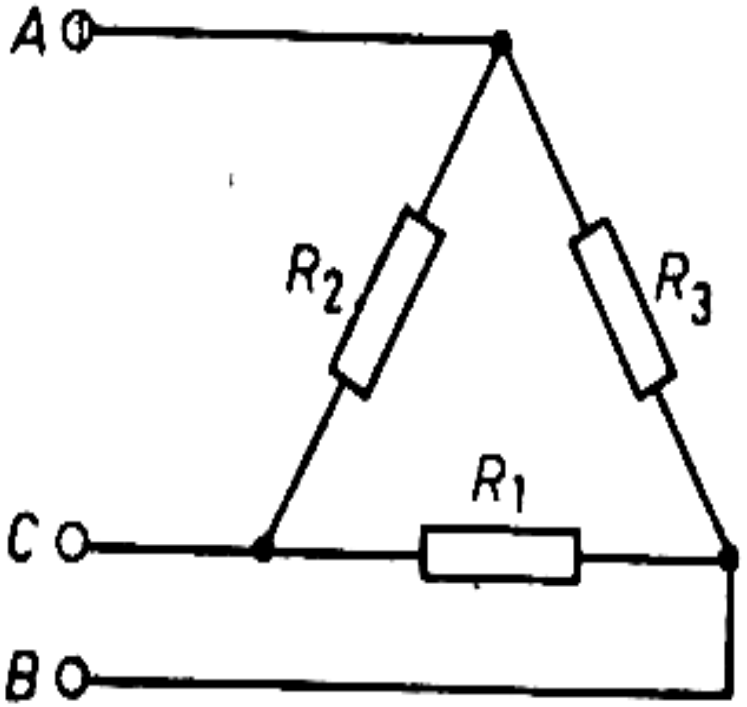
Problems.

Important Note.

STAR-DELTA TRANSFORMATION



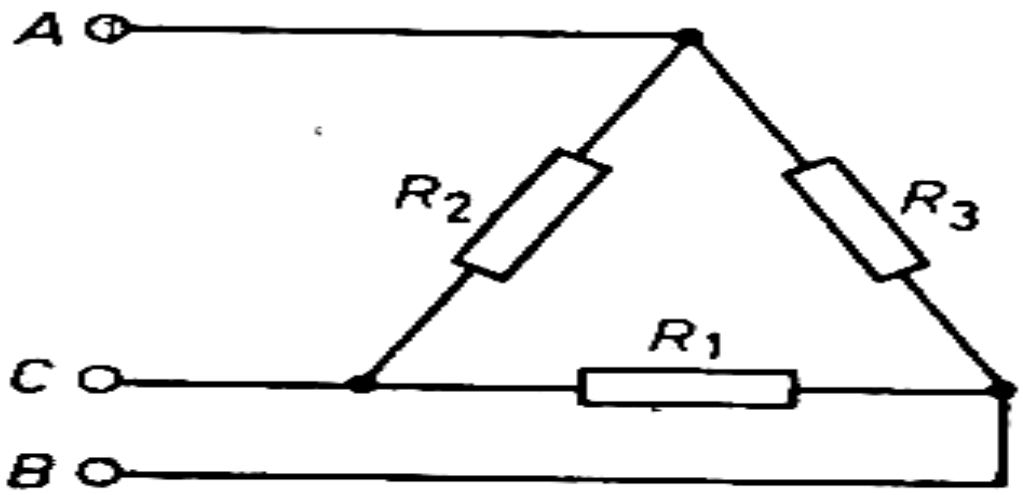
(a) Star (Y) section



(b) Delta or mesh (Δ) section

EQUIVALENCE

Equivalence can be found on the basis that the resistance between any pair of terminals in the two circuits have to be the same, when the third terminal is left open.



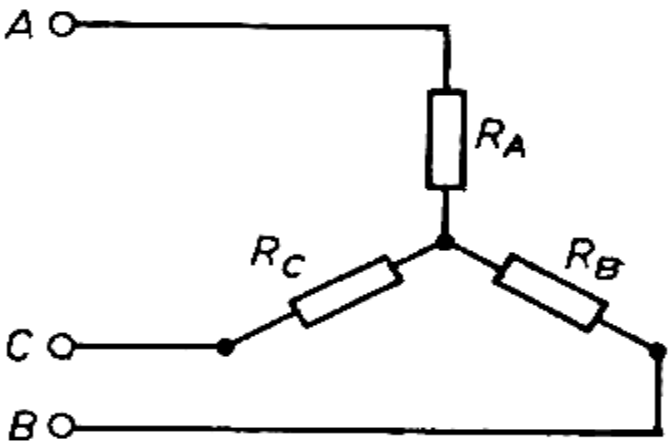
(b) Delta or mesh (Δ) section

First take delta connection: between A and C, there are two parallel paths, one having a resistance of R_2 and other having a resistance of (R_1+R_3)

Hence resistance between terminal A and C is

= R_2.(R_1+R_3)/[R_2+(R_1+R_3)]

Now take the star connection



The resistance between the same terminal A and C is (R_A+R_C)

Since terminal resistance have to be same so we must have

$$(R_A+R_C) = R_2.(R_1+R_3)/[R_2+(R_1+R_3)] \qquad (1)$$

Similarly for terminals A and B, B and C, we can have the following expression

$$(R_A+R_B) = R_3.(R_1+R_2)/[R_3+(R_1+R_2)] \qquad (2)$$
$$(R_B+R_C) = R_1.(R_2+R_3)/[R_1+(R_2+R_3)] \qquad (3)$$

DELTA to STAR

Now subtracting 2 from 1 and adding the result to 3, we will get the following values for R_1,R_2 and R_3.

$$R_A = \frac{R_2 R_3}{R_1 + R_2 + R_3}$$

$$R_B = \frac{R_3 R_1}{R_1 + R_2 + R_3}$$

$$R_C = \frac{R_1 R_2}{R_1 + R_2 + R_3}$$

How to remember?

Resistance of each arm of star is given by the product of the resistance of the two delta sides that meet at its ends divided by the sum of the three delta resistance.

STAR to DELTA

Multiplying 1 and 2, 2 and 3 , 3 and 1 and adding them together and simplifying, we will have the following result.

$$R_1 = \frac{R_A R_B + R_B R_C + R_C R_A}{R_A}$$

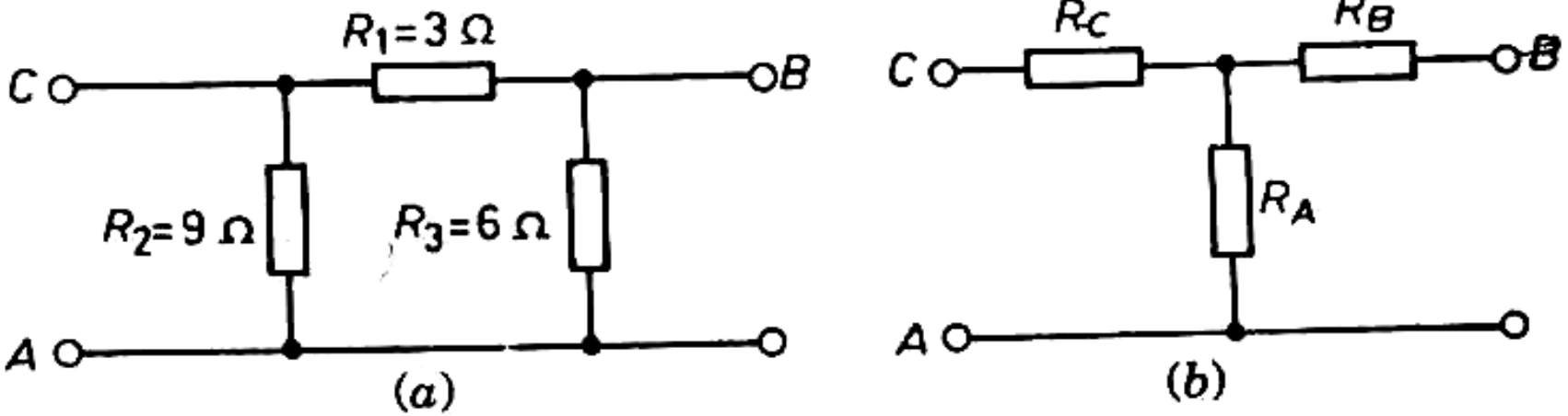
$$R_2 = \frac{R_A R_B + R_B R_C + R_C R_A}{R_B}$$

$$R_3 = \frac{R_A R_B + R_B R_C + R_C R_A}{R_C}$$

How to remember: The equivalent delta resistance between any two point is given by the product of resistance taken two at a time divided by the opposite resistance in the star configuration.

PROBLEM

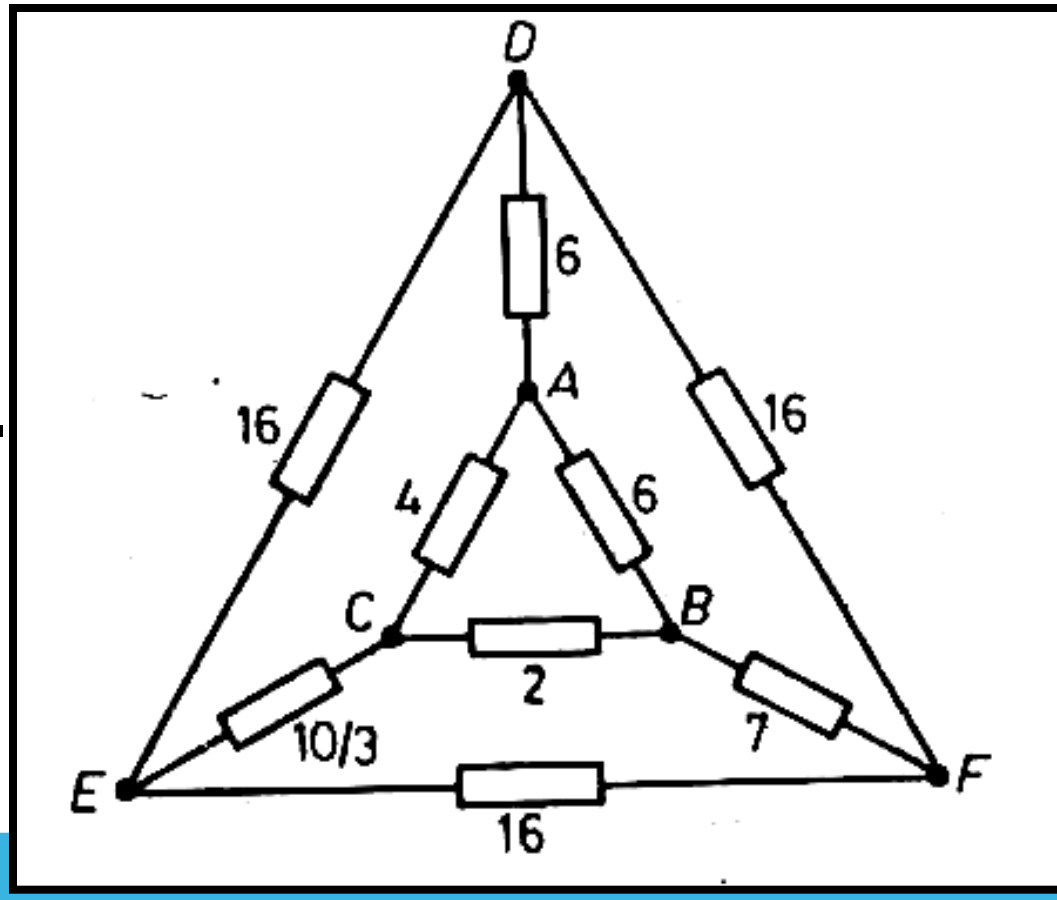
A delta-section of resistors is given in figure. Convert this into an equivalent star-section.



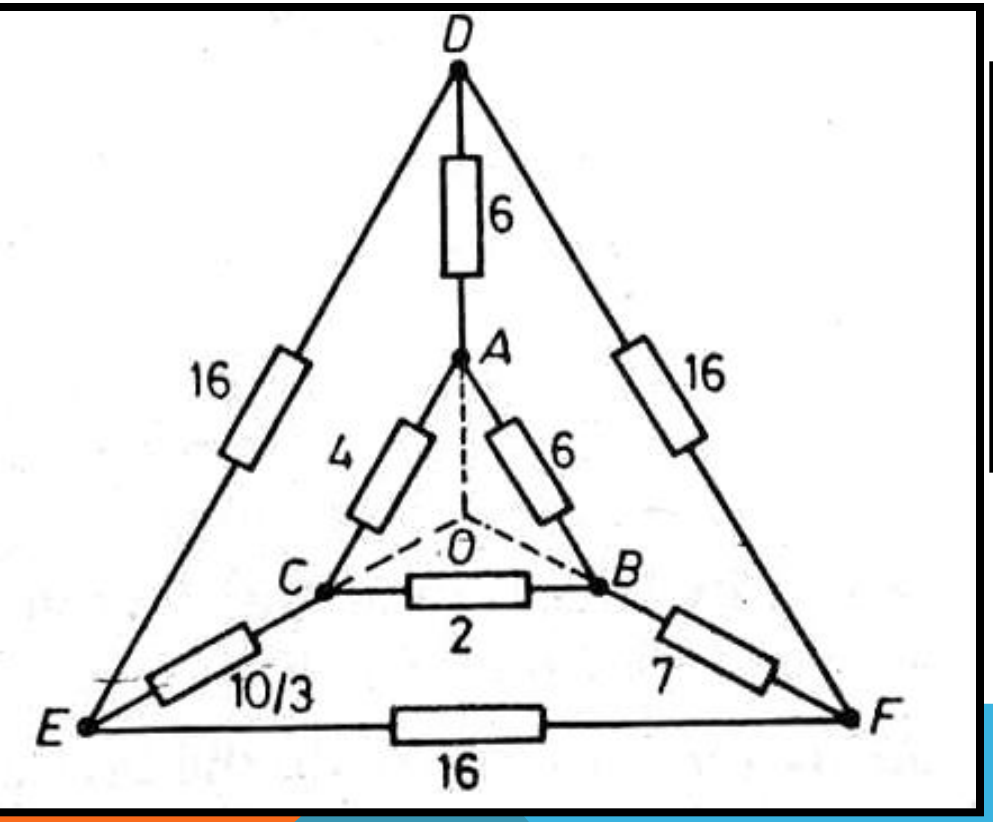
Ans. : $R_A = 3\ \Omega; \quad R_B = 1.0\ \Omega; \quad R_C = 1.5\ \Omega.$

PROBLEM

The figure shows a network. The number on each branch represents the value of resistance in ohms. Find the resistance between the points *E* and *F*.



SOLUTION



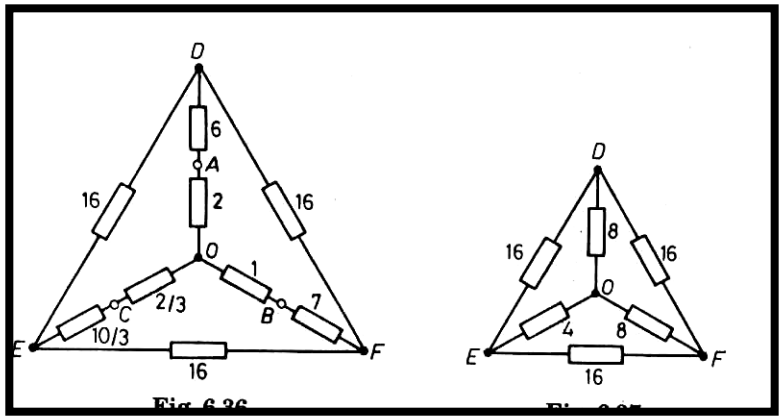
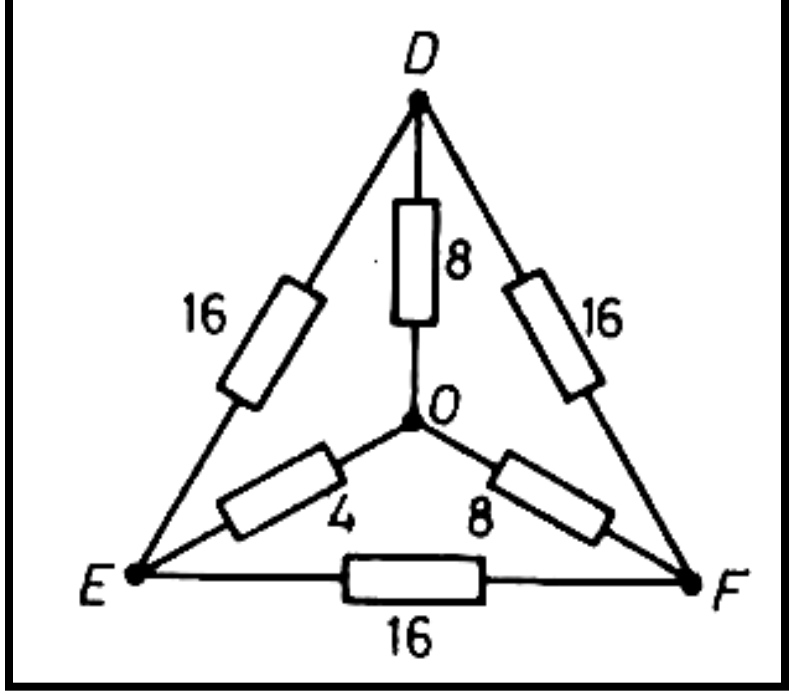
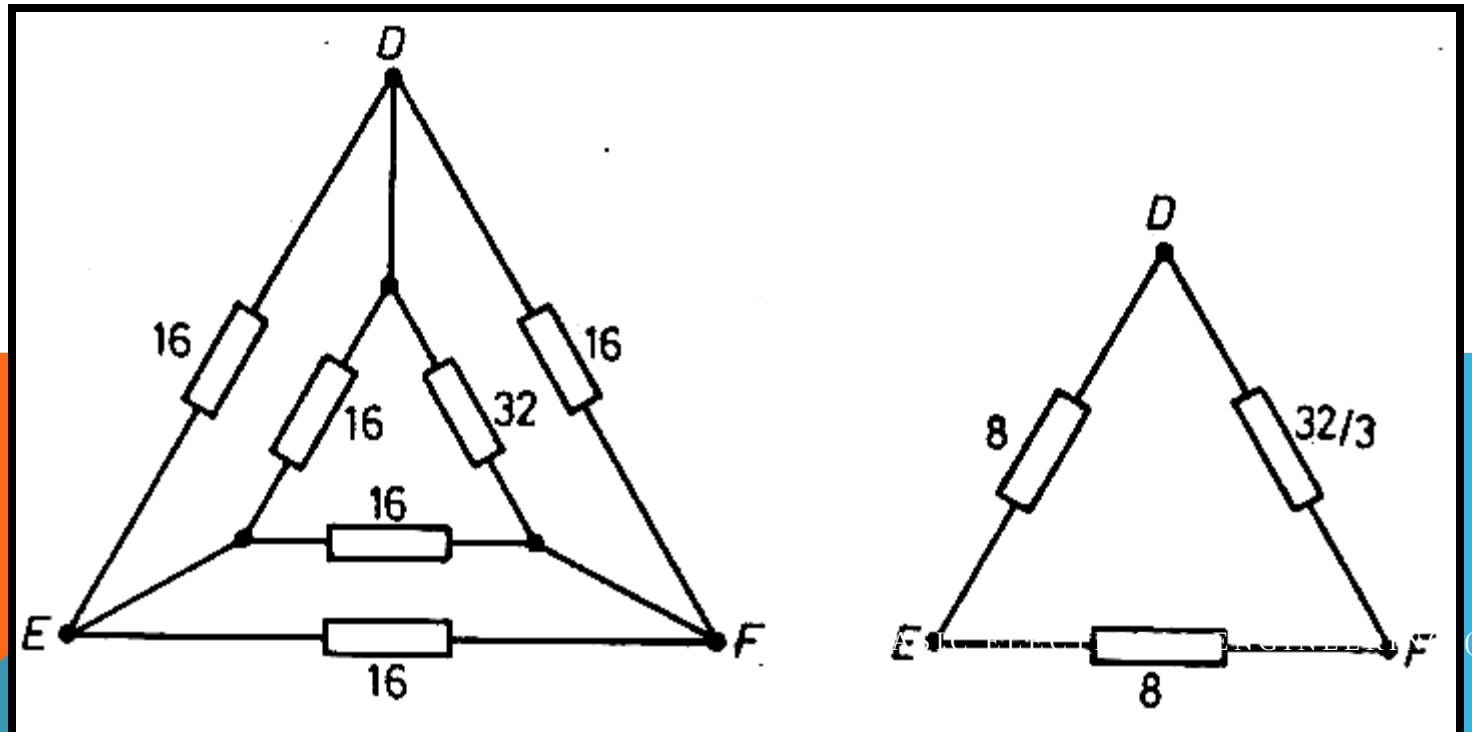


Fig. 6.36

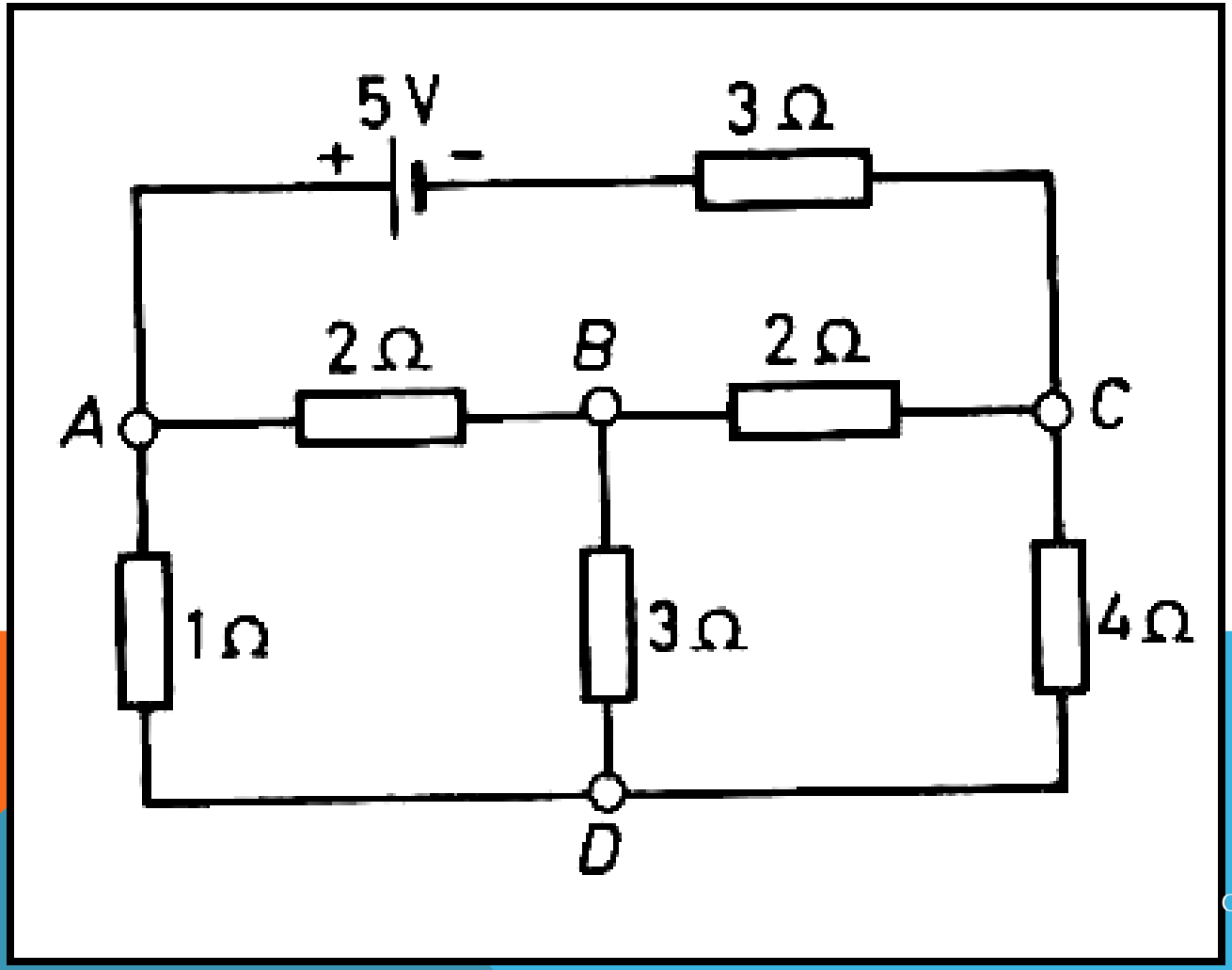


Ans. : 5.6 Ω

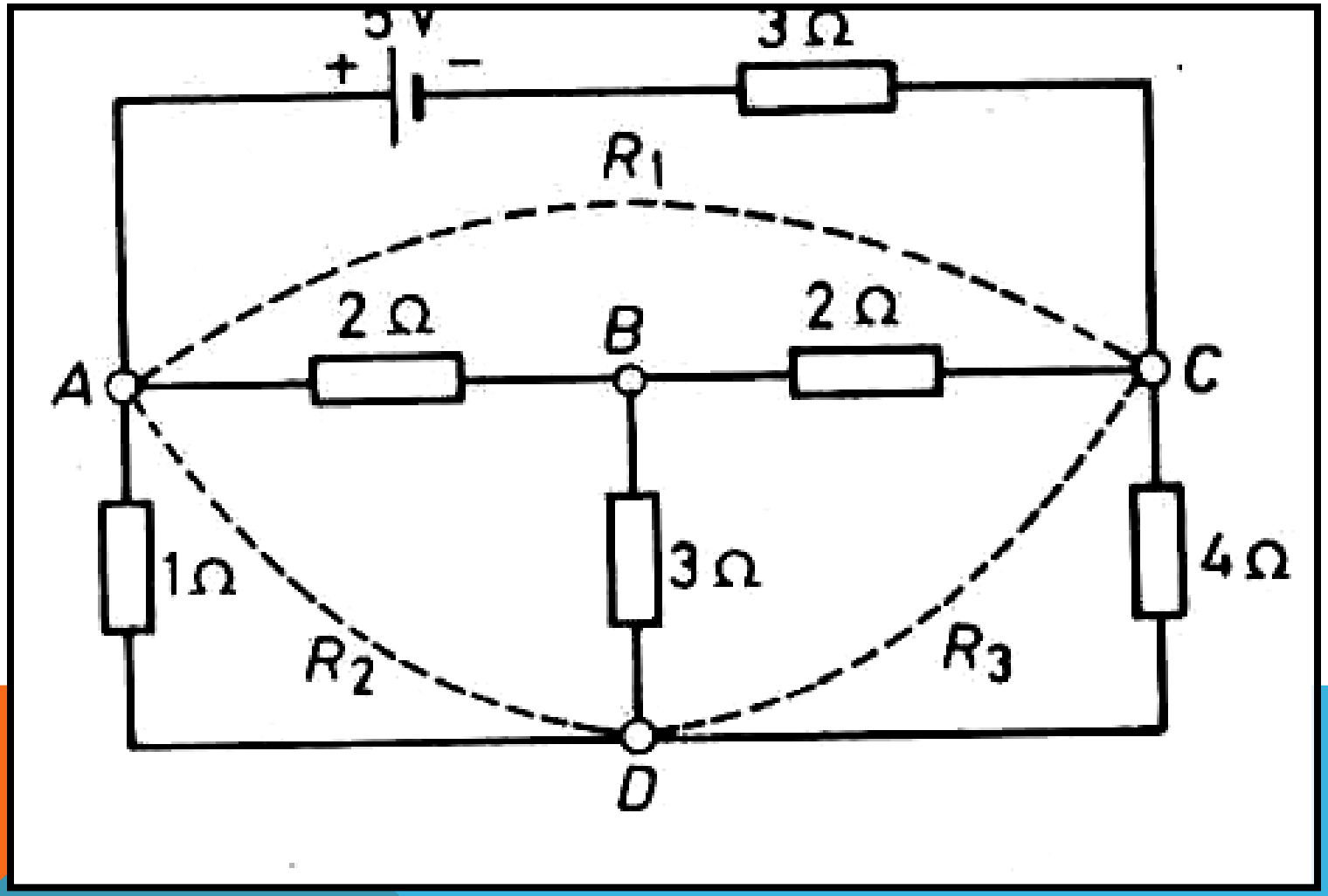


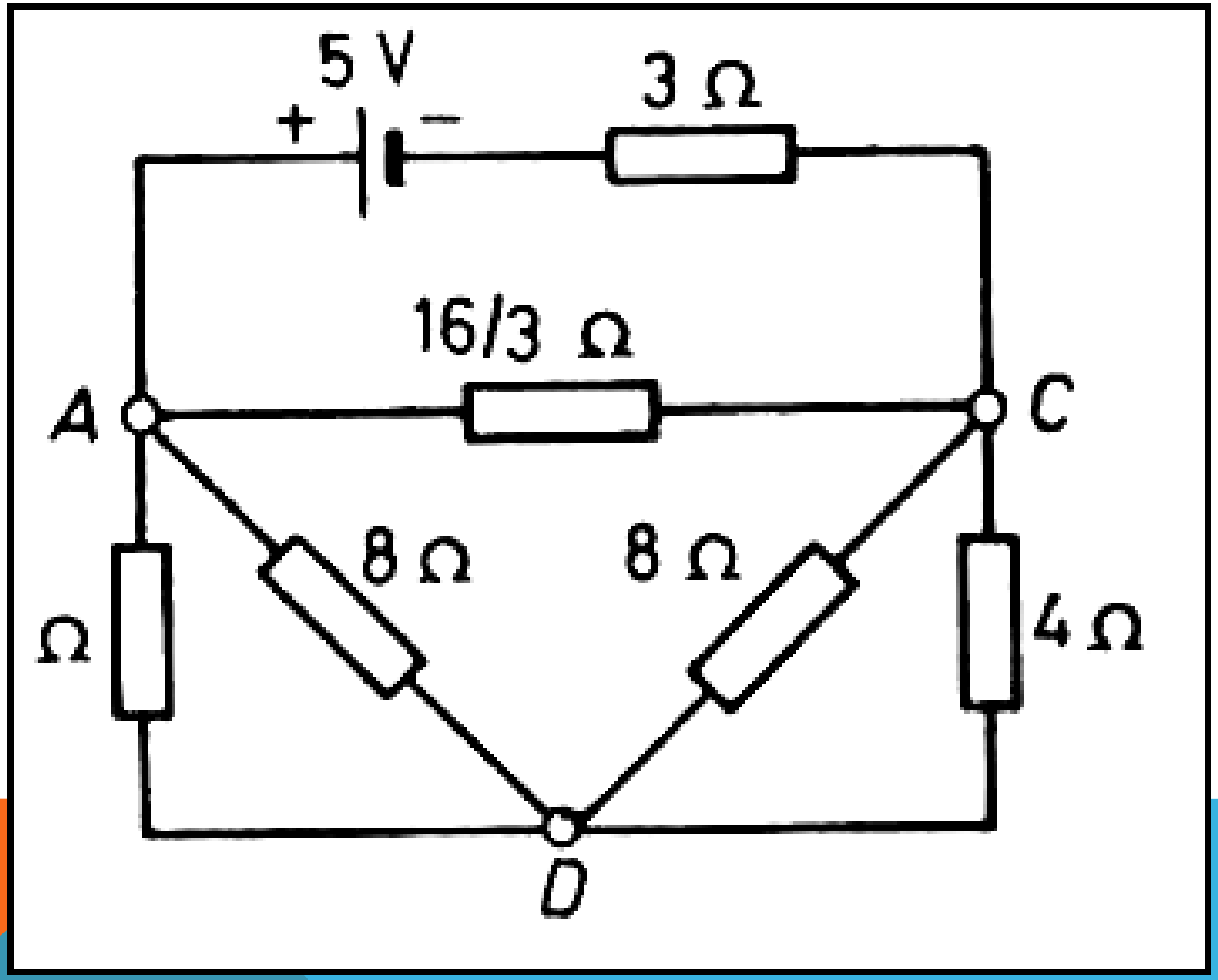
PROBLEM

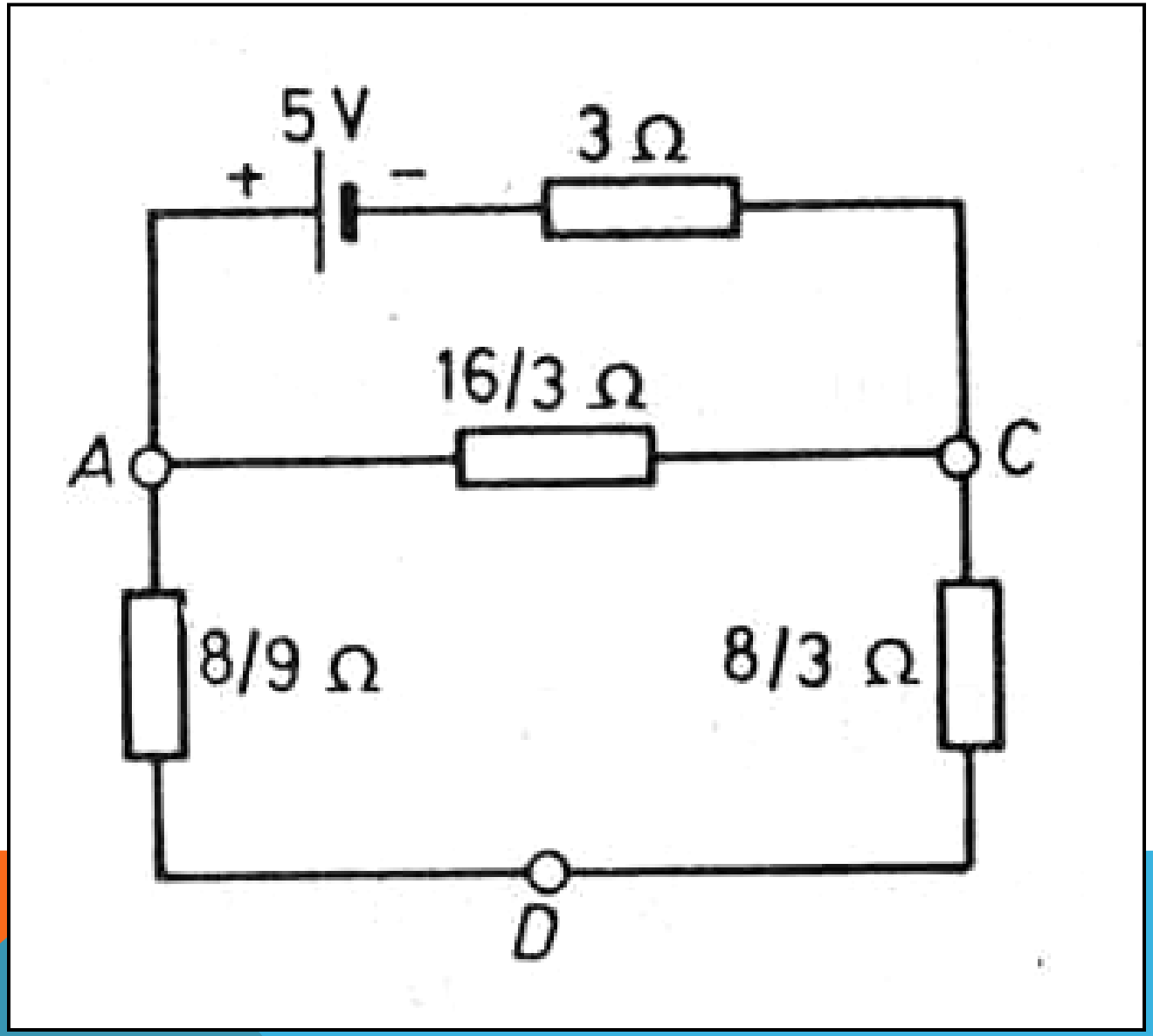
Find the current drawn from the 5 volt battery in the network shown in figure.

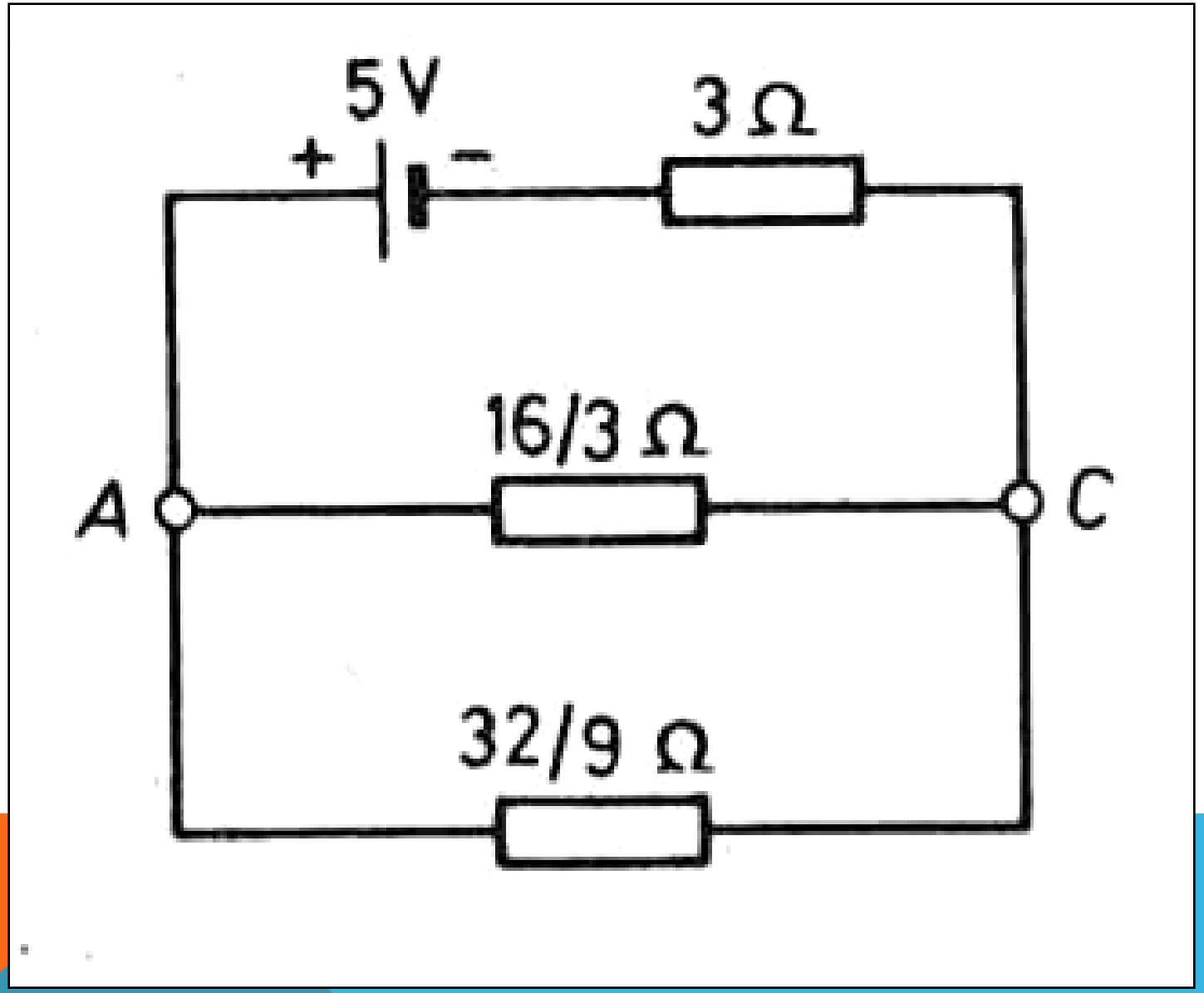


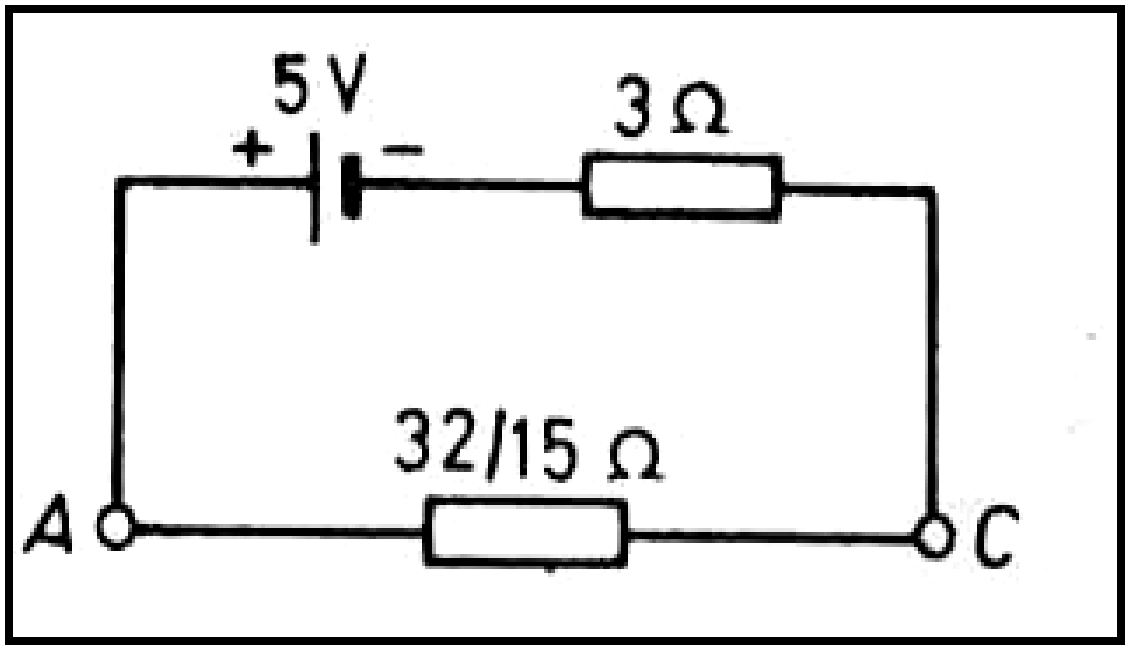
SOLUTION :



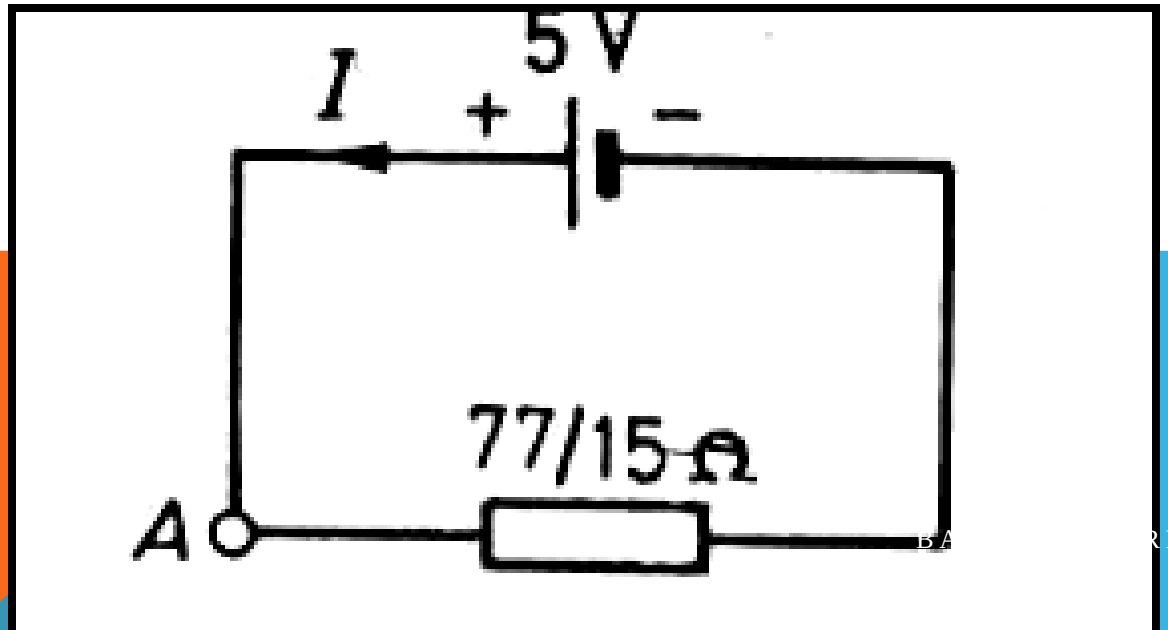

5 V
+
−
3 Ω
16/3 Ω
A
C
8 Ω
8 Ω
Ω
4 Ω
D


5 V
+
−
3 Ω
16/3 Ω
A
C
8/9 Ω
8/3 Ω
D


5 V
+
−
3 Ω
16/3 Ω
A
C
32/9 Ω



Ans. : 0.974 A



Note :

- During the network reduction or simplification process, some points in the original network are lost.

- Care must be taken during this process that no point of ultimate relevance is lost.