SHORT QUESTIONS

13.1 A potential difference is applied across the ends of a copper wire. What is the effect on the drift velocity of free electron by?

(i) Increasing the potential difference.

(ii) Decreasing the length and the temperature of the wire.

Ans. (i) As we know that the drift velocity of free electrons is directly proportional to the potential difference i.e.,

$$V_d \propto E$$

Therefore if potential difference is increases then the drift velocity of free electrons is also increases.

(ii) As the resistance depends (i.e., directly proportional) upon temperature and length of the conductor. So on decreasing the temperature and length of the conductors, the resistance decreases. So drift velocity increases.

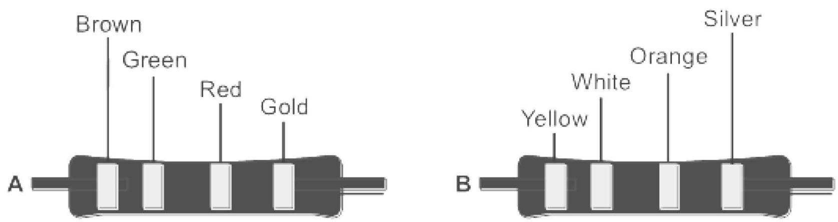
13.2 Do bends in a wire affect its electrical resistance? Explain.

Ans. The resistance of conductor of length L and cross-sectional area A is given by

$$R = \frac{\rho L}{A}$$

Where ρ is the resistivity whose value depends upon the nature of the conductor. If length L and cross-sectional area A of the wire is unchanged after bending then its electrical resistance will remain same.

13.3 What are the resistances of the resistors given in the figures A and B? What is the tolerance of each? Explain what is meant by the tolerance?



Ans. Figure A as we know that first three bands on the left show values of resistance and the extreme band gives tolerance of the resistance. Thus in this figure.

1^{st} band in brown = 1

2^{nd} band in green = 5

3^{rd} band is red = 2 = No of zeros = 00

4^{th} band is gold which shows tolerance = $\pm 5\%$

So the actual value of resistance = $1500 \pm 5\%$

Figure B

1^{st} band is yellow = 4

2^{nd} band is white = 9

3^{rd} band is orange = 3 = No of zeros = 000

4^{th} band is silver = Which shows tolerance

= ± 10%

So the actual resistance = 49000 ± 10%

Tolerance Tolerance means the possible variation from the marked value. For example, 1500Ω resistance with a tolerance of ±5% will have an actual value of resistance b/w 1425 to 1575.

13.4 Why does the resistance of a conductor rise with temperature?

Ans. As we know that resistance offered by a conductor to the flow of current is due to the collisions, of free electrons with atoms of lattice. As temperature of the conductor rises, the amplitude of vibration of the atoms in the lattice increases and hence the probability of their collisions with free electrons also increases. Hence resistance of conductor rise with temperature.

13.5 What are the difficulties in testing whether the filament of a lighted bulb obeys Ohm's law?

Ans. According to Ohm's law current is directly proportional to applied potential difference providing physical state of conductor must remain constant therefore when current passes through the filament of bulb, initially the temperature of filament is low and its resistance remains constant hence filament Obey's Ohm's law but with the passage of time, its temperature increases, so resistance of filament increases therefore Ohm's law is not valid due to increase in temperature.

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

Ans. As we know that

$$P = \frac{V^2}{R}$$

$$R = \frac{V^2}{P}$$

For 1^{st} case

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

For 2^{nd} case

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

(OR)

As $$P = \frac{V^2}{R}$$

$$R = \frac{V^2}{P}$$

If V = Constant

$$R \propto \frac{1}{P}$$

∴ 500 watt bulb has less resistance than 100 W.

So the resistance of 500 watt bulb is less than the resistance of 100 watt. But 500 watt bulb will draw more current as compared to 100 watt bulb.

13.7 Describe a circuit, which will give a continuously varying potential?

Ans. For continuously varying potential, we can use

(i) Rheostat as potential divider.

(ii) Potentiometer as potential divider.

Here we describe **rheostat as potential divider**.

A potential difference V is applied across the ends A and B of the rheostat as shown in figure.

The current I passing through R is

$$I = V/R$$

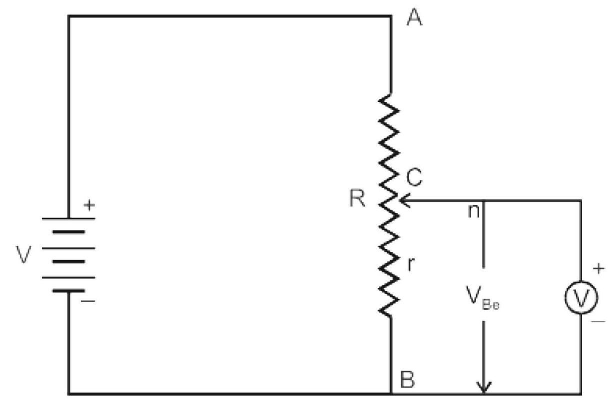
The potential difference between B and C is

$$V_{BC} = Ir$$

Putting values of I

$$\therefore \quad V_{BC} = \frac{V}{R} r$$

$$= \frac{r}{R} V$$



Where R = Resistance of wire AB.

r = Resistance of portion BC of wire

The circuit shown can provide its output potential difference varying from zero to full potential difference of battery depending on position of sliding contact C. From the equation we see that as we move from B to A the potential difference will change from zero to V.

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

Ans. We know that the relation between terminal potential difference and emf is

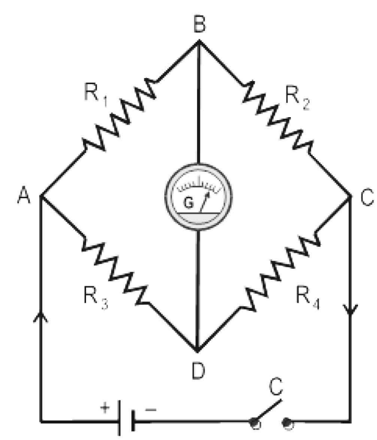
$$V_t = E - Ir$$

Here r is the internal resistance of cell.

It is clear that when current I is large, the factor Ir becomes large and V_t becomes small. Thus the potential difference of a battery decreases when current drawn from it increases.

13.9 What is Weatstone bridge? How can it be used to determine an unknown resistance?

Ans. Wheatstone bridge is an electrical circuit which is used to find unknown resistance of a wire.



Whenever bridge is balanced that is, galvanometer shows no deflection then following condition is satisfied.

$$\frac{R_1}{R_2} = \frac{R_3}{R_4}$$

In this circuit R_1, R_2, R_3 are known. If R_4 is unknown then

$$R_4 = \frac{R_3 R_2}{R_1}$$