Exercise-9(B)

1. **Figure below shows two conductors A and B. Their charges and potentials are given in the diagram. State the direction of (i) flow of electrons, and (ii) flow of current, when both the conductors are joined by a metal wire.**

Q = -10 coulomb
V = 5 volt

Q = 5 coulomb
V = 10 volt

Solution:

(a) The direction of flow of electrons is from A to B

(b) The direction of flow of current when both the conductors are joined by a metal wire is from B to A.

2. **How is the direction of flow of current between two charged conductors determined by their potentials?**

Solution:

The direction of current can be determined as current flows from high potential to low potential.

3. **Explain the concept of electric potential difference in terms of work done in transferring the charge.**

Solution:

The electric potential difference between two conductors is equivalent to the work done in transmitting a unit positive charge from one to another conductor.

4. **Define the term potential difference.**

Solution:

Potential difference between two conductors is equal to the work done in transferring a unit positive charge from one conductor to the other conductor. It is a scalar quantity.

If 'W' work is done in transferring a test charge q from one conductor to the other, the potential difference between them is given by:

$$V_1 - V_2 = \frac{W}{q}$$

5. **State and define the S.I. unit of potential difference.**

Solution:

The S.I. unit of potential difference is joule per coulomb which is named as volt (V).

It can defined as follows:

We know that, potential difference (V) is given by:

$$V = \frac{W}{q}$$

$$\text{Unit of potential difference} = \frac{\text{unit of work}}{\text{unit of charge}}$$

$$1\ V = \frac{1\ joule}{1\ coulomb}$$
$$1V = \frac{1J}{1\ C}$$

Hence, potential difference between two points is said to be 1 volt if work done in transferring 1 coulomb of charge from one point to the other point is 1 joule.

6. **'The potential difference between two conductors is 1 volt'. Explain the meaning of this statement.**
Solution:
If the potential difference between two conductors is 1 volt it means that 1 joule of work should be done to transfer 1 coulomb of charge from one conductor to the other.

7. **What do you understand by the term resistance?**
Solution:
Resistance(R) is the obstruction offered to the flow of current by a conductor. It is a scalar quantity.
Resistance can be given by:

$$\text{Resistance} = \frac{\text{Potential difference}}{\text{Current}}$$

8. **Explain why does a metal wire when connected to a cell offer resistance to the flow of current.**
Solution:
A metal wire has free electrons which moves in a random manner in the absence of any cell connected across it.
When the ends of the wire are connected to a cell, the electrons begin to move from the negative to the positive terminal of the cell through the wire, during which they collide with the fixed positive ions and other free electrons of the wire due to which the speed decreases and direction of motion changes.
They again accelerate after each collision towards the positive terminal and suffer collisions with other positive ions and free electrons again and the process continues.
Hence, the electrons do not move in bulk with increasing speeds from one end to the other but drift towards the positive terminal. This depicts how the wire offers resistance to current through it.

9. **State and define the S.I. unit of resistance.**
Solution:
S.I. unit of resistance is volt per ampere which is named as ohm (Ω).

$$1\ \text{ohm} = \frac{1\ volt}{1\ \text{ampere}} = \frac{1\ V}{1\ A}$$

The resistance of a conductor is said to be 1 ohm if a current of 1 ampere flows through it when the potential difference across its ends is 1 volt.

10. State Ohm's law.

Solution:

Ohm's law states that if a current I flows through a wire when potential difference across the ends of the wire is V, the resistance offered by the wire to the flow of current is the ratio of potential difference across it to the current flowing in it.

11. How are the potential difference (V), current (I) and resistance (R) related?

Solution:

The relation is as follows:

$$V = IR$$

Where V is the potential difference, I is the current, R is the resistance.

12. 'The resistance of wire is 1 ohm'. Explain the meaning of this statement.

Solution:

If the resistance of a wire is 1 ohm it means that if current of 1ampere flows through a component across which a potential difference of 1 volt is existent, then the resistance of that component is one ohm.

13. How is the current flowing in a conductor changed if the resistance of conductor is doubled keeping the potential difference across it the same?

Solution:

The current flowing in a conductor is halved if the resistance of the conductor is doubled keeping the potential difference across it the same.

14. State three factors on which the resistance of a wire depends. Explain how does the resistance depend on the factors stated by you.

Solution:

The three factors are as follows:

- Temperature of the wire – resistance of the wire is directly proportional to the temperature of the wire
- Length of the wire – resistance is directly proportional to the length of the wire
- Area of cross section of wire – resistance is inversely proportional to the area of cross section of the wire

15. How is the resistance of a wire affected if its (a) length is doubled, (b) radius is doubled?

Solution:

(a) The resistance of a wire becomes more or twice if the length of the wire is doubled.

(b) The resistance of a wire becomes less or one-fourth if the radius of the wire is doubled

16. State whether the resistance of filament of a bulb will decrease, remain unchanged or increase when it glows.

Solution:

When a bulb glows, the resistance of the filament increases.

17. Name the physical quantities of which the units are:

(i) Volt

(ii) Coulomb
(iii) Ohm
(iv) Ampere

Solution:

Listed below are the physical quantities:
(i) Volt – Potential difference
(ii) Coulomb - Charge
(iii) Ohm - Resistance
(iv) Ampere – Current

Multiple choice type:

1. **Current in a circuit flows:**
   (a) In direction from high potential to low potential
   (b) In direction from low potential to high potential
   (c) In direction of flow of electrons
   (d) In any direction

   Solution:

   (a) In direction from high potential to low potential
   Electric current is said to flow from a body at higher potential to a body at lower potential, in a direction opposite to the direction of flow of electrons.

2. **The unit of potential difference is:**
   (a) Ampere
   (b) Volt
   (c) Ohm
   (d) Coulomb

   Solution:

   (b) Volt
   Potential difference is measured in joule per coulomb which is named as volt (V).

3. **On increasing the resistance in a circuit, the current in it:**
   (a) Decreases
   (b) Increases
   (c) Remains unchanged
   (d) Nothing can be said

   Solution:

   (a) Decreases
   Current (I) is inversely proportional to the resistance (R).

Numericals:

1. **In transferring 1.5 C charge through a wire, 9 J of work is needed. Find the potential difference across the wire.**

   Solution:

   Given: charge = 1.5 C, work = 9 J, potential difference V = ?

We know that:

V = work/charge => w/q

⇨ 9/1.5 = 6V

2. **A cell of potential difference 12V is connected to a bulb. The resistance of filament of bulb when it glows, is 24Ω. Find the current drawn from the cell.**

Solution:

Given: V = 12V, R = 24Ω, I =?

We know that:

V = IR

I = V/R

= 12/24

= 0.5A

3. **A bulb draws current 1.5A at 6.0V. Find the resistance of filament of bulb while glowing.**

Solution:

Given: I = 1.5A, Potential difference = 6V, R=?

We know that:

V = IR

R = V/I

= 6/1.5

= 4Ω

4. **A current 0.2A flows in a wire of resistance 15Ω. Find the potential difference across the ends of the wire.**

Solution:

Given: I = 0.2A, Potential difference =?, R=15Ω

We know that:

V = IR

= 0.2 x 15

= 3V