RAVI TEST PAPERS & NOTES, WHATSAPP 8056206308

Electricity IMPORTANT QUESTIONS

10th Standard

Science

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

Answer : Electric cell or battery is a device that helps to maintain a potential difference across a conductor.

2) Define the unit of current.

Answer : The SI unit of electric current is ampere (A).
The current flowing through a conductor is said to be 1A, if a charge of 1coulomb (C) flows through it in 1second (s)
or $1A = \frac{1C}{1s}$

3) Calculate the number of electrons constituting one coulomb of charge.

Answer : We know that, charge on one electron = 1.6×10^{-19}C
$\Rightarrow 1.6 \times 10^{-19}$ coulomb charge = 1 electron.
$\therefore$ 1 coulomb charge=$\frac{1}{1.6\times10^{-19}} \simeq 6.25 \times 10^{18}$ electrons

4) What is meant by saying that the potential difference between two points is 1 V?

Answer : The potential difference between two points is said to be 1 V if 1 J of work is done in moving 1 Coulomb of electric charge from one point to other point.

5) How much energy is given to each coulomb of charge passing through a 6 V battery?

Answer : Given, charge, q = 1 C, potential, V = 6 V, W=?
As we know, W = q V = 1 $\times$6 = 6J
6J is given to each coulomb of charge passing through a 6V battery.

6) On what factors do the resistance of a conductor depend?

Answer : The resistance of a conductor depends on following factors:
(i) Length of the conductor.
(ii) Area of cross-section of the conductor.
(iii) Nature of material of the conductor.

7) 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 : Resistance is inversely proportional to the area of cross-section of the wire. Since, thick wire has a large area of cross-section, its resistance will be less. Thus, current will flow more easily through the thick wire.

8) 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?

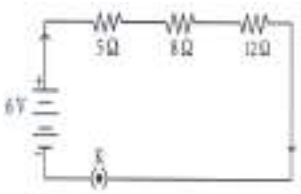
Answer : Let resistance be R. Potential difference V across the two ends becomes V/2. Since, I = V / R
As V $\rightarrow$ V/2, $I = \frac{V}{2R} = \frac{1}{2}I$
In other words, current through the component becomes half of its original value.

9) Why are coils of electric toasters and electric irons made of an alloy rather than a pure metal?

Answer : Alloys have a higher resistivity than their constituent metals. They do not oxidise or burn at higher temperatures as they have high melting point. Thus, they are used to make coils of electrical roasters and electric irons rather than pure metals.

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

Answer :



11) Judge the equivalent resistance when the following are connected in parallel
(a) 1Ω and $10^6\Omega$
(b) 1Ω, $10^3\Omega$, and $10^6\Omega$.

Answer : (a) 1Ω (b) 1Ω
When resistors are connected in parallel, then the equivalent resistance is less than the least resistance connected in the combination. In both the above cases, the equivalent resistance is less than 1Ω but is approximately 1Ω.

12) What are the advantages of connecting electrical devices in parallel with the battery instead of connecting them in series?

Answer : Following are the advantages of connecting electrical devices in parallel with the battery:
(i) Parallel circuits divides the current among the electrical devices, so that they can have necessary amount of current to operate properly.
(ii) If one of the devices in a parallel combination fuses or fails, then the other devices keep working without being affected.

13) How can three resistors of resistances 2Ω , 3Ω, and 6Ωbe connected to give a total resistance of (a) 4Ω (b) 1Ω?

Answer : (i) If 3 Ω and 6 Ω are connected in parallel, thus equivalent resistance of parallel combination
$= \frac{1}{1/3+1/6} = 2\Omega$
If this combination is connected in series with 2 Ω resistance, then total equivalent resistance
= $2\Omega + 2\Omega = 4\ \Omega$
The resistor connections are as shown below:
(ii) Since, equivalent resistance is less than the least value of resistance (i.e. 2 Ω), it means that all three resistors are connected in parallel.
Equivalent resistance $= \frac{1}{\frac{1}{2}+\frac{1}{3}+\frac{1}{6}} = 1\Omega$

14) What is (a) the highest, (b) the lowest total resistence. Which can be secured by combinations of four coils of resistance 4Ω, 8Ω, 12Ω, 24Ω ?

Answer : (a) Resistance is maximum when resistors are connected in series.
R_{max} = 4 + 8 + 12 + 24 = 48 Ω
(i) Resistance is minimum when resistors are connected in parallel.
$R_{\min} = 1/\left[\frac{1}{4}+\frac{1}{8}+\frac{1}{12}+\frac{1}{24}\right] = \frac{24}{12}\Omega = 2\Omega$

15) Why does the cord of an electric heater not glow while the heating element does?

Answer : Thc cord of an electric heater has lesser resistance than its heating element. So, more heat is produced in the heating element than the cord and it glows.

16) Compute the heat generated while transferring 96000 coulomb of charge in one hour through a potential difference of 50 V.

Answer : Given, Charge, q = 96000 C, Time, t = 1 h= 3600 s
Potential difference, V = 50 V
We know that,
Heat generated, H = VIt=$\frac{Vqt}{t}$ $\left[\because I = \frac{q}{t}\right]$
=Vq = 50 $\times$ 96000 = 4800000 J = 4800 kJ
4800 kJ is generated while transferring 96000 C of charge.

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

Answer : Given, Resistance, R = 20 Ω,
Current, I = 5 A, Time, t = 30 s
We know that,
Heat developed, H = I^2Rt
$=(5)^2 \times 20 \times 30 = 5 \times 5 \times 20 \times 30 = 15000$ J = 15 kJ
15 kJ heat is developed in 30 s.

18) What determines the rate at which energy is delivered by a current?

Answer : Electrical power determines the rate at which the energy is delivered by a current

19) An electric motor takes 5 A from a 220 V line. Determine the power of the motor and energy consumed in 2 h.

Answer : Given, I = 5 A, V = 220 V, t = 2h
$\therefore$ Power of motor,
P = VI = 220 $\times$ 5 = 1100 W = 1.1 kW
$\therefore$ Energy consumed = P t = 1.1 $\times$ 2 = 2.2 kWh
Thus, the power of the motor is 1.1 kW and energy consumed is 2.2 kWh.

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

Answer : The circuit diagram for the given system of resistors can be drawn as below
$\therefore$ Total resistance, R = $R_1 + R_2 + R_3 + R_4 + R_5$
= 0.2 Ω + 0.3 Ω + 0.4 Ω +0.5 Ω + 12 Ω
= 13.4 Ω
Current through all resistors in series is the same.
$\therefore$ Current through 12 Ω resistor = $\frac{V}{R}$
$= \frac{9V}{13.4\Omega} = 0.67A$

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

Answer : Given, V = 220 V, I = 5A
$\therefore$ Resistance of the wire, $R' = \frac{V}{I} = \frac{220}{5} = 44\Omega$
The net resistance 44 Ω is less than the individual resistance 176 Ω, so individual resistances are to be connected in parallel order.
In parallel connection, equivalent resistance
$R' = \frac{1}{\frac{1}{R}+\frac{1}{R}+\frac{1}{R}} = \frac{1}{\frac{n}{R}} = \frac{R}{n}$
$\therefore 44\Omega = \frac{176\Omega}{n} \quad or \quad n = \frac{176}{44} = 4 \quad resistors$

22) How is a voltmeter connected in the circuit to measure the potential difference between two points?

Answer : A voltmeter is always connected in parallel in the circuit to measure the potential difference between two points.

23) A copper wire has diameter 0.5 mm and resistivity of p = 1.6 x $10^{-8}\,\Omega m$. What will be the length of this wire to make its resistance 10 Ω? How much does the resistance change if diameter is doubled?

Answer : Given, radius of wire = diameter/ 2
$= \frac{0.5}{2} = 0.25 \text{ mm} = 0.25 \times 10^{-3} \text{ m}.$
p = 1.6 $\times$ 10^{-8} Ω-m and R = 10 Ω
(i) We know that, resistance,
$R = \frac{\rho l}{A} = \frac{\rho l}{\pi r^2} \quad \left[\because A = \pi r^2\right]$
$or \quad l = \frac{R\pi r^2}{\rho} = \frac{10\times3.14\times0.25\times0.25\times10^{-6}}{1.6\times10^{-8}}$
= 122.66 m
(ii) Resistance, $R \propto \frac{1}{d^2}$
If diameter is doubled, then resistance becomes one-fourth of its original value.

24) The values of current I flowing in a given resistor for the corresponding values of potential difference V across the resistor are as 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 also calculate the resistance of that resistor.

Answer : Resistance= Slope of graph

$= \frac{Y-intercept}{X-intercept} = \frac{(10.2-0)V}{(3.0-0)A} = 3.4\Omega$

Thus, the resistance of the resistor is 3.4 Ω

25) 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 : Given, V = 12 V, I = 2.5 mA = 2.5 $\times$ 10^{-3} A, R = ?

$\therefore Resistance, R = \frac{V}{I}$ [by Ohm's law]

$\Rightarrow R = \frac{12}{2.5\times10^{-3}} = 4.8 \times 10^3\Omega$

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

Answer : (i) If two 6 Ω resistors are connected in parallel, then the equivalent resistance is $\left(\frac{6}{2}\right) = 3\Omega$

This combination is connected in series with a 6 Ω resistor to get overall equivalent resistance of (6+3) =9 Ω.

(ii) Equivalent resistance of two 6 Ω resistances connected in series, R'=6+6= 12 Ω. Now, 12 Ω and 6 Ω resistors are connected in parallel.

Equivalent resistance, $R_{eq} = \frac{12\times6}{12+6} = \frac{72}{18} = 4 \quad \Omega$

27) Several electric bulbs designed to be used on a 220 V electric supply line are rated at 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?

Answer : Given, Potential difference, V = 220 V

Power, P = 10 W; Current, I = 5 A

$\therefore$ Resistance of bulb,

$R' = \frac{V^2}{P} = \frac{220\times220}{10} = 4840\Omega$

Since, bulbs are connected in parallel,

Equivalent resistance (R)

$= \frac{Individual \quad resistance(R')}{Number \quad of \quad bulbs \quad (n)}$

$\Rightarrow R = \frac{4840}{n}\Omega, V = IR$

$\Rightarrow 220 = \frac{5\times4840}{n}$

$\Rightarrow n = \frac{5\times4840}{220} = 110 \quad bulbs$

28) A hot plate of an electric oven connected to a 220 V line has two resistance coils A and B, each of 24 Ω resistance, which may be used separately, in series, or in parallel. What are the currents in the three cases?

Answer : Given, V = 220 V, R_A = R_B =24 Ω

(i) Current in plates when used separately,

$I = \frac{V}{R_A} = \frac{V}{R_B} = \frac{220}{24} = 9.16A$

(i) Current in plates when connected in series. Equivalent resistance in series,

R=R_A + R_B = 24 + 24 = 48 Ω

$\therefore$ Current flowing, $I = \frac{V}{R} = \frac{220}{48} = 4.58A$

(iii) Current in plates when connected in parallel. Equivalent resistance in parallel,

$R = \frac{R_AR_B}{R_A+R_B} = \frac{24\times24}{48} = 12 \quad \Omega$

$\therefore$ Current flowing, $I = \frac{V}{R} = \frac{220}{12} = 18.32$ = 18.32 A

29) Two lamps, one rated at 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 : Given, potential, V = 220 V

Power, P_1 =100 W

Power, P_2 =60 W

$\therefore Current, I_1 = \frac{P_1}{V}$

$= \frac{100}{220} = 0.45A$

Current, $I_2 = \frac{P_2}{V} = \frac{60}{220} = 0.27A$

∴ Total current drawn,

$I = I_1 + I_2$

= 0.45 + 0.27

= 0.72 A

30) Which uses more energy, a 250 W TV set in 1 h or a 1200 W toaster in 10 min?

Answer : Given, P_1 = 250 W, P_2 = 1200 W,

t_1 = 1h = 3600 s, t_2 = 10 min = 600 s

∴ Energy

$Q_1 = P_1t_1 = 250 \times 3600 = 900000$ J = 900 kJ

and $Q_2 = P_2t_2 = 1200 \times 600 = 720000$ J = 720 kJ

Thus, TV set uses more energy.

31) What does an electric circuit mean?

A continuous conducting path consisting of wires and other resistances and a switch between the two terminals of a cell or a battery along which an electric current flow is called a circuit.

32) 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.

Answer : Given, Resistance, R = 8 Ω , Current, J = 15 A

Time, t = 2 h = 7200 s

∴ Heat developed. $H = J^2Rr$

$=15 \times 15 \times 8 \times 7200$ J

∴ Rate of heat developed.

$P = \frac{H}{t} = \frac{15 \times 15 \times 8 \times 7200}{7200}$

= 1800 W or 1800J/s

Thus, the rate at which heat is developed in the heater is 1800 joule per second.

33) A current of 0.5 A is drawn by a filament of an electric bulb for 10 minutes. Find the amount of electric charge that flows through the circuit.

Answer : We are given, I = 0.5 A; t = 10 min = 600 s.

From Eq we have

Q = It

= 0.5 A × 600 s

= 300 C

34) How much work is done in moving a charge of 2 C across two points having a potential difference 12 V?

Answer : The amount of charge Q, that flows between two points at potential difference V (= 12 V) is 2 C. Thus, the amount of work W, done in moving the charge [from Eq. (V = W/Q)] is

W = VQ

= 12 V × 2 C

= 24 J

35) An electric bulb is connected to a 220 V generator. The current is 0.50 A. What is the power of the bulb?

Answer : P = VI

= 220V × 0.50 A

= 110 J/s

= 110 W

36) An electric refrigerator rated 400 W operates 8 hour/day. What is the cost of the energy to operate it for 30 days at Rs 3.00 per kW h?

Answer : The total energy consumed by the refrigerator in 30 days would be 400 W × 8.0 hour/day × 30 days = 96000 W h = 96 kW h
Thus the cost of energy to operate the refrigerator for 30 days is 96 kW h × Rs 3.00 per kW h = Rs 288.00

37) What is meant by the statement, "Potential difference between points A and B in an electric field is 1 volt"?

It means that 1 joule of work will be done in order to move 1 coulomb of charge from point A to B.

38) Give the unit of electric resistance

Ohm (1Ω)

39) A bulb is rated at 5.0 volt, 100 mA. Calculate its
(i) power and
(ii) resistance

Answer : Voltage (V) = 5.0 V
Current (I) = 100 mA = 0.1 A
(i) Power = VI = $5 \times 0.1 = 0.5$W
(ii) Resistance = $\frac{V}{I} = \frac{5}{0.1} = 50\Omega$

40) Two unequal resistances are connected in parallel. If you are not provided with any other parameters (e.g. numerical values of land R), what can be said about the voltage drop across the two resistors?

Answer : In parallel combination of resistors, the voltage drop across each resistor is same. So, for the two unequal resistances connected in parallel, the voltage drop across both the resistors will be same.

41) What is the S.I. unit of resistivity

Ohm metre.

42) Define resistance, Give its SI unit.

Answer : Resistance is the property of a conductor to resist the flow of current through it. Its SI unit is ohm and it is represented by 2Ω.

43) The potential difference between the terminals of an electric heater is 60 V when it draws a current of 4 A from the source. What current will the heater draw if the potential difference is increased to 120 V?

Answer : We are given, potential difference V = 60 V, current I = 4 A.
According to Ohm's law, R = V/I = 60 V/4 A = 15 Ω .
When the potential difference is increased to 120 V the current is given by
current = V/R = 120 V/15Ω = 8 A
The current through the heater becomes 8 A.

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According to Ohm's law, $R = \frac{V}{I} = \frac{60\ \text{V}}{4\ \text{A}} = 15\Omega.$
When the potential difference is increased to 120 V the current is given by current $= \frac{V}{R} = \frac{120\ \text{V}}{15\Omega} = 8\ \text{A}$
The current through the heater becomes 8 A .

45) A wire of given material having length l and area of cross-section A has a resistance of 4 Ω. What would be the resistance of another wire of the same material having length l/2 and area of cross-section 2A?

Answer : For first wire $R_1 = \rho\, l/A = 4\Omega$

Now for second wire

$R_2 = \rho \frac{l/2}{2A} = 1/4\ \rho\ l/A$

$R_2 = 1/4\ R_1$

$R_2 = 1\Omega$

The resistance of the new wire is 1Ω.

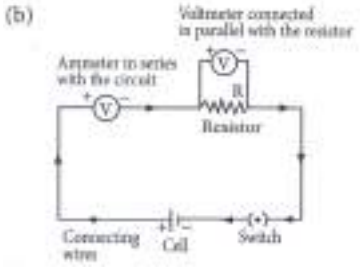
46) (a) Distinguish between the terms "overloading and short circuiting" as used in domestic circuits.
(b) Why are the coils of electric toasters made of an alloy rather than a pure metal?

Answer : (a) Short circuiting is the term used for defining the situation in which the neutral and live wires of an electric circuit come in direct contact. When too many electrical appliances are connected to a single socket, the appliances drawn much more current or power that the permissible limit from the main supply. This situation is termed as overloading.
(b) Resistivity of an alloy is much higher than its constituent metals Moreover, alloys do not oxidise as easily as the constituent metals at high temperature. Because of these reasons, coils of electric testers are made of an alloy rather than a pure meta.

47) (a) State Ohm's Law.
(b) Draw a schematic diagram of the circuit for studying Ohm's Law.

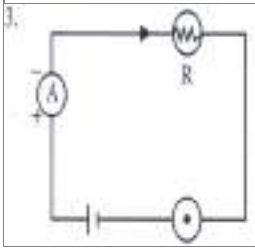
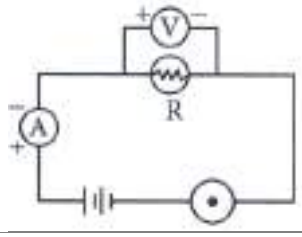
Answer : (a) Ohm's Law states that at constant temperature, current flowing through a conductor is directly proportional to the potential difference across its ends.

(b)



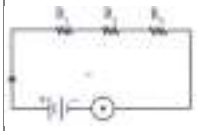
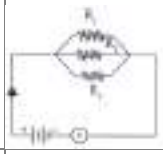
48) Differentiate between ammeter and voltmeter.

Answer :

Ammeter	Voltmeter
1. Ammeter is an instrument used to measure current in a circuit.	Voltmeter is used to measure potential difference between two points.
2. It is connected in series in a circuit.	It is connected in parallel in a circuit.
3. 	

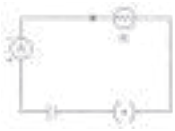
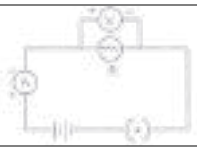
49) Give the differences between series and parallel connections of resistors.

Answer :

Series connection	Parallel connection
1. The potential difference (V) across the combination of resistors connected in series is equal to the sum of all the individual potential differnece.	The potential difference across all resistors in parallel connection remains constant.
2. Current (I) remains the same. 	Current (I) will be different for different resistor. 
3. The resistance will be the sum of all the resistors in the circuit. $R_s = R_1 + R_2 + R_3$.	Total resistance will be given as $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$
4. Equivalent resistance is high.	Equivalent resistance is less than each resistor.

50) Give two points of difference between ammeter and voltmeter.

Answer :

Ammeter	Voltmeter
1. Ammeter is an instrument used to measure current in a circuit.	Voltmeter is used to measure potential difference between two points.
2. It is connected in series in a circuit	It is connected in parallel to the circuit
3. 	

51) Give differences between conductors and insulators.

Answer :

Conductors	Insulators
1. Materials that allow electricity to pass through them.	Materials that do not allow electricity to pass through them.
2. These materials have loosely bounded free electrons.	These materials do not have loosely bounded free electrons.
3. Eg., metals and graphite.	E.g., non-metals, rubber, plastic etc.

52) Find the minimum resistance that can be made using five resistors each of $(1/5)\Omega$.

Answer : Minimum resistance can be obtained by connecting resistors in parallel, $R_{\text{eq}} = \frac{R}{n} = \frac{1/5}{5} = \frac{1}{25}\Omega$

53) An electric lamp, whose resistance is 20 Ω, and a conductor of 4 Ω resistance are connected to a 6 V battery (Fig). Calculate (a) the total resistance of the circuit, (b) the current through the circuit, and (c) the potential difference across the electric lamp and conductor.

Answer : The resistance of electric lamp, R_1 = 20 Ω,

The resistance of the conductor connected in series, R_2 = 4 Ω.

Then the total resistance in the circuit

$R = R_1 + R_2$

R_s = 20 Ω + 4 Ω = 24 Ω.

The total potential difference across the two terminals of the battery

V = 6 V.

Now by Ohm's law, the current through the circuit is given by

$I = V/R_s$

= 6 V/24 Ω

= 0.25 A

Applying Ohm's law to the electric lamp and conductor separately,

we get potential difference across the electric lamp,

V_1 = 20 Ω × 0.25 A = 5 V;

and, that across the conductor, V_2 = 4 Ω × 0.25 A = 1 V.

Suppose that we like to replace the series combination of electric lamp and conductor by a single and equivalent resistor. Its resistance must be such that a potential difference of 6 V across the battery terminals will cause a current of 0.25 A in the circuit. The resistance R of this equivalent resistor would be

R = V/I

= 6 V/ 0.25 A

= 24 Ω.

This is the total resistance of the series circuit; it is equal to the sum of the two resistances.

54) In the circuit diagram given in Fig, suppose the resistors R_1, R_2 and R_3 have the values 5 Ω, 10 Ω, 30 Ω, respectively, which have been connected to a battery of 12 V. Calculate (a) the current through each resistor, (b) the total current in the circuit, and (c) the total circuit

Answer : R_1 = 5 Ω, R2 = 10 Ω, and R3 = 30 Ω.

Potential difference across the battery, V = 12 V.

This is also the potential difference across each of the individual resistor; therefore, to calculate the current in the resistors, we use Ohm's law.

The current I_1 , through R_1 = V/ R_1

I_1 = 12 V/5 Ω = 2.4 A

The current I_2, through R_2 =V / R_2

$I_2 = 12\ \text{V}/10\Omega = 1.2\ \text{A}$

The current I_3 , through R_3 = V/R_3

$I_3 = 12\ \text{V}/30\Omega = 0.4\ \text{A}$

The total current in the circuit,

$I = I_1 + I_2 + I_3$

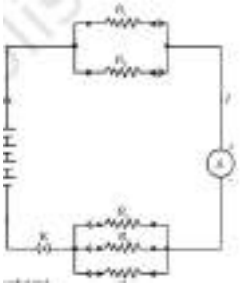
= (2.4 + 1.2 + 0.4) A = 4 A

The total resistance R_p, is given by [Eq]

$\frac{1}{R_p} = \frac{1}{5} + \frac{1}{10} + \frac{1}{30} = \frac{1}{3}$

Thus, R_p = 3 Ω

55) If in Fig, R_1 = 10 Ω, R_2 = 40 Ω, R_3 = 30 Ω, R_4 = 20 Ω, R_5 = 60 Ω, and a 12 V battery is connected to the arrangement. Calculate (a) the total resistance in the circuit, and (b) the total current flowing in the circuit.



Answer : Suppose we replace the parallel resistors R_1 and R_2 by an equivalent resistor of resistance, R'. Similarly we replace the parallel resistors R_3 , R_4 and R_5 by an equivalent single resistor of resistance R". Then using Eq., we have
1/ R' = 1/10 + 1/40 = 5/40; that is R' = 8 Ω.
Similarly, 1/ R" = 1/30 + 1/20 + 1/60 = 6/60; that is, R" = 10 Ω.
Thus, the total resistance, R = R' + R" = 18 Ω.
To calculate the current, we use Ohm's law, and get I = V/R = 12 V/18 Ω = 0.67 A.

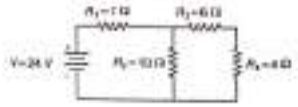
56) An electric iron consumes energy at a rate of 840 W when heating is at the maximum rate and 360 W when the heating is at the minimum. The voltage is 220 V. What are the current and the resistance in each case?

Answer : From Eq. (11.19), we know that the power input is P = V I
Thus the current I = P/V
(a) When heating is at the maximum rate,
I = 840 W/220 V = 3.82 A; and the resistance of the electric iron is R = V/I = 220 V/3.82 A = 57.60 Ω.
(b) When heating is at the minimum rate, I = 360 W/220 V = 1.64 A; and the resistance of the electric iron is R = V/I = 220 V/1.64 A = 134.15 Ω

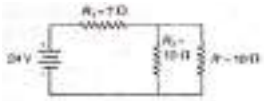
57) 100 J of heat is produced each second in a 4 Ω resistance. Find the potential difference across the resistor.

Answer : H = 100 J, R = 4 Ω, t = 1 s, V = ?
From Eq. we have the current through the resistor as
I = √(H/Rt)
= √[100 J/(4 Ω × 1 s)] = 5 A
Thus the potential difference across the resistor, V [from Eq.] is V = IR = 5 A × 4 Ω = 20 V.

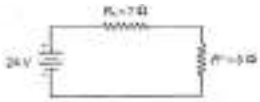
58) Calculate the total resistance and the total current in the circuit.



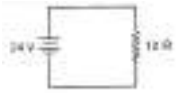
Answer : Here, resistances R_3 and R_4 are in series, so their equivalent resistance is
$R = R_3 + R_4 = 6 + 4 = 10\Omega$
The circuit is reduced to



Now, resistances R2 and R' are in parallel, so their equivalent resistance,



$R' = \frac{R_2 R'}{R_2 + R'} = \frac{10 \times 10}{10 + 10} = \frac{100}{20} = 5\Omega$
The circuit now becomes



The resistances R_1 and R' are in series, so their equivalent or total resistance of circuit, $R_{eq} = R_1 + R' = 7 + 5 = 12\Omega$
The final circuit is as shown
By Ohm's law, $I = \frac{V}{R_{eq}} = \frac{24}{12} = 2\ \text{A}$