ODM EDUCATIONAL GROUP
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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

SERIES COMBINATION

When two or more resistors are connected end to end to each other, then they are said to be connected in series

Derivation the formula for effective resistance when two resistors are connected in series

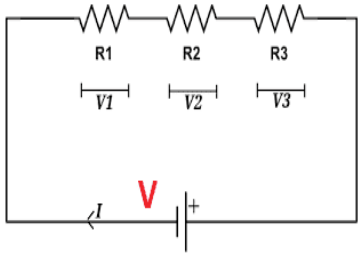
V = V1 + V2 + V3….

By Ohms law, V = IR

So. V = IR1+ IR2 + IR3

IR = IR1+ IR2 + IR3

R = R1 + R2 + R3



- The equivalent resistance is equal to the sum of the individual resista
- This is also known as the maximum effective resistance.
- Here the current through each resistor is same but the potential diffe

$$V = V1 + V2 + V3$$

$$I * Requ = IR1 + IR2 + IR3$$

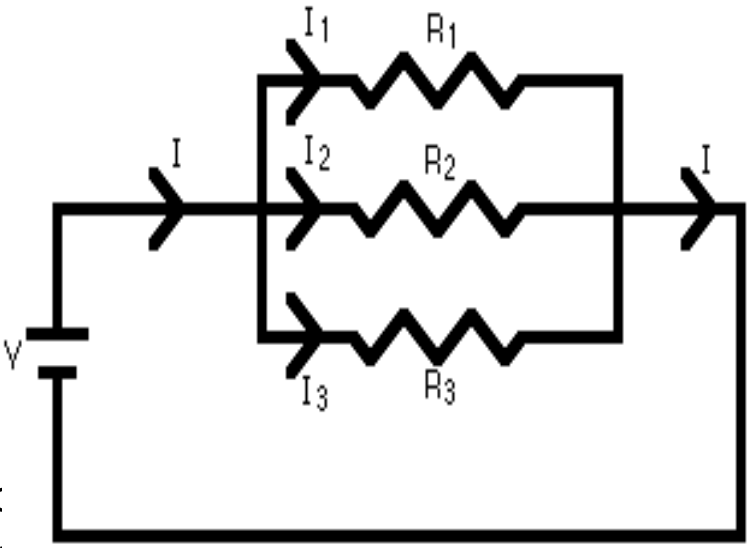
$$Requ = R1 + R2 + R3$$

PARALLEL CONNECTION.

- When two or more resistors are connected between two points to each other then they are said to be connected in parallel connection.
- Total current I = I1 + I2 + I3

  V/R = V/R1 + V/R2 + V/R3

  1/R = 1/R1 + 1/R2 + 1/R3.



- The reciprocal of equivalent resistance is equal to resistances.
- The equivalent resistance is less than the resistanc
- The current from the source is greater than the current through either resistor.
- The potential difference across each resistor is same.
- https://youtu.be/BbYtMQ8EYBg

NUMERICAL

Q1.Three resistors of 3Ω , 4Ω, and 12Ω are connected in parallel. Find out its equivalent resistance

ANS.1/R=1/3+1/4+1/12=2/3

R=3/2 ohm

Q2.Three resistors of 5Ω, 10Ω, and 15Ω are connected in series with a 12-volt power supply. Calculate their combined resistance, the current that flows in the circuit and the pd across each resistor.

ANS-Given: R1 = 5 ohm. R2 = 10 ohm, R3 = 15 ohm. V = 12 V.

R = R1 + R2 + R3

= 5 + 10 + 15 = 30 Ω

The current flowing through the circuit = V/ R = 12 / 30 = 0.4 A

V1 = IR1 = 0.4 X 5 = 2 V.

V2 = IR2 = 0.4 X 10 = 4 V.

V3 = IR3 = 0.4 X 15 = 6 V.

NUMERICA

Two resistors having resistance 4Ω and 6Ω are connected in parallel. Find their equivalent resistance.

Solution 6:

Let R' be their equivalent resistance of the 4Ω and 6Ω resistors connected in parallel.

Then, $\frac{1}{R'} = \frac{1}{4} + \frac{1}{6} = \frac{3+2}{12} = \frac{5}{12}\Omega$

Or, $R' = \frac{12}{5} = 2.4\Omega$

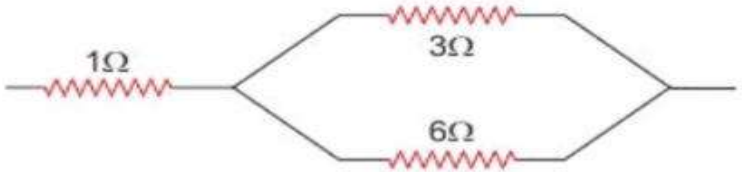
A circuit consists of a 1 ohm resistor in series with a parallel arrangement of 6 ohm and 3 ohm resistors. Calculate the total resistance if the circuit. Draw a diagram.

Solution 15:

$\frac{1}{r} = \frac{1}{6} + \frac{1}{3} + \frac{1}{2}$

R = 2 oh m

R = 2 + 1 = 3 oh m



Calculate the equivalent resistance of the following combination of resistors r_1, r_2, r_3 and r_4 if $r_1 = r_2 = r_3 = r_4 = 2.0\Omega$, between the points A and B in Fig. 8.42

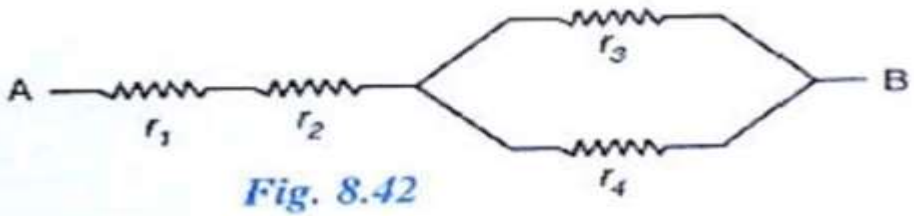


Fig. 8.42

Solution 10:

$r_1 = r_2 = r_3 = r_4 = 2.0\,ohm$

$r' = r_1 + r_2 = 2 + 2 = 4$ ohm

$$\frac{1}{r''} = \frac{1}{r_3} + \frac{1}{r_4} = \frac{1}{2} + \frac{1}{2} = 1$$

$r'' = 1$ohm

$r = r' + r'' = 4 + 1 = 5$ohm

A wire of uniform thickness with a resistance of 27Ω is cut into three equal pieces and they are joined in parallel. Find the equivalent resistance of the parallel combination.

Solution 14:

Wire cut into three pieces means new resistance = 27/3 = 9

Now three resistance connected in parallel :

$$\frac{1}{r} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} = \frac{1}{9} + \frac{1}{9} + \frac{1}{9}$$

r = 9/3 = 3 oh m

THANKING YOU

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