9. Electric Current

1 Mark Questions

Question 1.
Give reason, why metals conduct electric charge easily?

Answer:
Because metals possess a large number of free electrons.

Question 2.
How is an ampere related to a coulomb? (ASL)

Answer:
$$1 \text{ amp} = \frac{1C}{1\text{sec}}$$

Question 3.
What is the name of physical quantity which is equal to V/I?

Answer:
Electrical resistance.

Question 4.
How is one – 1 ohm related to ampere and volt?

Answer:
$$1 \text{ ohm} = \frac{1 \text{ volt}}{1 \text{ ampere}}$$

Question 5.
Which material is the best conductor?

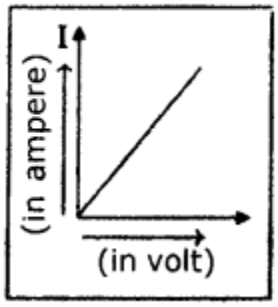
Answer:
Silver.

Question 6.
Resistance of an incandescent filament of a lamp is more than that when it is

at the room temperature. Why?
Answer:
Because resistance of metallic wire increases with increase in temperature.

Question 7.
What is the shape of V – I graph for a metallic wire?

Answer:
A straight line passing through origin.



Question 8.
When resistances are connected in series which physical quantity remains unchanged?

Answer:
Current.

Question 9.
When resistances are connected In parallel which physical quantity remains unchanged?

Answer:
Voltage.

Question 10.
The length of a wire is doubled and its cross-sectional area Is also doubled. What is the change ¡n its resistivity?

Answer:
There Is no change In resistivity. When the length of the wire is doubled, its

resistivity also double. But when the cross-sectFonal areas is doubled, Its resistivity becomes half of the double. So there is no charge.

Question 11.
What happens to resistance when lengths of a conductor is doubled without affecting the thickness of conductor?

Answer:
Resistance is doubled because R∝ l.

$$\frac{R_1}{R_2} = \frac{l_1}{l_2} \Rightarrow \frac{R}{R_2} = \frac{l}{2l}, \frac{R}{R_2} = \frac{1}{2} \Rightarrow R_2 = 2R$$

Question 12.
A battery of 6V is applied across a resistance of 15c. Find the Current flowing through the circuit.

Answer:
Current I = $\frac{V}{R}$, I = $\frac{6}{15}$ = 0.4 amp

Question 13.
How is power related to current and voltage?

Answer:
Power (P) = Potential difference (V) x Current (I).

Question 14.
How can we measure potential difference or emf?

Answer:
With the help of a voltmeter, we measure potential difference or emf.

Question 15.
What is a conductor of electricity?

Answer:
The material which transfers energy from battery (source) to the bulb is called a conductor A conductor possesses large number of free electrons. Eq: All metals.

Question 16.
What is a non-conductor?

Answer:
The material which cannot transfer energy from battery (source) to the bulb is called a non-conductor Electrons in a non-conductor are not free to move.

Question 17.
Which instrument is used to measure electric current? (AS1)

Answer:
An ammeter is used to measure electric current in a circuit. It is always connected In series to the circuit.

Question 18.
Define potential difference and give an expression to It.

Answer:
Electric potential difference between two points in an electric circuit is the work done to move a unit positive charge from one point to another.

$$\text{Potential difference } v = \frac{W}{q}$$

The S.I. unit of potential difference is 'Volt' and denoted by 'v'

Question 19.
State Ohm's law.

Answer:
Ohm's law: The potential difference between the ends of a conductor is directly proportional to the electric current passing through it at constant temperature.

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

Question 20.
What are the limitations of Ohm's law?

Answer:
Limitations of Ohm's law:

1. Ohm's law is valid for metal conductors, provided the temperature and other physical conditions remain constant,
2. Ohm's law is not applicable to gaseous conductors.
3. Ohm's law Is also not applicable to semiconductors such as Germanium and Silicon.

Question 21.
What is a resistor?

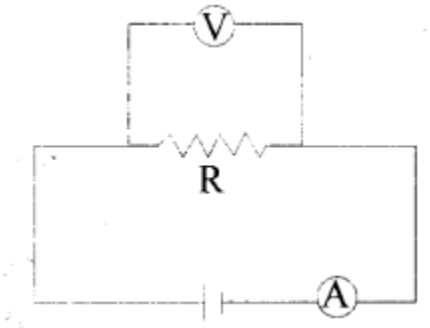
Answer:
The material which offers resistance to the motion of electrons is called resistor.

Question 22.
What are the uses of semiconductors?

Answer:
Semiconductors are used to make diodes, transistors, and integrated circuits (ICs). Ic's are used in all sorts of electronic devices, including computers, TV., mobile phones…. etc.

Question 23.
Draw the electric circuit with the help of a Battery, Voltmeter, Ammeter, Resistance and connecting wires.

Answer:



Question 24.
What do you mean by one 'unit' in household consumption of electrical energy?

Answer:
One unit in household consumption of electrical energy is equal to 1 KWH (Kilo Watt Hour)
1 KWH 1000 W x 1 Hour
(1000)W x (60 x 60) sec
1000 J/s x 3600 sec = 36 x 10 Joules.

Question 25.
When do you say that two or more resistors are connected in series?

Answer:
Two or more resistors are said to be connected In series If the same current flows through them.

Question 26.
When do you say that two or more resistors are connected in parallel?

Answer:
Two or more resistors are said to be connected In parallel if the same potential difference exists across them.

Question 27.
What is lattice?

Answer:
According to Drude and Lorentz, conductors like metals contain a large number of free electrons, while the positive ions are fixed in their locations. The arrangement of the positive ions Is called lattice.

Question 28.
Why do electrons move in specified direction when the conductor is connected to a battery?

Answer:
When the ends of the conductor are connected to the terminals of a battery, a

uniform electrical field is set up throughout the conductor. This field makes the electrons move in a specified direction.

Question 29.
Which instrument is used to measure potential difference or CML?

Answer:
A volt meter Is used to measure potential difference or emf across an electric device like battery. It must be connected parallel to the electric device.

Question 30.
What is drift speed of electrons?

Answer:
The electrons in a conductor move with constant average speed, known as drift speed or drift velocity.

Question 31.
Is the voltmeter connected in series or parallel In circuit? Why?

Answer:
Voltmeter should be connected parallel in the circuit to measure the potential difference between two points of conductor.

Question 32.
State the use of Ammeter? How to connect the Ammeter in electric circuit?

Answer:
Ammeter is used to measure electric current In a circuit. It should be connected in series in a circuit.

Question 33.
The home appliances like Fridge, T.V, Computer are connected In series or parallel? Why?

Answer:
They are connected in parallel because If any one device is damaged rest will work as usual because the circuit does not break.

Question 34.
Why are copper wires used as connecting wires?

Answer:
Copper is a good conductor of electricity so copper wires are used as connecting wires.

Question 35.
Name two special characteristics of fuse wire.

Answer:
High resistivity and low melting point.

Question 36.
Name two special characteristics of heating coil.

Answer:
High resistivity and high melting point.

Question 37.
What is Resistance? What are the SI Units of Resistance?

Answer:
Resistance of a conductor is defined as the obstruction to the motion of the electrons In a conductor. It's S.I unit is Ohm.

Question 38.
What happens if we use a fuse made up of same wire which is used to make the electric circuit?

Answer:
The fuse made of same wire cannot gets heated up and melts due its low resistance when excess current is drawn from the mains. Due to this, the electrical appliances In the house wiii be damaged.

2 Marks Questions

Question 1.
Give reasons for using lead in making fuses.

Answer:

- Let's used in making fuses because it has low melting point E.,, resistivity.
- If the current in the lead wire exceeds certain value the wire will heat up and melt, so the circuit in the households, opened and ail the electric devices are saved.

Question 2.
Define electric current and give an expression to It.

Answer:
Electric current is defined as the amount of charge crossing any cross-section of the conductor in one second.
Let Q be the charge crossing any cross-section of the conductor In time 't'.
∴ Electric current =

$$I = \frac{Q}{t}$$

The SI unit of current ¡s 'ampere' denoted by 'A'.

Question 3.
What is drift speed?

Answer:
Electrons in the conductor move w,th a constant average speed, which is known as drift speed or drift velocity.

$$\text{Drift velocity } V = \frac{1}{nqA}$$

Where, I = Electric current

n = number of charges

q = magnitude of electric charge

A = Area of cross-section of the conductor

Question 4.

Define emf.

Answer:
Electromotive force or emf is defined as the work done by the chemical force to move unit positive charge from negative terminal to positive terminal of the battery.

emf $\varepsilon = \frac{W}{q} = \frac{F_e d}{q}$

Where F_e is electric force

d is the distance between the terminals

q is the charge

The S.I unit of emf is 'Volt'.

Question 5.
What are the factors affecting the resistance of a material?

Answer:

1. The value of resistance of a conductor depends on temperature for constant potential difference.
2. Resistance of a conductor depends on the material of the conductor.
3. Resistance of a conductor is directly proportional to its length i.e., $R \propto l$

Resistance of a conductor is inversely proportional to the area of cross-section of

the material. i.e., $R \propto \frac{l}{A}$

Question 6.
Find the resistance of a bulb, on which 60W and 1.20 V is marked.

Answer:
60w, V= 120 V

We know $P=VI \Rightarrow \frac{V^2}{R}$

$\Rightarrow R = \frac{V^2}{R} = \frac{120 \times 120}{60} = 240\ \Omega$

Question 7.

Write any two differences between ohmic and non-ohmic conductors.

Answer:

Ohmic conductors	Non-ohmic conductors
1) Ohmic conductors follow the ohm's law	1) Non-ohmic conductors do not follow the ohm's law
2) Ohmic conductors are electric conductors.	2) Non-ohmic conductors are semiconductors.
3) V-I graph of ohmic conductors is a straight line is a curve.	3) V-I graph of non-ohmic conductors

Question 8.
Two wires have equal area of cross-section. One Is copper and other Is Aluminium have the same resistance. Find which one Is longer.

Answer:
Suppose the resistance of copper and aluminum, wires are R_1 and R_2, Suppose their area of cross section is A
The resistivity of copper $(P_1) = 1.68 \times 10^{-8}$
The resistivity of aluminum. $(P_2) = 2.82 \times 10^{-8}$
Given that $R_1 = R_2$

$$\rho_1 \frac{l_1}{A} = \rho_2 \frac{l_2}{A} \Rightarrow p_1 l_1 = p_2 l_2 \text{ (since A is the same)}$$

$$l_1 = 1.678\, l_2 \Rightarrow \frac{p_2 \times l_2}{p} = \frac{2.82 \times 10^{-8} \times l_1}{1.68 \times 10^{-8}}$$

Length of copper wire 1.678 times more than length of aluminum wire.

Question 9.
Define Ohmic and non-ohmic conductors and give two examples each of them.

Answer:
Ohmic conductors: The conductors which does not obey Ohm's law are called non-ohmic conductors. e.g.: Semiconductors, Electrolytes.

Question 10.
Three equal resistances are connected in series then in parallel. What will be the ratio of their resultant resistances?

Answer:
Suppose the resistance of equal resistors is 'R'. Suppose they are connected in series.
Then their equivalent resistance $R^1 = R + R + R = 3R$
If they are connected in parallel their equivalent resistance.

From $\frac{1}{R^{11}} = \frac{1}{R} + \frac{1}{R} + \frac{1}{R} = \frac{3}{R}$

$\frac{1}{R^{11}} = \frac{3}{R} \Rightarrow R^{11} = \frac{R}{3}$

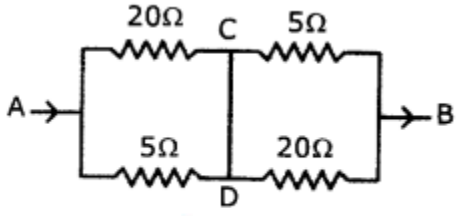
Ratio of resultant resistances = $R^1 : R^{11} = 3R : \frac{R}{3} = 9 : 1$

Question 11.
Write differences between overloading and short-circuiting.

Answer:
Currently chooses the path which has least resistance. So when electricity travels along a wrong route because of damaged wires or a fault in the connections, it leads to burn. This is known as short circuit.
When so many electrical appliances are connected to the same electrical main point then maximum current can be drawn from the mains which causes overheating and may cause a fire which is called 'overloading'.

4 Marks Questions

Question 1.
A circuit Is shown in the picture. 200 c ° The current passing through A Is I
a) What is the potential difference between A and B?
b) What is the equivalent resistance between A and B?
c) What amount of current is flown through C and D?



Answer:
a) According to Kirchhoff's loop law the algebraic sum of increase and

decrease In p.d across various components of the circuit In a closed circuit loop must be zero. So the p.d across CD is zero because it is a closed loop.
b) Here 20Ω, 5Ω are parallel to each other and resultants are In series to each other. Resultant resistance of 20Ω and 5Ω.

When they are connected in parallel is $\frac{1}{R'} = \frac{1}{20} + \frac{1}{5} = \frac{1+4}{20} = \frac{5}{20} = \frac{1}{4}$

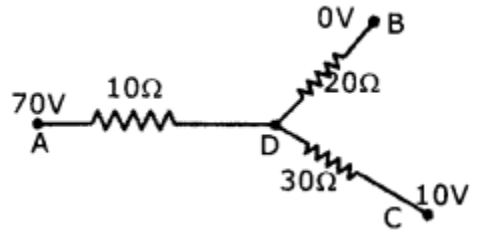
$\frac{1}{R'} = \frac{1}{4} \Rightarrow R = 4\Omega$

(c) $V_A - V_D = V_A - V_C$, So

$5I - 5i = 20i \Rightarrow 20i+5i \Rightarrow 5I = 25i \Rightarrow i = \frac{5I}{25} = \frac{1}{5}$

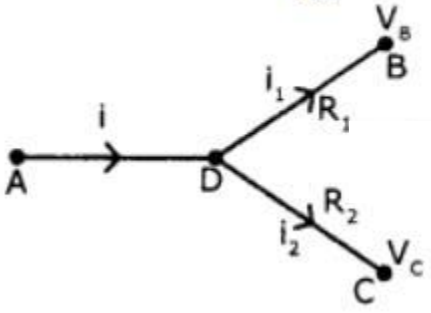
Current through CD = $I - 2i = I - \frac{2I}{5} = \frac{3}{5}$ I Amp

Question 2.
Observe the picture. The potential values at A, B, C are 70V, 0V, 10V
a) What is the potential at D?
b) Find the ratio of the flow of B current in AD, DB, DC.



Answer:
a) By following Ohm's law. p.d Is (V) = iR
In the given circuit we are applying junction laws.
'D' works as a junction so, $i = i_1 + i_2$
Let p.d at D is V_0.

We know that $i = \frac{V}{R}$



$$i = \frac{V}{R} = \frac{V_A - V_0}{R} = \frac{70 - V_0}{10}$$

$$i_1 = \frac{V_1}{R_1} = \frac{V_0 - V_B}{R_1} = \frac{V_0 - 0}{20}$$

$$i_2 = \frac{V_2}{R_2} = \frac{V_0 - V_C}{R_2} = \frac{V_0 - 10}{30}$$

By the law $i = i_1 + i_2$

$$\frac{70 - V_0}{10} = \frac{V_0 - 0}{20} + \frac{V_0 - 10}{30}$$

$$\frac{70 - V_0}{10} = \frac{30V_0 + 20V_0 - 200}{600}$$

$$70 - V_0 = \frac{50V_0 - 200}{60} = \frac{5V_0 - 20}{6}$$

$$(70 - V_0)\,6 = 5V_0 - 20$$

$$420 - 6V_0 = 5V_0 - 20$$

$$6V_0 + 5V_0 = 440$$

$$11V_0 = 440$$

$$V_0 = 440/11 = 40$$

∴ Potential at D is = V_0 = 40 V

b)Flow of current in AD is $i = \frac{V}{R} = \frac{V_A - V_0}{R} = \frac{70-40}{10} = \frac{30}{10} = 3$

(∴ Here V_A =70, V_0=40, R=10)

Flow of current in DB is $i_1 = \frac{V_0 - V_B}{R_1} = \frac{40-0}{20} = \frac{40}{20} = 2$

(∴ Here V_0=40, V_B=0, R_1 = 20)

Flow of current in DC is $i_2 = \frac{V_0 - V_C}{R_2} = \frac{40-10}{30} = \frac{30}{30} = 1$

(∴ Here V_0=40, V_C=0, R_2 = 30)

The ratio of the flow of current In AD, DB, and Dc is 3:2:1.s

Question 3.

In a circuit, 60V battery, three resistances $R_1 = 10\Omega$, $R_2 = 20\Omega$ and $R_3 = X\ \Omega$ are connected In series. If 1-ampere current flows in the circuit, find the resistance in R_3 by using Kirchhoff's loop law.

Answer:

According to Loop law,

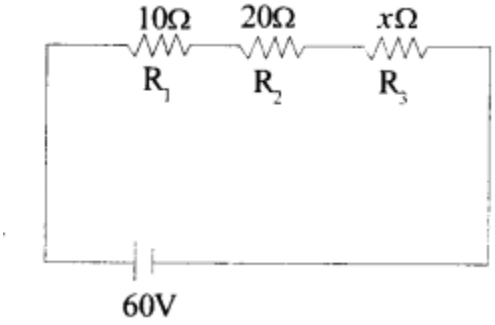
60-101- 201-XI=0

substituting I = 1 Amp, In the above equation, R

60 – 10 – 20 – x – 0

x = 30 Ω

∴ R_3 =30 Ω



Another method:

$R_1 = 10\ \Omega$, $R_2 = 20\ \Omega$, $R_3 = X\ \Omega$

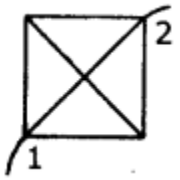
As they are connected in series, the resultant

ResistantR = $R_1 + R_2 + R_3$

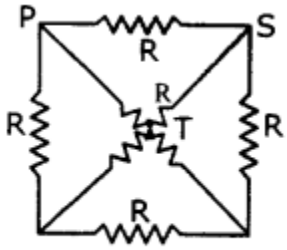
$= 10\ \Omega + 20\ \Omega + X\ \Omega$
$= 30\ \Omega + X\ \Omega$
$I = 1$ Amp, $V = 60v$

According to Ohm's law,
$V = IR$
$60\ V = I \times (30 + X\Omega)$
$60\ V = 30 + X\Omega$
$x = 60 - 30$
$X = 30$
$\therefore R_3 = 30\Omega$

Question 4.
A circuit is made with a copper wire as shown in the diagram. We know that conductor's resistance is directly proportional to its length. Calculate the equivalent resistance between points 1 and 2.



Answer:
Let the resistance of the wire be 'R' and length of the wire be l.
Let the length be 'l'
In a square diagonal is $2-\sqrt{}$ times its length $= 2-\sqrt{}\,l$
Resistance towards diagonal is $2-\sqrt{}R$.



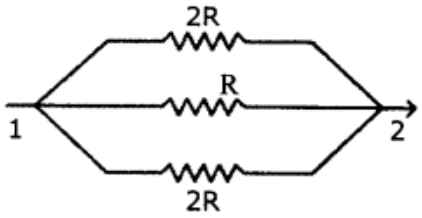
The circuit diagrams for the given arrangement is along PTR and QTS Is ineffective as no current flow through it.
PQ and PS are in series so effective resistance are $R_1 + R_2 = R + R = 2R$.
QR and SR are In series so effective resistance are $R_1 + R_3 = R + R = 2R$.

Redrawn of the circuit again as resultant resistance between the points 1 and 2 is

$$= \frac{1}{R_E} = \frac{1}{2R} + \frac{1}{\sqrt{2}R} + \frac{1}{2R} = \frac{1}{R}\left(\frac{1}{2} + \frac{1}{\sqrt{2}} + \frac{1}{2}\right) = \left(\frac{1+\sqrt{2}+1}{2}\right)$$

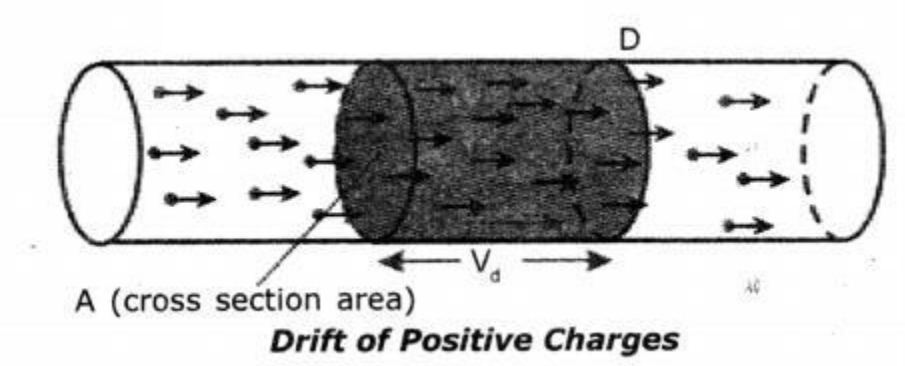
$$\frac{1}{R_E} = \frac{1}{R}\left(\frac{2+\sqrt{2}}{2}\right) = \frac{2+\sqrt{2}}{2R}$$

$$R_E = \frac{2R}{2+\sqrt{2}} = \frac{\sqrt{2}(\sqrt{2}R)}{\sqrt{2}(1+\sqrt{2})} = \frac{\sqrt{2}R}{1+\sqrt{2}}$$



Question 5.
Derive an expression to find drift velocity of electrons.

Answer:
1. Consider a conductor with cross-sectional area A. Assume that the two ends of the conductor are connected to a battery to make the current flow through it.

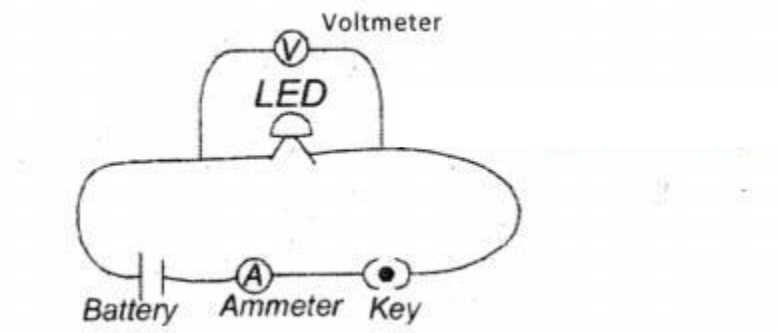


Drift of Positive Charges

2. Let 'V_d' be the drift speed of the charges and 'n' be the number of charges present in the conductor in an unit volume.
3. The distance covered by cacti charge in one second is 'V_d'
4. Then the volume of the conductor for this distance. A'V_d'
5. The number of charges contained in that volume = n. A'V_d'
6. Let q be the charge of each carrier.
7. Then the total charge crossing the cross-sectional area at position D in one-second in q Av_d'.
This is equal to electric current.
Electric current I = n q Av_d.
Drift velocity (V_d) = 1nqA

Question 6.
Show that the semiconductors do not obey Ohm's law.

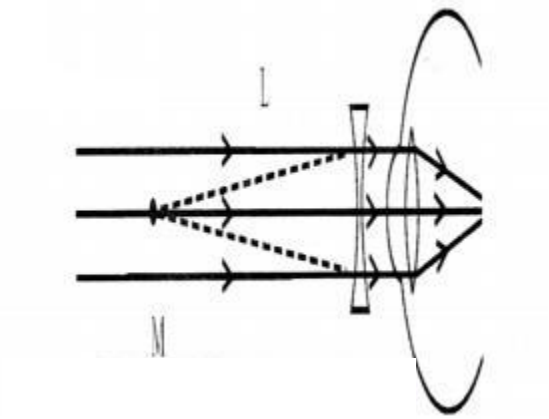
Answer:
1. Connect a circuit as shown n the figure.



2. Close the circuit and note the readings of ammeter (I) and voltmeter (V) tri the following table.

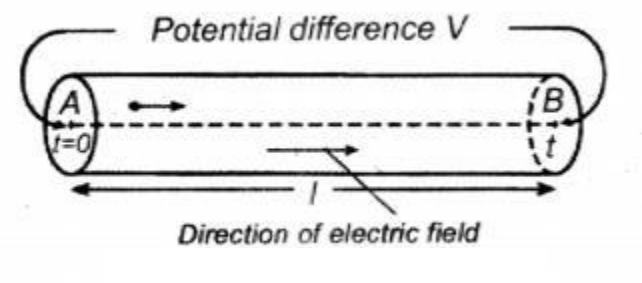
Potential difference (V)	Current (I)	V/I

3. Now connect two cells Instead of one cell in circuit.
4. Now note the respective readings of ammeter and voltmeter.
5. Repeat the same for 3, 4, and 5 cells.
6. Find the ratio of every time.
7. We find that the ratio Is not constant.
8. Draw a graph between V and I. You will get a graph as shown below.
9. This shows the semiconductors (LED is a semiconductor) do not obey Ohm's law.



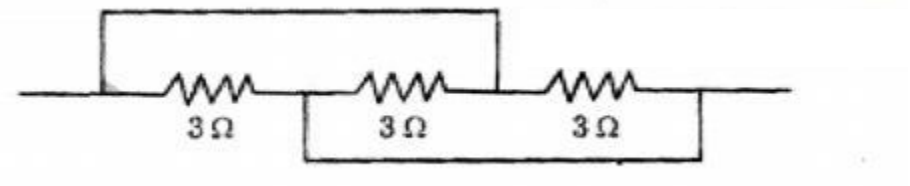
Question 7.
Deduce an expression to measure electric power.

Answer:
1. Consider that a charge (Q) Coulomb passes through a point A, moves to print B in the time interval 't' seconds.



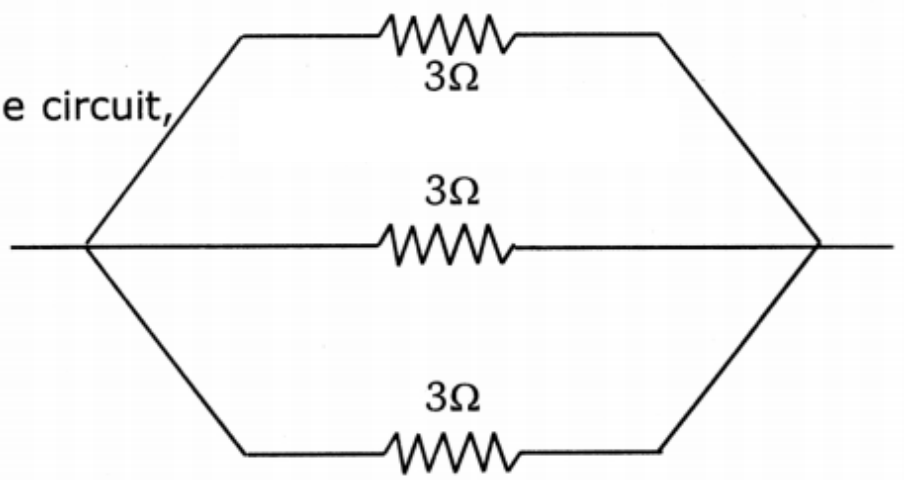
2. Let V be the potential difference between the points A and B.
3. The work done by electric field in time 't' is given by $W = QV$ …… (1)
4. The work is equal to the energy lost by the charge while passing through the conductor for time T.
5. Energy lost by the conductor in 1 sec $= W/t$
From (1) $W/t = QV/t$ …….. (2)
We know, $Q/t = I$ and $W/t = P$ (power)
Then(2) $\Rightarrow P = VI$ …….. (3)
This equation can be used to calculate power consumption by any electric device that is connected in a circuit.
From Ohm's law $V = I R$
(3) $\Rightarrow P = I^2 R$. (or) V^2/R …….. (4)
6. To know the power that can be extracted from a battery or any source can be calculated by $P = \varepsilon J$.
Whose ε the is the emf of the battery or source.

Question 8.
Find the resultant resistance for the following given arrangement. Find the current, when this arrangement Is connected with 9V battery.



Answer:

By re-drawing the circuit,



From the above circuit, all the resistors are in parallel combination

$$\therefore \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

Hence $R_1 = R_2 = R_3 = 3W$

$$\therefore \frac{1}{R} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$$

$$\frac{1}{R} = 3\left(\frac{1}{3}\right) = 1$$

$\therefore R = 1\ W$

Current given V = 9V

$$\therefore i = \frac{V}{R} = \frac{9}{1} = 9A$$

Question 9.

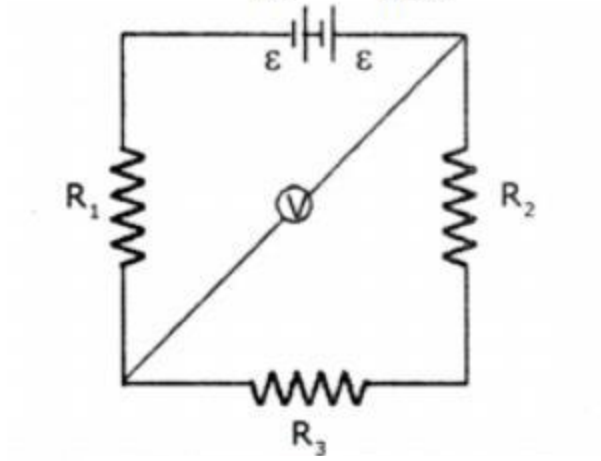
Observe the circuit given. $R_1 = R_2 = R_3 = 200\ \Omega$.

Then find out the electromotive force E of battery.

Answer:

Voltmeter reading V= 100 V, Voltmeter resistance = 1000

Current $i_1 = \frac{V}{R} = \frac{100}{1000} = 0.1$ Amperes



Considering ABDA, applying Kirchoff's voltage law, R,
$1000i_1 + 200i = 2E$
$1000 \times 0.1 + 200i = 2E$
$100+200i = 2E$ ..... (1)

Considering BCDB, applying Kirchofr's voltage law,
$(i-i_1)200 + 200(i-i_1) - 1000 \times i_1 = 0$

$(i-0.1) \times 200 + 200i - 200 \times 0.1 - 1000 \times 0.1 = 0$

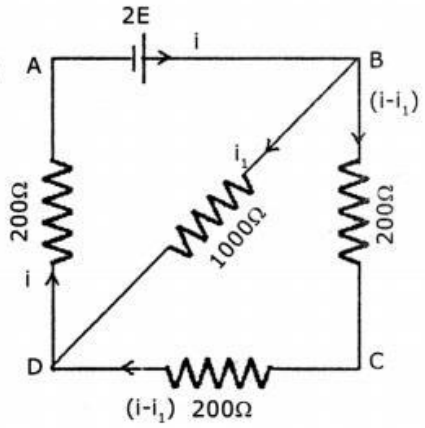
$200i - 20 + 200i - 20 - 100 = 0$

$140i = 140 \qquad i = \frac{140}{400} = \frac{7}{20}$

Substituting in Eq.(1) $100 + \frac{200}{20} \times \frac{7}{20} = 2E$

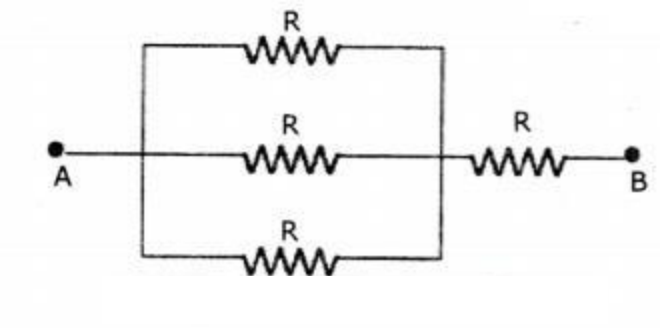
$170 = 2E$

$E = 85$ volts



Question 10.
The electric circuit is shown in the figure. Find out the equivalent resistance between A and B?

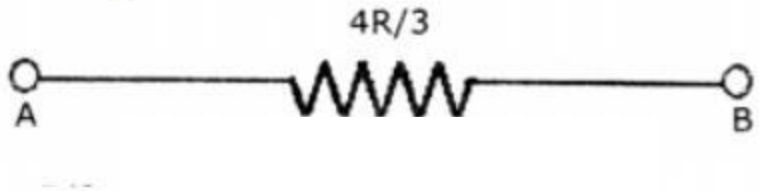
Answer:
The first three resistors are in parallel.



$$\frac{1}{R_{eff}} = \frac{1}{R} + \frac{1}{R} + \frac{1}{R} = \frac{3}{R}$$

$R_{ef} = \frac{R}{3}$

Again $\frac{R}{3}$ and R are connected in series.



$R_{ef} = R_1 + R_2 = \frac{R}{3} + R = \frac{4R}{3}$

Question 11.

Sudhakar has taken a substance in the form of wire. He applied different voltages to the wire and measured electrical currents. For this he used Ammeter and Voltmeter. He tabulated five measurements. Then plotted a graph as shown in the figure. In the graph he measured voltages in volts (V) and current (I) in Amperes.

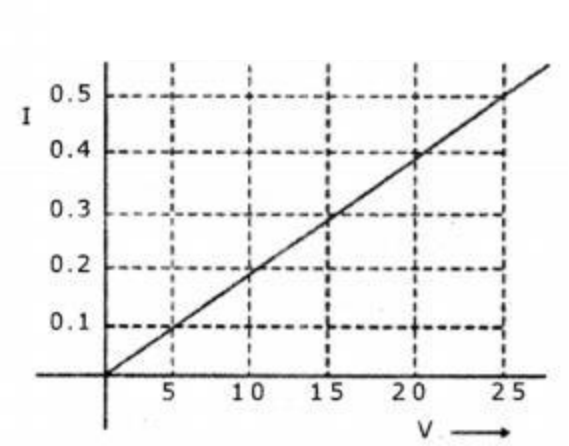
Answer the following

a) WhattypeofmaterlaiSudhakarselected for his experiment?

b) What is the resistance of the substance?

c) If potential difference is 20 Vat the ends of wire. How much electrical power is utilized by wire?

d) What is the law associated with the above graph?



Answer:

a) The graph is a straight line passing through origin. it is in the form of y = mx i.e., I mv. Here 'm' is slope of the graph.

Here m = \(\frac{1}{R}=\frac{1}{\operatorname{Resistance}} \)

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

The substance is Ohmic substance i.e., obeying Ohm's law. So it Is a metal like iron spoke, (or) Copper, Aluminium etc.

b) The resistance can be known from graph is

V = IR; R = $\frac{V}{I} = \frac{10}{0\times2} = \frac{100}{2}$ = 30 Ω

The reciprocal of slope of graph gives Resistance.

c) The electrical power can be measured by taking the area of graph i.e., area enclosed between the straight line and X – axis

Power (P) = Voltage x Current = V I

Area = Area of tnangle = $\frac{1}{2}$ x 20 x 0.4 = 4 Watts

d) Ohm's Law: The potential difference between the ends of a conductor is directly proportional to the electric current passing through It at constant temperature.

Question 12.

Your friend needs 10 ohms resistance. He came to you and asked, but you have 40 ohms resistance.

i) How many resistors your friend will ask you?

ii) How the resistors which are taken are connected

iii) Show that their effective resistance is lo ohms.

Answer:
i) A minimum of four resistors are required.
ii) They should be connected In parallel.
iii) When the resistors are connected in parallel, the equivalent resistance is given

$$\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}+\frac{1}{R_4}$$

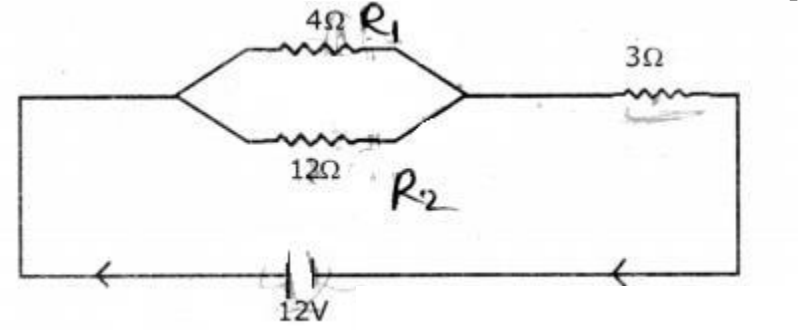
$$\frac{1}{R}=\frac{1}{40}+\frac{1}{40}+\frac{1}{40}+\frac{1}{40}=\frac{1+1+1+1}{40}=\frac{4}{40}$$

$$\frac{1}{R}=\frac{1}{10}$$

R = 10 Ω

Question 13.
12 V battery is connected in a circuit and to this 4Ω, 12Ω resistors are connected in parallel, 3Ω resistor is connected in series to this arrangement. Draw the electric circuit from this information and find the current in the circuit.

Answer:
The resultant resistance of 4Ω, 12Ω, connected in parallel is



$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R} = \frac{1}{4} + \frac{1}{12} \Rightarrow \frac{1}{R} = \frac{3+1}{12}$$

$$\therefore \frac{1}{R} = \frac{4}{12} \Rightarrow R = \frac{12}{4}$$

$$\therefore R = 3\Omega$$

The total resistance in the circuit is

$R = R_1 + R_2 = 3 + 3 = 6$

$\therefore R = 6\Omega$

The current in the circuit

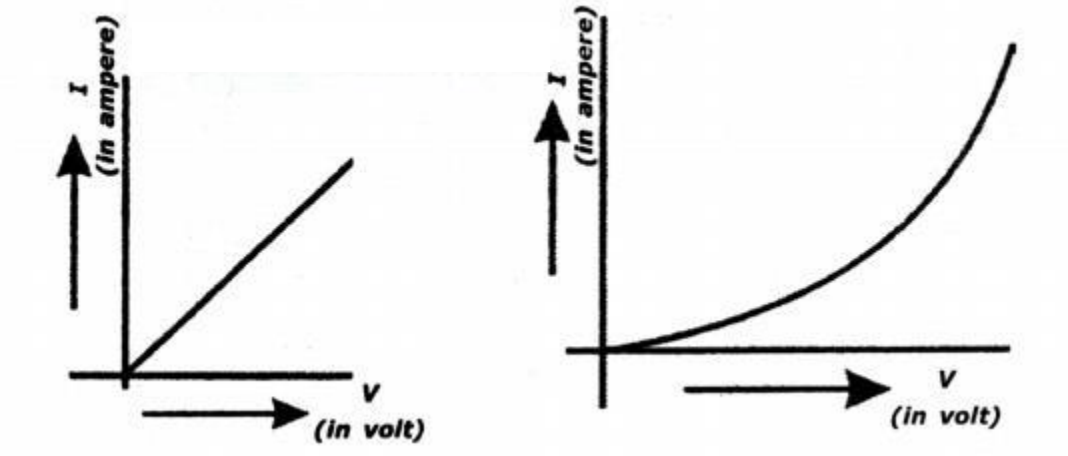
$$I = \frac{V}{R} \Rightarrow I = \frac{12}{6}$$

$\therefore I = 2A$

Question 14.

Draw the shape of V – I graph for a conductor and a semiconductor.

Answer:



Question 15.

Draw the symbols of the following.

i) Battery

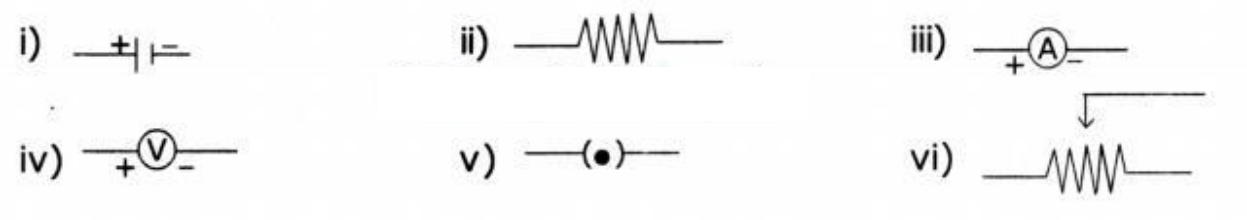
ii) Resistance

iii) Ammeter

iv) Voltmeter

v) Key
vi) Rheostat

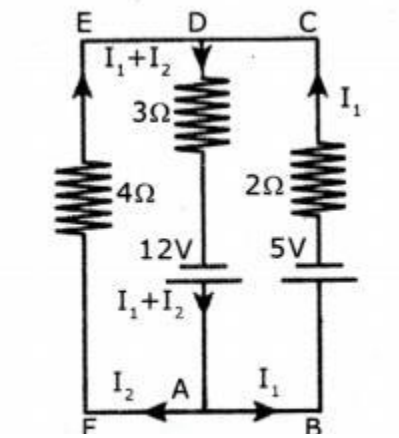
Answer:



Solved Example

Question 1.
Find electric current drawn (figure) from the battery of emf 12V.

Answer:
Let $I = I_1 + I_2$ be the current drawn from emf 12V.
From the figure.
Using the loop law, for the loop DABCD,
$-3(I_1 + I_2) + 12 - 2I_1 - 5 = 0$ ..... (a)
for the loop DAFED, .
$-3(I_1 + I_2) + 12 - 4I_2 = 0$ ..... (b)
Solving the equation (a) & (b)
We get $I_1 = 0.5$ A and $I_2 = 1.5$A
Total current drawn Is then $I = 0.5 + 1.5 = 2$A B



Do You Know

A multimeter is an electric measuring instrument that combines several measurement functions in one unit. A digital multimeter displays the measured value in numerals.
A multi-meter has three parts.

Display: The display usually has four digits and the ability to display a negative sign.
Selection knob: The selection knob allows the user to set the multimeter to read different functions such as milliamps (mA) of current, voltage (V), and resistance (Ω).

Ports: Multi-meters generally have two ports. One is usually labeled as 'COM' (common or ground port). This is where black test lead is connected. The other is labeled as mAVΩ port where the red lead is conventionally plugged in.

Warning: Most multimeters can measure AC quantities also, but AC circuits can be dangerous. So measure DC quantities only. (Page 188)