Kirchoff's Law

Kirchoff's First Law - The Current Law, (KCL)

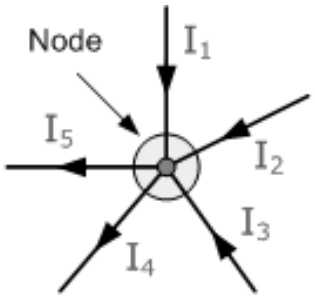
"The total current or charge entering a junction or node is exactly equal to the charge leaving the node as it has no other place to go except to leave, as no charge is lost within the node".

- In other words the algebraic sum of ALL the currents entering and leaving a node must be equal to zero,

$$I_{(exiting)} + I_{(entering)} = 0.$$

- This idea by Kirchoff is known as the Conservation of Charge**.**

Currents Entering the Node
=
Currents Leaving the Node



$$I_1 + I_2 + I_3 = I_4 + I_5 = 0$$

- Here, the 3 currents entering the node, I_1, I_2, I_3 are all positive in value and the 2 currents leaving the node, I_4 and I_5 are negative in value.
- Then this means we can also rewrite the equation as;

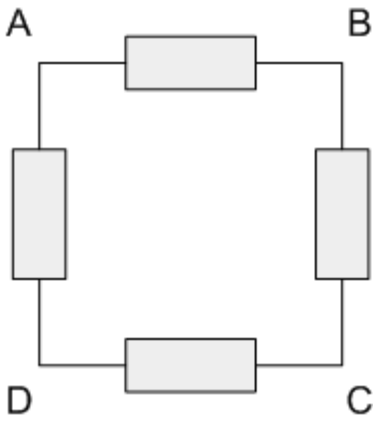
$$I_1 + I_2 + I_3 - I_4 - I_5 = 0$$

Kirchoff's Second Law - The Voltage Law, (KVL)

"In any closed loop network, the total voltage around the loop is equal to the sum of all the voltage drops within the same loop" which is also equal to zero. In other words the algebraic sum of all voltages within the loop must be equal to zero. This idea by Kirchoff is known as the Conservation of Energy**.**

"The algebraic sum of all voltages in a loop must equal zero"

The sum of all the voltage drops around the loop equal zero



$$V_{AB} + V_{BC} + V_{CD} + V_{DA} = 0$$

- Starting at any point in the loop continue in the same direction noting the direction of all the voltage drops, either positive or negative, and returning back to the same starting point.
- It is important to maintain the same direction either clockwise or anti-clockwise or the final voltage sum will not be equal to zero.
- We can use Kirchoff's voltage law when analysing series circuits.

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Source : http://nprcet.org/e%20content/first/ct.pdf