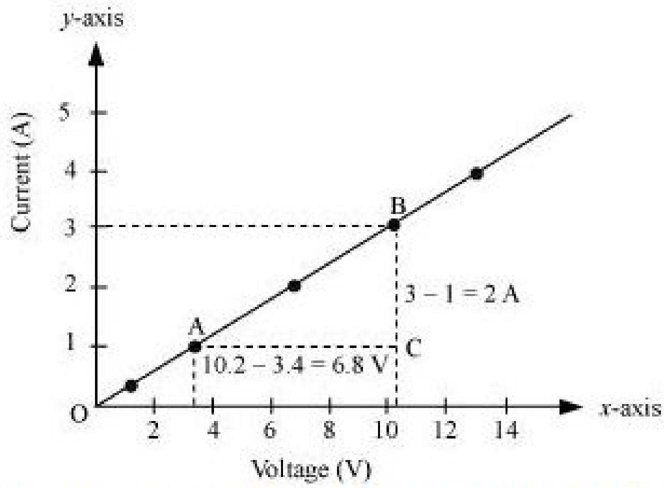
Question 7. The values of current I flowing in a given resistor for the corresponding values of potential difference V across the resistor are given below:

I (amperes)	0.5	1.0	2.0	3.0	4.0
V(volts)	1.6	3.4	6.7	10.2	13.2

Plot a graph between V and I and calculate the resistance of that resistor.
Answer:
The plot between voltage and current is called IV characteristic. The voltage is plotted on x-axis and current is plotted on y-axis. The values of the current for different values of the voltage are shown in the given table.

I (amperes)	0.5	1.0	2.0	3.0	4.0
V(volts)	1.6	3.4	6.7	10.2	13.2

The IV characteristic of the given resistor is plotted in the following figure.



The slope of the line gives the value of resistance (R) as,

$$\text{Slope} = \frac{1}{R} = \frac{BC}{AC} = \frac{2}{6.8}$$

$$R = \frac{6.8}{2} = 3.4\ \Omega$$

Therefore, the resistance of the resistor is $3.4\ \Omega$.

Question 8. When a 12 V battery is connected across an unknown resjstor, there is a current of 2.5 mA in the circuit. Find the value of

the resistance of the resistor.
Answer:
Resistance (R) of a resistor is given by Ohm's law as,

$$V = IR$$

$$R = \frac{V}{I}$$

Where,

Potential difference, V = 12 V

Current in the circuit, I = 2.5 mA = 2.5×10^{-3} A

$$R = \frac{12}{2.5 \times 10^{-3}} = 4.8 \times 10^{3}\ \Omega = 4.8\ \text{k}\Omega$$

Therefore, the resistance of the resistor is $4.8\ \text{k}\Omega$.

Question 9. A battery of 9 V ¡s connected in series with resistors of 0.2 ohm, 0.3 ohm, 0.4 ohm, 0.5 ohm and 12 ohm, respectively. How much current would flow through the 12 ohm resistor?
Answer:
There is no current division occurring in a series circuit. Current flow through the component is the same, given by Ohm's law as

$$V = IR$$

$$I = \frac{V}{R}$$

Where,

R is the equivalent resistance of resistances $0.2\ \Omega$, $0.3\ \Omega$, $0.4\ \Omega$, $0.5\ \Omega$, and $12\ \Omega$. These are connected in series. Hence, the sum of the resistances will give the value of R.

R = 0.2 + 0.3 + 0.4 + 0.5 + 12 = 13.4 Ω

Potential difference, V = 9 V

$$I = \frac{9}{13.4} = 0.671\ \text{A}$$

Therefore, the current that would flow through the 12 Ω resistor is 0.671 A.

Question 10. How many 176 ohm resistors (in parallel) are required to carry 5 A on a 220 V line?
Answer:
For x number of resistors of resistance 176 ohm, the equivalent resistance of the resistors connected in parallel is given by Ohms law as

$$V = IR$$

$$R = \frac{V}{I}$$

Where,

Supply voltage, V = 220 V

Current, I = 5 A

Equivalent resistance of the combination = R, given as

$$\frac{1}{R} = x \times \left(\frac{1}{176}\right)$$

$$R = \frac{176}{x}$$

From Ohm's law,

$$\frac{V}{I} = \frac{176}{x}$$

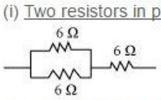
$$x = \frac{176 \times I}{V} = \frac{176 \times 5}{220} = 4$$

Therefore, four resistors of 176 ohm are required to draw the given amount of current.

Question 11. Show how you would connect three resistors each 0f resistance 6 ohm, so that the combination has a resistance of (i) 9 ohm, (ii) 4 ohm.
Answer:
If we connect the resistors in series, then the equivalent resistance will be the sum of the resistors,
i.e., 6 ohm + 6 ohm + 6 ohm = 18 ohm,which is not desired. If we connect the resistors bi parallel then the equivalent resistance will be

$\frac{6}{2} = 3\ \Omega$, which is also not desired. Hence, we should either connect the two resistors in series or parallel.

(i) Two resistors in parallel

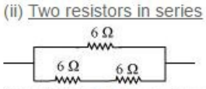


Two 6 Ω resistors are connected in parallel. Their equivalent resistance will be

$$\frac{1}{\frac{1}{6}+\frac{1}{6}} = \frac{6 \times 6}{6+6} = 3\,\Omega$$

The third 6 Ω resistor is in series with 3 Ω. Hence, the equivalent resistance of the circuit is 6 Ω + 3 Ω = 9 Ω.

(ii) Two resistors in series



Two 6 Ω resistors are in series. Their equivalent resistance will be the sum $6+6=12\ \Omega$

The third 6 Ω resistor is in parallel with 12 Ω. Hence, equivalent resistance will be

$$\frac{1}{\frac{1}{12}+\frac{1}{6}} = \frac{12 \times 6}{12+6} = 4\ \Omega$$

Therefore, the total resistance is $4\ \Omega$.

Question 12. Several electric bulbs designed to be used on a 220 V electric supply line, are rated 10 W. How many lamps can be connected in parallel with each other across the two wires 01220 V line if the maximum allowable current is 5 A?
Answer:

$$P_1 = \frac{V^2}{R_1}$$

$$R_1 = \frac{V^2}{P_1}$$

Where,

Supply voltage, $V = 220$ V

Maximum allowable current, $I = 5$ A

Rating of an electric bulb $P_1 = 10\ \text{W}$

$$R_1 = \frac{(220)^2}{10} = 4840\ \Omega$$

According to Ohms law,
V = IR
Where,
R is the total resistance of the circuit for x number of electric bulbs

$$R = \frac{V}{I} = \frac{220}{5} = 44\ \Omega$$

Resistance of each electric bulb, $R_1 = 4840\ \Omega$

$$\therefore \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_1} + \text{...up to } x \text{ times}$$

$$\frac{1}{R} = \frac{1}{R_1} \times x$$

$$x = \frac{R_1}{R} = \frac{4840}{44} = 110$$

Therefore 110 electric bulbs are connected in parallel.

*********** END **********