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ELECTRICITY

CHAPTER NO.12

SUB: PHYSICS

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LEARNING OUTCOMES

- **Students will be able to** :
- Connect resistors in series.
- Find the equivalent resistance of a system of resistors when they are connected in series.
- Find the equivalent resistance of a system of resistors when they are connected in parallel.

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POINTS TO BE COVERED

Series combination of resistors.

Parallel combination of resistors.

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SERIES COMBINATION

https://youtu.be/pd3RkGs1Tsg

A combination consists of three resistors in series. Four similar sets are connected in parallel. If the resistance of each resistor is 2 ohm, find the resistance of the combination.

Solution 11:

Resistance of each set:

$r_1 = 2 + 2 + 2 = 6$ ohm

$r_2 = 2 + 2 + 2 = 6$ ohm

$r_3 = 2 + 2 + 2 = 6$ ohm

$r_4 = 2 + 2 + 2 = 6$ ohm

Now these resistances are arranged in parallel :

$$\frac{1}{r} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} + \frac{1}{r_4}$$

$$\frac{1}{r} = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6}$$

$$r = \frac{6}{4} = 1.5\text{ohm}$$

Calculate the equivalent resistance between A and B in the adjacent diagram in Fig 8.46.

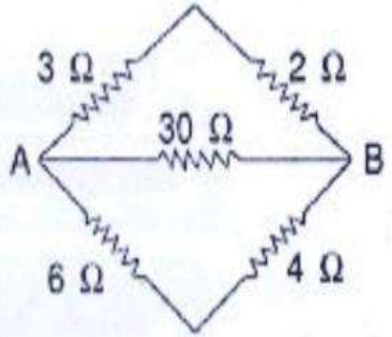


Fig. 8.46

Solution 17:

$R_1 = 3 + 2 = 5$ ohm

$R_2 = 30$ W

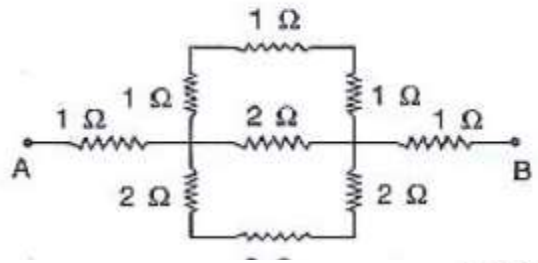
$R_3 = 6 + 4 = 10$ ohm

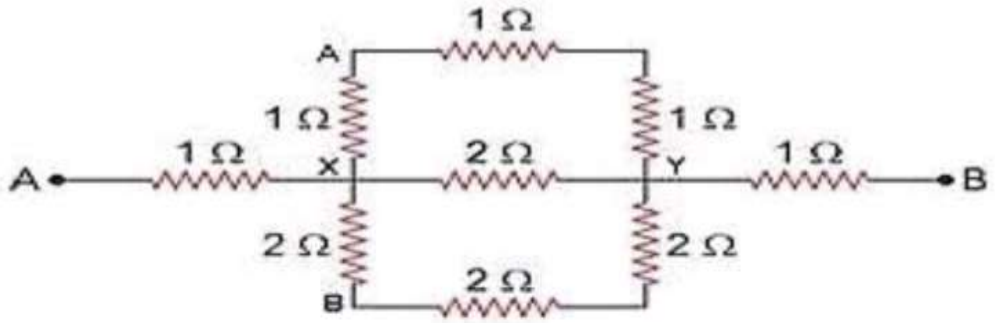
R_1, R_2 and R_3 are connected in parallel

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{5} + \frac{1}{30} + \frac{1}{10} = \frac{10}{30}$$

R = 3 oh m

Calculate the effective resistance between the points A and B in the circuit shown in Fig 8.44.





In the figure above,

Resistance between XAY = (1 + 1 + 1) = 3Ω

Resistance between XY = 2Ω

Resistance between XBY = 6Ω

Let R' be the net resistance between points X and Y

Then, $\frac{1}{R'} = \frac{1}{2} + \frac{1}{3} + \frac{1}{6} = \frac{3+2+1}{6} = \frac{6}{6}\Omega$

Or, $R^1 = 1\Omega$

Thus, we can say that between points A and B,

Three 1 Ω resistors are connected in series.

Let R_{AB} be the net resistance between points A and B.

Then, $R_{AB} = (1 + 1 + 1)\Omega = 3\Omega$

IN TEXT 12.1
NCERT
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Q1. What does an electric circuit mean ?

A continuous closed path made of electric components through which an electric current flows is known as an electric circuit. A simple circuit consists of the following components: (a) Conductors (b) Cell (c) Switch (d) Load

Q2. Define the unit of current.

The unit of current is ampere. Ampere is defined by the flow of one coulomb of charge per second.

Q3. Calculate the number of electrons constituting one coulomb of charge.

The value of the charge of an electron is 1.6 × 10-19 C. According to charge quantization, Q = nq, where n is the number of electrons and q is the charge of an electron. Substituting the values in the above equation, the number of electrons in a coulomb of charge can be calculated as follows:

1C= n.e= n*1.6 × 10-19 C n=1/1.6 × 10-19 C =25 × 1018

Therefore, the number of electrons constituting one coulomb of charge is 25 × 1018.

Five resistors, each 3 Ω, are connected as shown in Fig 8.48. Calculate the resistance (a) between the points P and Q. (b) between the points X and Y.

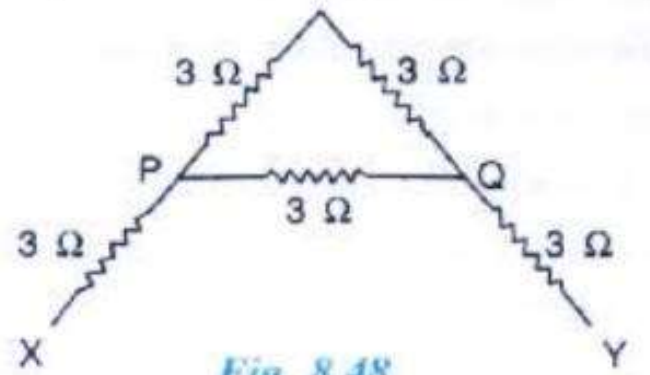

Fig. 8.48

Solution 19:

(a) $R_1=3+3=6$ W

$R_2=3$ W

R_1 and R_2 are connected in parallel

$$\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}=\frac{1}{6}+\frac{1}{3}=\frac{1}{2}$$

(b) As calculated above R=2 ohm

$R_3 = 3$ ohm

$R_4 = 3$ ohm

$R' = R + R_3 + R_4 = 2 + 3 + 3 = 8$ ohm

THANKING YOU

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