Current Electricity

AIPMT A flow of 10^7 electrons per second in a conducting wire. Constitutes current of.

(a) 1.6×10^{-12} A

(b) 1.6×10^{26} A

(c) 1.6×10^{-26} A

(d) 1.6×10^{12} Amp

$$i = \frac{q}{t} = \frac{ne}{t} = \quad q = ne$$

$t = 1$ $\quad q = 10^7 \times 1.6 \times 10^{-19}$ C

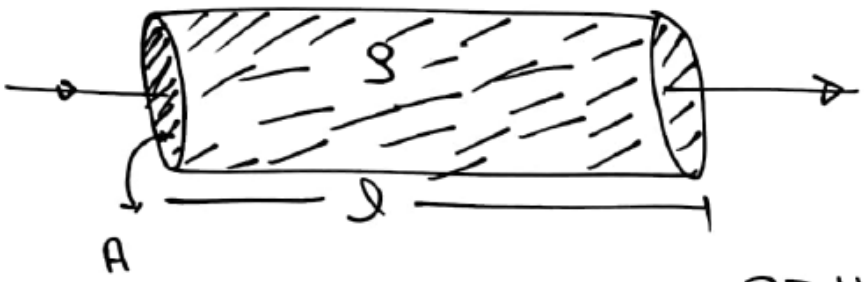
$q = 1.6 \times 10^{-12}$ C

$$i = \frac{q}{t} = \frac{1.6 \times 10^{-12}}{1} \text{ C/sec}$$

$i = 1.6 \times 10^{-12}$ Amp

Current Electricity

Resistance of a Conductor :-



Resistance of Conductor

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

SI Unit of R → ohm
denoted by Ω.

A = Area of cross-section

l = length of Conductor

ρ = resistivity of Conductor

ρmp depends on
→ It is property of material
→ does not depend on shape & size

⇒ SI Unit of resistivity (ρ) :- Ω-m

$$R = \frac{\rho l}{A} \Rightarrow \Omega = \frac{\rho \times m}{m^2}$$

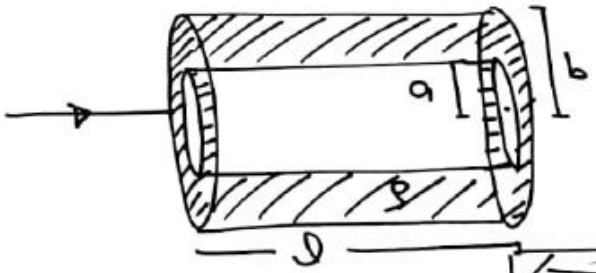
ρ → Ω-m

R, ρ both are scalar quantity

Current Electricity

Calculation of resistance(R):

JEE

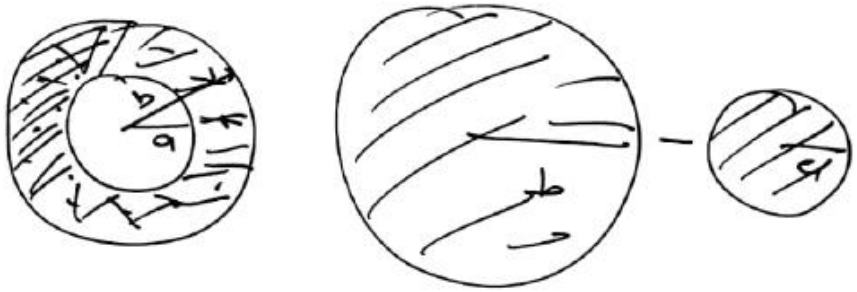


$$R = \frac{\rho l}{A}$$

$$A = \pi(b^2 - a^2)$$

$$R = \frac{\rho l}{\pi(b^2 - a^2)}$$

$\pi b^2 - \pi a^2$



$= \pi b^2 - \pi a^2$

$= \pi(b^2 - a^2)$

Current Electricity

Calculation of resistance(R):-

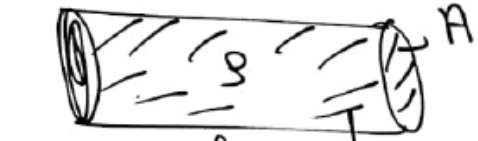
JEE

Q2) A Conductor of length l, area of cross-section is A. If Conductor is streched, length of the Conductor is double. Find Resistance of final Conductor if initial Resistance of Conductor is R [ρ = resistivity of Conductor]

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

$R_{net} = 4R$

Sol)



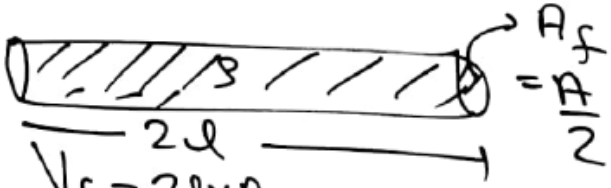
$R = \frac{\rho l}{A}$

$V = Al$

$V_i = V_f$

$Al = 2l \times A_f$

$A_f = \frac{A}{2}$



$V_f = 2l \times A_f$

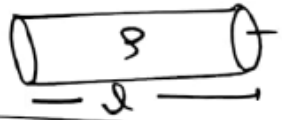
$R_{net} = \frac{\rho(2l)}{A/2} = 4\frac{\rho l}{A}$

Current Electricity

Calculation of resistance(R):-

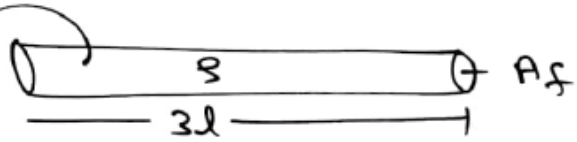
JEE

Q3]



$R = \frac{\rho l}{A}$ $V_i = Al$

$R_{new} = ?$



$V_f = 3l A_f$

$V_i = V_f$

$Al = 3lA_f$

$A_f = \frac{A}{3}$

$R_{new} = \frac{\rho(3l)}{A/3} = \frac{\rho(3l)\times 3}{A} = \frac{9\rho l}{A}$

$R_{new} = 9R$

***[rr] If length of Conductor Increase by n times then Resistance increases by n^2 times" [Volume Constant]

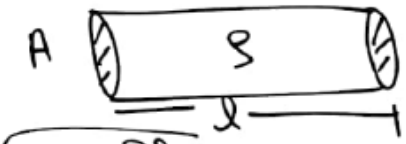
Current Electricity

Calculation of resistance(R):-

JEE

NEET 2017) The resistance of a wire is R ohm. If it is melted & stretched to n times its original length, its new Resistance will be.

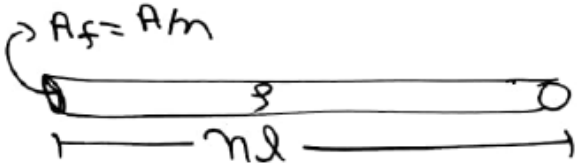
(a) R/n
(b) n^2R
(c) R/n
(d) nR



$R = \frac{\rho l}{A}$ $V_i = Al$

$Al = nl A_f$

$A_f = \frac{A}{n}$



$V_f = A_f \times nl$

$R_{new} = \frac{\rho(nl)}{A/n} = \frac{\rho(nl)n}{A} = \frac{n^2\rho l}{A}$

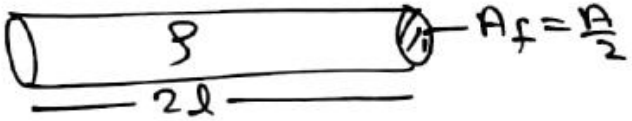
$R_{new} = n^2 \frac{\rho l}{A} = n^2 R$

Current Electricity

Calculation of resistance(R):

[NEET 2013] Q5) A wire of resistance 4Ω is stretched to twice its original length. The resistance of stretched wire would be.

(a) 8Ω.
(b) 16Ω.
(c) 2Ω.
(d) 4Ω.



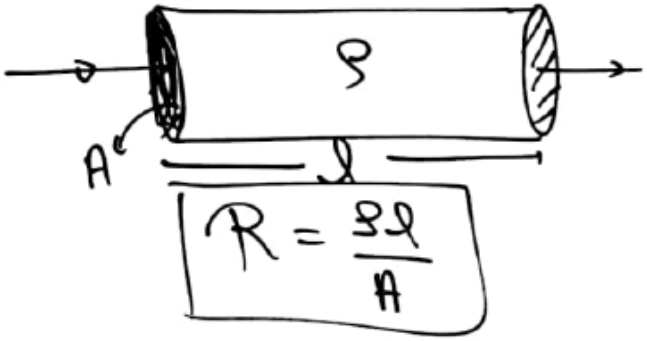
$R = \frac{\rho l}{A} = 4\Omega$ $\quad Al = A_f \times 2l$ $\quad R_{new} = \frac{\rho(2l)}{\frac{A}{2}} = 4\frac{\rho l}{A}$

$A_f = \frac{A}{2}$

$R_{new} = 4R$

$= 4 \times 4 = 16\Omega$

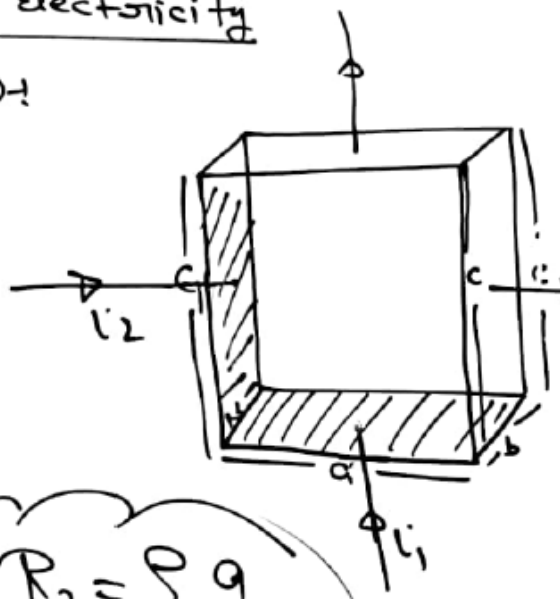
Calculation of resistance(R):



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

Solid Cube

resistivity (ρ)



$$R_1 = \frac{\rho c}{ab}$$

$$R_2 = \frac{\rho a}{bc}$$

AIPMT) Three copper wires of length ℓ cross-sectional areas are (ℓ, A) $(2\ell, A/2)$ & $(\ell/2, 2A)$. Resistance is minimum

(a) $2A$.

(b) $A/2$.

(c) A.

(d) Same in all three cases.

$$R_1 = \frac{\rho \ell}{A} = R$$

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

$$R_2 = \frac{\rho (2\ell)}{A/2} = 4\frac{\rho \ell}{A} = 4R$$

$$R_3 = \frac{\rho (\ell/2)}{2A} = \frac{\rho \ell}{4A} = \frac{R}{4}$$

AIPMT 2008) A wire of a certain material is streched slowly by 10 percent. Its new resistance & specific resistance becomes respectively

2015 - 50%

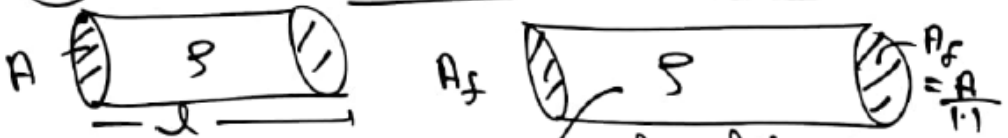
(a) both remain the same.

(b) 1.1 times, 1.1 times X

(c) 1.2 times, 1.1 times. X

(d) 1.21 times, same.

Specific resistance = Resistivity = ρ



$R = \frac{\rho l}{A}$ $Al = 1.1l \times A_f$

$A_f = \frac{A}{1.1}$

$R_{new} = 1.21R$

$R_{net} = \frac{\rho(1.1l)}{\frac{A}{1.1}}$

$R_{net} = \frac{\rho l}{A} \times 1.21$