

# CBSE Class 10 Science NCERT Solution

## Science Chapter 12 - Electricity

### In text Questions

Page Number: 200

**Question 1:-What does an electric circuit mean?**

**Answer:**

A continuous and closed path along which an electric current flows is called an electric circuit.

**Question 2:-Define the unit of current.**

**Answer:**

Unit of current is ampere. If one coulomb of charge flows through any section of a conductor in one second then the current through it is said to be one ampere.

$$I = Q/t \text{ or } 1 \text{ A} = 1 \text{ C s}^{-1}$$

**Question 3:-Calculate the number of electrons constituting one coulomb of charge.**

**Answer:**

Charge on one electron,  $e = 1.6 \times 10^{-19} \text{ C}$

Total charge,  $Q = 1 \text{ C}$

Number of electrons,  $n = Q/e = 1\text{C}/1.6 \times 10^{-19} = 6.25 \times 10^{18}$

Page Number: 202

**Question 1:-Name a device that helps to maintain a potential difference across a conductor.**

**Answer:**

A battery.

**Question 2:-What is meant by saying that the potential difference between two points is IV?**

**Answer:**

The potential difference between two points is said to be 1 volt if 1 joule of work is done in moving 1 coulomb of electric charge from one point to the other.

**Question 3:-How much energy is given to each coulomb of charge passing through a 6 V battery?**

**Answer:**

Energy given by battery = charge x potential difference  
or  $W = QV = 1C \times 6V = 6J$ .

**Page Number: 209**

**Question 1:-On what factors does the resistance of a conductor depend?**

**OR**

**List the factors on which the resistance of a conductor in the shape of a wire depends.**

**Answer:**

The resistance of the conductor depends on the following factors:

- a. Temperature of the conductor
- b. Cross-sectional area of the conductor
- c. Length of the conductor
- d. Nature of the material of the conductor

**Question 2:-Will current flow more easily through a thick wire or a thin wire of the same material, when connected to the same source? Why?**

**Answer:**

The current will flow more easily through a thick wire than a thin wire of the same material. Larger the area of cross-section of a conductor, more is the ease with which the electrons can move through the conductor. Therefore, smaller is the resistance of the conductor.

**Question 3:-Let the resistance of an electrical component remains constant while the potential difference across the two ends of the component decreases to half of its former value. What change will occur in the current through it?**

**Answer:**

When potential difference is halved, the current through the component also decreases to half of its initial value. This is according to ohm's law i.e.,  $V \propto I$ .

The change in the current flowing through the electrical component can be determined by Ohm's Law.

According to Ohm's Law, the current is given by

$$I = V/R$$

Now, the potential difference is reduced to half keeping the resistance constant,

Let the new voltage be  $V' = V/2$

Let the new resistance be  $R' = R$  and the new amount of current be  $I'$ .

The change in the current can be determined using Ohm's law as follows:

$$I' = \frac{V'}{R'} = \frac{\left(\frac{V}{2}\right)}{R} = \frac{1V}{2R} = \frac{1}{2}$$

Therefore, the current flowing the electrical component is reduced by half.

**Question 4:-Why are coils of electric toasters and electric irons are made of an-alloy rather than a pure metal?**

**OR**

**Why are alloys commonly used in electric heating devices? Given reason.**

**Answer:**

The coils of electric toasters, electric irons and other heating devices are made of an alloy rather than a pure metal because (i) the resistivity of an alloy is much higher than that of a pure metal, and (ii) an alloy does not undergo oxidation (or burn) easily even at high temperature, when it is red hot.

**Question 5:-Use the data in Table 12.2 (in NCERT Book on Page No. 207) to answer the following :**

**(i) Which among iron and mercury is a better conductor?**

**(ii) Which material is the best conductor?**

**Answer:**

(i) Resistivity of iron =  $10.0 \times 10^{-8} \Omega \text{ m}$

Resistivity of mercury =  $94.0 \times 10^{-8} \Omega \text{ m}$ .

Thus iron is a better conductor because it has lower resistivity than mercury.

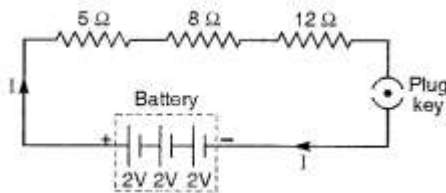
(ii) Because silver has the lowest resistivity ( $= 1.60 \times 10^{-8} \Omega \text{ m}$ ), therefore silver is the best conductor.

**Page Number: 213**

**Question 1:-Draw a schematic diagram of a circuit consisting of a battery of three cells of 2 V each, a 5Ω resistor, an 8 Ω resistor, and a 12 Ω resistor, and a plug key, all connected in series.**

**Answer:**

The required circuit diagram is shown below :



**Question 2:-Redraw the circuit of Questions 1, putting in an ammeter to measure the current through the resistors and a voltmeter to measure the potential difference across the 12 Ω resistor. What would be the readings in the ammeter and the voltmeter?**

**Solution:**

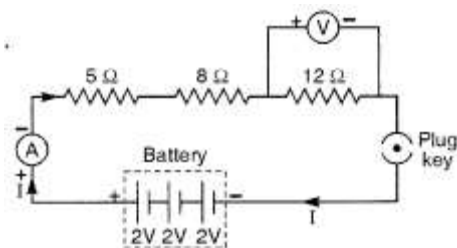
The required circuit diagram is shown on the right.

Total voltage,  $V = 3 \times 2 = 6\text{V}$

Total resistance,  $R = 5\Omega + 8\Omega + 12\Omega = 25\Omega$

$$\text{Reading of ammeter, } I = \frac{V}{R} = \frac{6}{25} = 0.24 \text{ A}$$

$$\text{Reading of voltmeter, } V = IR = 0.24 \times 12 = \mathbf{2.88 \text{ V.}}$$



**Question 1:-Judge the equivalent resistance when the following are connected in parallel :**

**(i) 1  $\Omega$  and 10<sup>6</sup>  $\Omega$ ,**

**(if) 1  $\Omega$  and 10<sup>3</sup>  $\Omega$  and 10<sup>6</sup>  $\Omega$ .**

**Answer:**

(a) When 1  $\Omega$  and 10<sup>6</sup> are connected in parallel, the equivalent resistance is given by

$$\frac{1}{R} = \frac{1}{1} + \frac{1}{10^6}$$

$$R = \frac{10^6}{1 + 10^6} \approx \frac{10^6}{10^6} = 1 \Omega$$

Therefore, the equivalent resistance is 1  $\Omega$ .

(b) When 1  $\Omega$ , 10<sup>3</sup>  $\Omega$ , and 10<sup>6</sup>  $\Omega$  are connected in parallel, the equivalent resistance is given by

$$\frac{1}{R} = \frac{1}{1} + \frac{1}{10^3} + \frac{1}{10^6}$$

Solving, we get

$$R = \frac{10^6 + 10^3 + 1}{10^6} = \frac{1000000}{1000001} = 0.999 \Omega$$

Therefore, the equivalent resistance is 0.999  $\Omega$ .

**Question 2:-An electric lamp of 100  $\Omega$ , a toaster of resistance 50  $\Omega$ , and a water filter of resistance 500  $\Omega$  are connected in parallel to a 220 V source. What is the resistance of an electric iron connected to the same source that takes as much current as all three appliances, and what is the current through it?**

**Solution:**

Resistance of electric lamp,  $R_1 = 100 \Omega$

Resistance of toaster,  $R_2 = 50 \Omega$

Resistance of water filter,  $R_3 = 500 \Omega$

Equivalent resistance  $R_p$  of the three appliances connected in parallel, is

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{100} + \frac{1}{50} + \frac{1}{500} = \frac{16}{500}$$

or 
$$R_p = \frac{500}{16} \Omega = 31.25 \Omega.$$

Resistance of electric iron = Equivalent resistance of the three appliances connected in parallel = 31.25  $\Omega$

Applied voltage,  $V = 220 \text{ V}$

Current,  $I = V/R = 220\text{V} / 31.25\Omega = 7.04\text{A}$

**Question 3:-What are the advantages of connecting electrical devices in parallel with the battery instead of connecting them in series?**

**Answer:**

Advantages of connecting electrical devices in parallel with the battery are :

1. In parallel circuits, if an electrical appliance stops working due to some defect, then all other appliances keep working normally.
2. In parallel circuits, each electrical appliance has its own switch due to which it can be turned on turned off independently, without affecting other appliances.
3. In parallel circuits, each electrical appliance gets the same voltage (220 V) as that of the power supply line.
4. In the parallel connection of electrical appliances, the overall resistance of the household circuit is reduced due to which the current from the power supply is high.

**Question 4:-How can three resistors of resistances 2Ω, 3 Ω, and 6Ω be connected to give a total resistance of (i) 4 Ω, (ii) 1 Ω?**

**Solution:**

(i) We can get a total resistance of 4Ω by connecting the 2Ω resistance in series with the parallel combination of 3Ω and 6Ω.

$$\text{So } R = R_1 + \frac{R_2 R_3}{R_2 + R_3} = 2 + \frac{3 \times 6}{3 + 6} = 4 \Omega$$

(ii) We can obtain a total resistance of 1Ω by connecting resistors of 2 Ω, 3 Ω and 6 Ω in parallel.

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{2} + \frac{1}{3} + \frac{1}{6} = \frac{1}{1} \quad \text{or } R = 1 \Omega.$$

**Question 5:-What is (i) the highest, (ii) the lowest total resistance that can be secured by combinations of four coils of resistance 4 Ω, 8 Ω, 12 Ω, 24 Ω?**

**Solution:**

(i) Highest resistance can be obtained by connecting the four coils in series.

$$\text{Then, } R = 4\Omega + 8\Omega + 12\Omega + 24\Omega = 48\Omega$$

(ii) Lowest resistance can be obtained by connecting the four coils in parallel.

$$\text{Then, } \frac{1}{R} = \frac{1}{4} + \frac{1}{8} + \frac{1}{12} + \frac{1}{24} = \frac{12}{24} = \frac{1}{2} \quad \text{or } R = 2 \Omega.$$

**Page Number: 218**

**Question 1:-Why does the cord of an electric heater not glow while the heating element does?**

**Solution:**

Heat generated in a circuit is given by  $I^2 R t$ . The heating element of an electric heater made of nichrome glows because it becomes red-hot due to the large amount of heat produced on passing current because of its high resistance, but the cord of the electric heater made of copper does not glow because negligible heat is produced in it by passing current because of its extremely low resistance.

**Question 2:-Compute the heat generated while transferring 96000 coulomb of charge in one hour through a potential difference of 50 V.**

**Solution:**

The heat generated can be computed by Joule's law as follows:

$$H = VI t$$

Where,

V is the voltage, V = 50 V

I is the current

t is the time in seconds, 1 hour = 3600 seconds

The amount of current can be calculated as follows:

$$\text{Amount of Current} = \frac{\text{Amount of charge}}{\text{Time flow of charge}}$$

Substituting the value, we get

$$I = \frac{96000}{3600} = 26.66 \text{ A}$$

Now, to find the heat generated,

$$H = 50 \times 26.66 \times 3600 = 4.8 \times 10^6 \text{ J}$$

The heat generated is  $4.8 \times 10^6 \text{ J}$ .

**Question 3:-An electric iron of resistance  $20\Omega$  takes a current of 5 A. Calculate the heat developed in 30 s.**

**Solution:**

The amount of heat generated can be calculated using the Joule's law of heating, which is given by the equation

$$H = VI t$$

Substituting the values in the above equation, we get,

$$H = 100 \times 5 \times 30 = 1.5 \times 10^4 \text{ J}$$

The amount of heat developed by the electric iron in 30 s is  $1.5 \times 10^4 \text{ J}$ .

**Page Number: 220**

**Question 1:-What determines the rate at which energy is delivered by a current?**

**Answer:**

Resistance of the circuit determines the rate at which energy is delivered by a current.

**Question 2:-An electric motor takes 5 A from a 220 V line. Determine the power of the motor and the energy consumed in 2 h.**

**Answer:**

The power of the motor can be calculated by the equation,

$$P = VI$$

Substituting the values in the above equation, we get

$$P = 220 \text{ V} \times 5 \text{ A} = 1100 \text{ W}$$

The energy consumed by the motor can be calculated using the equation,

$$E = P \times T$$

Substituting the values in the above equation, we get

$$P = 1100 \text{ W} \times 7200 = 7.92 \times 10^6 \text{ J}$$

The power of the motor is 1100 W and the energy consumed by the motor in 2 hours is  $7.92 \times 10^6 \text{ J}$ .

# NCERT Solutions for Class 10 Science

## Chapter 12

### Textbook Chapter End Questions

**Question 1:-**A piece of wire of resistance  $R$  is cut into five equal parts. These parts are then connected in parallel. If the equivalent resistance of this combination is  $R'$ , then the ratio  $R/R'$  is:

- (a) 125
- (b) 15
- (c) 5
- (d) 25

**Answer:**

- (d) 25

The resistance is cut into five equal parts, which means that the resistance of each part is  $R/5$ .

We know that each part is connected to each other in parallel, hence the equivalent resistance can be calculated as follows:

$$\frac{1}{R'} = \frac{5}{R} + \frac{5}{R} + \frac{5}{R} + \frac{5}{R} + \frac{5}{R} = \frac{5+5+5+5+5}{R} = \frac{25}{R}$$

$$\frac{R}{R'} = 25$$

The ratio of  $R/R'$  is 25.

**Question 2:-**Which of the following terms does not represent electrical power in a circuit?

- (a)  $I^2R$
- (b)  $IR^2$
- (c)  $VI$
- (d)  $V^2/R$

**Answer:**

- (b)  $IR^2$

Electrical power is given by the expression  $P = VI$ . (1)

According to Ohm's law,

$$V = IR$$

Substituting the value of  $V$  in (1), we get

$$P = (IR) \times I$$

$$P = I^2R$$

Similarly, from Ohm's law,

$$I = V/R$$

Substituting the value of  $I$  in (1), we get

$$P = V \times V/R = V^2/R$$

From this, it is clear that the equation  $IR^2$  does not represent electrical power in a circuit.

**Question 3:-An electric bulb is rated 220 V and 100 W. When it is operated on 110 V, the power consumed will be:**

- (a) 100 W
- (b) 75 W
- (c) 50 W
- (d) 25 W

**Answer:**

- (d) 25 W

The energy consumed by the appliance is given by the expression

$$P = VI = V^2/R$$

The resistance of the light bulb can be calculated as follows:

$$R = V^2/P$$

Substituting the values, we get

$$R = (220)^2/100 = 484 \Omega$$

Even if the supply voltage is reduced, the resistance remains the same. Hence, the power consumed can be calculated as follows:

$$P = V^2/R$$

Substituting the value, we get

$$P = (110)^2 V/484 \Omega = 25 W$$

Therefore, the power consumed when the electric bulb operates at 110 V is 25 W.

**Question 4:-Two conducting wires of the same material and of equal lengths and equal diameters are first connected in series and then parallel in a circuit across the same potential difference. The ratio of heat produced in series and parallel combinations would be:**

- (a) 1 : 2
- (b) 2 : 1
- (c) 1 : 4
- (d) 4 : 1

**Answer:**

- (c) 1 : 4

Let  $R_s$  and  $R_p$  be the equivalent resistance of the wires when connected in series and parallel respectively.

For the same potential difference  $V$ , the ratio of the heat produced in the circuit is given by

$$\frac{H_s}{H_p} = \frac{\frac{v^2}{R_s} t}{\frac{v^2}{R_p} t} = \frac{R_p}{R_s}$$

The equivalent resistance of resistors connected in series  $R_s$  is  $R + R = 2R$

The equivalent resistance of resistors connected in parallel  $R_p$  is  $\frac{1}{\frac{1}{R} + \frac{1}{R}} = \frac{R}{2}$

Hence, the ratio of the heat produced in series and parallel combinations would be

$$\frac{H_p}{H_s} = \frac{\frac{R}{2}}{2R} = \frac{1}{4}$$



Hence, the ratio of the heat produced is 1:4.

**Question 5:-How is a voltmeter connected in the circuit to measure the potential difference between two points?**

**Answer:**

A voltmeter is connected in parallel to measure the potential difference between two points.

**Question 6:-A copper wire has diameter 0.5 mm and resistivity of  $1.6 \times 10^{-8} \Omega \text{ m}$ . What will be the length of this wire to make its resistance  $10 \Omega$ ? How much does the resistance change if the diameter is doubled?**

**Answer:**

$$\text{Radius, } r = \frac{0.5}{2} = 0.25 \text{ mm} = \frac{0.25}{1000} \text{ m} = 0.25 \times 10^{-3} \text{ m, } \rho = 1.6 \times 10^{-8} \text{ ohm cm}$$

$$R = 10 \Omega, \quad l = ?$$

$$\text{Now, } R = \rho \frac{l}{A} = \rho \frac{l}{\pi r^2}$$

$$\text{Therefore, } l = \frac{\pi r^2 R}{\rho} = \frac{3.14 \times (0.025)^2 \times 10}{1.6 \times 10^{-6}} = 12265.625 \text{ cm}$$

$$= \mathbf{122.6 \text{ metre}}$$

$$\text{Again, } R = \rho \frac{l}{A} = \rho \frac{l}{\pi d^2/4}$$

$$\text{i.e., } R \propto \frac{1}{d^2}$$

If a wire of diameter doubled to it is taken, then area of cross-section becomes four times.

New resistance =  $10/4 = 2.5 \Omega$ , Thus the new resistance will be 1/4 times.

Decrease in resistance =  $(10 - 2.5) \Omega = 7.5 \Omega$

**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:**

|                    |     |     |     |      |      |
|--------------------|-----|-----|-----|------|------|
| <b>I (amperes)</b> | 0.5 | 1.0 | 2.0 | 3.0  | 4.0  |
| <b>V (volts)</b>   | 1.6 | 3.4 | 6.7 | 10.2 | 13.2 |

**Plot a graph between V and I and calculate the resistance of the resistor.**

**Solution:**

The graph between V and I for the above data is given below.

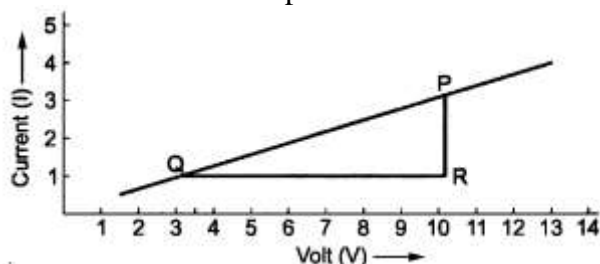
The slope of the graph will give the value of resistance.

Let us consider two points P and Q on the graph.

and from P along Y-axis, which meet at point R.

Now, QR =  $10.2\text{V} - 3.4\text{V} = 6.8\text{V}$

And PR =  $3 - 1 = 2$  ampere



$$\text{Slope} = \frac{PR}{QR} = \frac{I}{V} = \frac{1}{R} = \frac{2}{6.8} = \frac{1}{3.4}$$

Thus, resistance,  $R = 3.4 \Omega$

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

**Solution:**

Here,  $V = 12 \text{ V}$  and  $I = 2.5 \text{ mA} = 2.5 \times 10^{-3} \text{ A}$

$\therefore$  Resistance,  $R = V/I = 12\text{V} / 2.5 \times 10^{-3}\text{A} = 4,800 \Omega = 4.8 \times 10^3 \Omega$

**Question 9:-**A battery of 9V is connected in series with resistors of 0.2  $\Omega$ , 0.3  $\Omega$ , 0.4  $\Omega$ , 0.5  $\Omega$  and 12  $\Omega$ , respectively. How much current would flow through the 12  $\Omega$  resistor?

**Solution:**

Total resistance,  $R = 0.2 \Omega + 0.3 \Omega + 0.4 \Omega + 0.5 \Omega + 12 \Omega = 13.4 \Omega$

Potential difference,  $V = 9 \text{ V}$

Current through the series circuit,  $I = V/R = 12\text{V}/13.4\Omega = 0.67 \text{ A}$

$\therefore$  There is no division of current in series. Therefore current through 12  $\Omega$  resistor = 0.67 A.

**Question 10:-**How many 176  $\Omega$  resistors (in parallel) are required to carry 5 A on a 220 V line?

**Solution:**

Suppose  $n$  resistors of 176  $\Omega$  are connected in parallel.

Then, 
$$\frac{1}{R} = \frac{1}{176} + \frac{1}{176} + \dots n \text{ times}$$

or 
$$\frac{1}{R} = \frac{n}{176} \quad \text{or} \quad R = \frac{176}{n} \Omega$$

By Ohm's law,  $R = \frac{V}{I} \quad \text{or} \quad \frac{176}{n} = \frac{220}{5} \quad \text{or} \quad n = \frac{176 \times 5}{220} = 4$

Thus 4 resistors are needed to be connect.

**Question 11:-**Show how you would connect three resistors, each of resistance 6  $\Omega$ , so that the combination has a resistance of (i) 9  $\Omega$ , (ii) 4  $\Omega$

**Solution:**

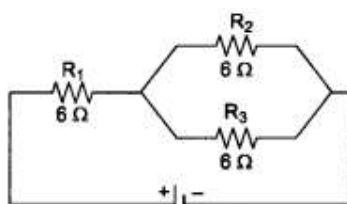
Here,  $R_1 = R_2 = R_3 = 6 \Omega$ .

(i) When we connect  $R_1$  in series with the parallel combination of  $R_2$  and  $R_3$  as shown in Fig. (a).

The equivalent resistance is

$$R = R_1 + \frac{R_2 R_3}{R_2 + R_3} = 6 + \frac{6 \times 6}{6 + 6}$$

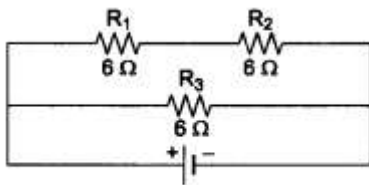
$$= 6 + 3 = 9 \Omega$$



**Fig. (a)**

(ii) When we connect a series combination of  $R_1$  and  $R_2$  in parallel with  $R_3$ , as shown in Fig. (b), the equivalent resistance is

$$R = \frac{12 \times 6}{12 + 6} = \frac{72}{18} = 4 \Omega.$$



**Fig. (b)**

**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 of 220 V line if the maximum allowable current is 5 A?

**Solution:**

Here, current,  $I = 5$  A, voltage,  $V = 220$  V

$\therefore$  Maximum power,  $P = I \times V = 5 \times 220 = 1100$ W

Required no. of lamps = Max. Power/ Power of lamp =  $1100/10 = 110$

$\therefore$  110 lamps can be connected in parallel.

**Question 13:-**A hot plate of an electric oven connected to a 220 V line has two resistance coils A and B, each of 24  $\Omega$  resistance, which may be used separately, in series, or in parallel. What are the currents in the three cases?

**Solution:**

(i) When the two coils A and B are used separately.  $R = 24 \Omega$ ,  $V = 220$  V

$$\text{Current, } I = \frac{V}{R} = \frac{220 \text{ V}}{24 \Omega} = 9.167 \text{ A}$$

(ii) When the two coils are connected in series,

$$R = 24 \Omega + 24 \Omega = 48 \Omega$$

$$V = 220 \text{ V}$$

$$\text{Current, } I = \frac{V}{R} = \frac{220 \text{ V}}{48 \Omega} = 4.58 \text{ A}$$

(iii) When the two coils are connected in parallel.

$$R = \frac{24 \times 24}{24 + 24} = 12 \Omega$$

$$V = 220 \text{ V}$$

$$\text{Current, } I = \frac{V}{R} = \frac{220 \text{ V}}{12 \Omega} = 18.33 \text{ A}$$

**Question 14:-**Compare the power used in the 2  $\Omega$  resistor in each of the following circuits

(i) a 6 V battery in series with 1  $\Omega$  and 2  $\Omega$  resistors, and

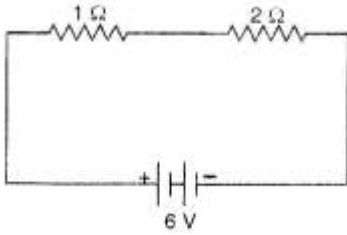
(ii) a 4 V battery in parallel with 12  $\Omega$  and 2  $\Omega$  resistors.

**Solution:**

(i) The circuit diagram is shown in figure.

Total resistance,  $R = 1\Omega + 2\Omega = 3\Omega$

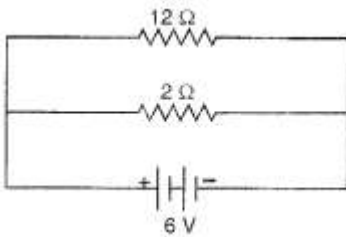
Potential difference,  $V = 6\text{ V}$



Power used in  $2\Omega$  resistor  $P = I^2R = (2)^2 \times 2 = 8\text{ W}$

(ii) The circuit diagram for this case is shown:

Power used in  $2\Omega$  resistor  $P = V^2/R = 4^2/2 = 8\text{ W}$ .



[∴ Current is different for different resistors in parallel combination.]

**Question 15:-Two lamps, one rated 100 W at 220 V, and the other 60 W at 220 V, are connected in parallel to electric mains supply. What current is drawn from the line if the supply voltage is 220 V?**

**Solution:**

Power of first lamp ( $P_1$ ) = 100 W

Potential difference ( $V$ ) = 220 V

$$\therefore \text{Current through first lamp } (I_1) = \frac{P_1}{V} = \frac{100}{220}\text{ A}$$

$$\text{Resistance of first lamp } (R_1) = \frac{V}{I_1} = \frac{220}{100/220}\Omega = 484\Omega$$

Similarly, for second lamp,  $P_2 = 60\text{ W}$ ,  $V = 220\text{ V}$

$$\therefore \text{Current flowing through the second lamp } (I_2) = \frac{P_2}{V} = \frac{60}{220}\text{ A}$$

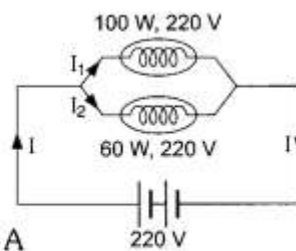
$$\text{Resistance of second lamp } (R_2) = \frac{V}{I_2} = \frac{220}{60/220}\Omega = \frac{220 \times 220}{60} = \frac{2420}{3}\Omega$$

$$\therefore \text{Equivalent resistance in mains, } \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{484} + \frac{3}{2420} = \frac{5+3}{2420} = \frac{8}{2420}$$

$$\text{or } R = \frac{2420}{8}\Omega$$

And potential difference of mains  $V = 220\text{ V}$

$$\therefore \text{Current drawn from the mains } (I) = \frac{V}{R} = \frac{220}{2420/8} = \frac{220 \times 8}{2420} = 0.727\text{A} = \mathbf{0.73\text{A}}$$



**Question 16:-Which uses more energy, a 250 W TV set in 1 hr, or a 1200 W toaster in 10 minutes?**

**Solution:**

Energy used by 250 W TV set in 1 hour = 250 W x 1 h = 250 Wh

Energy used by 1200 W toaster in 10 minutes = 1200 W x 10 min  
= 1200 x 1060 = 200 Wh 60

Thus, the TV set uses more energy than the toaster.

**Question 17:-An electric heater of resistance 8 Ω draws 15 A from the service mains 2 hours. Calculate the rate at which heat is developed in the heater.**

**Solution:**

Here, R = 8 Ω, I = 15 A, t = 2 h

The rate at which heat is developed in the heater is equal to the power.

Therefore, P = I<sup>2</sup> R = (15)<sup>2</sup> x 8 = 1800 Js<sup>-1</sup>

**Question 18:-Explain the following:**

**(i) Why is tungsten used almost exclusively for filament of electric lamps ?**

**(ii) Why are the conductors of electric heating devices, such as bread-toasters and electric irons, made of an alloy rather than a pure metal?**

**(iii) Why is the series arrangement not used for domestic circuits?**

**(iv) How does the resistance of a wire vary with its area of cross-section?**

**(v) Why are copper and aluminum wires usually employed for electricity transmission?**

**Answer:**

(i) The tungsten is used almost exclusively for filament of electric lamps because it has a very high melting point (3300°C). On passing electricity through tungsten filament, its temperature reaches to 2700°C and it gives heat and light energy without being melted.

(ii) The conductors of electric heating devices such as bread-toasters and electric irons, are made of an alloy rather than a pure metal because the resistivity of an alloy is much higher than that of pure metal and an alloy does not undergo oxidation (or burn) easily even at high temperature.

(iii) The series arrangement is not used for domestic circuits because in series circuit, if one electrical appliance stops working due to some defect, then all other appliances also stop working because the whole circuit is broken.

(iv) The resistance of a wire is inversely proportional to its area of cross-section, i.e., Resistance R ∝ (1/πr<sup>2</sup>). If the area of cross section of a conductor of fixed length is increased, then resistance decreases because there are more free electrons for movement in conductor.

(v) Copper and aluminum wires usually employed for electricity transmission because they have very low resistances. So, they do not become too hot on passing electric current.