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 ohm resistances, which may be used separately, in series, or in parallel- What are the currents in the three cases?
Answer:
Supply voltage. V= 220V
Resistance of one coil, R = 24 ohm
(i) Coils are used separately

According to Ohm's law,

$$V = I_1 R_1$$

Where,

$I_1$ is the current flowing through the coil

$$I_1 = \frac{V}{R_1} = \frac{220}{24} = 9.166 \text{ A}$$

Therefore, 9.16 A current will flow through the coil when used separately.
(ii) Coils are connected in sertes

Total resistance, $R_2 = 24\ \Omega + 24\ \Omega = 48\ \Omega$

According to Ohm's law,

$$V = I_2 R_2$$

Where,

$I_2$ is the current flowing through the series circuit

$$I_2 = \frac{V}{R_2} = \frac{220}{48} = 4.58 \text{ A}$$

Therefore. 4.58 A current will flow through the circuit when the coils are connected in Series.
(iii) Coils are connected in parallel

Total resistance, $R_3$ is given as $\frac{1}{\frac{1}{24} + \frac{1}{24}} = \frac{24}{2} = 12\ \Omega$

According to Ohm's law,

$$V = I_3 R_3$$

Where,

$I_3$ is the current flowing through the circuit

$$I_3 = \frac{V}{R_3} = \frac{220}{12} = 18.33 \text{ A}$$

Therefore, 18.33 A current will flow through the circuit when coils are connected in parallel.

Question 14. Compare the power used in the 2 ohm resistor in each of the following circuits:
(i) a 6 V battery in series with 1 ohm and 2 ohm resistors. and
(ii) a 4 V battery in parallel with 12 ohm and 2 ohm resistors.
Answer:
(i) Potential difference, V = 6 V
1 ohm and 2 ohm resistors are connected in series. Therefore, equivalent resistance of the circuit, R = 1 + 2 = 3 ohm

According to Ohm's law,

$V = IR$

Where,

$I$ is the current through the circuit

$$I = \frac{6}{3} = 2 \text{ A}$$

This current will flow through each component of the circuit because there is no division of current in series circuits Hence, current flowing through the 2 0 resistor is 2 A Power is given by the expression,
$P = (I)^2R = (2)^2 \times 2 = 8$ W
(ii) Potential difference, V = 4 V
12 ohm and 2 ohm resistors are connected in parallel. The voltage across each component of a parallel circuit remains the same. Hence, the voltage across 2 ohm resistor will be 4 V.
Power consumed by 2 ohm resistor is given by

$$P = \frac{V^2}{R} = \frac{4^2}{2} = 8 \text{ W}$$

Therefore, the power used by 2 Ω resistor is 8 W.

Quntlon 15. Two lamps, one rated 100 W at 220 V, and the other 6o W at 22o 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, potential difference across each of them will be 220 V, because no division of voltage occurs in a parallel circuit.
Current drawn by the bulb of rating 1oo W is given by,

$$\text{Power} = \text{Voltage} \times \text{Current}$$

$$\text{Current} = \frac{\text{Power}}{\text{Voltage}} = \frac{100}{220} \text{ A}$$

Similarly, current drawn by the bulb of rating 60 W is given by,

$$\text{Power} = \text{Voltage} \times \text{Current}$$

$$\text{Current} = \frac{\text{Power}}{\text{Voltage}} = \frac{60}{220} \text{ A}$$

$$\text{Hence, current drawn from the line} = \frac{100}{220} + \frac{60}{220} = 0.727 \text{ A}$$

Question 16. Which uses more energy, a 250 W TVset in 1 hr or a

1200 W toaster in 10 minutes?
Answer:
Energy consumed by an electrical appliance is given by the expression.
H = Pt
Where,
Power of the appliance = P
Time = t
Energy consumed by a TV set of power 250 W in 1 h = 250 × 3600 = $9 \times 10^5$ J
Energy consumed by a toaster of power 1200 W in lo minutes 1200 × 600 = $7.2 \times 10^5$ J
Therefore, the energy consumed by a 250 W TV set in 1 h is more than the energy consumed by a toaster of power 1200 W in 10 minutes.

Question 17. An electric heater of resistance 8 ohm draws 15 A from the service mains 2 hours. Calculate the rate at which heat is developed in the heater.
Answer:
Rate of heat produced by a device is given by the expression for power as
$P = I^2R$
Where,
Resistance of the electric heater. R = 8 ohm
Current drawn I = 15A
$P = (15)^2 \times 8 = 1800$ J/s
Therefore, heat s produced by the heater at the rate of 1800 J/s.

Question 18. Explain the following.
(a) Why is the tungsten used almost exclusively for filament of electric lamps?
(b) Why are the conductors of electric heating devices, such as bread-toasters and electric irons made of an alloy rather than a pure metal?
(c) Why is the series arrangement not used for domestic circuits?
(d) How does the resistance of a wire vary with its area of cross-section?
(e) Why are copper and aluminium wires usually employed for electricity transmission?
Answer:
(a) The melting point and resistivity of tungsten are very high. It does not burn readily at a high temperature. The electric lamps glow at very high temperatures. Hence, tungsten is mainly used as heating element of electric bulbs.
(b) The conductors of electric heating devices such as bread toasters and electric irons are made of alloy because resistivity of an alloy is more than that of metals. It produces large amount of heat.
(c) There is voltage division in series circuits. Each component of a series circuit receives a small voltage for a large supply Voltage. As a result, the amount of current decreases and the device becomes hot. Hence, series arrangement is not used in domestic circuits.
(d) Resistance (R) of a wire is inversely proportional to its area of cross-section (A), i.e.,

$$R \propto \frac{1}{A}$$

(e) Copper and aluminium wires have low resistivity. They are good conductors of electricity. Hence, they are usually employed for electricity transmission.

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