PHYSICS - X- PART-2

1 Effects of Electric Current

Arrangement of Resistors in Circuits

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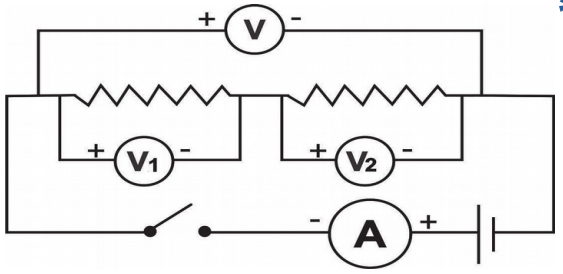

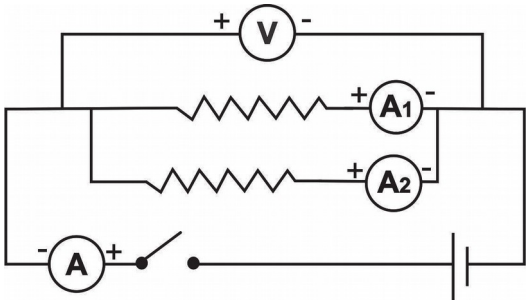

1. Series Connection

When a circuit is completed by connecting the resistors one after the other, it is called series connection.

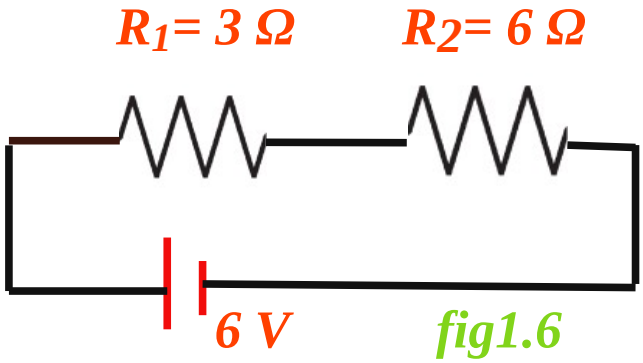

fig1.6

Effective resistance, $R = R_1 + R_2$

Effective resistance is the sum of the resistance of all the resistors when they are connected in series.

Ex. 1 (Fig.1.6)

$R_1 = 3\ \Omega$

$R_2 = 6\ \Omega$

Effective resistance, $R = R_1 + R_2$

$R = 3\ \Omega + 6\ \Omega$

$R = 9\ \Omega$

When resistors are connected in series,

* *The potential difference gets divided*
* *The current through each resistor will be the same.*
* *The effective resistance increases.*

2. Parallel Connection

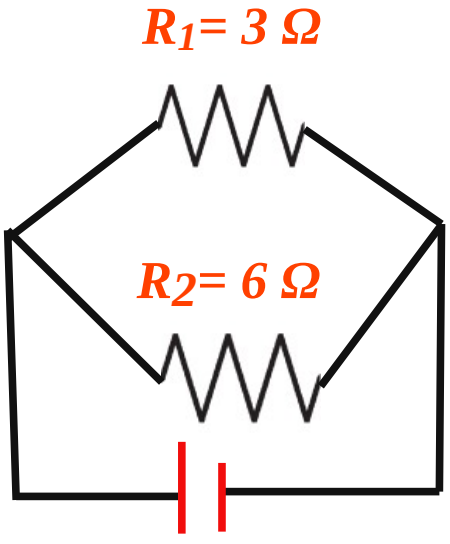

fig1.7

Effective resistance, $1/R = 1/R_1 + 1/R_2$

$$R = \frac{R_1 \times R_2}{R_1 + R_2}$$

Ex. 2 (Fig.1.7)

$R_1 = 3\ \Omega$

$R_2 = 6\ \Omega$

Effective resistance, $R = \frac{R_1 \times R_2}{R_1 + R_2}$

$R = \frac{3\ \Omega \times 6\ \Omega}{3\ \Omega + 6\ \Omega}$

$R = 2\ \Omega$

When resistors are connected in Parallel,

* *The potential difference in each resistors are same.*
* *Current through each resistors are different.*
* *The effective resistance decreases.*

If resistors of the same value are connected in parallel, then $R = \frac{r}{n}$, where n is the number of resistors and r is the resistance of one resistor.

Complete the following table

Resistors in series	Resistors in parallel
• Effective resistance increases	•
•	• The current through each resistor is different. It gets divided as per the value of resistors.
• The potential difference across each resistor is different. It gets divided as per the value of resistors.	•
•	• Each resistor can be controlled by using separate switches.

Heating Effect of Electricity- Uses

• *Name the part in which electrical energy changes into heat energy.*

- *Heating coils*

• *Which material is used to make this part?*

- *Nichrome (Nichrome is an alloy of nickel, chromium and iron)*

• *What are the peculiarities of such substances?*

- *High resistivity*
- *Ability to remain in red hot condition for a long time without getting oxidised*
- *High melting point*

Safety fuse

Safety fuse is a device that works on the heating effect of electric current.

* *Which material is used to make fuse wire?*

- *Fuse wire, an alloy of tin and lead,*

* *What are the peculiarities of fuse wire?*

-low melting point.

* ***Which are the circumstances that cause high electric current, leading to the melting of fuse wire?***

-Short Circuit and Overloading

* ***How is the fuse wire connected to a circuit?***

- In series.

Short Circuit

If the positive and the negative terminals of a battery or the two wires from the mains come into contact without the presence of a resistance in between, they are said to be short-circuited.

Overloading

A circuit is said to be overloaded if the total power of all the appliances connected to it is more than what the circuit can withstand.

Amperage

Amperage (A) is the ratio of the power of an equipment to the voltage applied. Amperage increases with the thickness of the conductor.

* ***When a fuse wire is included in a household wiring, what are the precautions to be taken?***

- ***The ends of the fuse wire must be connected firmly at appropriate points.***

- ***The fuse wire should not project out of the carrier base.***

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WORKSHEET - 1

- *You know that according to Joule s Law, more heat will be produced when electric current is increased. What happens to the fuse wire due to this?*

- *When heat is generated, why does the fuse wire melt?*

- *When the fuse wire melts, the circuit is broken. What happens to the current in the circuit?*

- *Why is the fuse used in a circuit called safety fuse? Explain.*

Electric power

* *The amount of energy consumed by an electrical appliance in unit time is its power.*

* *The unit of power is watt (W)*

$$\text{Power, } P = \frac{\text{Work}}{\text{time}} = \frac{H}{t}$$

$$P = VI$$

$$P = I^2R$$

$$P = V^2 / R$$

$$\text{Amperage} = \frac{\text{Wattage}}{\text{Voltage}} = \frac{W}{V}$$

WORKSHEET - 2

1, An appliance of power 540 W is used in a branch circuit. If the voltage is 230 V, what is its amperage?

2, A heating appliance has a resistance of 115 Ω. If 2 A current flows through it, what is the power of the appliance?

3, 22 A current of 0.4 A flows through an electric bulb working at 230 V. What is the power of the bulb?

4, An electric heater conducts 4 A current when 60 V is applied across its terminals. What will be the current if the potential difference is 120 V?

5, Three resistors of 2 Ω , 3 Ω and 6 Ω are given in the class.

(a) What is the highest resistance that you can get using all of them?

(b) What is the least resistance that you can get using all of them?

(c) Can you make a resistance 4.5 Ω using these three? Draw the circuit.

6, What is the current if 12 Ω and 4 Ω resistors are connected in parallel and 12 V potential difference is applied?

7, 10 resistors of 2 Ω each are connected in parallel. Calculate the effective resistance.