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Section: A

Question 01

Conductivity is the measure of the ease at which an electric charge or heat can pass through a material. A conductor is a material which gives very little resistance to the flow of an electric current or thermal energy.

Since conductivity is the measure of how easily electricity flown, electrical resistivity measures how much a material resists the flow of electricity. That is the main difference between resistivity and conductivity.

Question 02

Surface charge density (σ) is the quantity of charge per unit area, measured in coulombs per square meter ($C.m^{-2}$), at any point on a surface charge distribution on a two dimensional surface. charg density can be either positive or negative, since electric charge can be either positive or negative. The unit is $C.m^{-2}$.

Question 03

Here given;

$\epsilon = 9\,V.$

$R = 7.9\,\Omega$

$r = 3.7\,\Omega.$

We know,

$$I = \frac{\epsilon}{R + r}$$

$$= \frac{9}{7.9 + 3.7}$$

$$= 0.78\ A.$$

Now, we have to find the terminal voltage of the battery;

$$V_{term} = \epsilon - Ir$$

$$= 9 - (0.78 \times 3.7)$$

$$= 6.114\ V.$$

(Result)

Question 04

Here, $L = 7.00\ m$

$r = 6\ mm$

$= 6 \times 10^{-3}$

Now; $A = \pi r^2 = \pi \times (6 \times 10^{-3})^2$

$= 1.13 \times 10^{-4}\ m^2$

We know,

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

$$\Rightarrow \rho = \frac{RA}{L}$$

$$= \frac{20.192 \times 1.13 \times 10^{-4}}{7}$$

$$= 3.259 \times 10^{-4}$$

(Result)

Now,

$E = 3.75 \times 10^{-2}\ V/m$

$I = 13\ mA$

$= 1.3 \times 10^{-3}\ A$

$$\therefore E = \frac{IR}{L}$$

$$\Rightarrow R = \frac{EL}{I}$$

$$= \frac{3.75 \times 10^{-2} \times 7}{1.3 \times 10^{-3}}$$

$$= 20.192$$

Question 05

Red = 2, $10^2 = 100$

Green = 5, $10^5 = 100000$

black = 0, $10^0 = 1$

Yellow = 4, $10^4 = 10000$

Brown = 1, $10^1 = 10$

Nominal = $25 \times 10^0 = 25\ \Omega$ (Black)

maximum = $25 + 25 \times 0.1 = 27.5\ \Omega$.
(Brown)

Minimum = $25 - 25 \times 0.1$

$= 22.5\ \Omega$.
(Green) (Result)

Question-06

10 Ω and 8.667 Ω are in Parrallel.

and now,

$$(10 \parallel 8.667) + 5 + 0.5$$

$$= \left(\frac{10 \times 8.667}{10 + 8.667}\right) + 5 + 0.5$$

$$= 10.142\ \Omega.$$

$$V = I R$$

$$\Rightarrow I = \frac{V}{R} = \frac{9}{10.142} = 0.8873$$

$$I_1 = \frac{8.667}{10 + 8.667} + 0.8873 = 0.411\,A$$

$$I_2 = \frac{10}{10 + 8.667} \times 0.8873$$

$$= 0.4753\,A$$

$$I_3 = \frac{4}{8+4} \times I_L$$

$$= \frac{8}{8+4} \times 0.4753$$

$$= 0.1584\ A$$

$$V_n = IR$$

$$= 0.8873 \times 5$$

$$= 4.4365\ V$$

(ii) $V_{term} = E - Ir$

$$= 9 - 0.8873 \times 0.5$$

$$= 8.5563\ V.$$

(Result)