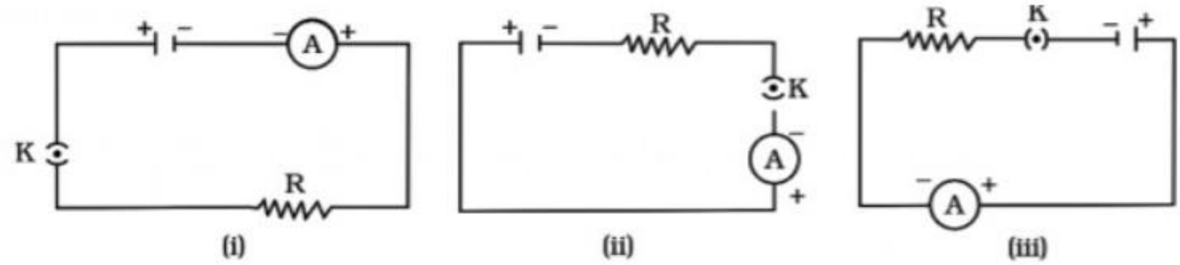
Chapter – 12 Electricity

Multiple Choice Questions (MCQs)

Q1. A cell, a resistor, a key and an ammeter are arranged as shown in the circuit diagram of figure. The current recorded in the ammeter will be

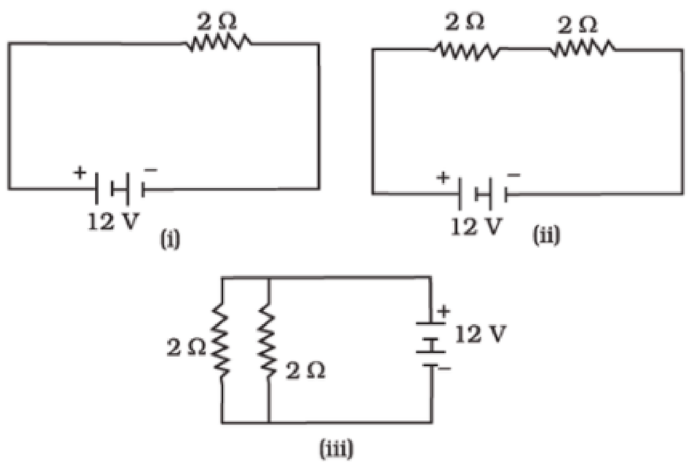


a) **Maximum in (i)**
b) **Maximum in (ii)**
c) **Maximum in (iii)**
d) **The same in all the cases**

Answer: Option d)

A cell, a resistor, a key and an ammeter are in series. In series connections the order of elements in the circuit does not depend on the amount of current flowing through it.

Q2. In the following circuits, heat produced in the resistor or combination of resistor connected to a 12 V battery will be



a) **Same in all the cases**
b) **Maximum in case (i)**
c) **Maximum in case (ii)**
d) **Maximum in case (iii)**

Answer: Option d)

Case (i), net resistance = $R_1 = 2\Omega$

Case (ii), net resistance = $R_2 = 2 + 2 = 4\Omega$

Case (iii), net resistance = $\frac{1}{R_3} = \frac{1}{2} + \frac{1}{2} = R_3 = 1\Omega$

$$H = \frac{(Potential\ difference)V^2}{(Total\ Resistance)R} \times (time)$$

So, the voltage in three cases for equivalent resistance is same.

Hence, $H \propto \frac{1}{R}$. The value of net resistance will be minimum in case (iii), so heat produced will be maximum.

Q3. Electrical resistivity of a given metallic wire depends upon

a) Its length
b) Its thickness
c) Its shape
d) Nature of the material

Answer: Option d)

Resistivity of a given metallic wire depends on number density of free electrons in the conductor which is the nature of material, that is,

$$\rho \propto \frac{1}{n}$$

N is the number of free electrons per unit volume, it depends on the temperature of conductor.

Q4. A current of 1 A is drawn by a filament of an electric hub. Number of electrons passing through a cross-section of the filament in 168 would be roughly

a) $\mathbf{10^{20}}$
b) $\mathbf{10^{16}}$
c) $\mathbf{10^{18}}$
d) $\mathbf{10^{23}}$

Answer: Option a)

Given: Current, $I = 1A$

Time, $t = 16\ s$

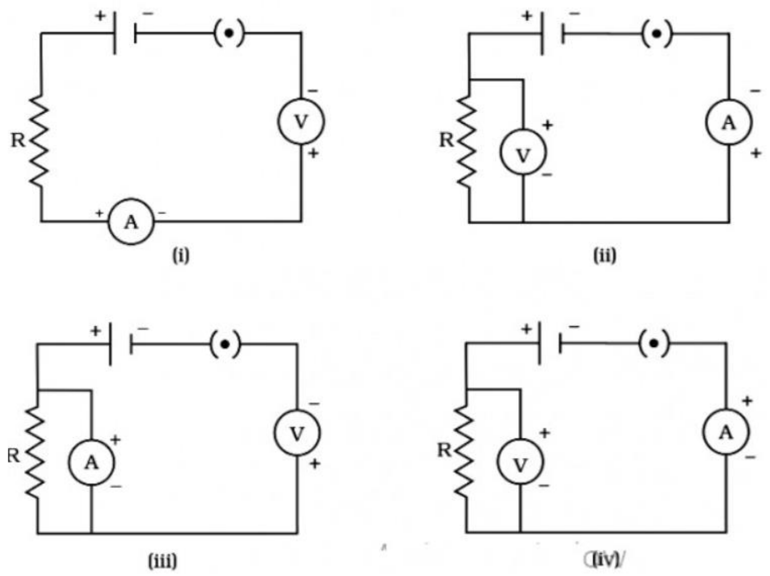
Number of electrons $n = ?$

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

$$n = \frac{It}{e} = \frac{1 \times 16}{1.6 \times 10^{-19}} = 10^{20}$$

$$n = 10^{20}$$

Q5. Identify the circuit in which the electrical components have been properly connected.



a) **(i)**
b) **(ii)**
c) **(iii)**
d) **(iv)**

Answer: Option b)

To identify the circuit, following conditions are must to be satisfied:

a) An ammeter is always connected in series.
b) The voltmeter should be connected in parallel.
c) The positive terminals of V and A is joined to positive terminal of the cell and t negative terminals is joined to the negative terminal of the cell.

So, the above conditions are satisfied by the case (ii).

Q6. What is the maximum resistance which can be made using five resistors each of $1/5\ \Omega$?

a) $1/5\ \Omega$
b) $10\ \Omega$
c) $5\ \Omega$
d) $1\ \Omega$

Answer: Option d)

Maximum resistance is when resistors are connected in series, so the equivalent resistance,

$$R_s = n \times R$$

$$R_s = 5 \times \frac{1}{5} = 1\ \Omega$$

Q7. What is the minimum resistance which can be made using five resistors each of $1/5\ \Omega$?

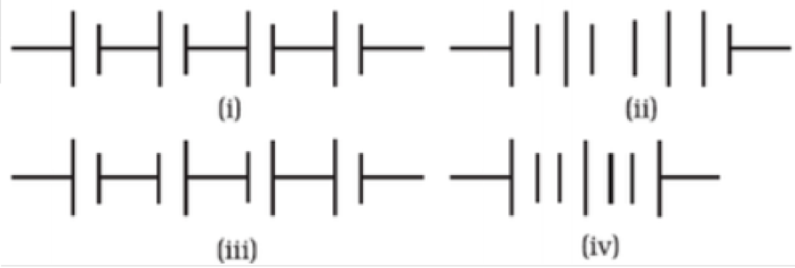
a) $1/5\ \Omega$
b) $1/25\ \Omega$
c) $1/10\ \Omega$
d) $25\ \Omega$

Answer: Option b)

The minimum resistance is when resistors are connected in parallel, so the equivalent resistance,

$$R_p = \frac{R}{n} = \frac{1/5}{5} = \frac{1}{25}\Omega$$

Q8. The proper representation of series combination of cells obtaining maximum potential is



a) (i)
b) (ii)
c) (iii)
d) (iv)

Answer: Option a)

In series combination of cells, the negative terminal of the first cell is connected to the positive terminal of the second cell and the negative terminal of the second cell is connected to the positive terminal of the third cell.

Q9. Which of the following represents voltage?

$\boldsymbol{a)}\ \frac{\boldsymbol{Work\ done}}{\boldsymbol{Current \times Time}}$

$\boldsymbol{b)\ Work\ done\ \times Charge}$

$\boldsymbol{c)}\ \frac{\boldsymbol{Work\ done \times Time}}{\boldsymbol{Current}}$

$\boldsymbol{d)\ Work\ done \times Charge \times Time}$

Answer: Option a)

Work done, $W = Vq = VIt$

$V = Voltage$

$I = Current\ flowing$

$t = Time\ taken$

$$V = \frac{W}{I \times t} = \frac{Work\ done}{Current\ \times Time}$$

Q10. A cylindrical conductor conducts of length $\boldsymbol{l}$ and uniform area of cross-section $\boldsymbol{A}$ has resistance $\boldsymbol{R}$. Another conductor of length $\boldsymbol{2l}$ and resistance $\boldsymbol{R}$ of the same material has area of cross-section.

- **a)** $\boldsymbol{A/2}$
- **b)** $\boldsymbol{3A/2}$
- **c)** $\boldsymbol{2A}$
- **d)** $\boldsymbol{3A}$

Answer: Option c)

Case – 1:

Resistivity of the conductor,

$$\rho = \frac{RA'}{l}$$

Case – 2:

Resistivity of the conductor,

$$\rho = \frac{RA'}{2l}$$

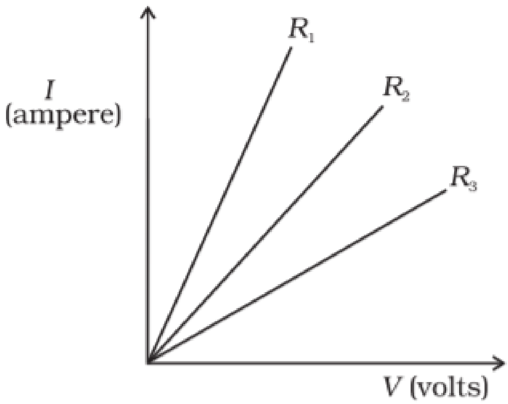
Since, resistivity of the conductor will be same for same material.

On substituting the value of ρ in above equation:

$$\frac{RA'}{l} = \frac{RA'}{2l}$$

$$A' = 2A$$

Q11. A student carries out an experiment and plots the V-I graph of three samples of nichrome wire with resistances R_1, R_2 and R_3 respectively as shown in Figure. Which of the following is true?

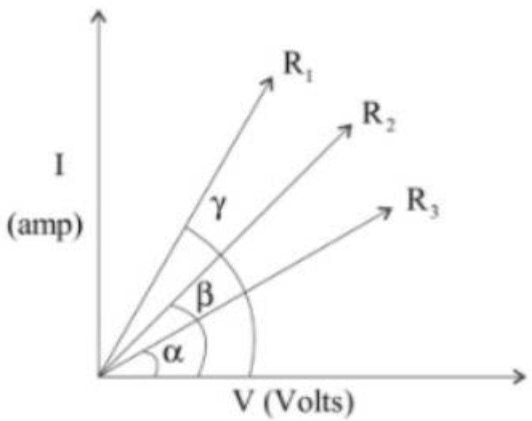


- **a)** $R_1 = R_2 = R_3$
- **b)** $R_1 > R_2 > R_3$
- **c)** $R_3 > R_2 > R_1$
- **d)** $R_2 > R_3 > R_1$

Answer: Option c)

A student plots the V-I graph of three samples of nichrome wire with resistance R_1, R_2 and R_3. The V and I tells us about the resistance and

$$(slope\ of\ V\ and\ I) \propto \frac{1}{Resistance}$$



Hence, $R_3 > R_2 > R_1$

Q12. If the current I through a resistor is increased by 100% (assume that temperature remains unchanged), the increase in power dissipated will be

a) $\mathbf{100}\%$
b) $\mathbf{200}\ \%$
c) $\mathbf{300}\%$
d) $\mathbf{400}\ \%$

Answer: Option c)

Power, $P = I^2R$

$P_1 = I^2R$

$P_2 = (2I)^2R = 4I^2R$

Increase in power dissipated $= P_2 - P_1$

$= 4I^2R - I^2R$

$= 3I^2R$

% increase in power dissipated $= 300\%$

Q13. The resistivity does not change if

a) **The material is changed**
b) **The temperature is changed**
c) **The shape of the resistor is changed**
d) **Both material and temperature are changed**

Answer: Option c)

Resistivity depends on the nature of the material and the temperature but do not depend on the shape of the resistor.

Q14. In an electrical circuit three incandescent bulbs A, B and C of rating 40 W, 60 W and 100 W respectively are connected in parallel to an electric source. Which of the following is likely to happen regarding their brightness?

a) **Brightness of all the bulbs will be the same**
b) **Brightness of bulb A will be the maximum**
c) **Brightness of bulb B will be more than that of A**
d) **Brightness of bulb C will be less than that of B**

Answer: Option c)

In an electric circuit, 3 incandescent bulbs A, B and C of 40 W, 60 W and 100 W are connected in parallel, then the bulb with the highest wattage glows with maximum brightness.

$$Power\ dissipated\ \propto Brighteness$$

So, the brightness of the bulb B is 100 W is maximum.

$$B_{100} > B_{60} > B_{40}$$

Q15. In an electrical circuit, two resistors of $2\,\Omega$ and $4\,\Omega$ respectively are connected in series to a 6V battery. The heat dissipated by the $4\,\Omega$ resistor in $5\ s$ will be

a) $\mathbf{5\,J}$
b) $\mathbf{10\,J}$
c) $\mathbf{20\,J}$
d) $\mathbf{30\,J}$

Answer: Option c)

Given: resistor, $R_1 = 2\ \Omega$ and $R_2 = 4\ \Omega$

Voltage, $V = 6V_1$

Time, $t = 5\ s$

Resistance, $R = 4\ \Omega$

Heat dissipated, $H = ?$

Solution: Resistor, $R_s = R_1 + R_2 = 2 + 4 = 6\ \Omega$

Current,

$$I = \frac{V}{R} = \frac{6}{6} = 1\ A$$

Heat dissipated, $H = I^2R = 1 \times 4 \times 5 = 20\ J$

Q16. An electric kettle consumes 1 kW of electric power when operated at 220 V. A fuse wire of what rating must be used for it?

a) **1 A**
b) **2 A**
c) **4 A**
d) **5 A**

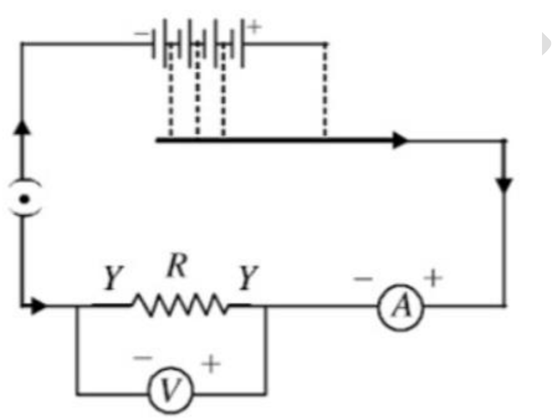
Answer: Option d)

Power, $P = 1\ kW = 1000\ W$

Voltage, $V = 220\ V$

Current, I =?P

$$I = \frac{P}{V} = \frac{1000}{220} = 4.5\ A$$



So, the rating of fuse-wire is 5 A which is greater than 4.5 A.

Q17. Two resistors of resistance 2 Ω and 4 Ω when connected to a battery will have

a) **same current flowing through them when connected in parallel**
b) **same current flowing through them when connected in series**
c) **same potential difference across them when connected in series**
d) **different potential difference across them when connected in parallel**

Answer: Option b)

In series connection of resistance, the same current will flow through each resistor where in parallel combination same voltage exists across each resistor. So, two resistors of resistances 2 Ω and 4 Ω are connected in series has same current flowing through it.

Q18. Unit of electric power may also be expressed as

a) volt ampere
b) kilowatt hour
c) watt second
d) joule second

Answer: Option a)

Power is given as,

$$P = voltage \times current$$

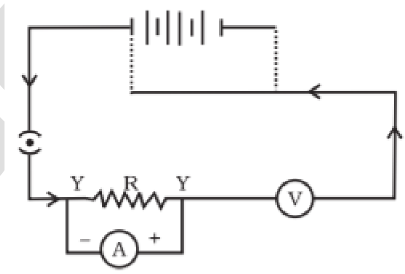
S.I unit of voltage = Volt

S.I unit of current = Ampere

Hence, its unit is volt ampere.

Short Answer Type Questions

Q19. A child has drawn the electric circuit to study Ohm's law as shown in Figure. His teacher told that the circuit diagram needs correction. Study the circuit diagram and redraw it after making all corrections.

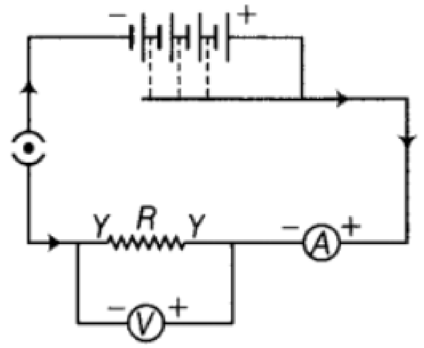


Answer:

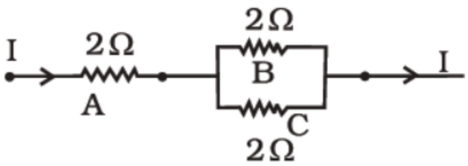
The given circuit diagram is not correct because;

i) Ammeter is in parallel with R and voltmeter connected in series. Ammeter is connected in series and voltmeter in parallel, because same current flows in the series and same voltage is in parallel combination.
ii) The current is drawn from negative terminal and enter into the battery at terminal which is not possible in one battery circuit.
iii) Cells are not connected in series in the battery of the circuit.

Hence, the correct diagram is:



Q20. Three 2 Ω resistors, A, B and C, are connected as shown in Figure. Each of them dissipates energy and can withstand a maximum power of 18W without melting. Find the maximum current that can flow through the three resistors?



Answer:

Given:

Resistance, $R = 2\Omega$

Maximum power, $P_{max} = 18\ W$

Maximum current, $I_{max} = ?$

$$P = I^2 R$$

$$I = \frac{\sqrt{18}}{\sqrt{2}} = 3\ A = I_{max}$$

Maximum current that flows through 2 Ω resistor is $3\ A$.

The current along B and C because in parallel connection, voltage across B and C remain same.

Hence,

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

Since, B and C have same resistance 2Ω each, same current, that is, 1.5 A flows through B and C.

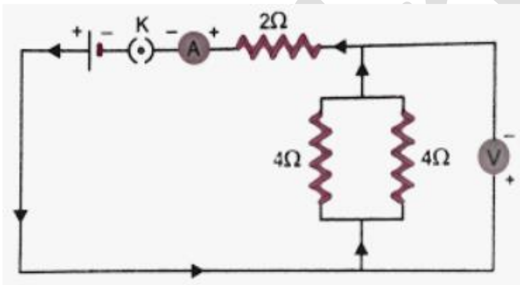
Q21. Should the resistance of an ammeter be low or high? Give reason.**

Answer:

The resistance of an ammeter is low. An ammeter is connected in series with the circuit to measure current. If resistance is not very low, its inclusion in the circuit will reduce the current to be measured.

Q22. Draw a circuit diagram of an electric circuit containing a cell, a key, an ammeter, a resistor of 2 Ω in series with a combination of two resistors (4 Ω each) in parallel and a voltmeter across the parallel combination. Will the potential difference across the 2 Ω resistor be the same as that across the parallel combination of 4Ω resistors? Give reason.

Answer:



The resistance of parallel combination of two resistors (4 Ω each) is 2 Ω.

The same current passes through the 2 Ω resistor and 2 Ω. So, voltage drop by them will be same, hence the voltage V is same across 2 Ω resistor and the parallel combination of two resistors, cell of 4 Ω.

Q23. How does use of a fuse wire protect electrical appliances?

Answer:

A fuse is a circuit connection that will be destroyed by excessive current flow. Creating an open circuit, to protect electrical appliances from receiving too high current. It is the weakest link in the circuit, which fails before the other components are damaged.

A normal fuse contains thin wire strips that melts when heated by excessive current flow. A fuse will consist of low melting point and high resistivity and it is always connected in live wire.

Q 24. What is electrical resistivity? In a series electrical circuit comprising a resistor made up of a metallic wire, the ammeter reads 5 A. The reading of the ammeter decreases to half when the length of the wire is doubled. Why?

Answer:

Electrical resistivity of a material is defined as the resistance of a conductor of unit length and unit cross-sectional area.

The resistance of a uniform conductor is;

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

$I = length\ of\ conductor$

$\rho = electrical\ resistivity\ of\ the\ material$

$A\ is\ cross\ sectional\ area$

If I id doubled the, R will also be doubled.

$$R' = \rho \frac{2l}{A} = 2\frac{\rho l}{A} = 2R$$

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

$$I' = \frac{V}{2R} = \frac{I}{2}$$

$$R\ is\ doubled\ and\ I\ becomes\ \frac{I}{2}$$

Q25. What is the commercial unit of electrical energy? Represent it in terms of joules.

Answer:

The commercial unit of electrical energy is kilowatt hour, written as kWh.

$$1\ kWh = 1kW \times h$$

$$= 1000\ W\ \times 3600\ s$$

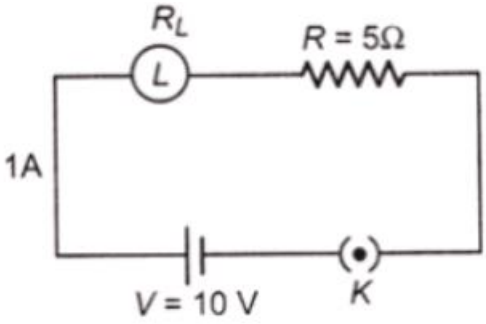
$$= 3.6 \times 10^6\ J$$

Q26. A current of 1 ampere flows in a series circuit containing an electric lamp and a conductor of 5 Ω when connected to a 10 V battery. Calculate the resistance of the electric lamp. Now if a resistance of 10 Ω is connected in parallel with this series combination, what change (if any) in current flowing through 5 Ω conductor and potential difference across the lamp will take place? Give reason.

Answer:

Given: Current, $I = 1\ A$

Resistance of conductor, $R = 5\,\Omega$



Voltage, $V = 10\,V$

Resistance of lamp, $R_L = ?$

Total resistance in the circuit,

$$R_T = \frac{V}{F} = \frac{10}{1} = 10\Omega$$

$$R_L = R_T - R = 10 - 5 = 5\Omega$$

So, the potential difference across the lamp

$$= IR_L = 1 \times 5 = 5\,V$$

When $10\,\Omega$ resistance is connected in parallel with total resistance R_L $(R_L + R = 10\Omega)$, then total resistance R' in the circuit is given by;

$$\frac{1}{R'} = \frac{1}{10} + \frac{1}{R_r} = \frac{1}{10} + \frac{1}{10} = \frac{2}{10} = \frac{1}{5}$$

$$R' = 5\,\Omega$$

Current through the circuit,

$$I' = \frac{V}{R'} = \frac{10}{5} = 2\,A$$

Since, $10\,\Omega$ add with R_T are in parallel, current through R_T is

$$\frac{I'}{2} = \frac{2}{2} = 1\,A$$

So, the current lamp and conductor of $5\,\Omega$ in series is 1 A. Also, potential difference across lamp

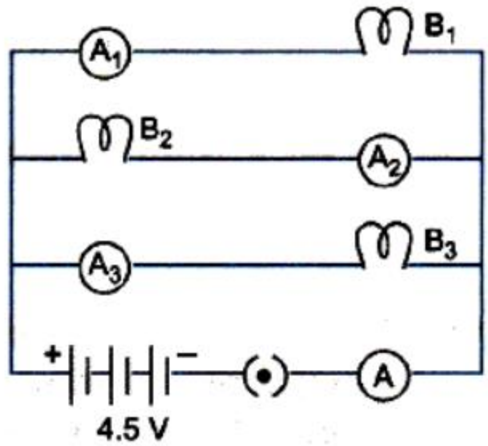
$$\frac{I'}{2} \times 5 = 1 \times 5 = 5\,V$$

Q27. Why is parallel arrangement used in domestic wiring?

Answer:

i. All the appliances work at the same voltage as that of the electric supply.
ii. If the appliances is out of order, example, if a bulb get fused, all other appliances keep on working as the circuit is not broken in parallel arrangement of devices.

Q28. B1, B2 and B3 are three identical bulbs connected as shown in Figure. When all the three bulbs glow, a current of 3A is recorded by the ammeter A.



(i) What happens to the glow of the other two bulbs when the bulb B1 gets fused?
(ii) What happens to the reading of A1, A2, A3 and A when the bulb B2 gets fused?
(iii) How much power is dissipated in the circuit when all the three bulbs glow together?

Answer:

resistance of three bulbs in parallel

$$R_{eq} = \frac{V}{I} = \frac{4.5}{3} = 1.5\ \Omega$$

If R is the resistance of each wire, then

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

$$R = 3R_{eq}$$

$$R = 3 \times 1.5 = 4.5\ \Omega$$

So, the current in each bulb,

$$I = \frac{V}{R} = \frac{4.5\Omega}{4.5\Omega} = 1\ A$$

i) When bulb B_1 gets fused, the current in bulb B_2 and B_3 remain same $I_2 = I_3 = 1\ A$, because voltage across the B_2 and B_3 bulb is same, so their glow remains unaffected.

ii) When bulb when bulb B_2 gets fused, the current in B_2 becomes zero and current in B_1 and B_3 remains 1A, because voltage across $B_1\ and\ B_3$ bulb remains same

Total current, $I = I_1 + I_2 + I_3 = 1 + 0 + 1 = 2A$

iii) When all the three bulbs are connected.

Power dissipated,

$$P = \frac{V^2}{R_{eq}} = \frac{(4.5)^2}{1.5} = 13.5\ W$$

Long Answer Questions

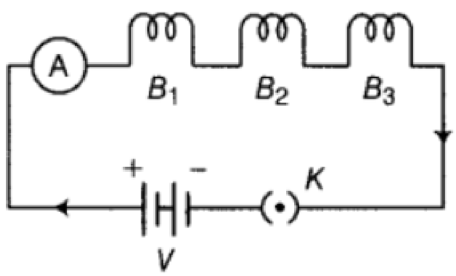
Q29. Three incandescent bulbs of 100 W each are connected in series in an electric circuit. In another circuit another set of three bulbs of the same wattage are connected in parallel to the same source.

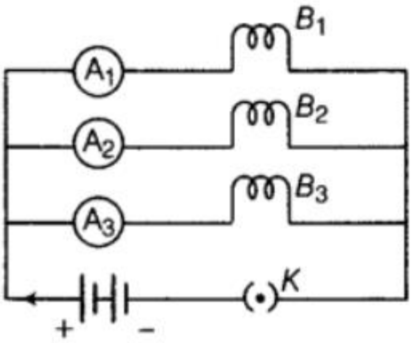
(a) Will the bulb in the two circuits glow with the same brightness? Justify your answer.

(b) Now let one bulb in both the circuits get fused. Will the rest of the bulbs continue to glow in each circuit? Give reason.

Answer:

Assuming the resistance of each bulb be R. the circuit diagram in two cases as:





Equivalent resistance in series combination

$R_s = R + R + R = 3R$ and voltage = V

Let current through each bulb in series combination be I_1.

By Ohm's law,

$$V = I_1 \times 3R = I_1 = \frac{V}{3R}$$

Power consumption of each bulb in series,

$$P_1 = I_1^2(3R) = \frac{(V)^2}{3R} \times 3R = \frac{V^2}{9R^2} \times 3R$$

$$= \frac{V^2}{3R}$$

For parallel circuit,

The resistance of each bulb = R

Voltage across each bulb = V

Power consumption of each bulb in parallel is

$$P_2 = \frac{V^2}{R}$$

Now,

$$\frac{P_2}{P_1} = \frac{(V^2/R)}{(V^2/3R)}$$

$$\frac{V^2}{R} \times \frac{3R}{V^2} = 3$$

$$P_2 = 3P_1$$

So, each bulb in parallel combination glows 3 times brighter to that of each bulb in series combination.

b) When one bulb gets fused in both the circuits, then in series , circuit gets broken and current stops flowing whereas in parallel combination same voltage continues on the remaining bulbs and they continue to glow with same brightness.

Q30. State Ohm's law? How can it be verified experimentally? Does it hold good under all conditions? Comment.

Answer:

Ohm's law states "the electric current flowing through a conductor is directly proportional to the potential applied across, when the temperature is constant".

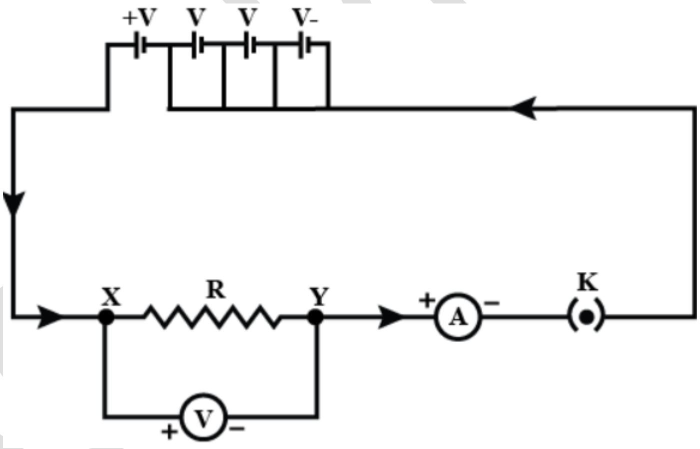
$$V \propto I$$

$$V = IR$$

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

R = constant or resistance of the conductor.

The experimental set-up is shown below:



A battery of 4 cells resistance wire, A an Ammeter and V a Voltmeter.

Step 1: Initially use one cell only. Put in key K and note current a voltage by noting Ammeter and Voltmeter reading respectively. Let these be I_1 and V_1.

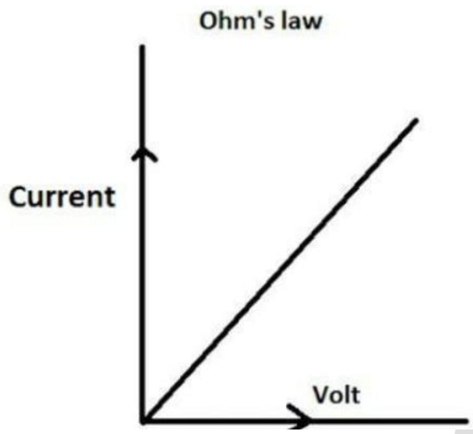
Step 2: then connect the two cells' in the circuit and note current I_2 and potential difference V_2 across the resistance.

Step 3: Similarly, take readings with 3 and 4 cells' in the circuit.

From the observations' we find that

$$\frac{V_1}{I_1} = \frac{V_2}{I_2} = \frac{V_3}{I_3} = \frac{V_4}{I_4} = constant = R$$

If we plot V-I graph comes out to be a straight line. It experimentally verifies ohm's law.



Ohm's law is not good under all conditions as it is not a fundamental law of nature. It is obeyed by metallic conductors only when physical conditions like temperature etc. are kept unchanged. It is not obeyed by a lamp filament, junction diode, thermistor etc. called non-ohmic conductor.

Q31. What is electrical resistivity of a material? What is its unit? Describe an experiment to study the factor on which the resistance of conducting wire depends.

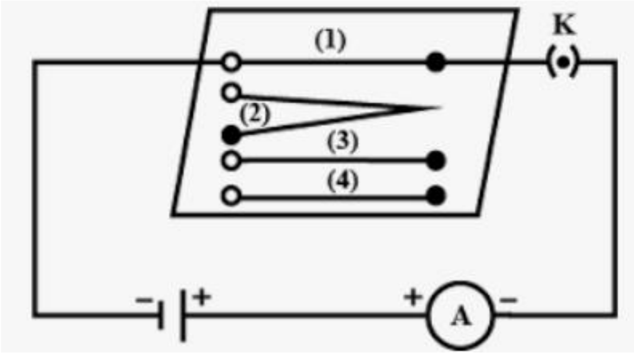
Answers:

The electrical resistivity of a material is the resistance of a conductor made of that material of unit length and unit cross-sectional area. Its S.I unit is Ohm metre.

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

$$\rho = \frac{RA}{l}$$

Considering an electric circuit consisting of a cell, an ammeter, a nichrome wire of length L and a plug key as shown:



At point plug the key and note the current in ammeter. Replace the nichrome wire by another nichrome wire of same thickness but twice the length that is 2t at point 2. Again, note the reading. Now, replace the wire by a thicker nichrome wire of same length l (marked 3). A thicker wire has a larger cross-sectional area.

Note down the current through the circuit. Replace nichrome wire with copper wire of same length and area of cross-section. Note the value of current and the difference in the current in all cases. When the length of the wire is doubled, then the ammeter reading decreases to half, that is, current through the wire is halved. Since, resistance of the wire,

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

Then R is doubled which implies $R \propto L$

When the nichrome wire is replaced by a thicker one of same material and length, the current in the wire increases which means, the resistance of the thicker wire is less than that of the thinner. Thus,

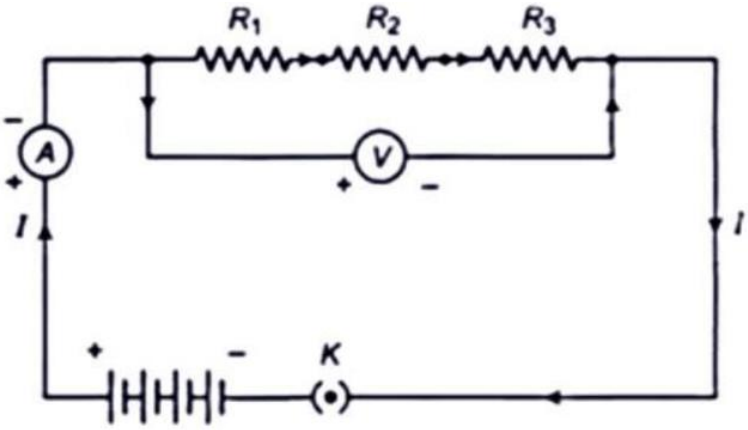
$$R \propto \frac{1}{A}$$

When the nichrome wire is replaced by a copper wire of the same length and same cross-sectional area, then the current on the ammeter is more that is the resistance of copper wire is more than that of the nichrome wire of the same dimension, that is, the resistance of the wire depends on the nature of its material.

Q32. How will you infer with the help of an experiment that the same current flows through every part of the circuit containing three resistance in series connected to a battery?

Answer:

Let the experiment set-up comprises of three resistors R_1, R_2 and R_3 of three different values such as $1\,\Omega$, $2\,\Omega$ and $3\,\Omega$ which are connected in series. Connect them with a battery of 6 V an ammeter and plug a key.



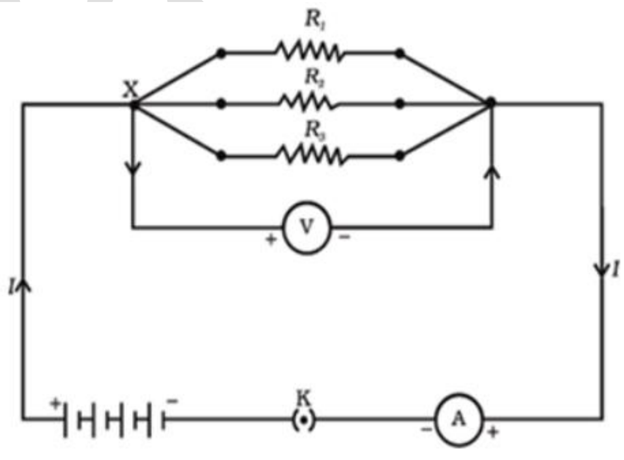
The key K is closed and the ammeter reading is recorded. Now, the position of ammeter is changed in between the resistance again, the ammeter reading is recorded each time, there was identical reading each time, which shows that same current flows through every part of the circuit containing three resistance in series connected to a battery.

Q33. How will you conclude that the same potential difference (voltage) exists across three resistors connected in a parallel arrangement to a battery?

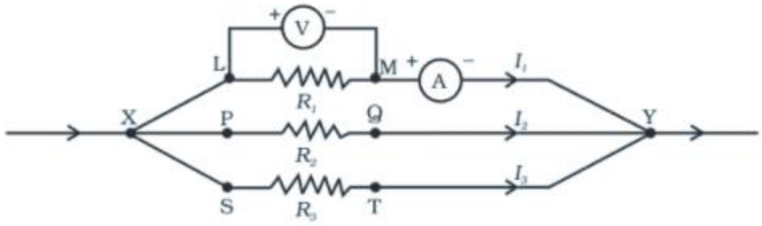
Answer:

The experiment consist of three resistors, R_1, R_2 and R_3 which are joined in parallel combinator and connecting with a battery, an ammeter (A), a voltmeter (V) and a plug key K.

The key K is closed and the voltmeter and ammeter readings are recorded



The key K is open and removing the ammeter and voltmeter from the circuit and insert the voltmeter V in parallel with R_1 and ammeter in series with the resistor R_1 as shown. Again, the voltmeter and ammeter readings are recorded.



Similarly, measuring the potential difference across resistance R_2 and R_3. All the voltmeter readings in each parallel resistor it will be the same.

Q34. What is Joule's heating effect? How can it be demonstrated experimentally? List its four applications in daily life.

Answer:

The heating effect of current is defined by Joules law of heating that is the heat H produced by a resistor of resistance R due to current flowing through it for time t is

$$H = I^2Rt$$

It is also called ohmic heating and resistive heating.

In a conductor when an electric field is applied, the free electrons start drifting opposite to the direction of the electric field and collide with the atoms which have lost the electrons.

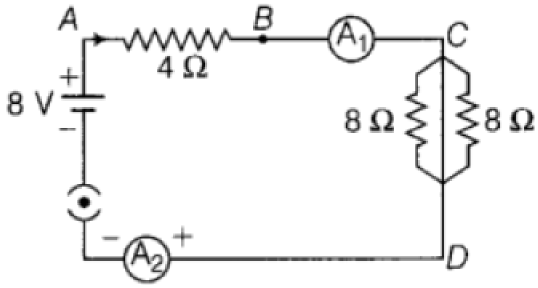
As a result of these collisions some energy of the electrons is transferred to the atoms which vibrate as they gain energy. Thus, heat is developed in the conductor. Greater the current, greater will be the rate of collision and so greater will be the heat produced.

The four applications using heating effect of current are:

i) Room heater
ii) Electric bulb
iii) Electric iron
iv) Electric fuse.

Q35. Find out the following in the electric circuit given in figure

a) Effective resistance of two $8\ \Omega$ resistors in the combustion.
b) Current flowing through $4\ \Omega$ resistor
c) Potential difference across $4\ \Omega$ resistance
d) Power dissipated in $4\ \Omega$ resistor
e) Difference in ammeter readings, if any



Answer:

a) Since, two $8\ \Omega$ resistors are in parallel, then their effective resistance R_p is given by

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

$$\frac{1}{R_p} = \frac{1}{8} + \frac{1}{8} = \frac{1}{4}\Omega$$

b) Total resistance in the circuit $R = 4\ \Omega +\ R_p$

$$= 4\Omega + 4\Omega$$

$$= 8\Omega$$

Current through the circuit,

$$I = \frac{V}{R} = \frac{8}{8} = 1\ A$$

Thus, current through $4\ \Omega$ resistor is 1A as $4\ \Omega$ and R_p are in series and same current flows through them.

c) Potential difference across 4Ω resistor is potential drop by the 4Ω resistor

$$V = IR = 1 \times 4 = 4V$$

d) Power dissipated in 4Ω resistor $P = I^2R = 1^2 \times 4 = 4\ W$

e) There is no difference in the readings of ammeters A_1 and A_2 as same current flows through all elements in a series current.