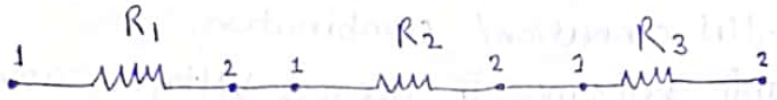
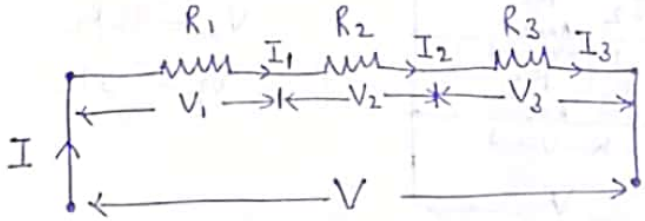
Series and Parallel combination of Resistors

① Series combination of resistors :-

यदि resistances इस प्रकार connected हों कि एक resistance का दूसरा terminal दूसरे resistance के 1st terminal से connected हो तथा इसी प्रकार दूसरे resistance का 2nd terminal तीसरे resistance के पहले (1st) terminal से connected हो तो यह series connection of resistances (प्रतिरोधों का श्रेणीक्रम) कहलाता है।



Series connected resistances



In series connection, $V = V_1 + V_2 + V_3$ ——— (1)

Same current flows through each resistance,

So, $I_1 = I_2 = I_3 = I$

Also, $V_1 = I R_1$, $V_2 = I R_2$, $V_3 = I R_3$

So, $V = I R_1 + I R_2 + I R_3$ — (2) from eq. (1)

Let equivalent resistance is R_{se}

from (2)

$I R_{se} = I R_1 + I R_2 + I R_3$

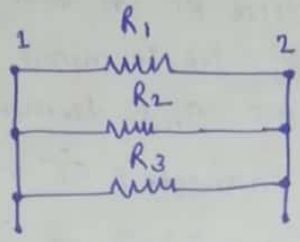
or $\boxed{R_{se} = R_1 + R_2 + R_3}$

इसी प्रकार यदि N resistances ~~series~~ series में connected हों,

$\boxed{R_{se} = R_1 + R_2 + R_3 + \ldots\ldots + R_N}$

Parallel combination of Resistances:

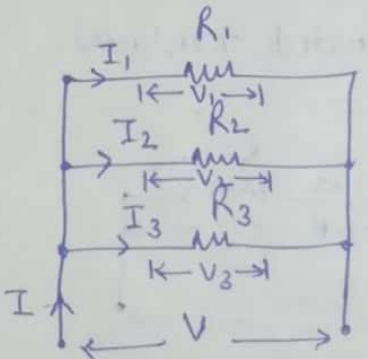
यदि resistances इस प्रकार connected हों कि सभी resistances का प्रथम (1st) terminal एक साथ connected हों तथा दूसरा terminal एक साथ connected हों तो यह parallel connection कहलाता है।



Parallel connection of Resistances

In parallel connection/ combination.

* सभी resistances के accross voltage same (equal) होती है।



$V_1 = I_1 R_1$

$V_2 = I_2 R_2$

$V_3 = I_3 R_3$

In circuit diagram.

$$V = V_1 = V_2 = V_3$$

Let, I = supply current (total current), R_P =

According to KVL, $I = I_1 + I_2 + I_3$

or $\frac{V}{R_P} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$

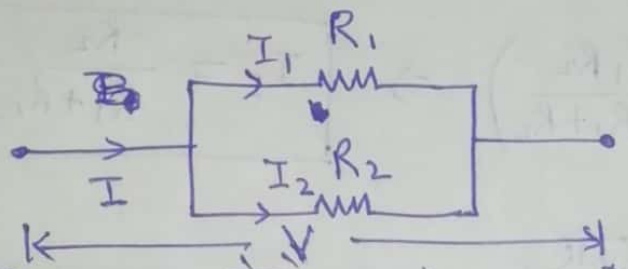
or $\boxed{\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$

यदि N resistances parallel में connected हों, तब

$$\boxed{\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots \frac{1}{R_N}}$$

धारा विभाजक नियम (Current Division Rule)

इस नियम का प्रयोग तब किया जाता है जबकि दो resistances parallel में connected हो तथा हमें total circuit current ज्ञात हो जबकि प्रत्येक resistance में current का मान ज्ञात करना हो।



माना दोनों resistances के accross V voltage applied है जिसके कारण total current I flow होती है।

from, Circuit,

$$V = I R_p$$ where R_p = equivalent Resistance

Now, $$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\text{or } \frac{1}{R_p} = \frac{R_1 + R_2}{R_1 R_2}$$

$$\text{or } R_p = \frac{R_1 R_2}{R_1 + R_2}$$

$$\text{So, } V = I \left(\frac{R_1 R_2}{R_1 + R_2} \right) \text{ or } \quad \text{---(1)}$$

~~$I = \frac{V}{\left(\frac{R_1 + R_2}{R_1 R_2}\right)}$~~

Now, $\because I_1 = \frac{V}{R_1}$

and $I_2 = \frac{V}{R_2}$

from eq. (1),

$$I_1 = \frac{I}{R_1}\left(\frac{R_1 R_2}{R_1 + R_2}\right) \Rightarrow \boxed{I_1 = \frac{R_2}{R_1 + R_2} I}$$

इसी प्रकार,

$$I_2 = \frac{I}{R_2}\left(\frac{R_1 R_2}{R_1 + R_2}\right) \Rightarrow \boxed{I_2 = \frac{R_1}{R_1 + R_2} I}$$