ELECTRICITY
Ohm's Law

Ohm's Law:

It states that the current passing through a conductor is directly proportional to the potential difference across its ends, provided the temperature and other physical conditions (mechanical stain etc.), remain unchanged i.e.

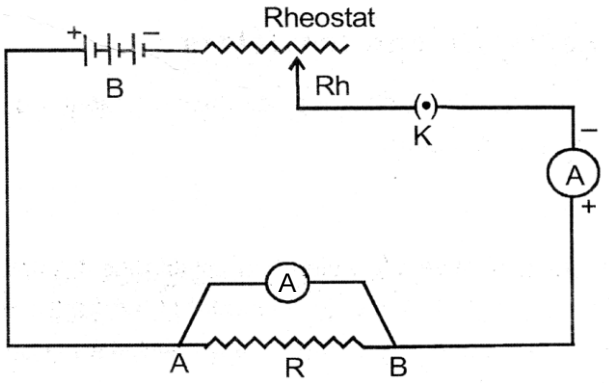
Where R is a content called resistance of the conductor.
The relation R = V/I is referred to an Ohm's law, after the German physicist George Simon Ohm (1789 -1854), who discovered it.
It is quite clear from the above equation that

(i) The current **I** is proportional to the potential difference **V** between the ends of the resistor.

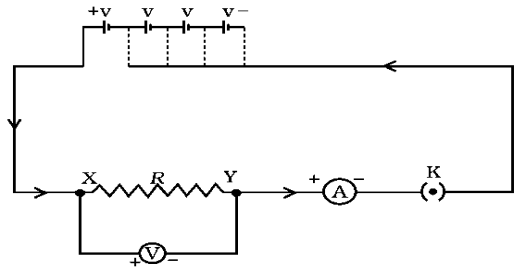
(ii) Current **I** is inversely proportional to the resistance.

Experimental verification of ohm's law:

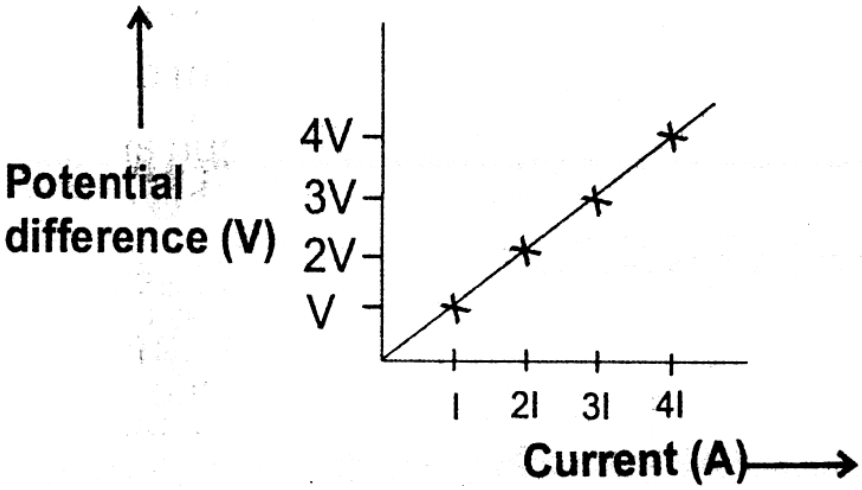
Set up a circuit as shown in the figure below consisting of a wire AB, a current measuring instrument called ammeter, an instrument measuring the potential difference called voltmeter and a number of cells, each of which provided some constant potential difference across the two points of a conductor. First, use one cell and note the current in the circuit and the potential difference across the wire AB. Suppose potential difference due to the cell produces a current **I** in the circuit and a potential difference
(**V**) across the wire AB. Repeat this experiment with two cells, three cells and four cells.



Note the successive readings in the ammeter and the voltmeter. WE will find that with two cells in the circuit, the current would be **2I** and the potential difference **2v.** Similarly, with three cells the current is **3I** and potential difference **3v** and so on. [The important precaution to observe here is not allow the current of flow in the wire continuously. This can be done by taking off the plug key and closing it only when the current is to be drawn.]
Now, plot a graph between the current and the potential difference. we will be a straight-line graph.



- Set up a circuit as shown in, consisting of a nichrome wire XY of length, say 0.5 m, an ammeter, a voltmeter and four cells of 1.5 V each. (Nichrome is an alloy of nickel, chromium, manganese, and iron metals.)



- First use only one cell as the source in the circuit. Note the reading in the ammeter I, for the current and reading of the voltmeter V for the potential difference across the nichrome wire XY in the circuit. Tabulate them in the Table given.
- Next connect two cells in the circuit and note the respective readings of the ammeter and voltmeter for the values of current through the nichrome wire and potential difference across the nichrome wire
- Repeat the above steps using three cells and then four cells in the circuit separately
- Calculate the ratio of V to I for each pair of potential difference V and current I.

It is the property of a conductor to resist the flow of charges through it. Its SI unit is ohm, represented by the Greek letter **Ω**. According to Ohm's law,

$$R = V/I$$

If the potential difference across the two ends of a conductor is 1 V and the current through it is 1 A, then the resistance R, of the conductor

is 1 Ω. That is, 1 ohm = 1 volt /1 ampere
Also from we get I = V/R
It is obvious from that the current through a resistor is inversely proportional to its resistance. If the resistance is doubled the current gets halved. In many practical cases it is necessary to increase or decrease the current in an electric circuit. A component used to regulate current without changing the voltage source is called variable resistance. In an electric circuit, a device called rheostat is often used to change the resistance in the circuit. We will now study about electrical resistance of a conductor with the help of following Activity.

In this Activity we observe that the current is different for different components. Why do they differ? Certain components offer an easy path for the flow of electric current while the others resist the flow.

We know that motion of electrons in an electric circuit constitutes an electric current. The electrons, however, are not completely free to move within a conductor. They are restrained by the attraction of the atoms among which they move. Thus, motion of electrons through a conductor is retarded by its resistance. A component of a given size that offers a low resistance is a good conductor. A conductor having some appreciable resistance is called a resistor. A component of identical size that offers a higher resistance is a poor conductor. An insulator of the same size offers even higher resistance