



PHYSICS

BOOKS - VK GLOBAL PUBLICATION PHYSICS

(HINGLISH)

ELECTRICITY

Ncert Intext Question

1. What does an electric circuit mean?



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2. Define the unit of current.



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



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



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5. What is meant by saying that the potential difference between two points is 1 V?

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

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7. On what factors does the resistance of a conductor depend?

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8. Will current flow more easily through a thick wire or a thin wire of the same material, when connected to the same source? Why?



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9. Let the resistance of an electrical component remain 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?



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

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11. Which among iron and mercury is a better conductor?

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12. Which material is the best conductor?

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



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14. Redraw the circuit, putting in an ammeter to measure the current through the resistors and a voltmeter to measure the potential difference across the 12Ω resistor. What would be the readings in the ammeter and the voltmeter?



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



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16. An electric lamp of 100Ω , a toaster of resistance 50Ω , and a water filter of resistance 500Ω are connected in parallel to a 220 V source. What is the resistance of an electric iron connected to the same

source that takes as much current as all three appliances, and what is the current through it?



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



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18. How can three resistors of resistance 2Ω , 3Ω and 6Ω be connected to give a total resistance of (i) 4Ω , (ii) 1Ω ?



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19. What is (i) the highest, (ii) the lowest total resistance that can be secured by combinations of four coils of resistance 4Ω , 8Ω , 12Ω , 24Ω ?



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20. Why does the cord of an electric heater not glow while the heating element does?



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21. Compute the heat generated while transforming 96,000 coulombs of charge in one hour through a potential difference of 50 V.



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



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23. What determines the rate at which energy is delivered by a current?



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



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Ncert Exercise

1. A piece of wire of resistance R is cut into five equal parts. These parts are then connected in parallel. R If

the equivalent resistance of this combination is R' ,

then the ratio $\frac{R}{R'}$ is:

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2. An electric bulb is rated 220 V and 100 W. When it is operated on 110 V, the power consumed will be:

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3. Two conducting wires of the same material and of equal lengths and equal diameters are first connected in series and then parallel in a circuit across the same potential difference. The ratio of

heat produced in series and parallel combination would be:

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

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5. A copper wire has diameter 0.5 mm and resistivity of $1.6 \times 10^{-8} \Omega \text{ m}$. What will be the length of this

wire to make its resistance 10Ω . How much does the resistance change if the diameter is doubled?



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6. The values of current I flowing in a given resistor for the corresponding values of potential difference V across the resistor are 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 calculate the resistance of that resistor,



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7. 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.



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



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



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



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11. Several electric bulbs designed to be used on a 220 V electric supply line, are rated 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?



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



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13. Compare the power used in the 2Ω resistor in each of the following circuits:

(i) a 6 V battery in series with 1Ω and 2Ω resistors, and (ii) a 4 V battery in parallel with 12Ω and 2Ω resistors.



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14. Two lamps, one rated 100 W at 220 V, and the other 60 W at 220 V, are connected in parallel electric mains supply. What current is drawn from the line if the supply voltage is 220 V?



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15. Which uses more energy, a 250 W TV set in 1 h or a 1200 W toaster in 10 minutes?



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16. An electric heater of resistance 8Ω draws 15 A from the service mains 2 hours. Calculate the rate at which heat is developed in the heater.



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17. Explain

Why is the tungsten used almost exclusively for filament of electric lamp?



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18. Explain

Why are the conductors of electric heating devices, such as bread-toasters and electric irons, made of an alloy rather than a pure metal?



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19. Explain

Why is the series arrangement not used for domestic circuits?



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20. Explain

How does the resistance of a wire vary with its area of cross-section?



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21. Explain

Why are copper and aluminium wires usually employed for electricity transmission?

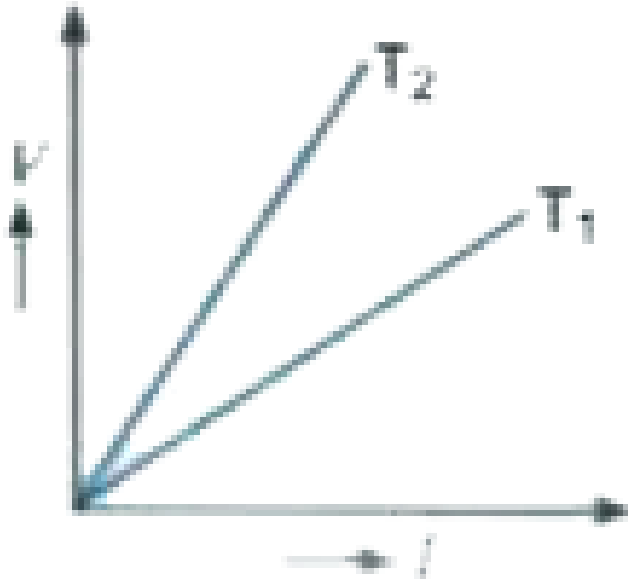


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Very Short Answer Question

1. The voltage-current (V-I) graph of a metallic conductor at two different temperature T_1 and T_2 is shown in figure. At which temperature is the

resistance higher?



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2. Why is resistance less when resistors are joined in parallel?

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3. Why is resistance more in series combination?

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4. What are the special features of a heating wire?

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5. What is the resistance of an ideal voltmeter?

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6. Which one has more resistance 100 watt bulb or 60 watt bulb both operating at 220 V?



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7. Write the expression for the heat energy produced in a wire of resistance R and carrying current I .



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8. Name the physical quantity whose unit is J/C .



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9. What the resistance of an air gap?



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10. What is the commercial unit of electric energy?



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11. What happens to the resistance of a wire if it is made thinner?



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12. In series combination which remains constant-current or voltage?



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13. Which substance is used for making resistance coil of electric heater and why?



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14. Which physical quantity remains constant when resistances are connected in parallel?



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15. How is the ammeter connected in the circuit?



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16. Why is an ammeter connected in series in an electric circuit?



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17. Name two devices in which electricity is converted into heat.



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18. Name the alloy which is used for making the filament of bulbs.



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19. Name the instrument used for measuring potential difference.



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20. Name the instrument used for measuring electric current flowing in an electric circuit.



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21. The following table gives the value of electrical resistivity of some materials:

Material	Copper	Silver	Constantan
Electrical resistivity (in $\Omega \text{ m}$)	1.62×10^{-8}	1.6×10^{-8}	49×10^{-6}

Which one of these materials is the best conductor of electricity?



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Short Answer Question I

1. Why does resistance of a metallic conductor increase with increase in temperature?



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2. Why is it not advisable to handle high voltage electrical circuit with wet hands?



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3. Though the same current flows through line wires or the filament of a bulb, yet only the latter glows. Why?



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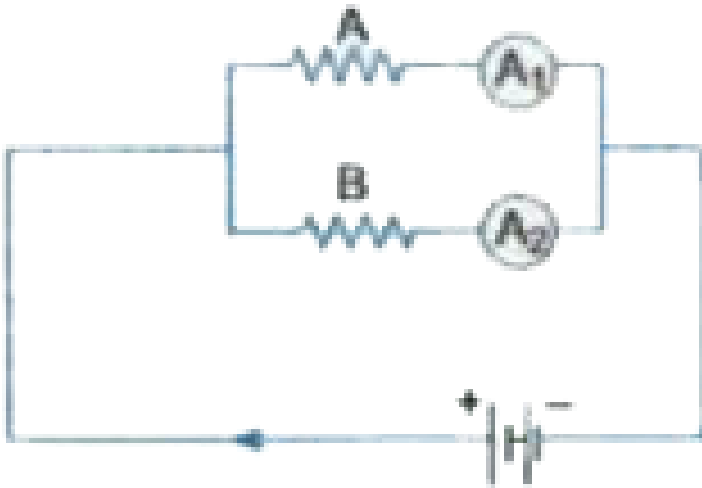
4. Heat is generated continuously in an electric heater but the temperature of its element becomes constant after some time. Why?



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5. In the given circuit diagram, two resistance wires A and B are of same area of cross-section and same material, but A is longer than B. Which ammeter A_1 or A_2 will indicate higher reading for current? Give

reason.



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6. Two wires of equal length, one of copper and the other of manganin (an alloy) have the same thickness. Which one can be used for (i) electrical transmission lines (ii) electrical heating devices? Why?



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7. A student 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.



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8. What is electrical resistivity? In a series electrical circuit comprising of a resistor having 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?



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Short Answer Question li

1. Why does an electric bulb become dim when an electric heater in parallel circuit is switched on? Why does dimness decrease after sometime?



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2. A metallic wire of resistance R is cut into ten parts of equal length. Two pieces each are joined in series and then five such combinations are joined in parallel. What will be the effective resistance of the combination?



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3. A wire of length L and resistance R is stretched so that its length is doubled and the area of cross-section is halved. How will its:

(a) resistance change?

(b) resistivity change?

Justify your answer in each case.



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4. (a) The components of an electric circuit are 0.5 m long nichrome wire XY, an ammeter, a voltmeter, four cells of 1.5 V each, rheostat and a plug key. Draw a circuit diagram to study the relation between potential difference across the terminals X and Y of the wire and current flowing through it.

(b) State the law that relates potential difference across a conductor with the current flowing through it.



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



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

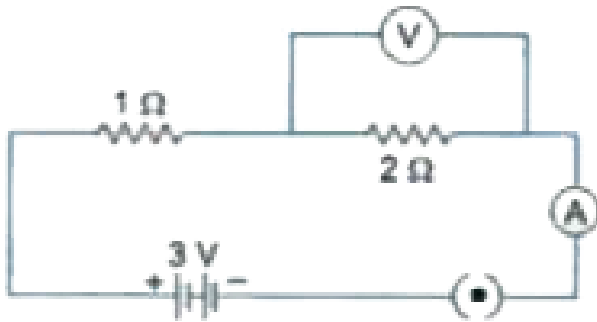
(a) Will the bulb in the two circuits glow with the same brightness? Justify your answer.

(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.



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7. What would be the reading of ammeter and voltmeter in the given circuit?



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8. Read the following information:

(i) Resistivity of copper is lower than that of aluminium which, in turn, is lower than that of constantan.

(ii) Six wires labelled as A, B, C, D, E, F have been designed as per the following parameters:

Wire	Length	Diameter	Material	Resistance
A	l	$2d$	Aluminium	R_1
B	$2l$	$d/2$	Constantan	R_2

C	$3l$	$d/2$	Constantan	R_3
D	$l/2$	$3d$	Copper	R_4
E	$2l$	$2d$	Aluminium	R_5
F	$l/2$	$4d$	Copper	R_6

Answer the following questions using the above data:

(a) Which of the wires has maximum resistance and why?

(b) Which of the wires has minimum resistance and why?

(c) Arrange R_1 , R_3 and R_5 in ascending order of their values. Justify your answer.



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Long Answer Questions

1. (i) The potential difference between two points in an electric circuit is 1 volt. What does it mean? Name a device that helps to measure the potential difference across a conductor.

(ii) Why does the connecting cord of an electric heater not glow while the heating element does?

(iii) Electrical resistivities of some substances at $20^{\circ}C$ are given below:

Silver	$1.60 \times 10^{-8} \Omega \text{ m}$
Copper	$1.62 \times 10^{-8} \Omega \text{ m}$
Tungsten	$5.2 \times 10^{-8} \Omega \text{ m}$
Iron	$10.0 \times 10^{-8} \Omega \text{ m}$
Mercury	$94.0 \times 10^{-8} \Omega \text{ m}$
Nichrome	$100 \times 10^{-8} \Omega \text{ m}$

Answer the following questions using above data:

(a) Among silver and copper, which one is a better conductor? Why?

(b) Which material would you advise to be used in electrical heating devices and why?

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2. (a) Name an instrument that measures electric current in a circuit. Define the unit of electric current.

(b) What do the following symbols represent in a circuit diagram?

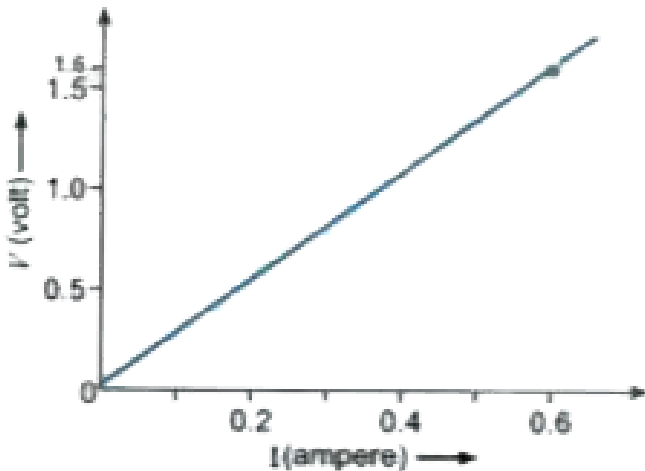


(c) An electric circuit consisting of a 0.5 m long

nichrome wire XY, an ammeter, a voltmeter, four cells of 1.5 V each and a plug key was set up.

(i) Draw the electric circuit diagram to study the relation between the potential difference maintained between the points 'X' and 'Y' and the electric current flowing through XY.

(ii) Following graph was plotted between V and I values using above circuit:



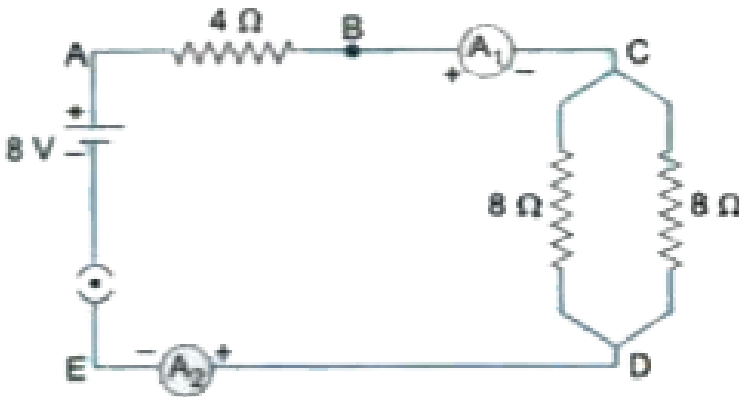
What would be the values of ratios when the

potential difference is 0.8 V, 1.2 V and 1.6 respectively?

What conclusion do you draw from these values?

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3. Find out the following in the electric circuit given in figure alongside:

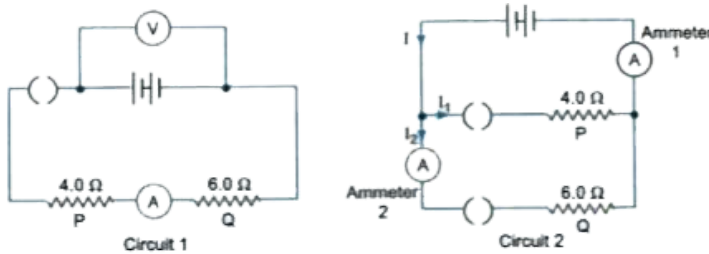


(a) Effective resistance of two 8Ω resistors in the combination

- (b) Current flowing through 4Ω resistor
- (c) Potential difference across 4Ω resistance
- (d) Power dissipated in 4Ω resistor
- (e) Difference in ammeter readings, if any

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4. Figure shows two electrical circuits.



The batteries in circuit 1 and circuit 2 are identical.

- (a) Put ticks in the table below to describe the connections of the two resistors P and Q.

	Series	Parallel
Circuit 1		
Circuit 2		

(b) The resistor P and Q are used as small electrical heaters.

State two advantages of connecting them as shown in circuit 2.

(c) In circuit 1, the ammeter reads 1.2A when the switch is closed.

Calculate the reading of the voltmeter in this circuit.

(d) The two switches in circuit 2 are closed. Calculate the combined resistance of the two resistors in this circuit.

(e) When the switches are closed in circuit 2, ammeter 1 reads 5 A and ammeter 2 reads 2A.

Calculate

- (i) the current in resistor P,
- (ii) the power supplied to resistor Q,
- (iii) the energy transformed in resistor Q in 300s.

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Numericals

1. 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 any point of the circuit.

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2. A current of 5 A is flowing through a resistor of 15Ω . Calculate the potential difference between the ends of the resistor.

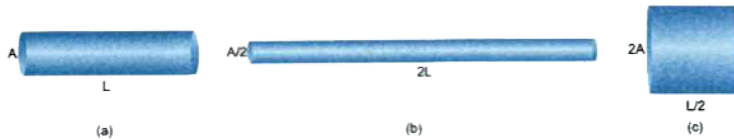


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Numericals Resistance And Resistivity

1. Figure (a), (b) and (c) show three cylindrical copper conductors alongwith their face areas and length. Which of the conductors will have highest resistance

and why?



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2. A piece of wire of resistance 20Ω is drawn out so that its length is increased to twice its original length. Calculate the resistance of the wire in the new situation.



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3. Resistance of a metal wire of length 1 m is 26Ω at $20^\circ C$. If the diameter of the wire is 0.3 mm, what will be the resistivity of the metal at that temperature?



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4. A 40 resistance wire is doubled on it. Calculate the new resistance of the wire.



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5. A current of 1 ampere flows in a series circuit having an electric lamp and a conductor of 5Ω when

connected to a 10 V battery. Calculate the resistance of the electric lamp.

Now if a resistance of 10Ω is connected in parallel with this series combination, what change (if any) in current flowing through 5Ω conductor and potential difference across the lamp will take place? Give reason.



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6. Two resistors, with resistances 5Ω and 10Ω respectively are to be connected to a battery of emf 6V so as to obtain:

(i) minimum current

(ii) maximum current

(a) How will you connect the resistances in each case?

(b) Calculate the strength of the total current in the circuit in the two cases.



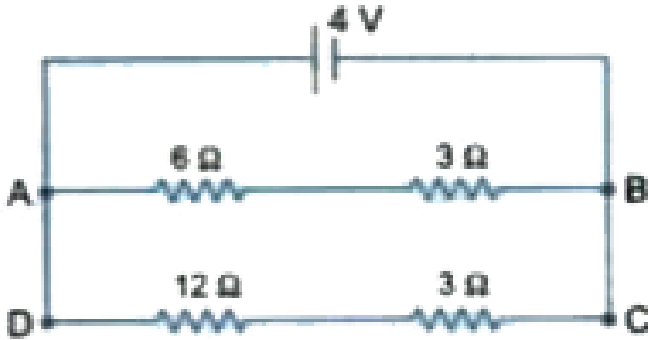
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7. For the circuit shown in the given diagram:

What is the value of

(i) current through 6Ω resistor?

(ii) potential difference across 12Ω resistor?



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8. Two resistances when connected in parallel give resultant value of 2 ohm, when connected series the value becomes 9 ohm. Calculate the value of each resistance.



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9. A piece of wire of resistance R is cut into five equal parts. These parts are then connected in parallel. If the equivalent resistance of this combination is R' , then find the ratio $\frac{R}{R'}$



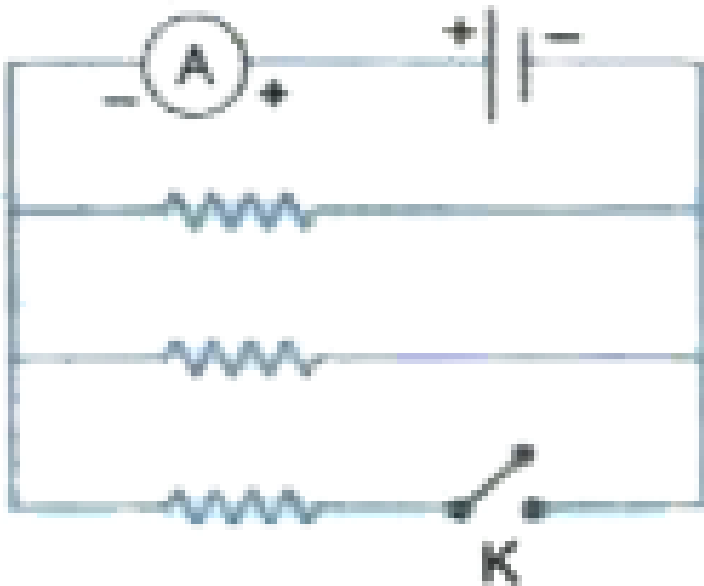
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10. If in the figure

$$R_1 = 10\Omega, R_2 = 40\Omega, R_3 = 30\Omega, R_4 = 20\Omega, R_5 = 60\Omega$$

and a 12 V battery is connected to the arrangement, calculate (i) the total resistance in the circuit and (ii) the total current flowing in the circuit.

11. In the given circuit diagram, the cell and the ammeter, both have negligible resistance. The resistances are identical. With the switch K open, the ammeter reads 0.6 A. What will be the ammeter reading when the switch is closed?

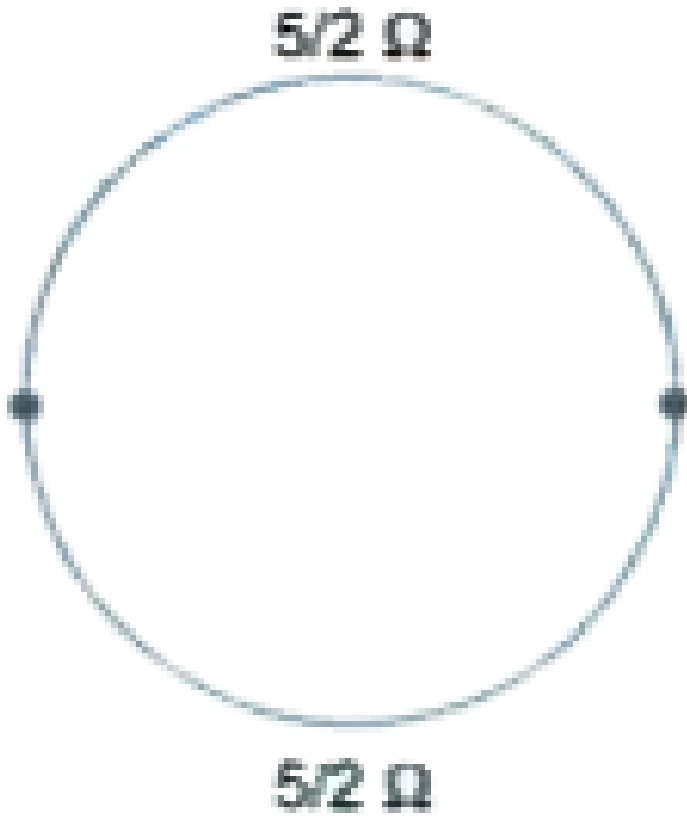




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12. A wire of resistance 5 Ohms is bent in the form of a closed circle. What is the effective resistance between the two points at ends of any diameter of

the circle?



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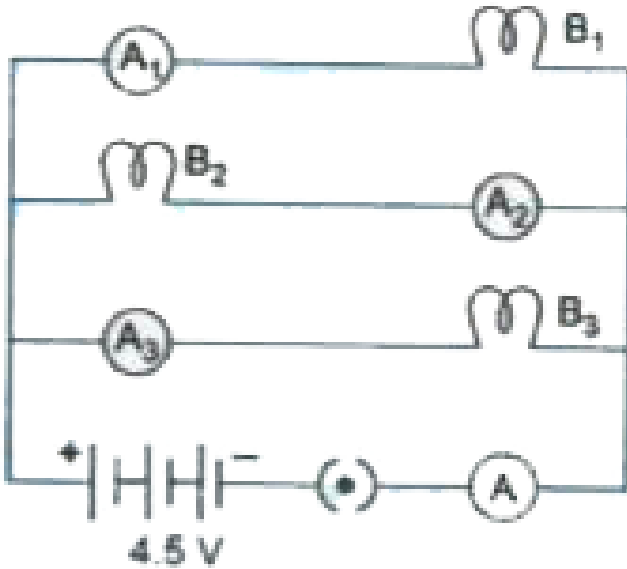
13. B_1, B_2, B_3 are three identical bulbs connected as shown in figure. Ammeters A_1, A_2, A_3 are connected as shown. When all the bulbs glow, the current of 3A is recorded by ammeter A.

(i) What happens to the glow of the other two bulbs when bulb B_1 gets fused?

(ii) What happens to the reading of A_1, A_2, A_3 and A when the bulb B_2 gets fused?

(iii) How much power is dissipated in the circuit when

all the three bulbs glow together?



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14. An electric iron has a rating of 750 W, 220 V.

Calculate

(i) the current passing through it, and

(ii) its resistance, when in use.



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15. A geyser is rated 1500 W, 250 V. It is connected to 250 V mains. Calculate (i) the current drawn, (ii) the energy consumed in 50 hours, and (iii) the cost of energy consumed at ₹2.20 per kWh.



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16. Two resistors of 4Ω and 6Ω are connected in parallel. The combination is connected across a 6 volt battery of negligible resistance. Calculate (i) the

power supplied by the battery, (ii) the power dissipated in each resistor.



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17. An electric bulb is rated 220 V and 100 W. Calculate the power consumed when it is operated on 110 V.



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18. Two conducting wires of the same material and of equal lengths and equal diameters are first connected in series and then parallel in a circuit

across the same potential difference. Find the ratio of heat produced in series and parallel combination.



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19. Which has a higher resistance: a 50 W-220 V lamp or a 25 W-220 V lamp ? Calculate the ratio of the resistances.



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20. An electric iron consumes energy at a rate of 840 W when heating it at the maximum rate and 360 W when heating it at the minimum. The applied

voltage is 220 V. What is the value of current and the resistance in each case?



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21. A heater coil is rated 100 W, 200 V. It is cut into two identical parts. Both parts are connected together in parallel to the same source of 200 V. Calculate the energy liberated per second in the new combination.



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22. Two lamps, one rated at 40 W - 220 V and the other at 60 W - 220 V, are connected in parallel to the electric supply at 220 V.

(i) Draw a circuit diagram to show the connections.

(ii) Calculate the current drawn from the electric supply source.

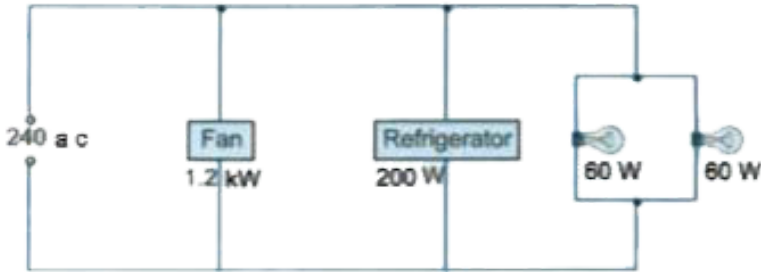
(iii) Calculate the total energy consumed by the two lamps together when they operate for one hour.



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23. Figure shows a 240 V ac mains circuit to which a number of appliances are connected and switched

on.



(a) Calculate the power supplied to the circuit.

(b) Calculate

(i) the current in the refrigerator,

(ii) the energy used by the fan in 3 hours,

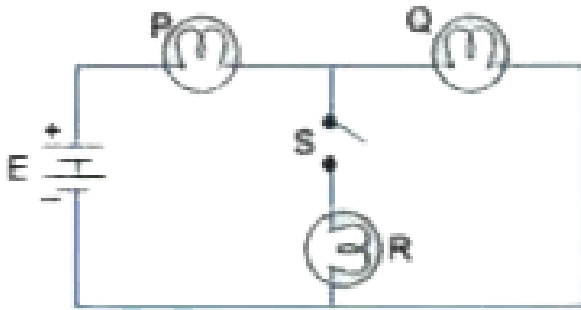
(iii) the resistance of the filament of one lamp.



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Hots Higher Order Thinking Skills

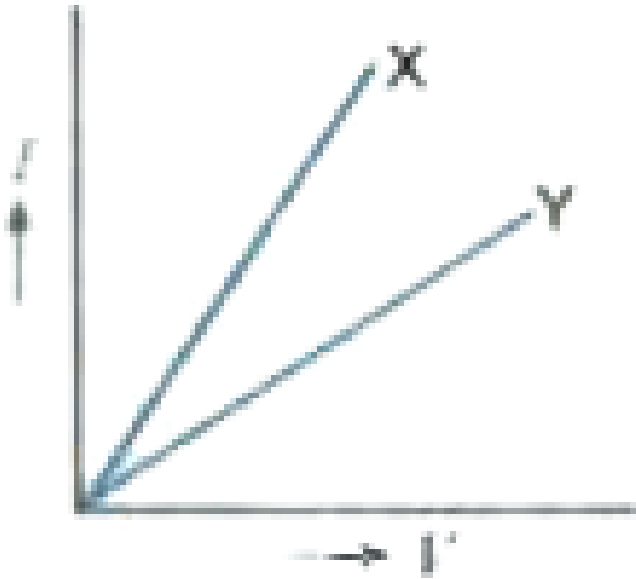
1. A battery E is connected to three identical lamps P, Q and R as shown in figure:



Initially the switch S is kept open and the lamp P and Q are observed to glow with some brightness. Then switch S is closed. How will the brightness of glow of bulbs P and will change? Justify your answer.

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2. V-I graph for the metallic wires X and Y at constant temperature are as shown in figure:



Assuming that the two wires have same length and same diameter, explain as to which of the two wires has higher resistivity and why?

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3. Why is an ammeter likely to be burnt out if it is connected in parallel in a circuit?



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4. Current I flowing through resistor results in dissipation of power P . By what percentage will the power dissipated in the resistor increase if the current through the resistor is increased by 50%? Justify your answer with the help of mathematical calculations.



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5. What are the possible values of resistances which one can obtain by using resistors of values 2Ω , 3Ω and 6Ω ? Justify your answer.



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6. Out of two electric bulbs of $50\text{ W} - 220\text{ V}$ and $100\text{ W} - 220\text{ V}$. Which one will glow brighter when they are connected (i) in series, and (ii) in parallel?

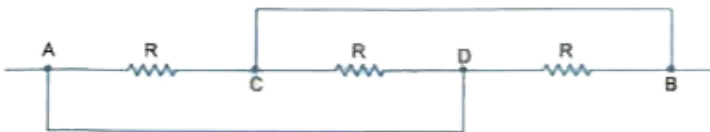


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7. Given n resistors each of resistance R , how will you combine them to get the (i) maximum, and (ii) minimum effective resistance? What is the ratio of the maximum to minimum resistance?

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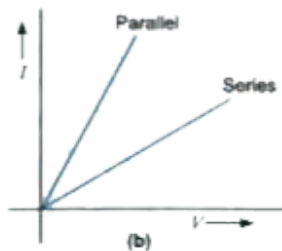
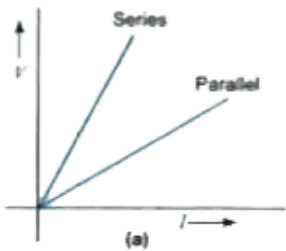
8. What is the resistance from A to B in the network shown in the figure?



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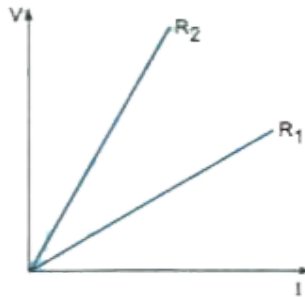
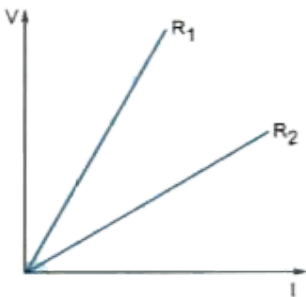
9. Two students perform the experiment on series and parallel combinations of two given resistors R_1 and R_2 and plot the following V-I graphs (a) and (b).

Which of the graphs is (are) correctly labelled in terms of the words 'series' and 'parallel'? Justify your answer.



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10. Two students perform experiments on two given resistors R_1 and R_2 and plot the following V-I graphs. If $R_1 > R_2$ which of the two diagrams correctly represent the situation on the plotted curves? Justify your answer.



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Some Important Numericals

1. A copper wire has a diameter 0.5 mm and resistivity $1.6 \times 10^{-2} m$.

(i) What will be the length of this wire to make the resistance of 12Ω ?

(ii) How much will be the resistance of another copper wire of same length but half the diameter?



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2. How can three resistances of 2, 3 and 6 ohms be connected so as to give a total resistance of 1 ohm?

Justify your answer.



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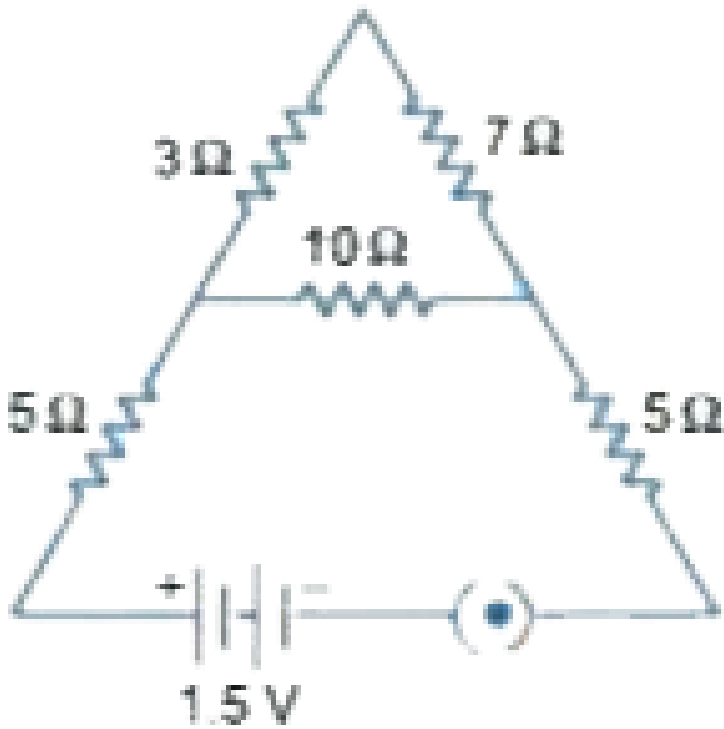
3. A voltmeter reads 24 V across a resistor and an ammeter reads a current of 3 A through it. Calculate R. What will be the current through the resistor if the voltage changes to 12 V?



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4. Five resistances are connected in the shape of letter A as shown in figure alongside. Determine the

total resistance of the circuit.



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5. A wire of uniform cross-section and length l has a resistance of 4Ω . The wire is cut into four equal pieces. Each piece is then stretched to length ' l '. Thereafter, the four wires are joined in parallel. Calculate the net resistance.



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6. A cable of resistance 12Ω carries electric power from a generator producing 250 kW at 10,000 V. Calculate (i) the current in the cable, (ii) the power lost in the cable during transmission, and (iii) the p.d. across the ends of the cable.



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7. Calculate the electrical energy produced in 5 minutes when a current of 2 A is sent through a conductor by a potential difference of 500 volts.



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8. Two bulbs have the following ratings: (i) 40 W at 220 V, and (ii) 40 W at 110 V. The filament of which bulb has a higher resistance? What is the ratio of their resistances?



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9. A potential difference of 40V is applied across a resistance of 8Ω for a period of 2 minutes.

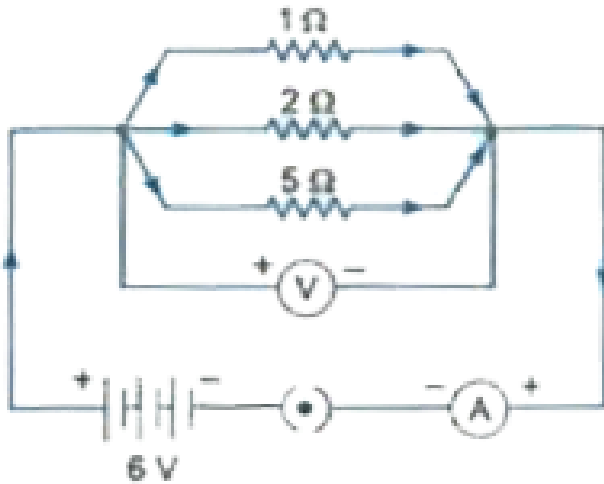
(i) What current is drawn?

(ii) Calculate the charge which passes through the resistor.



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10. For the given circuit diagram calculate:



- (i) the current through each resistor.
- (ii) the total current in the circuit.
- (iii) the total effective resistance of the circuit



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11. An electric iron has a rating of 750 W, 220 V.

Calculate

(i) the current passing through it.

(ii) its resistance, when in use.



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12. A torch bulb is rated 3V and 600 mA. Calculate its resistance if it is lighted for 4 hours.



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