Electricity

Check Point 01

Q. 1. If a body has positive charge, then what does it mean?

Answer: If a body has positive charge it means that it has less no. of electrons than the no. of protons. Due to this imbalance of the charges, the body will attract the negative charged body.

Q. 2. In which direction does current flow in an electric circuit?

Answer: In an electrical circuit the current flows from the positive to the negative. The conventional current always flows in the direction opposite to the direction of flow of the electron.

Q. 3. The charge on an electron is 1.6×10^{-19}C. Find the number of electrons that will flow per second to constitute a current of 2A.

Answer: We know that;

Q = ne

Were,

n is an integral multiple can take values 1, 2, 3….

e- is the charge on the electron.

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

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

Thus, $n = \frac{I \times t}{e}$

$$n = \frac{2 \times 1}{1.6 \times 10^{-19}}$$

$$\therefore n = 1.25 \times 10^{19}$$

Q. 4. Write a low resistance device name which is always connected in series with the device through which the current is to be measured.

Answer: Ammeter is a device that is connected in series so as to measure the current through the circuit. It has a very low resistance so that maximum current passes through it and thus the correct amount of current through the circuit can be measured.

Q. 5. If work done in moving a charge of 20 mC from infinity to a point O in an electric field is 15 J, then what is the electric potential at this point?

Answer: We know that work done in moving a charge Q in a potential V is given by:

$$W = Q \times V$$

$$\therefore V = \frac{W}{Q}$$

$$V = \frac{15J}{20 \times 10^{-3}}$$

Since, Q = 20mC = 20×10-3C

$$V = 7.5 \times 10^{2}C$$

Q. 6. Write a high resistance device name which is always connected in parallel.

Answer: Voltmeter is a high resistive device that is used to measure the voltage across a component. It is always connected in parallel to the component whose voltage is to be measured. It is highly resistive so that the current cannot pass through it and thus the current will pass through the component connected in parallel to it so as to measure the accurate voltage drop across the component.

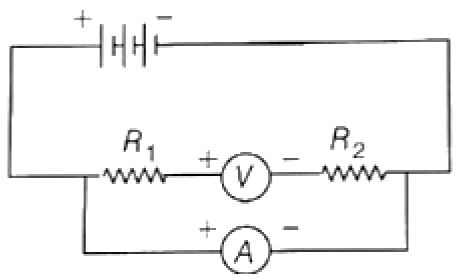
Check Point 02

Q. 1. What does it mean a circuit is closed or open?

Answer: If a circuit is closed that means electrons can easily flow through the circuit and thus electric current will flow through it.

If a circuit is open that means the electrons will not be able to flow through the circuit which means that there will be no current flowing through it.

Q. 2. A student made an electric circuit as shown below

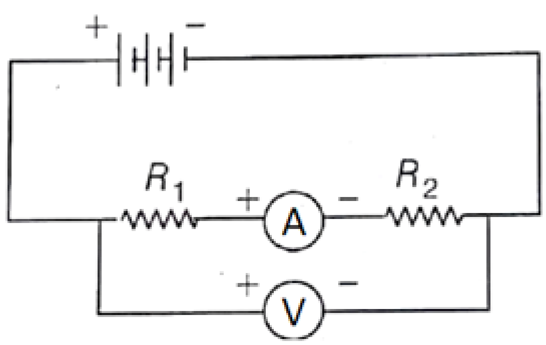


Is there any mistake in this circuit? If any then correct it.

Answer: Here, in this circuit, the student has kept the ammeter in parallel and the voltmeter in series with the circuit.

But actually, the ammeter should always be connected in series as it has a very low resistance so when we connect the ammeter in series, maximum current will pass through it and thus the correct amount of current through the circuit can be measured.

In the same way, the voltmeter should always be connected in parallel as it is highly resistive due to which the current cannot pass through it and thus the current will pass through the component connected in parallel to it so as to measure the accurate voltage drop across the component.



Q. 3. Define the electric resistance of a wire and also write its SI unit.

Answer: Electric resistance (R) is defined as the ratio of the voltage applied (V) to the current (I) flowing through the circuit.

It is given by the formula:

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

Its SI unit is known as ohm (Ω).

Q. 4. Keeping the potential difference constant, the resistance of a circuit is halved. Then, how much does the current changes?

Answer: We know that by Ohm's Law:

$$V = I \times R$$

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

Now,

$$R = \frac{R}{2}$$

$$\therefore I = \frac{V}{R/2} = 2\frac{V}{R}$$

We know that: $\frac{V}{R} = I$

$$\therefore I = 2I$$

Thus, from this we can conclude that if the resistance of the circuit is halved then the current gets doubled.

Q. 5. What is the difference between a good conductor and a poor conductor? Give two example of each.

Answer:

Good Conductor	Poor Conductor
1. It allows the electricity to pass through it easily.	1. It doesn't allow the electricity to pass through it.
2. It has less resistivity towards the flow of current.	2. It have more resistivity towards the flow of current
3. Example: Iron, Graphite	3. Example: Wood, Plastic

Q. 6. The potential difference across wire is 75V and its electric resistance is 30Ω. Find out the electric current through the wire.

Answer: We know that by Ohm's Law: $V = I \times R$

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

Here: V = 75V

And, R = 30Ω

$$I = \frac{75V}{30\Omega}$$

$$\therefore I = 2.5A$$

Q. 7. If the length of a wire is halved and its cross-sectional area is doubled, then what would be the resistance of the wire?

(Given, initially the resistance of the wire is R)

Answer: The formula of resistance is:

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

Where, $\rho =$ resistivity

$l =$ Length of the conductor

A = Area of the conductor

If length of the conductor is halved then, $l_1 = \frac{l}{2}$

And, the cross sectional area is doubled, $A_1 = 2A$

$$\therefore R_1 = \frac{\rho \times l_1}{A_1}$$

$$R_1 = \frac{\rho \times {}^{l}/_{2}}{2A}$$

$$R_1 = \frac{1}{4} \times \frac{\rho \times l}{A}$$

Now, $\frac{\rho \times l}{A} = R$

$$\therefore R_1 = \frac{R}{4}$$

Thus, we can conclude that the new resistance of the wire when the area of wire is doublead and length is haved become � the initial resistance.

Q. 8. Define the electric resistivity of material and also write its SI unit.

Answer: Resistivity: It is defined as the resistance offered by a conductor having unit length and unit cross-sectional area. It is denoted by ρ (rho).

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

The SI unit of resistivity ρ in Ωm.

Check Point 03

Q. 1. In which type of combination of different resistors will have equal value of electric current through them?

Answer: When different resistors are connected in series combination the current passing through them remains the same.

$V_{eq} = V_1 + V_2 + V_3 + \ldots + V_n$)

Since, V= IR

Putting the value in the above equation.

V_{eq}= I(R_1 +R_2 +R_3…+R_n)

I R_{eq}=I (R_1 +R_2 +R_3…+R_n)

R_{eq}=(R_1 +R_2 +R_3…+R_n)

Thus, we can say that the current remain constanct in series connection.

Q. 2. IF different resistors have the same value of electric potential across them, in which way they are connected to each other?

Answer: When different resistors are connected in parallel combination the voltage drop remains the same.

Q. 3. Why, we do not use series combination of connecting electric appliances in household circuit?

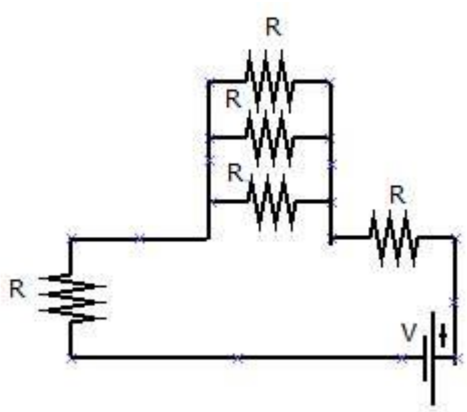
Answer: We do not use series combination for connecting electrical appliances in household circuit because if there will be a short circuit in one of the appliance which led to break in the circuit will cause the working of other appliance connected in the series.

Thus, Parallel combination is used for connecting electrical appliance in the household circuit.

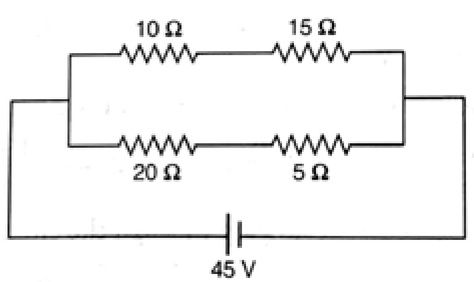
Q. 4. What do you understand by a mixed combination of resistances?

Answer: A Mixed combination of resistances means When two more resistance are connected in series and parallel simultaneously.

These type of combination are known as Mixed combination.



Q. 5. In the circuit shown below, calculate the net resistance of the circuit.



Answer: Here, the resistances 10Ω and 15Ω are connected in series and also the resistances 20Ω and 5Ω are also connected in series.

Thus, $R_1 = 10\Omega + 15\Omega = 25\Omega$

$R_2 = 20\Omega + 5\Omega = 25\Omega$

Now, these two resistances R_1 and R_2 are connected in parallel

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

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

$$R = \frac{25 \times 25}{25 + 25}\Omega = \frac{625}{50}\Omega$$

$$R = 12.5\Omega$$

Thus the net resistance is 12.5Ω.

Check Point 04

Q. 1. What is the heating effect of electric current?

Answer: When current flows through a conductor, it produces some amount of heat. This phenomenon is known as the heating effect of electric current.

The heat (H) produced during the heating effect of electric current is given by the formula:

Heat, $H = I^2 Rt$

Where, I = Current

R = Resistance of conductor

t = time

The SI unit of the heat produced is Joules (J).

Q. 2. State the factors on which the heat produced in a current conductor depends. Give one practical application of this effect.

Answer: The factors on which heating effect in a current conductor depends are:

a) The time for which the current is flowing through the circuit. Greater the time greater will be the heating effect.

b) Resistance of the conductor. More resistance yields more heating effect.

c) The amount of current flowing through the circuit.

Application: This principle of heating effect of current carrying conductor is used in the iron.

Q. 3. A fuse wire consists of an alloy of lead and tin. Why?

Answer: The fuse wire is made up of lead and tin alloy as this alloy has a very low melting point and a very high resistivity. When a large amount of current flows through this alloy, due to the high resistivity heat is produced due to the flow of high current Which make the alloy melts (as it has a very low melting point). Thus, as alloy melts the circuit breaks and the appliances connected to it are saved from any damage due to the high amount of current flowing in the circuit. The iron heats up as current flows through it and thus we are able to press the clothes easily.

Q. 4. An electric heater of resistance 500Ω is connected to a mains supply for 30 min. If 15A current flows through the filament of the heater, then calculate the heat energy produced in the heater.

Answer: We know that the formula of heat is given by:

Heat, $H = I^2 Rt$

Where;

t = 30 min = 30×60 sec = 1800sec

I = 15A

R = 500Ω

$$\therefore \mathrm{H} = (15)^2 \times 500 \times 1800 \mathrm{~J}$$

$$\mathrm{H} = 225 \times 500 \times 1800 \mathrm{~J}$$

$$\therefore \mathrm{H} = 20.25 \times 10^7 \mathrm{J}$$

Thus Total heat produced by the heater is 20.25×10^7 J in 30 min due to flow of 15 A current.

Q. 5. Why are electric bulbs filled with chemically inactive nitrogen and argon?

Answer: The electric bulbs are filled with chemically inactive as Nitrogen or Argon.

As when the current is passed through the bulb, the buld filament made of tungsten glow due to its high resistivity if exposed to air will cause the decomposition of tungsten metal in air which can leds

Tungsten element to melt thus causing circuit to break.

Thus for the long life of the bulb the electric bulb is filled with chemically inactive as nitrogen and argon.

Q. 6. What is the maximum power in kilowatts of the appliance that can be connected safely to a 13A, 230V mains socket?

Answer: We know that the formula of power is: $\mathrm{P = VI}$

Here;

V = 230V

I = 13A

$$\mathrm{P = 230 \times 13\ W}$$

$$\therefore \mathrm{P = 2990W}$$

$$\mathrm{or, P = 2.99kW}$$

Thus, the maximum power is 2.99kWcan be drawn from the circuit.

Q. 7. Power of a lamp is 60 W. Find the energy in joules consumed by it in 1s.

Answer: We know that the power can be stated as the amount of electric energy consumed per unit time.

$$Power, P = \frac{Energy\ consumed, E}{Unit\ Time, T}$$

On solving For Energy, we get

Energy, $E = \frac{P}{T}$

Here;

P = 60W

t = 1s

$$\mathrm{E = 60W \times 1sec}$$

$\therefore E = 60J$

Thus, the energy in joules is 60J.

Chapter Exercise

Q. 1. Electric fuse is an important component of all domestic circuits. Why?

Answer: Electric fuse is used as a safety device. Whenever, there is a large amount of current flowing through a circuit due to some faults, due to the lower melting point of the alloy, the fuse melts down which breaks the circuit connection.

Thus, electric fuse is an important component of all domestic circuits.

Q. 2. State the law which governs the amount of heat produced in a metallic conductor when current is passed through it for a given time. Express this law mathematically.

Answer:

When current flows through a conductor for a unit time, it produces some amount of heat. This phenomenon is known as the heating effect of electric current.

The heat (H) produced during the heating effect of electric current is given by the formula:

$$H = I^2Rt$$

Here, I = Current

R = Resistance of conductor

t = time

The SI unit of the heat produced is Joules (J).

Q. 3. Name two common materials, used as heating elements.

Answer: The two common materials, used as heating element are:

i. Tungsten wire.
ii. Nichrome Wire (It is made of 80% of Nickle and 20% of chromium.

Q. 4. Relate 1 kWh and SI unit of energy.

Answer: 1kwh = 1000watt×3600seconds

$$= 3.6 \times 10^6 \text{ wattsecond}$$

$$= 3.6 \times 10^6 \text{ joule (J)}$$

The SI unit of energy is joules (J).

Thus, we conclude that the 1kwH is 3.6×10^6 J

Q. 5. You are given three bulbs of 40 W, 60 W and 100W. Which of them has lower resistance?

Answer: We know that the formula of power is given by: $P = \frac{V^2}{R}$

So, from this equation we can see that power is inversely proportional to the resistance R. which means that lower is the resistance, more will be the power.

Thus we can say that: 100W will have the lower resistance.

Q. 6. Mention two special features of the material used as an element of an electric iron.

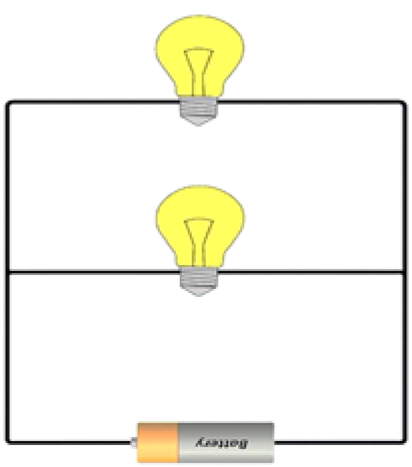
Answer: Two features of the material used as an element of an electric iron are:

a) It should have low melting point.

b) It should have a very high resistance.

Q. 7. Write the advantages of connecting electrical appliances in parallel and disadvantages of connecting them in series in a household circuit.

Answer: Parallel Connection: The electrical appliances should always be connected in parallel combination because if there is any fault/damage in any of the appliances then in series combination the whole circuit will get open but in parallel combination only that part containing the damaged appliance is open which will have no effect on the working of other appliances in the circuit.



Series Connection: We do not use series combination for connecting electrical appliances in household circuit as whenever there will be a damage/breakage in the circuit of any one appliance of the household then, due to the series connection all other connections will also break.

Q. 8. Derive the relation between kilowatt hour and joule.

Answer: $1\text{kwh} = 1000\text{watt} \times 3600\text{seconds}$

$= 3.6 \times 10^6 \text{ wattsecond}$

$= 3.6 \times 10^6 \text{ joule (J)}$

The SI unit of energy is joules (J).

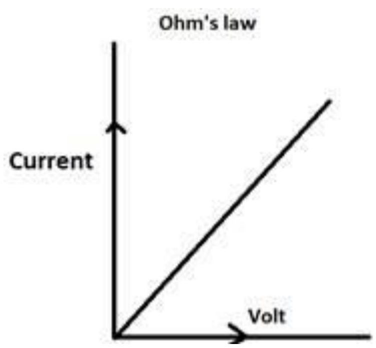
Q. 9. What kind of graph is obtained by plotting values of V and I? Why?

Answer: The graph obtained by plotting the values of V and I is a linear graph. We will observe that as the voltage V increases the value of current I also increases linearly.

This happens because we know that according to the Ohm's Law:

$V \propto I$

$\therefore V = IR$



Q. 10. It is possible to replace resistors joined in series by an equivalent single resistor of resistance. How?

Answer: Yes, it is possible to replace resistors joined in series by an equivalent single register.

Example: Suppose there are three resistors of 1Ω, 2Ω and 3Ω connected in series.

So, if we want to attach only one resistor instead of these three resistors then we and add these resistors ie.

1Ω + 2Ω + 3Ω = 6Ω

Thus, we can place a single equivalent resistance of 6Ω instead of these three resistors.

Q. 11. Aluminium wire has radius 0.25 mm and length or 75 m. If the resistance of the wire is 10Ω, calculate the resistivity of aluminium.

Answer: The formula of resistance is: $R = \frac{\rho \times l}{A}$

Where, $\rho =$ resistivity

$l =$ Length of the conductor

A = Area of the conductor

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

Here:

R = 10 Ω

r = 0.25mm

l = 75m

We know that the area of the wire will be: $A = \pi r^2$

$$\therefore A = 3.14 \times (0.25 \times 10^{-3})^2$$

$$A = 0.196 \times 10^{-6} \text{ m}^2$$

Putting the given values in the above formula,

$$\rho = \frac{10 \times 0.196 \times 10^{-6}}{75}$$

$$\rho = 26.133 \times 10^{-6} \text{Am}$$

Q. 12. You are given three resistors each of 3Ω and you are asked to get all possible values of resistance when you connect them in different combinations. How many values of resistance can you get?

Answer: Here: R_1 = 3Ω

R_2 = 3Ω

R_3 = 3Ω

• Parallel combination:

R1, R2 and R3 connected in stair like pattern one above the other.

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

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

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

$$R_{eq} = \frac{3}{3}\Omega$$

$$R_{eq} = 1\Omega$$

• Series Combination:

R1, R2 and R3 connected in same line across the potential difference V

$$R_{eq} = R_1 + R_2 + R_3$$

$$R_{eq} = 3 + 3 + 3$$

$$R_{eq} = 9\Omega$$

• Mixed combination:

R1 is connected in series with the parallel combination fo R2 and R3.

$$\frac{1}{R_p} = \frac{1}{R_2} + \frac{1}{R_3}$$

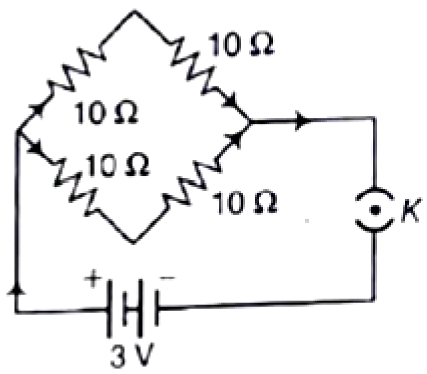
Putting the values of the resistance, we get

Thus, we get $R_p = 1.5\ \Omega$

R_s= R_1+ R_p= 3+1.5= 4.5 Ω

Thus, the net resistance of the circuit is 4.5Ω

Q. 13. Find the current drawn from the battery by network of four resistors shown in the figure?



Answer: Given:

V = 3V

$R_1 = R_2 = R_3 = R_4 = 10\Omega$

Here, R_1 and R_2 are connected in series

And, R_3 and R_4 are connected in series.

$$\therefore \frac{1}{R_{eq}} = \frac{1}{R_1 + R_2} + \frac{1}{R_3 + R_4}$$

$$\frac{1}{R_{eq}} = \frac{1}{10 + 10} + \frac{1}{10 + 10} = \frac{1}{20} + \frac{1}{20} = \frac{2}{20}$$

$$R_{eq} = \frac{20}{2}$$

Now, by Ohm's Law

$$V = I \times R$$

$$I = \frac{V}{R} = \frac{3}{10}$$

$$\therefore I = 0.3A$$

Thus, Current drawn by the resistor from the battery is 0.3 A

Q. 14. A wire is cut into three equal parts and then connected in parallel with the same source. How will its.

(i) resistance and resistivity gets affected?
(ii) How would the total current and the current through the parts change?

Answer: i. Here, the new resistance: $R = \frac{R}{3}$

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

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

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

$$\frac{1}{R_{eq}} = \frac{9}{R}$$

$$R_{eq} = \frac{R}{9}\Omega$$

The resistivity is dependent on the nature of the material.

Hence, there will be no change in the reisitivity of the wire.

ii. Now, by Ohm’s Law

$$V = I \times R$$

$$I = \frac{V}{R} = \frac{V}{R/9} = \frac{9V}{R}$$

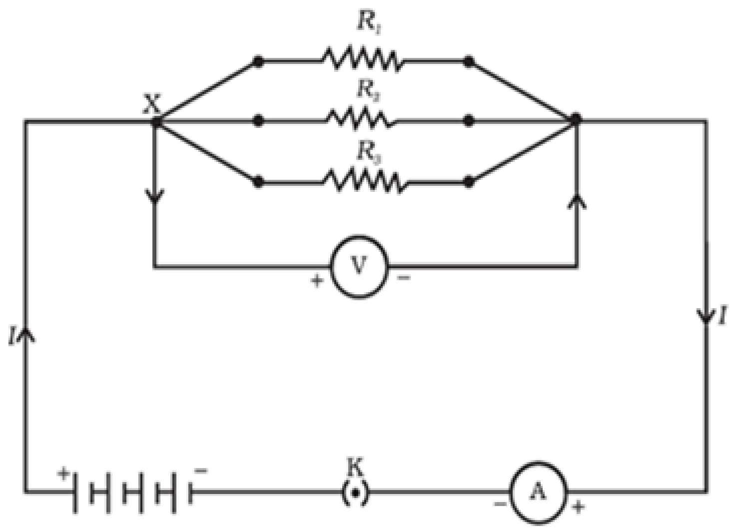
$$\therefore I = 9 \times I$$

Thus, the current will increase 9 times than the previous current.

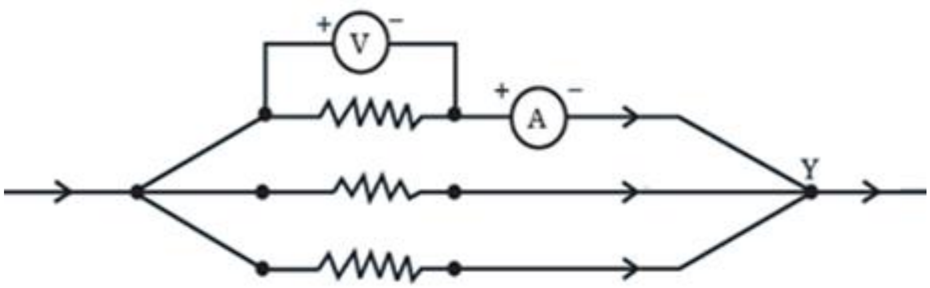
Q. 15. How will you conclude that the same potential difference (voltage) exists across three resistors connected in a parallel arrangement to a battery?

Answer: • Suppose 3 resistances are R_1, R_2 and R_3. We will connect these resistances in parallel with an ammeter (A), a voltmeter (V), a plug key (K)and a battery of known voltage as shown in figure given below.

• We will close the key K and record the ammeter and voltmeter readings.



• Now we will open the key and switch the position of voltmeter and ammeter as show in the figure given below.



• We will close the switch and note the readings. Similarly, we will switch the position of voltmeter to resistances R_2 and R_3 and observe the readings.

• We will find that readings of ammeter keeps on changing but readings of voltmeter in all cases almost remain same in all cases.

Q. 16. What will be the length of a nichrome wire resistance 5.0Ω, if the length of similar wire of 120 cm has resistance of 2.5 Ω? Why?

Answer: Here,

l_2 = 120cm = 1.20m

R_1 = 5.0Ω

R_2 = 2.5Ω

Now,

$$R_1 = \frac{\rho \times l_1}{A}$$

And

$$R_2 = \frac{\rho \times l_2}{A}$$

(Here, resistivity ρ and the area A remain same as the wires are similar.)

$$\therefore \frac{R_1}{R_2} = \frac{\rho \times l_1 / A}{\rho \times l_2 / A}$$

$$\frac{R_1}{R_2} = \frac{l_1}{l_2} = \frac{l_1}{120 \times 10^{-2}}$$

Now,

$$\frac{5.0}{2.5} = \frac{l_1}{120 \times 10^{-2}}$$

$l_1 = 2 \times 120 \times 10^{-2}$ m

$l_1 = 24 \times 10^{-1}$ m

$\therefore l_1 = 240$ cm

Q. 17. Disha was given two thin wires A and B in science laboratory. The teacher asked her to find out which wire was "fuse wire" and which one was "nichrome wire". Disha was given batteries of 3 V and 12 V and some connecting wires. The teachers also advised her to switch off fan while performing the activities and take necessary precautions to avoid burns. Disha performed the activities for testing and concluded that wire A is nichrome wire, whereas wire B is fuse wire.

On the basis of above information, answer the following questions

(i) Describe the activity which Disha performed to conclude that wire A is nichrome wire.
(ii) Describe the activity which Disha performed to conclude that wire B is fuse wire.

Answer: i) • Disha connected wire A with both the batteries.

• When wire A was connected with 3v battery, Disha found that the wire started heating.

• When the wire A was connected with 12V battery, she found that the wire is emitting a large amount of heat.

• Thus, she concluded that wire A is a nichrome wire as nichrome wire has a very large resistance and it produces a large amount of heat.

ii) • Disha connected wire B with both the batteries.

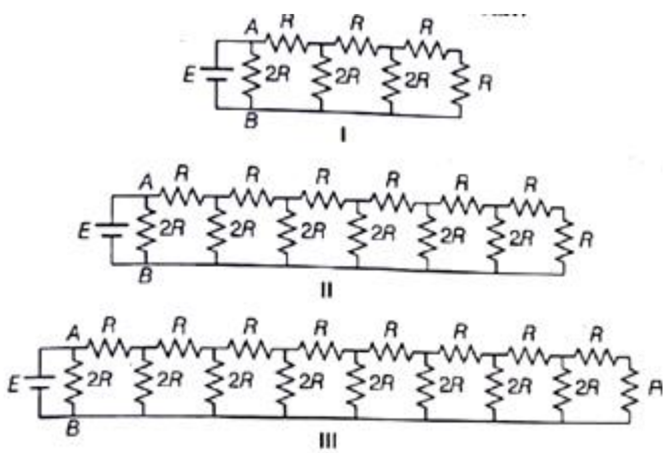
• When wire B was connected with 3v battery, did not find anything.

• When the wire B was connected with 12V battery, she found that the wire has started melting and.

• Thus, she concluded that wire B is a fuse wire as fuse wire has a very low melting point and it melts as a large amount of current is made to pass through it.

Challengers

Q. 1. Three different circuits (I, II and III) are constructed using identical batteries and resistors of R and 2R ohm. What can be said about current I in arm AB of each circuit.



A. $I_I > I_{II} > I_{III}$

B. $I_I < I_{II} < I_{III}$

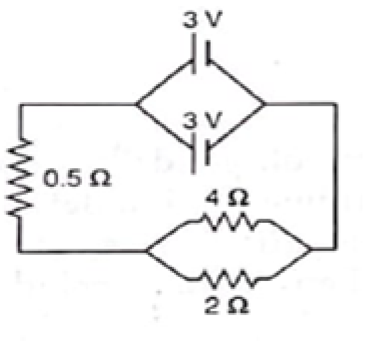
C. $I_{II} < I_I < I_{III}$

D. $I_I = I_{II} = I_{III}$

Answer: The equivalent in all the three circuits comes out to be the same so $I_I = I_{II} = I_{III}$. The reason being, the two end resistors of R and R ohms add upto 2R and the subsequently the two resistors of 2R in parallel are equivalent to a single resistor of R ohms and then the process repeats until the arm AB is reached , so, finally the equivalent resistance of all the circuits is same.

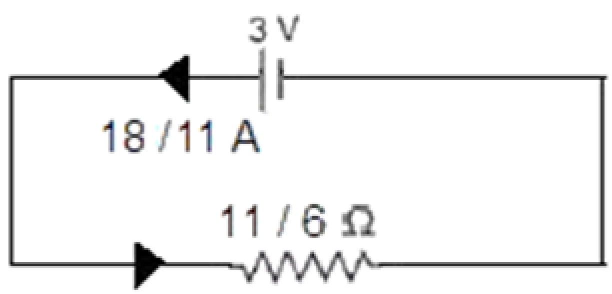
Q. 2. Two cells of 3V each are connected in parallel. An external resistance of 0.5 Ω is connected is series to the junction of two parallel resistors of 4 Ω and 2Ω

and then to common terminal of battery through each resistor as shown in figure. What is the current flowing through 4Ω resistor?



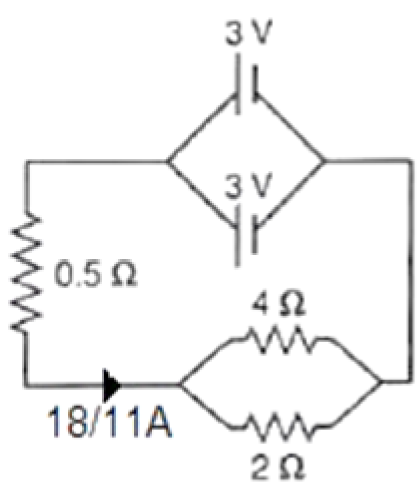
A. 0.25 A
B. 0.55A
C. 0.35 A
D. 1.50A

Answer:



The given circuit can be reduced to: -

The equivalent resistance can be calculated as: -



$R_{eq} = \frac{4.2}{4+2} + 0.5 = \frac{11}{6}\,\Omega$

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The net current in the circuit is given as $I = \frac{V}{R}$

$= \frac{3}{\left(\frac{11}{6}\right)}$

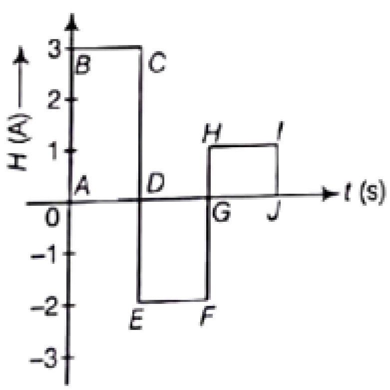
$= \frac{18}{11}$ A, so,

I_{net} = 18/11 A.

The circuit can be drawn as shown aside,

The voltage drop across the parallel resistance combination is $\frac{24}{11V}$, so net current in the 4 Ω resistor is $\frac{6}{11A}$ = 0.55 A.

Q. 3. The current flowing through a wire of resistance 2 Ω varies with time as shown in figure alongside. The amount of heat produced



(in J) in 3 would be

A. 2J
B. 18J
C. 28J
D. 10J

Answer: Assuming that each interval is of 1 seconds, we can calculate the heat for each interval and just sum it up to find the net heat produced,

Heat, $H= I^2 RT$

Where,

I is the current,

R is the resistance,

T is the time taken

For AD,

I=3, R=2 Ω, T=1 sec

Putting the values in the above formula, we get

$H_{AD}=3^2 . 2 . 1=18$ J

For DG,

I=-2 A, R= 2Ω, T=1 sec

Putting the values in the above formula, we get

$H_{DG}=(-2)^2 . 2 . 1=8$ J

For GJ,

I=1 A, R=2 Ω, T=1 sec

Putting the values in the above equation, we get

$H_{GJ}=1^2 . 2 . 1=2$ J

So Total amount of heat generated in 3 sec

$H_{NET} = 18 + 8 + 2 = 28$ J

Q. 4. In the movie Tang and Cash, Kurt Russell and Sylvester Stallone escape from a prison by jumping off the top of a tall wall through the air and onto a high voltage power line. Before the jump, Stallone objects to the idea, telling Russell respond with "You did not take high school Physics. Did you? As long as you are only touching one wire. And your feet are not touching the ground, you do not get electrocuted. "Is this a correct statement?

Answer: The statement is correct.

Explanation: The statement is true since for the motion of charges through a material requires a high potential and a low potential. Since, there feets are not touching the ground, the electric charges are not able to flow their body.

Thus we conclude that the electric charges require a potential difference to flow flow across a material. This only the region that the bird sitting on the High tension line are not electrocuted.

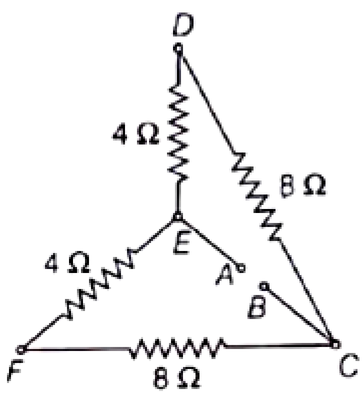
Q. 5. Two wire A and B with circular cross-sections having identical lengths and are made of the same material. Yet, wire A has four times the resistance of wire B. How many times greater is the diameter of wire B than wire A?

Answer: If wire A has four times the resistance, then it must have the smaller cross-sectional area since resistance and cross-sectional area are inversely proportional. In fact, A must have one-fourth the cross-sectional area of B. Since the cross-sectional area of a circular cross-section is given by the expression:

$$A = \pi \times r^2$$

Wire A must have one-half the radius of wire B and therefore one-half the diameter. Put another way, the diameter of wire B is two times greater than the diameter of wire A.

Q. 6. Calculate the equivalent resistance of the network across the points A and B shown in figure.



Answer: Here in this diagram, say:

$R_1 = 4\Omega$

$R_2 = 8\Omega$

$R_3 = 4\Omega$

$R_4 = 8\Omega$

When we want to find the resistance across points A and B then resistance R_1 and R_2 are connected in series and resistances R3 and R4 are also connected in series.

Thus,

$R_5 = R_1 + R_2 = 4\Omega + 8\Omega = 12\Omega$

And, $R_6 = R_3 + R_4 = 4\Omega + 8\Omega = 12\Omega$

Now, this R5 and R6 are connected to each other in parallel. Thus the equivalent resistance R_{AB} across points A and B is:

$$\frac{1}{R_{AB}} = \frac{1}{R_5} + \frac{1}{R_6}$$

$$\frac{1}{R_{AB}} = \frac{1}{12} + \frac{1}{12}$$

$$\frac{1}{R_{AB}} = \frac{2}{12} = \frac{1}{6}$$

$$\therefore R_{AB} = 6\Omega$$

Q. 7. The amount of energy transferred when 10C of charge passes through a potential difference of 20 V is the same as the energy needed to raise a 2kg mass through a distance x. Find the value of x, take the value of g as 10 m/s^2

Answer: Given:

Mass of the object = 2 kg,

Charge = 10 C,

Potential difference = 20 V,

Calculations:

We know that the Energy transferred which a charge q is moved through a potential difference V is given by

E = q . V

Where,

Q is the charge

V is the potential difference

Also gravitational potential energy stored in an object is given as:

E= m× g× H

Where,

M is the mass of the object,

G is gravitational acceleration,

H is the displacement,

As per the problem both are equal,

m.g.x = q. V

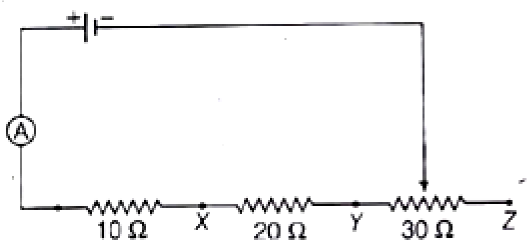
Putting the values in tehequation, we get

2× 10× x = 10. 20

$x = \frac{20}{2}$

= 10 meters.

Q. 8. The diagram shows a cell connected in series with an ammeter and three resistors (10 Ω, 20Ω, 30Ω). The circuit can be completed by a movable constant M. When M is connected to x, then ammeter reads 0.6 A. what is the ammeter reading when M is connected to y?



Answer: The current when it is connected to x is 0.6 A, so net resistance is 10 ohms so the cell voltage is 10 × 0.6 = 6 V.

Now when M is connected to y

The net resistance is sum of the resistance of 10 Ω and 20 Ω

R_{net}=10+20=30 Ω

As we know by ohms law,

V=I R

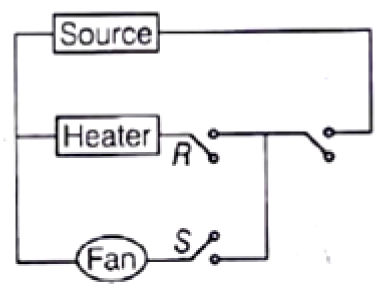
Putting the values in the equation, we get

6 V= **I**× 30 Ω

$I = \frac{6}{30}$ = 0.2 A.

Thus, the reading of ammeter is 0.2 A.

Q. 9. The circuit diagram is for a fan dryer that blows either hot air of cold air. Both switches R and S are as shown often. Which switch (s) is/are to be closed to obtain either hot or cold air?



Answer: In this circuit if we want Hot air to come out of the hair dryer then we will have to close both the switches R and S.

If we want cold air then we need to close the switch S. This will cause only the fan to work and the heater will be OFF ans thus we'll get cold air as an output.