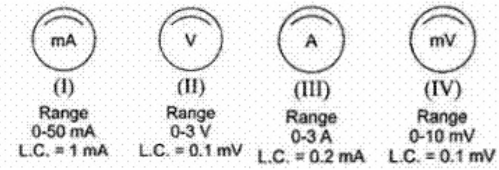
CBSE Test Paper-03

Chapter 12 Electricity and its Effects

1. Four different measuring instruments are shown below. Out of these, the instrument that can be used for measuring current is/are the instruments labelled as **(1)**



   a. II and IV with IV more reliable of the two
   b. II and III with II more reliable of the two
   c. I and III with III more reliable of the two
   d. I and IV with IV more reliable of the two

2. Match the following with the correct response: **(1)**

(1) Electric current	(A) Ampere
(2) Resistance	(B) Volt
(3) Potential difference	(C) Ohm
(4) Resistivity	(D) Ohm-m

   a. 1-A, 2-C, 3-B, 4-D
   b. 1-D, 2-A, 3-C, 4-B
   c. 1-B, 2-D, 3-A, 4-C
   d. 1-C, 2-B, 3-D, 4-A

3. Three students X, Y and Z, while performing the experiment to study the dependence of current on the potential difference across a resistor, connect the ammeter (A), the battery (B), the key (K) and the resistor (R), in series, in the following three different orders.

   X → B, K, R, A, B

   Y → B, A, K,R,B

   Z → B, R, K, A, B

   Who has connected them in the correct order ? **(1)**

   1. Z

2. X
3. X, Y and Z
4. Y

4. Three bulbs of 100 W, 200 W and 60 W are connected in series to the main supply of 220 V. The current will be**: (1)**

   A. Equal in 100 W and 200 W.

   B. Equal in 200 W and 60 W.

   C. Different in all bulbs.

   D. None of the above

   a. A and B
   b. B and D
   c. A, B and C
   d. A and C

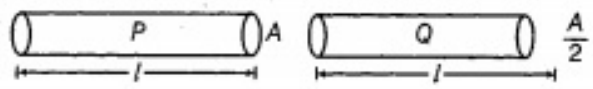
5. Which of the following fuse should be used for an electric iron of 1 kW when operated at 220 V? **(1)**

   a. 1 A
   b. 3 A
   c. 7 A
   d. 5 A

6. Find the minimum resistance that can be made using five resistors each of $\frac{1}{5}\Omega$. **(1)**

7. Name the physical quantity whose unit is J/C. **(1)**

8. Out of the two wires P and Q shown below which one has greater resistance? Justify it. **(1)**



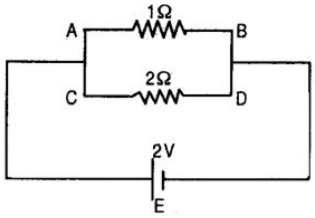
9. Why closed path is required for the flow of current? **(1)**

10. 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? **(3)**

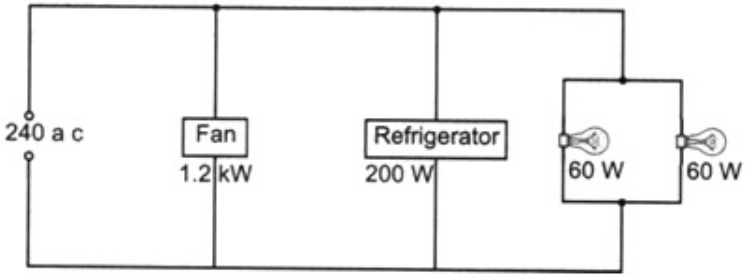
11. Two metallic wires A and B are connected in series. Wire A has length l and radius r, while wire B has length 2l and radius 2r. Find the ratio of total resistance of series combination and the resistance of wire A, if both the wires are of the same material? **(3)**

12. Which among iron and mercury a better conductor? **(3)**

13. What is the current through each of the resistances in the following circuit ? **(2)**



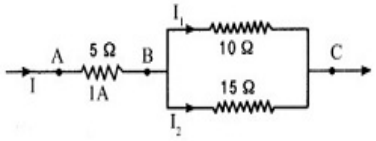
14. Figure shows a 240 V A.C mains circuit to which a number of appliances are connected and switched on. **(5)**



i. Calculate the power supplied to the circuit.
ii. Calculate:
    a. the current through the refrigerator,
    b. the energy used by the fan in 3 hours,
    c. the resistance of the filament of one lamp.

15. Three resistors are connected as shown in Fig. Through a resistor of 5 ohms; a current of 1A is flowing. **(5)**

i. what is the current through the other two resistors?
ii. what is the potential difference (P.D.) across AB and AC?
iii. what is the total resistance?



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Chapter 12 Electricity and its Effects

Answers

1. c. I and III with III more reliable of the two

   Explanation: Option with 4 and 2 is wrong as they are with voltmeters. Option I is nearest. The best option may be I and III with III more accuracy of the two since L.C. is less.

2. a. 1-A, 2-C, 3-B, 4-D

   Explanation: The SI unit of electric current is ampere (symbol A). It is named after the French scientist - Andre Marie Ampere. The ohm (symbol Ω) is the SI unit of electrical resistance, named after German physicist - Georg Simon Ohm. The SI unit of potential difference is volt (symbol V), named after the Italian physicist - Alessandro Volta. The SI unit of resistivity is ohm-metre (symbol Ω-m).

(1) Electric current	(A) Ampere
(2) Resistance	(C) Ohm
(3) Potential difference	(B) Volt
(4) Resistivity	(D) Ohm-m

3. c. X, Y and Z

   Explanation: The current in the series does not depend upon order in which these instruments are connected. Where they are connected does not matter. They should be in series for the flow to be observed.

4. a. A and B

   Explanation: The current will be same in all the bulbs. In a series combination of resistors, the same current flows through each resistor. The current is the same in every part of the circuit.

5. d. 5 A

   Explanation: Current rating of the fuse, $I > \frac{P}{V}$ or $I > \frac{1000}{220}$ or $I > 4.55A$. A

fuse is a device used in electrical systems to protect against excessive current; hence, the appropriate fuse for the electric iron at 220 V would be that of 5 A.

6. For getting minimum resistance R we can connect five resistors in parallel Combination .We know that :$R = 1/5, n = 5$
   $R_{\text{eq}} = \frac{R}{n} = \frac{1/5}{5} = \frac{1}{25}\Omega$

7. Electric potential. It is represented by V.

8. We know that resistance and cross-section area are inversly proportional to each other. So less area of cross section means more resistance .
   R $\propto \frac{1}{A}$ [since lengths are same]
   So, out of two, wire Q has greater resistance.

9. A closed path is required for the flow of current so that charges can move in a particular direction in a given circuit. But if path is not closed means circuit is open, then there is air between the gap, and we know that air is an insulator for flow of charges, so the current stop flowing in the circuit.

10. ∵The resistance of a conductor is directly proportional to the length of the conductor $(R \propto l)$.
    ∴The resistance of the metallic wire, when it is cut into ten parts of equal length,r = $\frac{R}{10}$
    Two such pieces when joined in series, the equivalent resistance of these two parts = r + r
    = 2r = $\frac{2R}{10}$
    ∴Equivalent resistance of two parts
    =$2 \times \frac{R}{10}$
    = $\frac{R}{5}$
    5 such parts are connected in parallel.
    ∴ the total resistance R',
    $\frac{1}{R'}$ = $\frac{1}{\frac{R}{5}} + \frac{1}{\frac{R}{5}} + \frac{1}{\frac{R}{5}} + \frac{1}{\frac{R}{5}} + \frac{1}{\frac{R}{5}}$
    = $\frac{25}{R}$
    Hence, R' = $\frac{R}{25}$

11. Resistance of wire $A(R_1) = \frac{\rho l}{A} = \frac{\rho l}{\pi r^2}$

    Resistance of wire $B(R_2) = \frac{\rho l/}{A/} = \frac{\rho 2l}{\pi(2r)^2} = \frac{\rho 2l}{4\pi r^2}$

    Total resistance in series

    R=$R_1 + R_2$

    R = $\frac{\rho l}{\pi r^2} + \frac{\rho 2l}{4\pi r^2}$

    R = $\frac{\rho l}{\pi r^2}(1 + \frac{1}{2}) = \frac{3\rho l}{2\pi r^2}$

    Ratio of the total resistance in series to the resistance of A =

    $\frac{R}{R_1} = \frac{3\rho l}{2\pi r^2} / \frac{\rho l}{\pi r^2}$

    $\frac{R}{R_1} = \frac{3\rho l}{2\pi r^2} \times \frac{\pi r^2}{\rho l}$

    $\frac{R}{R_1} = \frac{3}{2}$

    So, the required answer =3:2

12. Resistivity of iron is 10×10^{-8} ohm m and that of mercury 94×10^{-8} ohm m, therefore iron is a better conductor as compared to mercury.

13. Resistors 1Ω and 2 Ω are in parallel.

    $\frac{1}{R} = \frac{1}{1} + \frac{1}{2} = \frac{2+1}{2} = \frac{3}{2}$

    R = $\frac{2}{3}\Omega$

    Total current = $\frac{E}{R} = \frac{2}{\frac{2}{3}} = 3A$

    The current will divide into two parts in inverse ratio of the resistances.

    $\therefore$ I_1 = I $\frac{2}{1+2} = 3 \times \frac{2}{3} = 2A$ through 1Ω resistor.

    and I_2 = I$\frac{1}{1+2} = 3 \times \frac{1}{3} = 1A$ through 2Ω resistor.

14. i. Power supplied to the circuit

    = 1.2 $\times$ 1000 W + 200 W + 60 W + 60W

    = 1200 W + 200 W + 60 W + 60 W

    = 1520 W

    = 1.52 kW

    $\therefore$ The power supplied to the circuit is 1.52kW

    ii. a. Current in the refrigerator = $\frac{Power}{Voltage}$ $(\because P = V \times I)$

    = $\frac{200W}{240V}$

= 0.83 A

∴ The current through the refrigerator is 0.83 A

b. Energy = Power × Time

= 1.2 kW × 3h

= 1.2 × 1000 × 3× 60 × 60s

= 1200 ×3× 3600 J

= 12960000 J

= $1.3 \times 10^7 J$

∴ The energy used by the fan in 3 hrs is $1.3 \times 10^7 J$

c. Current, I = $\frac{P}{V}$

= $\frac{60}{240}$ = 0.25 A

Resistance (Filament) = $\frac{V}{I}$

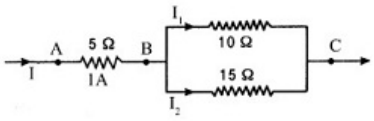
= $\frac{240}{0.25}$ = 960Ω

∴ The resistance of the filament of the bulb is 960 Ω

15. Let us first find the total resistance. Now resistance of 10 Ω and 15 Ω are in parallel.

If R_p is the effective resistance between B and C, then

$\frac{1}{R_p} = \frac{1}{10} + \frac{1}{15} = \frac{3+2}{30} = \frac{5}{30} Or\ R_p$ = 6 Ω



Again AB and BC are in series.

Therefore, the total resistance = Resistance between A and B plus resistance between B and C.

i.e. Total resistance = 5 Ω + 6 Ω = 11 Ω

Potential difference between A and B = IR = 1 × 5 = 5 V

Potential difference between B and C = 1 × 6 = 6 V

Potential difference between A and C = 1 × 11 = 11 V

Current through A and B = 1 A

This current divides into two parts, one part I_1 passing through 10 Ω and other part I_2 passing through 15 Ω each producing a P.D. of 6V (between B and C)

∴ I_1 (10) = 6 or I_1 = $\frac{6}{10}$ = 0.6 A and I_2(15) = 6 or I_2 = $\frac{6}{15}$ = 0.4 A