NCERT Solutions Class 10 – Electricity – cbsephysics.com

Page No: 200

Question 1: What does an electric circuit mean?

Answer: A continuous and closed path of an electric current loop consisting of electrical components is called an electric circuit. An electric circuit is one type of network consisting of electric devices, a source of electricity, and wires that are connected, giving a return path for the current.

Question 2: Define the unit of current.

Answer: The unit of electric current is ampere (A).
If 1C charge is flowing through a current-carrying wire in 1 second, then the amount of current is called 1 A.

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

Answer: The charge of one electron is 1.6×10^{-19}C.
i.e., 1.6×10^{-19}C of charge is contained in 1 electron.
∴ 1 C of charge is contained in $(1/1.6 \times 10^{-19}) = 6.25 \times 10^{18}$ electrons.
Therefore, approx. 6×10^{18} electrons constitute 1 coulomb of charge.

Page No: 202

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

Answer: Any source of electricity, such as a battery, cell, power supply, etc., helps to maintain a potential difference across a conductor by changing the amount of flow of electrical current.

Question 2: What is meant by saying that the potential difference between two points is 1 V?

Answer: If 1 J of work is required to move 1 C charge from one point to another, then the potential difference between the two points is 1 V.

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

Answer: The amount of work done required to move 1-coulomb charge between the two points of potential difference 6 Volt is - 6 Joule.
Now we know that,
Potential difference =(Work Done/Charge)
∴ Work done = Potential difference (V)× charge(Q)
Where, Q = 1 C and V = 6 V
∴ Work done = 6×1= 6 Joule.

Page No: 209
Question 1: On what factors does the resistance of a conductor depend?

Answer: The resistance of a conductor depends upon the following factors:
(a) Length of the conductor (Directly proportional)
(b) Material of the conductor (Resistivity)
(c) Cross-sectional area of the conductor (Inversely proportional)
(d) Temperature 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 the thick wire because the resistance of a conductor is inversely proportional to its area of cross-section. i.e., a thick wire has less resistance than a thin wire.

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: According to Ohm's law
$V = IR$

⇒ $I=V/R$ …. (1)

Now Potential difference is half of its initial value.

∴ New potential difference $V'=V/2$

Resistance remains constant = R

We can write,

$I' = V'/R$

$I' = (V/2)/R$

$I' = (1/2)\ (V/R)$

$I' = (1/2)\ I = I/2$

Therefore, the amount of current flowing through the electrical circuit is reduced by half of its initial value.

Question 4: Why are coils of electric toasters and electric irons made of an alloy rather than a puremetal?

Answer: The resistivity and melting point of an alloy is much higher than the pure metal. Hence, at high temperatures, the alloys do not melt easily. Therefore, the coils of heating appliances such as electric toasters and electric irons are made of an alloy called Nichrome rather than the pure metal.

Question 5: Use the data in Table 12.2 to answer the following –
(a) Which among iron and mercury is a better conductor?
(b) Which material is the best conductor?

Table 12.2 Electrical resistivity of some substances at 20°C

–	**Material**	**Resistivity (Ω m)**
Conductors	Silver	1.60×10^{-8}
	Copper	1.62×10^{-8}
	Aluminum	2.63×10^{-8}
	Tungsten	5.20×10^{-8}
	Nickel	6.84×10^{-8}
	Iron	10.0×10^{-8}
	Chromium	12.9×10^{-8}
	Mercury	94.0×10^{-8}
	Manganese	1.84×10^{-6}
	Constantan (an alloy of Cu and Ni)	49×10^{-6}

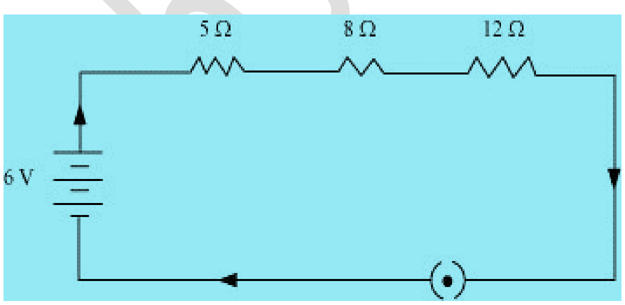
Alloys	Manganin (An alloy of Cu, Mn, and Ni)	44×10^{-6}
	Nichrome (Alloy of Ni, Cr, Mn, and Fe)	100×10^{-6}
	Glass	$10^{10} - 10^{14}$
Insulators	Hard rubber	$10^{13} - 10^{16}$
	Ebonite	$10^{15} - 10^{17}$
	Diamond	$10^{12} - 10^{13}$
	Paper (dry)	10^{12}

Answer: Resistivity of iron = $10.0 \times 10^{-8}\ \Omega$ and Resistivity of mercury = $94.0 \times 10^{-8}\ \Omega$
Resistivity of mercury is more than that of iron. This implies that the resistance of mercury is much higher than iron, so iron is a relatively good conductor than mercury.
In the table, we can see that the resistivity of silver is the lowest among all the listed materials. Hence, silver is the best conductor here.

Page No: 213

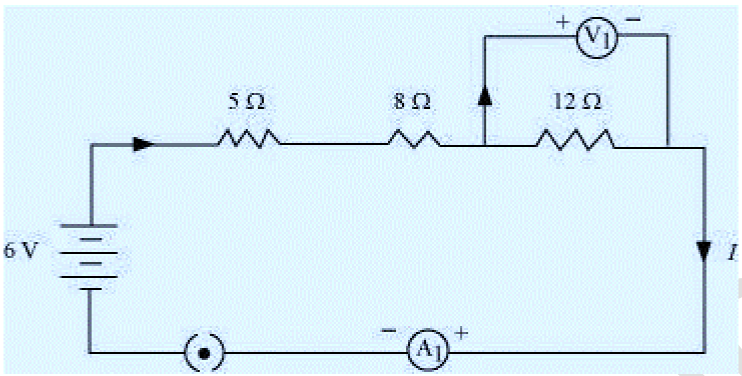
Question 1: Draw a schematic diagram of a circuit consisting of a battery of three cells of 2 V each, a 5Ω resistor, an 8 Ω resistor, and a 12 Ω resistor, and a plug key, all connected in series.

Answer: As the cells are connected in series, the potential difference of the battery will be -
$V = 2\ V + 2\ V + 2\ V = 6V$.
The following circuit diagram is given below:



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

Answer: An ammeter is always connected in series with the resistors to measure the current flowing through the circuit.
To measure the potential difference across a load resistance, we have to connect the voltmeter in parallel, as shown in the following figure.



According to Ohm's law V= IR,
Where, Potential difference, $V = 6$ V, Current flowing through the circuit/resistors = I
Equivalent resistance of the circuit, $R = 5 + 8 + 12 = 25\Omega$
$I = V/R = 6/25 = 0.24$ A
Let us consider, potential difference across 12 Ω resistor = V_1
Current flowing through the 12 Ω resistor, $I = 0.24$ A
By using Ohm's law, $V_1 = IR = 0.24 \times 12 = 2.88\ V$
[Therefore, the reading of the ammeter will be 0.24 A., and the reading of the voltmeter will be 2.88 V.]

Page No: 216

Question 1: Judge the equivalent resistance when the following are connected in parallel – (a) 1 Ω and10^6 Ω, (b) 1 Ω and 10^3 Ω and 10^6 Ω.

Answer: When 1 Ω and 10^6 Ω are connected in parallel:

The equivalent resistance R will be -

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

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

Therefore, equivalent resistance will be nearly equal to 1 Ω

: **When 1Ω, 103 Ω, and 106 Ω are connected in parallel**

The equivalent resistance R will be -

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

$$R = \frac{1000000}{1001001} = 0.999\ \Omega$$

Therefore, the equivalent resistance will be 0.999 Ω.

Question 2: An electric lamp of 100 Ω, a toaster of resistance 50 Ω, and a water filter of resistance 500 Ω 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?

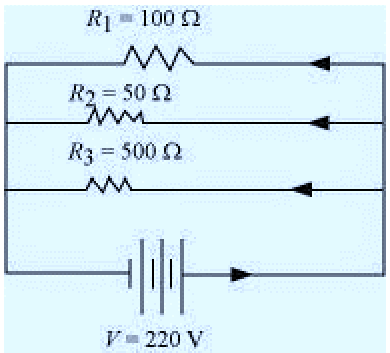
Answer: Resistance of lamp, $R_1 = 100\ \Omega$.

Resistance of toaster, $R_2 = 50\ \Omega$.

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

The potential difference of the source, $V = 220\ V$

As they are connected in parallel, their equivalent resistance R will be -



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

According to Ohm's law,

$V = IR$

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

Where,

Current flowing through the circuit = I

$I = \frac{220}{\frac{500}{16}} = \frac{220/16}{50} = 7.04$ A

7.04 A of current is drawn by all the three given appliances.

Therefore, current drawn by an electric iron connected to the same source of potential 220 V = 7.04 A

Let R' be the resistance of the electric iron. According to Ohm's law,

$V = IR'$

$R' = \frac{V}{I} = \frac{220}{7.04} = 31.25\ \Omega$

Therefore, the resistance of the electric iron is 31.25 Ω and the current flowing through it is 7.04 A.

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

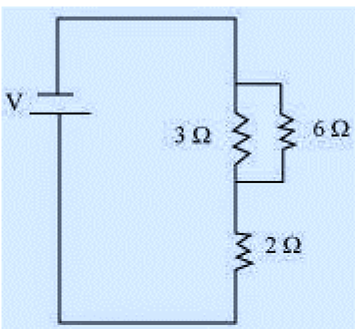
Answer:

Advantages of connecting electrical devices in parallel:

1. Our electrical appliance needed a particular voltage for working properly. In a parallel connection, the potential difference remains constant among the appliances.
2. The total effective resistance of the circuit becomes less; hence Joules heating effect can be neglected easily.
3. Less amount of energy is wasted, i.e., The efficiency of a parallel circuit is high compared to a series circuit.

Question 4: How can three resistors of resistances 2 Ω, 3 Ω and 6 Ω be connected to give a totalresistance of (a) 4 **Ω,** (b) 1 **Ω?**

Answer: Those resistances should connect 2 Ω, 3 Ω, and 6 Ω respectively to get equivalent resistance of 4 Ω,

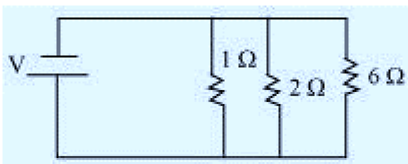


Explanation:6 Ω and 3 Ω resistors are connected in parallel; their equivalent resistance will be given by

$$\frac{6 \times 3}{6+3} = 2\ \Omega$$

Again, this equivalent resistance 2 Ω is connected to another 2 Ω resistor in series.
Therefore, final equivalent resistance of the circuit becomes = 2 Ω + 2 Ω = 4 Ω

Those resistances should connect 2 Ω, 3 Ω, and 6 Ω respectively to get equivalent resistance of 1 Ω,



All the resistors are connected in series. Therefore, their equivalent resistance will be R =

$$\frac{1}{\frac{1}{2}+\frac{1}{3}+\frac{1}{6}} = \frac{1}{\frac{3+2+1}{6}} = \frac{6}{6} = 1\ \Omega$$

Therefore, the total resistance of the circuit will be 1 Ω.

Question 5: What is (a) the highest, (b) the lowest total resistance that can be secured by combinations of four coils of resistance 4 Ω, 8 Ω, 12 Ω, 24 Ω?
Answer: There are four coils of resistances 4 Ω, 8 Ω, 12 Ω, and 24 Ω respectively.

If we connect these four coils in series, then the equivalent resistance will be the highest,
And, the resultant resistance will be R = 4 + 8 + 12 + 24 = 48 Ω

If we connect these four coils in parallel, then the equivalent resistance will be the lowest,
And, the resultant resistance will be R =

$$\frac{1}{\frac{1}{4}+\frac{1}{8}+\frac{1}{12}+\frac{1}{24}} = \frac{1}{\frac{6+3+2+1}{24}} = \frac{24}{12} = 2\ \Omega$$

Therefore, 2 Ω is the lowest total resistance of that circuit.

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Page No: 218

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

Answer: The heating element of the heater is made up of alloy, which has very high resistance, so when current flows through the heating element, it becomes too hot and glows.

But the resistance of the cord is very less as it is made up of a good conductor. Hence, no heat energy is radiated.

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

Answer: Charge, Q = 96000C

Time, t= 1hr = 3600s.

Potential difference, V= 50V.

Now we know that, H= VIt

So, we have to calculate I first.

We know, I= Q/t

∴ I = 96000/3600 = 80/3 A

Now, H= VIt

$H= 50 \times \frac{80}{3} \times 60 \times 60 = 4.8 \times 10^6$ J

Therefore, the amount of heat generated is 4.8×10^6 J.

Question 3: An electric iron of resistance 20 Ω takes a current of 5 A. Calculate the heat developed in 30s.

Answer: From joule's law of heating, H= VIt

Current, I = 5 A, Time t = 30 s

Voltage, $V = I \times R$ = 5 x 20 = 100 V.

Therefore, the amount of heat developed, H = 100 x 5 x 30 = 1.5×10^4 J.

Page No: 220

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

Answer: Electric power, we know that the rate at which energy is consumed is known as electric power.

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: Power (P) is defined by the expression, $P = VI$

Given, Voltage = 220 V.

Current, $I = 5$ A

∴ $P = 220 \times 5 = 1100$ W

Total Energy consumed by the motor = P×t

Time, $t = 2$ hour = 2 x 60 x 60 = 7200 s

∴ $P = (1100 \times 7200) = 7.92 \times 10^6$ J

Therefore, the power of the motor = 1100 W and the energy consumed by the motor in 2 hours is 7.92×10^6 J.

Page No: 221, Exercise

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) 1/25

(b) 1/5

(c) 5

(d) 25

Answer: The ratio of R/R′ is 25.

The resistance is cut into five equal parts, so new the resistance of each part is R/5.

As they are connected in parallel, hence the equivalent resistance can be calculated as follows:

1/R'= 5/R +5/R+ 5/R+5/R+5/R

1/R'= 25/R

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

Question 3: An electric bulb is rated 220 V and 100 W. When it is operated on 110 V, the power consumed will be -
100 W
75 W
50 W
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 - $R = V^2/P$

Substituting the given values, we get $R = (220)^2/100 = 484\ \Omega$

The power consumed - $P = V^2/R$

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

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

Question 4: Two conducting wires of the same material and of equal lengths and equal diameters are firstconnected 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.

From joules law of heating, the produced heat is -

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

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

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

Question 5: How is a voltmeter connected in the circuit to measure the potential difference between two points?
Answer: To measure the potential difference between two points, a voltmeter should be connected in parallel between two measurable points.

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

Answer:

Area of cross-section of the wire, A =π (d/2)^2

Diameter= 0.5 mm = 0.0005 m

Resistance, R = 10 Ω.

Now,

$$R = \rho \frac{l}{A}$$

The area of cross-section of the wire can be calculated as follows

$$A = \pi (\frac{Diameter}{2})^2$$

Substituting the values in the formula, we get

$$l = \frac{RA}{\rho} = \frac{10 \times 3.14 \times (\frac{0.0005^2}{2})}{(1.6 \times 10^{-8})} = \frac{10 \times 3.14 \times 25}{4 \times 1.6} = 122.72 \text{ m}$$

If the diameter of the wire is doubled, then the new diameter will be 1 mm or 0.001 m. Therefore, the resistance can be calculated as follows:

$$R = \rho \frac{l}{A} = 1.6 \times 10^{-8} \times \frac{122.72 \text{ m}}{\pi (\frac{0.001}{2})^2} = 250.2 \times 10^{-2} = 2.5 \, \Omega$$

Therefore, the length of the wire is 122.72 m, and the new resistance of the wire becomes 2.5 Ω.

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 –

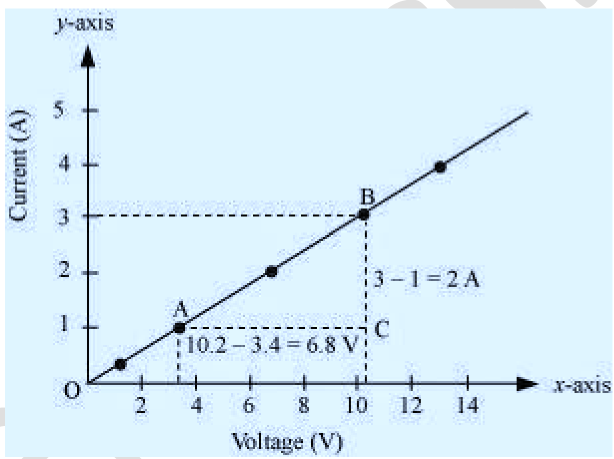
I (amperes)	0.5	1.0	2.0	3.0	4.0
V (volts)	1.6	3.4	6.7	10.2	13.2

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

Answer: The plot of voltage and current is called the *I-V* characteristic. The voltage is plotted on the *x*-axis,and the current is plotted on the *y*-axis. The values of the current for different values of the voltage are shown in the given table.

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

The *I-V* characteristic of the given resistor is plotted in the following figure.



The slope of the line = 1/*R* = (BC/AC) = 2/6.8

R= 6.8/2 = 3.4 Ω

Therefore, the resistance of the resistor is 3.4 Ω.

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.

Answer:

Where, Potential difference, $V = 12\ V$

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

From Ohm's law as, $V = IR$

Or, $R = V/I$

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

Therefore, the resistance of the resistor is 4.8 kΩ

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

$V = IR$ $I = V/R$

Where,

R is the equivalent resistance of resistances 0.2 Ω, 0.3 Ω, 0.4 Ω, 0.5 Ω, and 12 Ω. They are connected in series. Hence, the equivalent resistances will give the value of $R = 0.2 + 0.3 + 0.4 + 0.5 + 12 = 13.4\ \Omega$

Potential difference, $V = 9$,

$I = V/R = (9/13.4) = 0.671$ A

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

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

Answer:

Let x number of resistors of resistance 176 Ω required, and they are connected in parallel-

Supply voltage, $V = 220\ V$

Current, $I = 5$ A

The equivalent resistance of the combination = R

Then,

$$\frac{1}{R} = x \times \frac{1}{176} = R = \frac{176}{x}$$

Now, using Ohm's law, the number of resistors can be calculated as follows:

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

Substituting the values, we get

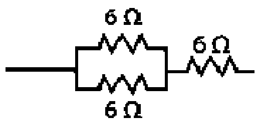
$$\frac{176}{x} = \frac{V}{I}$$

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

The number of required resistances is 4

Question 11: Show how you would connect three resistors, each of resistance 6 ohm, so that the combination has a resistance of (i) 9 Ω, (ii) 4 Ω.

Answer: First combination -



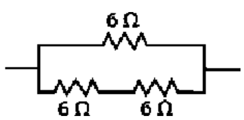
Here, two 6 Ω resistors are connected in parallel, and one in series to get the desired resistance -

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

The third resistor is in series. Hence the equivalent resistance becomes-

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

Second combination -



Here, two 6 Ω resistors are connected in series, and then left one 6 Ω is connected to parallel with them to get the desired resistance -

When two resistors are connected in series, their equivalent resistance is given by

$R = 6\ \Omega + 6\ \Omega = 12\ \Omega$

The third resistor is connected in parallel with 12 Ω. Therefore, the equivalent resistance becomes:

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

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

Answer: Supply voltage, $V = 220\ V$

Maximum allowable current, $I = 5$ A.

Power of electric bulb P=10 watts.

Hence, $R_1 = V^2/P = (220)^2/10 = 4840\ \Omega$

The resistance of x number of electric bulbs is calculated as follows:

R = V/I = 220/5 = 44 Ω

The resistance of each electric bulb is 4840 Ω.

The equivalent resistance of x bulbs is given by

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_1} + \frac{1}{R_1} \pm \cdots upto\ x\ times$$

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

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

∴ Therefore, 110 electric bulbs 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 Ω resistances, which may be used separately, in series, or in parallel. What are thecurrents in the three cases?

Answer: Supply voltage, $V = 220\ V$

Resistance of each coil, $R = 24\ \Omega$

When coils are used separately -

Using Ohm's law, we can calculate the current flowing through each coil as follows:

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

Substituting the values, we get

$$I = \frac{220\text{ V}}{24\ \Omega} = 9.166\text{ A}$$

Therefore, 9.166 A of current flows through each resistor when they are used separately.

Case (ii) When coils are connected in series:

The total resistance becomes R = 24 Ω + 24 Ω = 48 Ω

The current flowing through the series circuit can be calculated as follows:

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

Therefore, 4.58 A flows through the circuit.

Case (iii) When they are connected in parallel:

When the coils are connected in parallel, the equivalent resistance can be calculated as follows:

$$R = \frac{24 \times 24}{24 + 24} = \frac{576}{48} = 12\ \Omega$$

Using Ohm's law, the current flowing through the parallel circuit is given by

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

Therefore, the amount of current flow in the parallel circuit is 18.33 A.

Question 14: Compare the power used in the 2 Ω resistor in each of the following circuits: (i) a 6 V battery in series with 1 Ω and 2 Ω resistors, and (ii) a 4 V battery in parallel with 12 Ω and 2 Ω resistors.

Answer: Potential difference, $V = 6$ V

1 Ω and 2 Ω resistors are connected in series.
Therefore, equivalent resistance becomes, $R = 1 + 2 = 3$ Ω
According to Ohm's law, $V = IR$
∴ $I = V/R = 6/3 = 2$ A
Hence, 2A current will flow through each component of the circuit because they are connected in series.
Therefore, Power $P = (I)^2R = (2)^2 \times 2 = 8$ W
In the second case-
Potential difference, $V = 4$ V
12 Ω and 2 Ω resistors are connected in parallel.
Power consumed by 2 Ω resistor is given by
∴ $P = V^2/R = 4^2/2 = 8$ W
Therefore, the power used by the 2 Ω resistor is 8 W.

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*?

Answer: Both the bulbs are connected in parallel. Therefore, the potential difference across each bulb will be 220 *V* because no division of voltage occurs in a parallel circuit.
Current drawn by the 100 W bulb is given by, Power = Voltage x Current = Power/Voltage = 60/220 A
∴ current drawn from the line is given by = 100/220 + 60/220 = 0.727 A

Question 16: Which uses more energy, a 250 W TV set in 1 hour or a 1200 W toaster in 10 minutes?
Answer: Energy consumed by an electrical appliance is given by the expression= P × t
∴ Energy consumed by a TV set of power 250 W in 1 h = $250 \times 3600 = 9 \times 10^5$ J
∴ Energy consumed by a toaster of power 1200 W in 10 minutes = $1200 \times 600 = 7.2 \times 10^5$ J
Therefore, more energy is consumed by a 250 W TV set in 1 hour than the energy consumed by a toaster of power 1200 W in 10 minutes.

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

Answer:

Given, Resistance of the electric heater, R= 8 Ω.

Current drawn, I = 15 A

The rate of heat produced by a device is P= $(15)^2$ x 8 = 1800 J/s

Therefore, the heat is produced by the heater at the rate of 1800 J/s.

Question 18: Explain the following:

1. Why is the tungsten used almost exclusively for filament of electric lamps?

Answer:

The melting point and of Tungsten is an alloy that has a very high melting point and veryhigh resistivity, so it does not burn easily at a high temperature.

2. Why are the conductors of electric heating devices, such as bread-toasters and electricirons, made of an alloy rather than a pure metal?

Answer:

The resistivity and melting point of tungsten is very high. Therefore, it doesn't melt easily due to high temperatures. Due to high resistance, more temperature is also generated. Hence, tungsten is used as the filament of electric lamps.

3. Why is the series arrangement not used for domestic circuits?

Answer:

a. In series circuits, voltage is divided among each component of a series circuit. Therefore, every component receives a small voltage.

b. Due to series connection, the effective resistance of the circuit becomes very high. So more heat energy is generated all over the circuit that making and the device burn.

c. Our home appliances are designed so that they will work properly only at a particular potential difference.

So, we should not use series arrangements for domestic circuits.

4. How does the resistance of a wire vary with its area of cross-section?

Answer:

Resistance (R) of a wire is inversely proportional to its area of cross-section (A), i.e., thin wires have higher resistance than thick wires.

5. Why are copper and aluminum wires usually employed for electricity transmission?

Answer:

a. Copper and aluminum are good conductors of electricity; also, they have low resistivity.

b. Due to very low resistance, much less heat is generated in the wire, so much less energy is wasted.

So, they are usually used for electricity transmission.