

Additional Conceptual Short Questions with Answers

1. Is the filament resistance lower or higher in a 500W, 220V light bulb than in a 100W, 220V bulb?

Ans.

Solution

Data

$$P_1 = 500\text{W}$$

$$V_1 = 220\text{V}$$

$$R_1 = ?$$

Calculations

$$P_1 = \frac{V_1^2}{R_1}$$

$$\Rightarrow R_1 = \frac{V_1^2}{P_1}$$

$$R_1 = \frac{(220)^2}{500} = 96.8\Omega$$

Solution

Data

$$P_2 = 600\text{W}$$

$$V_2 = 220\text{V}$$

$$R_2 = ?$$

Calculations

$$P_2 = \frac{V_2^2}{R_2}$$

$$\Rightarrow R_2 = \frac{V_2^2}{P_2}$$

Result $R_2 = \frac{(220)^2}{100} = 484\Omega$

So, 100W light bulb has greater resistance.

2. Explain why the terminal potential difference of a battery decreases when the current drawn from it is increased?

Ans.

Reason:

When the current drawn from the battery is increased, so the potential drop across the internal resistance also increases (i.e. the energy dissipation as heat into the battery is increased). Therefore, according to following relation,

$$V_1 = E - Ir$$

the terminal potential difference is decreased.

3. Often, you might have noticed birds sitting safely on high tension wires. Why are they not electrocuted even when sitting on a part of wire where insulation has worn off?

Ans. For electrocution, the current should pass through the body. The current passes only if there is a potential difference between different parts of the body. When bird is sitting on high tension wire without insulation, the potential difference between its two feet is zero as both feet are on the same potential.

$$\Delta V = 0 \quad \Rightarrow I = \frac{\Delta V}{R} = \frac{0}{R} = 0$$

No current flows through the body of the bird and it is not electrocuted.

4. Why a Thin region of light bulb filament has more possibility to burn than the thicker one?

Ans. As $R \propto \frac{1}{A}$

The thin region of the filament has smaller area than thicker one. Therefore, thin region has more resistance than thicker one. Since heat produced per second is I^2R . As current is constant through the whole filament, heat produced is greater where resistance is greater. The resistance is greater in the thin region, temperature of thin region rises more and thin region has more possibility to burn than the thicker region.

5. Is it possible to have a situation in which the terminal potential difference can be greater than emf of a battery?

Ans. Yes, terminal potential difference can be greater than emf when a battery is being charged.

6. A wire of resistance R is stretched till its length is increased n times its original length. What is its resistance now?

Ans. Initially $R = \rho \frac{L}{A}$ (1)

After stretching

$$R' = \rho \frac{L'}{A'} \quad (2)$$

Since volume remain constant

$$A'L = AL$$

$$A' = \frac{AL}{L'}$$

Putting the values of A' in the equation (2)

$$R' = \rho \frac{L'}{\frac{AL}{L'}} = \rho \frac{L'^2}{AL}$$

$$\text{As } L' = nL$$

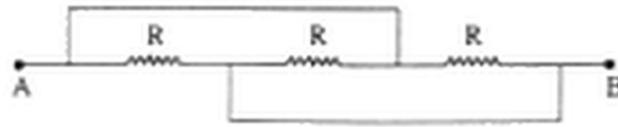
$$R' = \rho \frac{(nL)^2}{AL} = \rho \frac{n^2 L^2}{AL}$$

$$R' = n^2 \left(\frac{\rho L}{A} \right) \quad (3)$$

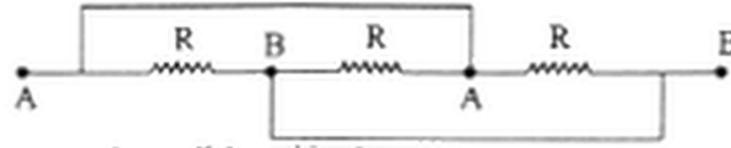
putting value from eq in (3)

$$R' = n^2 R$$

7. In the given network find the equivalent resistance between A and B?



Ans.



All the three resistance in parallel combination

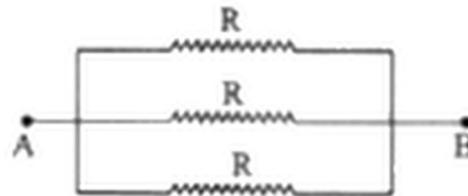
Therefore

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

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

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

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



Self-Assessment Paper 1

Q.No.2 Write Short Answers of any SIX of the following questions.

1. What is EEG? What is the role of potential difference in the function of EEG?
2. Why is the I-V graph of ohmic conductor straight line while that of semi-conductors is not?
3. Why does the resistance of a conductor rise with temperature?
4. Does the direction of emf provided by a battery depends on the direction of current flow through the battery?
5. What do you mean by drift speed of the electrons in a conductor?
6. What is the difference between resistance and resistivity of a conductor?

7. A wire is stretched so that its radius becomes half, how would it affect the resistance of the wire?

Q.No.3 Extensive Question.

Q. (a) What is a Wheatstone bridge? How can we find the unknown resistance with it?

(b) A resistor of 50 ohm has a potential difference of 100V D.C. across it for 1 hour. Calculate (a) power (b) energy?

Self-Assessment Paper 2

Q.No.2 Write Short Answers of the following questions.

1. Describe a circuit which is used for continuously varying potential.
2. Do bends in a wire affect its electrical resistance?
3. A heavy duty battery of a truck maintains a current of 3A for 24 hours. How much charge flows from the battery during this time?
4. Is the filament resistance lower or higher in a 500W, 220V light bulb than in a 100W, 220V bulb?
5. What is the principle of working of a potentiometer? Give its some uses.
6. Why does the terminal potential difference decrease when the current drawn through it will increase?
7. What is a Wheatstone bridge? How can it be used to determine an unknown resistance?

Q.No.3 Extensive Questions.

Q. (a) What do you understand by the term resistivity, how the resistivity of the conductor increases with the increase in temperature, also define the temperature coefficient of resistivity.

(b) 1×10^{17} electrons pass through a conductor in $1 \mu\text{s}$. Find the current in amperes flowing through the conductor Electronic charge is $1.6 \times 10^{-19}\text{C}$.

