Current electricity

Current: rate of flow of charge

Current= charge/time Or I = Q/t
Units: current = Ampere (A)
Charge = Coulomb (C)
Time = seconds (S)

Voltage or potential difference: Amount of work done by the battery in moving a charge around the electrical circuit

Voltage = work done / charge V= W/Q
Units: voltage = Volts (V)
Work done = Joules (J)
Charge = Coulomb (C)

Electromotive force(EMF) = amount of work done by the battery in moving a charge around a complete circuit (ie. Both internal and external circuit)

EMF = work done / charge E = W / Q

Units: EMF = Volts (V)
Work done = Joules (J)
Charge = Coulomb (C)

Resistance: a component which restricts or resists the flow of charge

Resistance = voltage / current R = V x I

Units: resistance = Ohms
Voltage = Volts (V)
Current = Ampere (A)

Power: rate of work done

Power = work done / time, P = W / T ,
P = I x V , P = I^2 x R , P = V^2 / R

Units: voltage = Volts (V)
Work done = Joules (J)
Charge = Coulombs (C)

Energy: ability to do work

Energy = Power x time, E = I x V x T ,
E = I^2 x R x T , E = V^2 / t

Ohms law:

According to Ohms law the voltage across a resistor is known to be directly proportional to the amount of current flowing in the circuit provided that the temperature remains constant

Based on this law, the graph of voltage against current will be a straight line passing through the origin. The gradient of this graph gives the ratio of voltage upon current hence we can say that the gradient represents the resistance of the material.

If the axis of the graph is flipped that is we plot a graph of current against voltage, the graph will still be a straight line but the gradient will now represent the inverse of resistance

Note: all materials which obey this law are known as ohmic conductors examples include a resistor

Ohmic conductors exhibit the following properties:

- they obey Ohms law
- Their graph will be a straight line
- Their resistance remains constant

Non ohmic conductors:

- do not obey ohms law
- Their graph will be a curve
- Resistance will either increase or decrease
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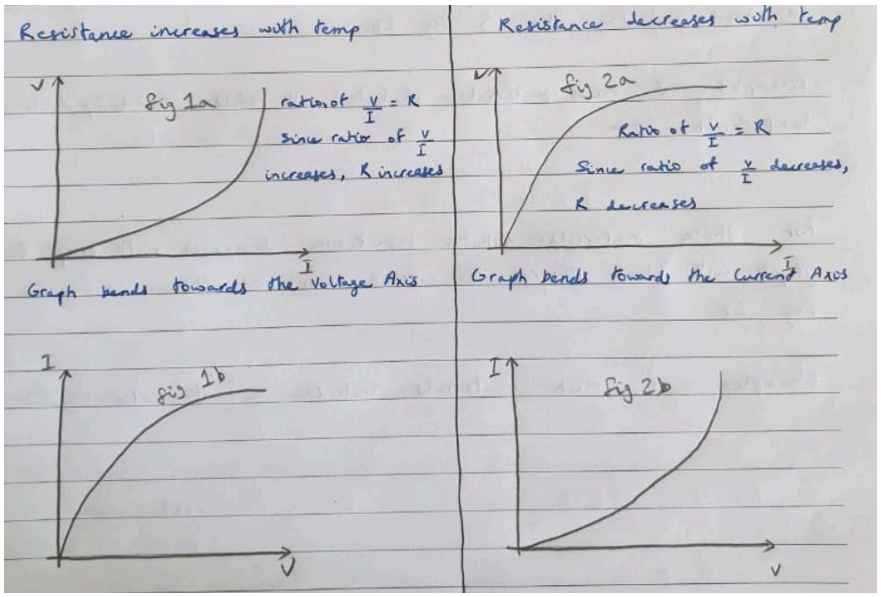

- For those non ohmic conductors whose resistance increases with temperature the graph will bend towards the voltage axis as shown in fig 1a and 1b
- For those materials whose resistance decreases with temperature, the graph will bend towards the current axis as shown in fig. 2a and 2b

If there are only two resistors we can use the shortcut formula product/ sum. The current in the circuit can be calculated using V = IR. This current supplied by the battery gets divided in parallel such that higher resistance gets lower current and lower resistance gets higher current. Voltage across each resistor remains the same in a parallel combination.

Series and parallel circuits

- In series a single switch will operate the entire circuit in parallel different appliances can be operated using their own independent switches.
- In series if one appliance was damaged the entire circuit will not operate. In parallel if one appliance is damaged the others will continue to operate.
- In series every appliance gets supplied with the same current. In parallel it is possible for us to supply different amounts of current to different appliances.
- In series voltage gets divided therefore appliances cannot work with optimum efficiency however in parallel each appliance gets the same voltag

Use of circuit components in series and parallel combination

variable resistor:

- It is also called a rheostat.
- It's purpose is to adjust the current in the circuit so the voltage across any component for example a fan or a bulb can be varied.
- The circuit arrangement for the use of a variable resistor is shown in fig.1
- In this circuit the variable resistor behaves as a dimmer. When the resistance of the variable resistor is increased, it's voltage also increases. This causes the voltage across the bulb to decrease and hence the bulb lights up dimly. When the resistance of the variable resistor is decreased it's voltage decreases as well. This causes the voltage across the bulb to increase and so the bulb lights up brightly.

Thermistor:

- It is a temperature sensitive device
- The resistance of thermistor changes with temperature. That is as the temperature increases the resistance of the thermistor decreases and as the temperature decreases resistance increases.
- Thermistors are used in fire alarm circuits, whose arrangement is shown below. The working principle is, at room temperature thermistor offers a higher resistance therefore gets more voltage, hence the voltage across the fixed resistor and the alarm is very low, therefore the alarm does not get activated. When the temperature of the surrounding begins to rise, the resistance of thermistor decreases hence it's voltage also decreases. This causes the voltage across the fixed resistor and the alarm to increase. When this voltage reaches a certain threshold value, the alarm gets activated and a warning sound is produced.

Light dependent resistor:

- LDR is a light sensitive device
- As light intesitity increases(bright room) the resistance of LDR decreases and when light intensity decreases (dark room) the resistance of LDR increases.
- An LDR circuit is used in automated steeet lights whose arrangement is shown in the diagram below
- The working principle for this arrangement is, during daytime LDR offers a low resistance therefore the LDR gets a smaller share of voltage hence, the bulb is not switched on. As night time approaches the resistance of LDR increases hence the voltage across the LDR also increases, this causes the voltage of the bulb to increase and when it's value reaches a certain threshold the bulb lights up automatically.

Potential divider:

- it is also called potentiometer
- The circuit of potential divider is used to alter the voltage across the bulb so that the brightness of the bulb can be changed.
- when the sliding contact is positioned further away from the fixed end, the bulb gets maximum voltage, making it light up brightly. When the sliding contact is moved towards the fixed point, it's voltage across the bulb decreases which makes it light up dimly

Diode

In a forward biased condition as shown in the first diagram, dioxide offers a lower restance, and allows current to flow through therefore the bulb lights up brightly, in reversed biased condition as shown in the second diagram, the diode offers a very high resistance and does not allow the current to flow therefore the lamp does not light up. When a diode is connected to an ac supply as shown in the third diagram the bulb blinks continuously. Based on the above statements, we can conclude that:

- diode allows current to flow only
- It converts ac supply to dc
- This property is called rectification, therefore diode behaves as a rectifier

Note: in terms of graphical illustration, this property of rectification can be explained as shown below

In recent times diodes are used in LED's, light emitting diode. When forward biased the LED switches off. When connected to an ac supply the LED blinks continuously