CHAPTER-12

ELECTRICITY

MULTIPLE-CHOICE QUESTIONS

Q.1. When electric current is passed, electrons move from:

(a) high potential to low potential.

(b) low potential to high potential.

(c) in the direction of the current.

(d) against the direction of the current. (ANS -b)

Q.2. Electrical resistivity of any given metallic wire depends upon

(a) its thickness (b) its shape

(c) nature of the material (d) its length

ANS -c

Q.3. What is the commercial unit of electrical energy?

(a) Joules (b) Kilojoules

(c) Kilowatt-hour (d) Watt-hour

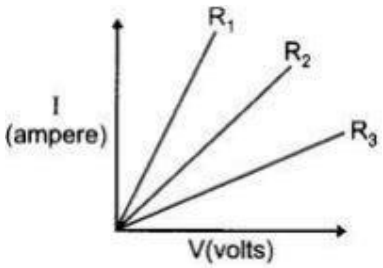
ANS -c

Q.4. The heating element of an electric iron is made up of:

(a) copper (b) nichrome (c) aluminium (d) iron

ANS -b

Q.5. 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. Which of the following is true?



(a) R1 = R2 = R3 (b) R1 > R2 > R3

(c) R3 > R2 > R1 (d) R2 > R3 > R1

ANS -C

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

(a) 5 J (b) 10 J (c) 20 J (d) 30 J

ANS -c

Q.7. Coulomb is the SI unit of:

(a) Charge (b) current (c) potential difference (d) resistance

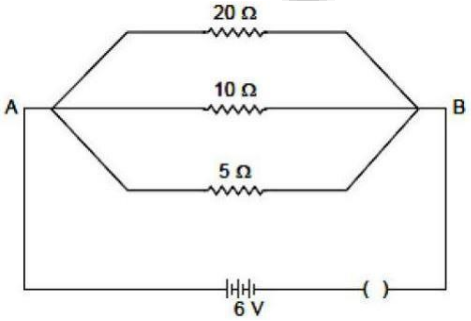
ANS-a

Q.8. Work of 14 J is done to move 2 C charge between two points on a conducting wire. What is the potential difference between the two points?

(a) 28 V (b) 14 V (c) 7 V (d) 3.5 V

ANS -c

Q.9. Calculate the current flow through the 10 Ω resistor in the following circuit.



(a) 1.2 A (b) 0.6 A (c) 0.2 A (d) 2.0 A

ANS - b

Q.10. If R1 and R2 be the resistance of the filament of 40 W and 60 W, respectively operating 220 V, then

(a) R1 < R2 (b) R2 < R1 (c) R1 = R2 (d) R1 ≥ R2

ANS- b

Q.11. Two resistors connected in series give an equivalent resistance of 10 Ω. When connected in parallel, give 2.4 Ω. Then the individual resistance is

(a) each of 5 Ω (b) 6 Ω and 4 Ω (c) 7 Ω and 4 Ω (d) 8 Ω and 2 Ω

ANS-b

Q.12. The resistance of a wire of length 300 m and cross-section area, 1.0 mm^2 made of material of resistivity 1.0 x 10^{-7} Ω is:

(a). 2 Ω (b). 3 Ω (c). 20 Ω (d). 30 Ω

ANS d

Q.13. Which of the given statements is true regarding ammeter and voltmeter? (a).

Ammeter is connected in series with the required device, Voltmeter in parallel (b).

Both ammeter and voltmeter are connected in series with required device

(c). The voltmeter is connected in series with the device, Ammeter in parallel(d).

They can be connected in any way

ANS -a

Q.14. The obstruction offered by material of conductor to the passage of electric current is known as :

(a) Resistance (b) Conductance (c) Inductance (d) None of these

ANS - a

Q.15. The unit of potential difference is :

(a) Volt (b) Ohm (c) Ampere (d) Faraday

ANS -a

Q.16. The instrument used for measuring electric current is :

(a) Ammeter (b) Galvanometer (c) Voltmeter (d) Potentiometer

ANS- a

Q.17. While a cell is being charged, energy is converted into energy.

a. mechanical, electrical b. electrical, chemical

c. heat, electrical d. chemical, heat

ANS -b

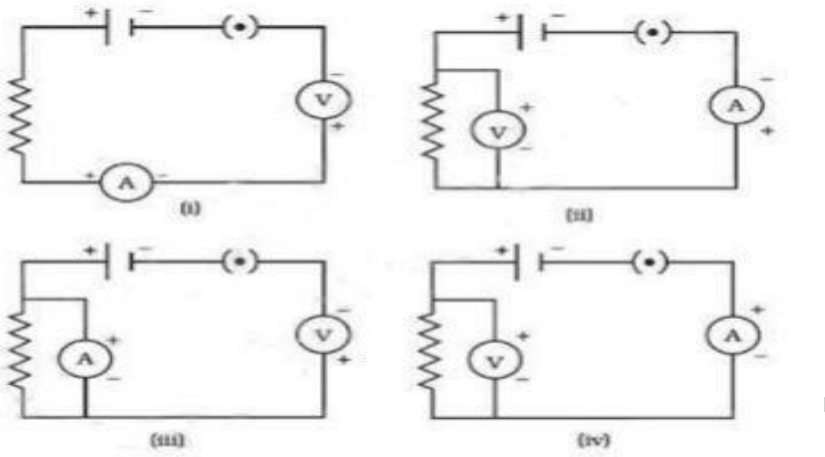
Q.18. Copper is not preferred to make fuse wire because it .

a. is a good conductor of electricity b. has a low melting point

c. has a high melting point d. is not easily available

ANS -b

Q.19. Identify the correct circuit diagram:



(a) i

(b) ii

(c) iii

(d) iv

ANS-d

Q.20. The unit of resistivity is:

(a) V A (b) V A (c) V m /A (d) VA/m

ANS-c

ASSERTION-REASON TYPE QUESTIONS

Following questions consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

Q.1. **Assertion (A) :** Longer wires have greater resistance and the smaller wires have lesser resistance.

Reason (R) : Resistance is inversely proportional to the length of the wire.-

ANS - c

Q.2. **Assertion (A) :** Tungsten metal is used for making filaments of incandescent lamps.

Reason (R) : The melting point of tungsten is very low.

ANS -c

Assertion (A) : Alloys are commonly used in electrical heating devices, like electrical iron, toastersetc.

Reason (R) : Alloys do not oxidise (burn) readily at high temperatures.

ANS -a

Q. 4. **Assertion (A) :** Bending a wire does not affect electrical resistance.

Reason (R) : Resistance of a wire is proportional to resistivity of material.

ANS – b

CASE STUDY BASED QUESTIONS

1.Electrical resistivities of some substances, at 20°C are given below in the table. Study the table andanswer the given questions.

Silver	$1.60 \times 10^{-8}\ \Omega m$
Copper	$1.62 \times 10^{-8}\ \Omega m$
Tungsten	$5.2 \times 10^{-8}\ \Omega m$
Mercury	$94 \times 10^{-8}\ \Omega m$
Iron	$10 \times 10^{-8}\ \Omega m$
Nichrome	$100 \times 10^{-6}\ \Omega m$

1. Which is a better conductor of electric current ?

(A) Silver (B) Copper (C) Tungsten (D) Mercury

Ans. Option (A) is correct. Explanation: Silver is a better conductor because it has lower resistivity.

2. Which element will be used for electrical transmission lines ?

(A) Iron (B) Copper (C) Tungsten (D) mercury U

Ans. Option (B) is correct. Explanation: Copper, because it is economical, less oxidative than other metals and has low resistivity.

3. Nichrome is used in the heating elements of electric heating device because:

(A) It has high resistivity

(B) It does not oxidise readily at high temperature

(C) Both of the above

(D) None of the above U

Ans. Option (C) is correct. Explanation: Nichrome, as it has very high resistivity / as it is an alloy, it doesnot oxidize readily at high temperature.

4. Series arrangement is not used for domestic circuits because:

(A) Current drawn is less

(B) Current drawn is more

(C) Neither of the above

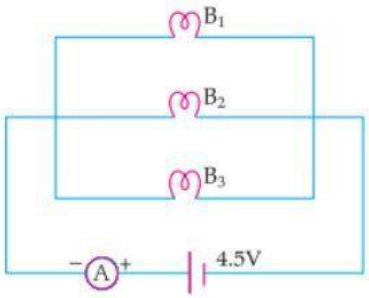
(D) Both of the above Ans.

Option (A) is correct.

Explanation: In series arrangement, same current will flow through all the appliances which is not required and the equivalent resistance becomes higher, hence the current drawn becomes less.

2. In the given circuit, three identical bulbs B1, B2 and B3 are connected in parallel with a battery of 4.5

V. Study the diagram and answer the questions given below:



1. What will happen to the other two bulbs if the bulb B3 gets fused ?

(A) They will also stop glowing.

(B) Other bulbs will glow with same brightness.

(C) They will glow with low brightness.

(D) They glow with more brightness.

Ans. Option (B) is correct.

Explanation: Other bulbs will glow with same brightness because glowing of bulbs depend upon powerand potential difference, and resistance remain same for other bulbs

2.If the wattage of each bulb is 1.5 W, how much readings will the ammeter A show when all the three bulbs glow simultaneously?

(A) 1.1 A

(B) 2.1 A

(C) 1.5 A

(D) None of the above Ans.

Option (A) is correct.

Explanation: When the bulbs are in parallel, wattage will be added (4.5 W) and the ammeter reading

would be, I = P/V = 4.5 /4 = 1.1 A

3. Find the total resistance of the circuit.

(A) 1.0 Ω

(B) 4.1 Ω

(C) 1.5 Ω

(D) 2.0 Ω

Ans. Option (B) is correct.

Explanation: Ammeter reading = 1.1 A, V = 4.5 V, R = V/I = 4.5/1.1 = 4.1 Ω

4. How many resistors of 88 Ω are connected in parallel to carry 10 A current on a 220 V line ?

(A) 2 resistors

(B) 1 resistors

(C) 3 resistors

(D) 4 resistors

Ans. Option (D) is correct.

Explanation: Ohm's law, V = I Rp , 220 =10 x Rp, Rp = 220/10 =22 Ω For parallel connection 1/ Rp =1/ R1+1/ R2+1/ R3+ -----+ 1/ Rn Here R1 = R2=R3---------- = Rn

ie, 1/ Rp = n/R , Rp = R/n , 22 = 88/n , n=4 resistors.

TWO MARKS QUESTIONS

Q.1. Calculate the number of electrons that would flow per second through the cross- section of a wire when 1 A current flows in it.

Ans :

Given: I = 1A , t = 1 s , Q = It , Q =1Ax 1s = 1C But Q = ne or n = Q/e = 1 /1.6x10^{-19}

= 6.25 x 10^{8} electrons

Q.2. Define the following terms:

(a) one ampere (b) 1 volt.

Answer:

One Ampere: The SI unit of electric current is ampere (A). One ampere is the electric current when one coulomb of charge flows through a conductor in one second.

One Volt: The SI unit of potential difference is volt (V). One volt is the potential difference between two points in an electric circuit when one joule of work is done to move a charge of one coulomb fromone point to the other.

Q.3. Keeping the potential difference constant, the resistance of a circuit is doubled. By how much does the current change?

Answer:

V = IR or V/R= I ,

Since the resistance and the current are inversely proportional, the current will become half.

Q.4. How much work is done in moving a charge of magnitude 3 C across two points having a potential difference of 12 V?

Answer:

Given : Q = 3 C, V = 12 V

To find: W , as V = W/Q or W = VQ = 12 × 3 = 36 J

Q.5. Define electric power. Write an expression relating electric power, potential difference and resistance.

Ans. **Electric power :** It is the amount of electric energy consumed in a circuit per unit time. **Expression :** $P = V^2/R$ Where, P = Electric Power, V = Potential difference, R = Resistance

Q.6.Give reason for the following:

a. Tungsten used almost exclusively for filament of electric lamp.

b. Why do we use copper and aluminium wires for transmission of electric current?

Ans :

a. Tungsten is used in making the filament of electric lamp because it has high resistivity and high melting point.

b. The copper and aluminium have low resistivity and high conductivity.

Q.7. List in a tabular form two differences between a voltmeter and an ammeter.

	Voltmeter	Ammeter
1	It is used to measure P.D. across two points in an electric circuit.	It is used to measure electric current in an electric circuit.
2	Its resistance is very high.	Its resistance is very low.
3	An voltmeter is connected inparallel in an electric circuit.	An ammeter is connected in series in an electric circuit.

Q.8.Write the factors on which heat produced in a resistor depends

Ans: heat produced in a resistor is directly proportional to

- Square of current (I^2)
- Resistance of the resistor (R) and
- Time for which the current flows through the resistor. (t)

$H = I^2Rt$ joules , hence By Ohm's law, we get $H = VIt$ joules $= V^2 t/R$ joules

Q.9.Distinguish between resistances in series and resistances in parallel.

Answer:

Resistances in series:

1. If a number of resistances are connected in such a way that the same current flows through each resistance, then the arrangement is called resistances in series.

2. The current across each resistance is same.

3. The equivalent resistance in series combination is greater than the individual resistances.

4. This combination decreases the current in the circuit.

Resistances in parallel:

1. If a number of resistances are connected between two common points in such a way that the potential differences across each of them is the same, then the arrangement is called resistances in parallel.

2. The voltage across each resistance is same.

3. The equivalent resistance in parallel combination is smaller than each of the individual resistances.

4. This combination increases the current in the circuit.

Q.10. What is the better way of connecting lights and other electrical appliances in domestic wiring? Why?

Answer: The better way of connecting lights and other electrical appliances in domestic wiring is parallel connection because of the following advantages:

• In parallel circuit, if one appliance stops working due to some defect, then all other appliances keep working normally.

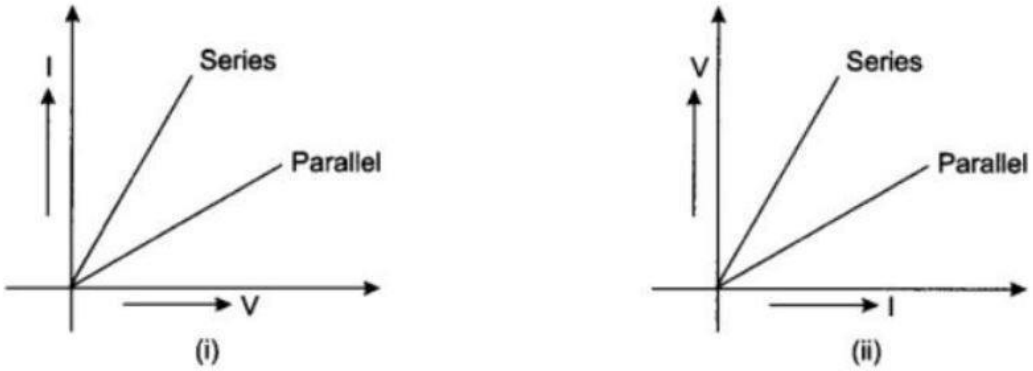
• In parallel circuit, each electrical appliance has its own switch due to which it can be turned on or off, without affecting other appliances.

• In parallel circuit, each electrical appliance gets the same voltage (220 V) as that of the power supply

line.

• In parallel circuit, the overall resistance of the domestic circuit is reduced due to which the current from the power supply is high.

Q.11. Two students perform experiments on series and parallel combinations of two given resistors R1 and R2 and plot the following V-I graphs.



Which of the graphs is (are) correctly labelled in terms of the words 'Series and parallel'? justify youranswer.

In case of series combination, the effective resistance = R1 + R2 is more, hence slope of V – I graph willbe more. It is otherwise in case of I – V graph. So, series and parallel are correctly marked in graph (ii).

Q.12. A bulb is rated at 5.0 V, 100 mA. Calculate its (a) power and (b) resistance.

Ans: Rating of bulb, V = 5 0. Volt, I = 100 mA = 100 $x10^{-3}$ A = 0.1A

a. Power of bulb P = V x I or P = 5 .0 x 0 .1 = 0.5W

b. V = IR or R =V/I = 5/0.1 = 50 Ω

THREE MARKS QUESTIONS

Q.13.(a) List the factors on which the resistance of a conductor in the shape of a wire depends.

(b) Why are metals good conductors of electricity whereas glass is a bad conductor of electricity? Give reason.

(c) Why are alloys commonly used in electrical heating devices? Give reason.

Ans: a. Factors on which resistance of a wire depends:

i. Resistance is directly proportional to length (l)

ii. Resistance is inversely proportional to area of cross-section(A).

i.e. $R \alpha l$, $R \alpha 1/A$ or $R \alpha l/A$

or $R = \rho l/A$, here ρ is the resistivity of the material at a particular temperature (ie, resistivitydepends on material and temperature)

b. Metals are good conductors due to having large number of free electrons and their low resistivity. Glass is a bad conductor because it has no free electrons and its resistivity is higher.

c. Alloys are commonly used in electrical heating devices due to their high resistivity and highmelting point.

Q. 14. A nichrome wire has a resistance of 10 Ω. Find the resistance of another nichrome wire, whose length is three times and area of cross-section four times the first wire.

Ans: we have resistance $R = \rho l/A$

For first wire length $L1 = l$, Area of cross section $A1 = ASo$,

for first wire resistance $R1 = \rho l/A = 10\ \Omega$

For second wire length $L2 = 3l$, Area of cross section $A2 = 4ASo$,

for second wire resistance $R2 = \rho 3l/4A$

$$R_1/R_2 = \frac{\rho\, l/A}{\rho\, 3l/4A} = \frac{4}{3}$$

$$\text{Or } R_2 = \frac{3}{4} R_1 = \frac{3}{4} \times 10 = \frac{15}{2}\ \Omega$$

Q.15. State the formula co-relating the electric current flowing in a conductor and the voltage applied

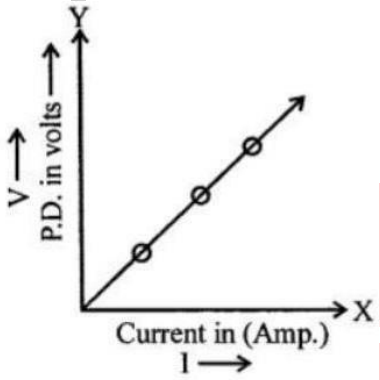
across it. Also, show this relationship by drawing a graph. What would be the resistance of a conductor, if the current flowing through it is 0.35 ampere when the potential difference acrossit is 1.4 volt?

Ans: potential difference V = IR where I is electric current and R, resistance of conductorie, V

α I

If we plot a graph b/w V and I, it is a straight line.

Graph b/w V and I:



Given current I = 0.35 A, potential difference V = 1.4 V

Resistance R = = V/I , R = 1.4 / .35 = 4 Ω

Q. 16.Calculate the total cost of running the following electrical devices in the month of September, ifthe rate of 1 unit of electricity is Rs. 6.00. (i) Electric heater of 1000 W for 5 hours daily. (ii) Electric refrigerator of 400 W for 10 hours daily

Ans. P_1 = 1000 W = 1kW, t_1= 5h,

P_2 = 400 W = 400 /1000 kW = 0.4KW, t_2 = 10h

No. of days in September, n = 30

E1 =P1 × t1 × n = 1 kW × 5h × 30 = 150 kWh E2

=P2 × t2 × n = 0.4kW x 10h x 30 = 120kWh

∴ Total energy = (150 + 120) kWh = 270 kWh ,so Total cost = 270 x 6 = Rs. 1620/-

Q. 17.(i) Consider a conductor of resistance 'R', length 'L', thickness 'd' and resistivity 'ρ'. Now this conductor is cut into four equal parts. What will be the new resistivity of each of these parts? Why?

(ii) Find the resistance if all of these parts are connected in:

(a) Parallel (b) Series

(iii) Out of the combinations of resistors mentioned above in the previous part, for a given voltage which combination will consume more power and why?

Ans. (i) Resistivity will not change as it do not depend on the dimensions of the conductor. It dependson the nature of material of the conductor.

(ii) The length of each part become L/4, ρ is constant and R = ρL/A

Resistance of each part = R_{part} = $\frac{\rho L/4}{A} = \frac{R}{4}\Omega$

(a) In parallel the $\frac{1}{Rp} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} + \frac{1}{R4}$

Here R1 = R2= R3 =R4 = $R_{part} = \frac{R}{4}\Omega$

ie, $\frac{1}{Rp} = \frac{4}{R} + \frac{4}{R} + \frac{4}{R} + \frac{4}{R} = \frac{16}{R}\Omega$

(b) In series the Rs = $\frac{R}{4} + \frac{R}{4} + \frac{R}{4} + \frac{R}{4} = R\,\Omega$

(ii) We know that Power P given as P=V.I =V^2/R (V= IR)

For given voltage **parallel connection consume more power because it have low equivalent resistance.**

Q.18. Two bulbs A and B are rated as 90W–120V and 60W–120V respectively. They are connected in parallel across a 120V source. Find the current in each bulb. Which bulb will consume more energy?

Ans: First Bulb: 90 W–120 V.

Resistance of first bulb $R_1 = V^2/P1 = 120 \times 120/90 = 160\ \Omega$Current

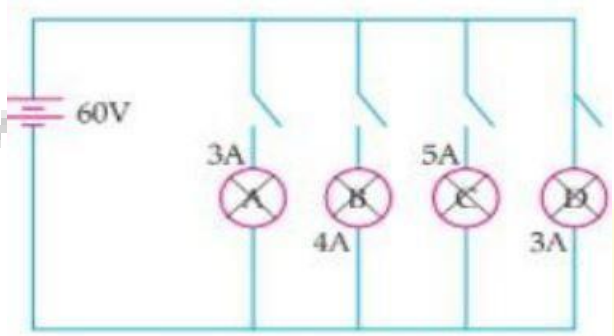
in first bulb $I_1 = V/R_1 = 120/160 = .75$ A

Resistance of second bulb $R2 = V^2/P_2 = 120 \times 120/60 = 240\ \Omega$

Current in second bulb $I_2 = V/R_2 = 120/240 = .50$ A

Power of first bulb is more than second bulb, so first bulb will consume more energy.

Q.19. In the given circuit, A, B, C and D are four lamps connected with a battery of 60 V.



Analyse the circuit to answer the following questions.

(i) What kind of combination are the lamps arranged in (series or parallel)?

(ii) Explain with reference to your above answer, what are the advantages (any two) of this combination of lamps?

(iii)Explain with proper calculations which lamp glows the brightest?

(iv)Find out the total resistance of the circuit R

Ans. (i) The lamps are in parallel.

(ii) Advantages: If one lamp is faulty, it will not affect the working of the other lamps. They will also be using the full potential of the battery as they are connected in parallel. (ii) The lamp with the highest power will glow the brightest. Since P=VI and In this case, all the bulbs have the same voltage. But lamp C has the highest current.

Hence, for Lamp C, power P = 5 × 60 Watt = 300 W. (the maximum).

The total current in the circuit = 3+4+5+3 A = 15A , Voltage = 60VR = V/I = 60/15 = 4 Ω