

Answer on Question #45159-Physics-Electromagnetism

What is a non-ohmic conductor? Derive the current-voltage relation for non-ohmic conductor.

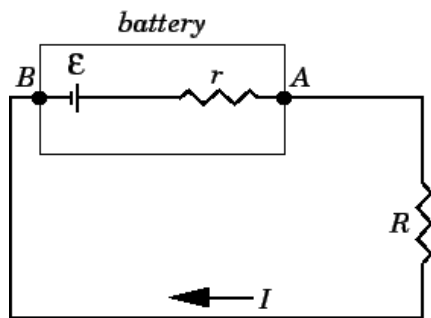
Answer

A non-ohmic conductor is a conductor that doesn't obey ohm's law. This law states that for any ohmic conductor, the potential difference between any two points on its circuit is directly proportional to the amount of current passing through the circuit.

Non-ohmic conductors have nonlinear graphs of current vs. voltage (since the equation

$Resistance = \frac{Voltage}{Current}$ is not obeyed). Different non-ohmic conductors have different V-I graphs. Diodes, light bulbs and LEDs, semiconductor p-n diodes, battery acid or alkaline solutions, alkali halide crystals, the ionized mercury vapor in a fluorescent lamp, and cathode ray tubes are non-ohmic.

Let's derive the current-voltage relation for battery.



A battery of emf E and internal resistance r connected to a load resistor of resistance R .

The voltage V of the battery is related to its emf E and internal resistance r via

$$V = E - Ir.$$

Therefore we have non-ohmic conductor ($r \neq \frac{V}{I}$).

