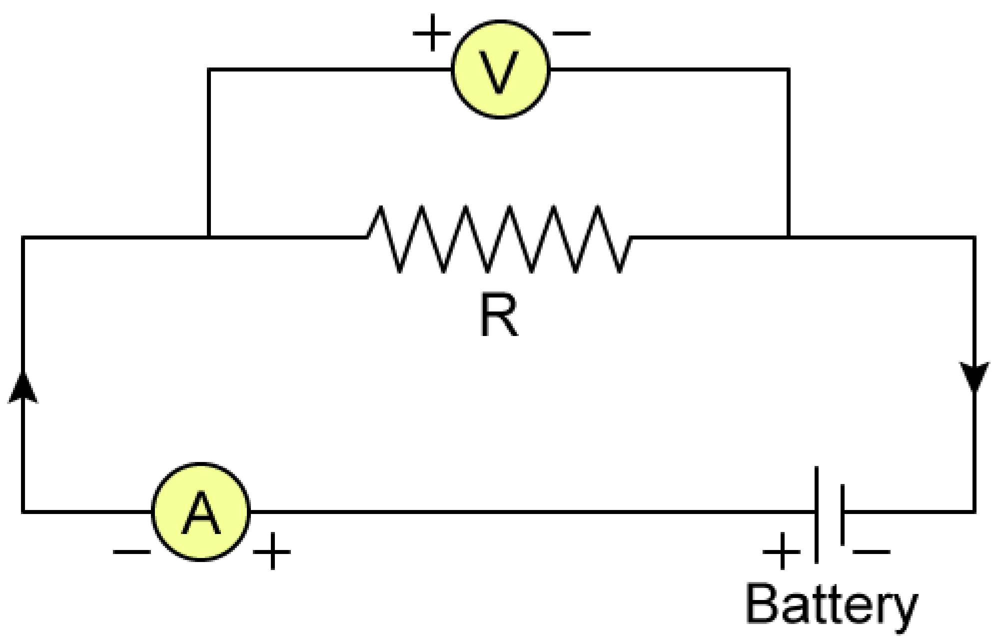
Applied Physics Lecture 2

Ohm's Law

How much current flows in a conductor when a certain potential difference is set up across its ends?



German Physicist George Simon Ohm showed

> "The current flowing through a conductor is directly proportional to the potential difference across its ends provided the physical state such as temperature etc. of the conductor remains constant".

$$V = IR$$

$$I = V/R \text{ (or } R = V/I\text{)}$$

V (in volts), R (ohms or mostly kilo ohms), I (ampere or mostly milli amperes)

$I \propto V$ $(direct\ )and$ $I \propto 1/R$ (Inverse)

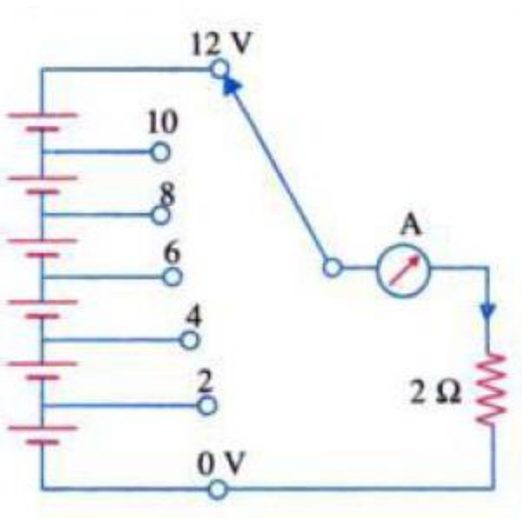
If any 2 quantities are given we can find 3rd one.

R depends on nature, dimension or physical state of the conductor.

Resistance: Opposition to the flow of electrons due to their continuous collision with the atom of lattice.

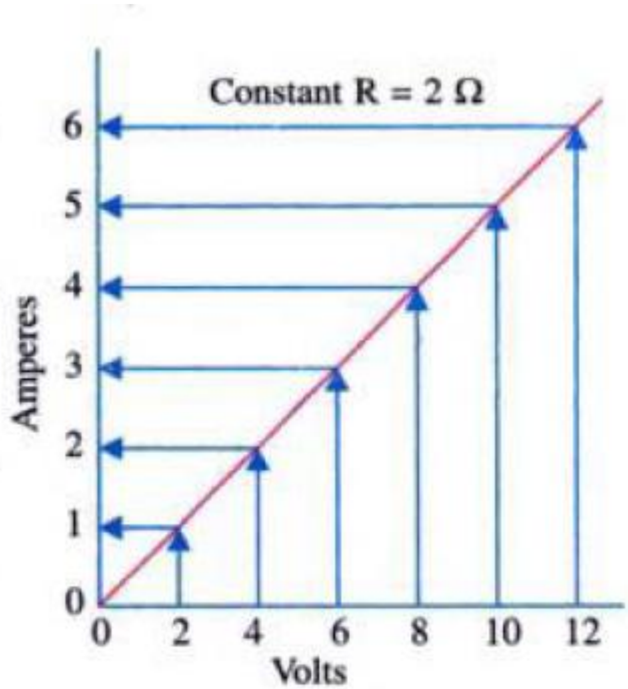
Graphical Form:

Independent variable is taken on x- axis and dependent on y-axis



VOLTS	OHMS	CURRENT
0	2	0
2	2	1
4	2	2
6	2	3
8	2	4
10	2	5
12	2	6

The V-I graph for above circuit is



Linear and Non-linear Resistor

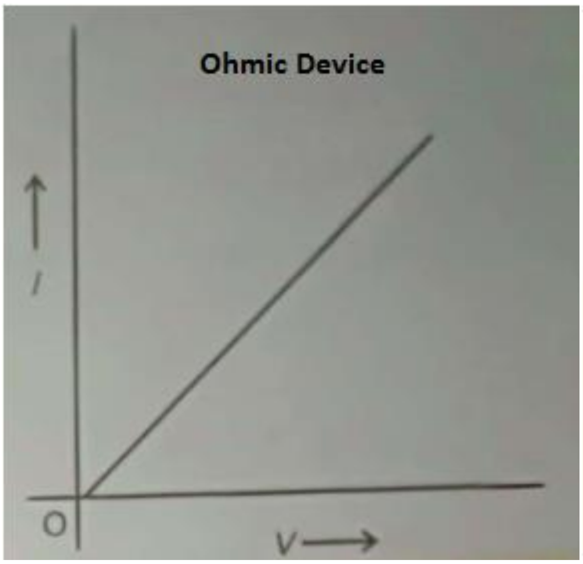
Linear: V-I graph is straight line (means V and I are proportional and R remains constant)

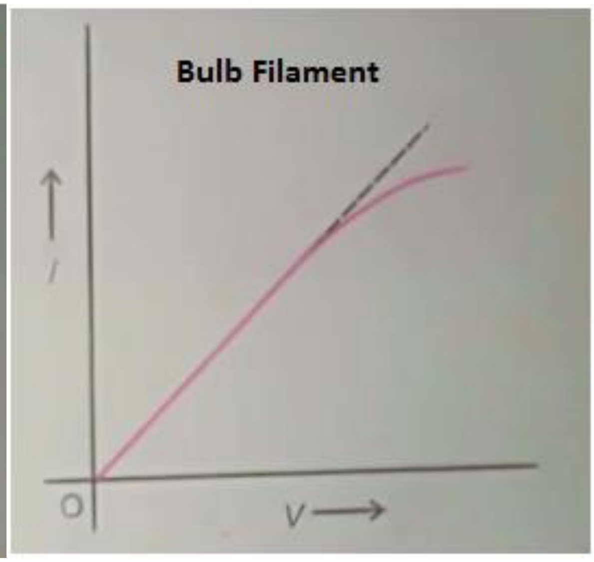
Non Linear: If V-I graph is not straight line (R does not remain constant). In bulb filament due to heat production the value of R increases so current decreases and V and I are not proportional.

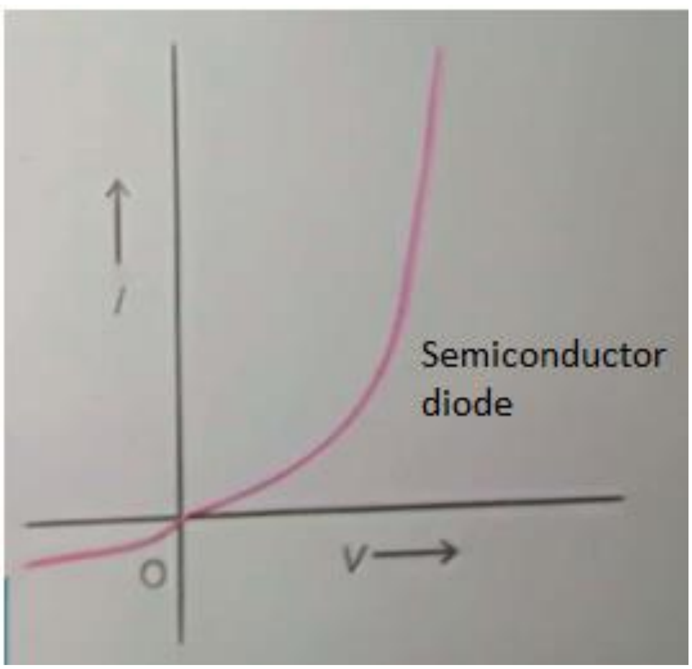
Ohmic and Non ohmic devices

Ohmic: obeys ohm's law (e.g. most of metals like nichrome, copper, silver etc.)

Non-Ohmic: do not obey ohm's law (semiconductor diodes, filament bulbs)







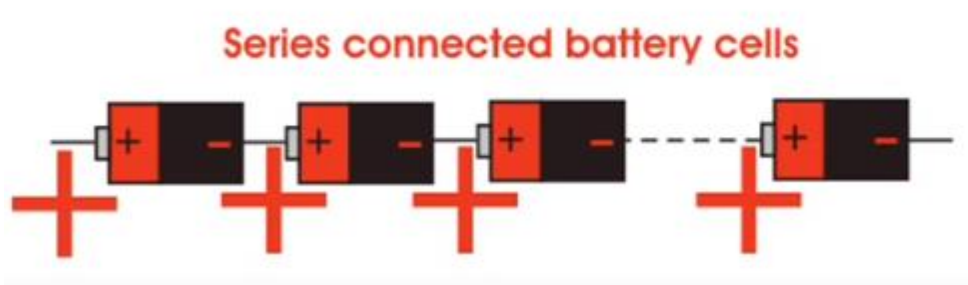
Cells in Series

In series circuit current remains the same and total voltage is sum of individual voltages of cells in series.

$V = V_1 + V_2 + V_3 + \ldots\ldots\ldots\ldots$

$I = I_1 = I_2 = I_3 = \ldots\ldots.$

Current value does not exceed that of the single cell (or lowest value). This combination is used when higher voltages are required.



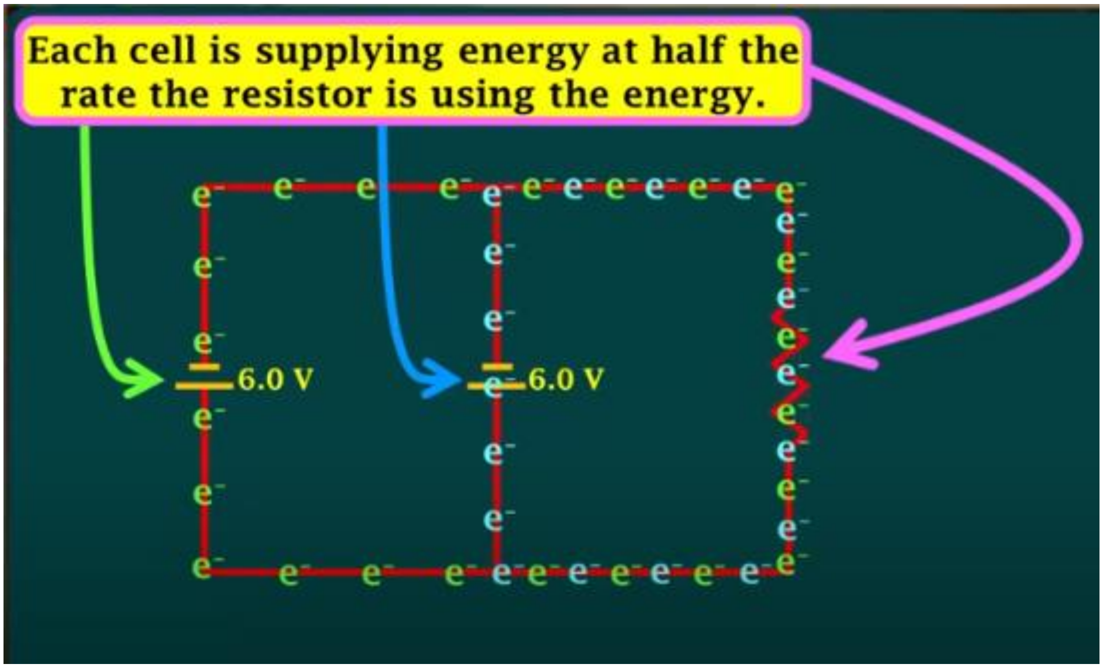
Cells in Parallel

Voltage is parallel circuit remains the same and total current is sum of individual currents

$V = V_1 = V_2 = V_3 = \ldots\ldots\ldots\ldots$

$I = I_1 + I_2 + I_3 + \ldots\ldots.$

This combination is used when increased currents are required.



Batteries remain long lasting.

Both combinations:

used in radio and television receivers.