If charge flowing through a conductor in time 't' is given by equation q = 1.5 t^2 + t. Then current at t = 2s will be -

(A) 4A (B) 5A

(C) 6A ~~(D)~~ 7A

(4)

$q = (1.5t^2 + t)$

i

$t = 2$ sec

$\frac{d}{dx} x^n = nx^{n-1}$

$i = 3\times 2 + 1 = 7$ Amp

(q) flowing is variable

$i = \frac{dq}{dt} = \frac{d}{dt}(1.5t^2 + t)$

$= \frac{d}{dt}(1.5t^2) + \frac{d}{dt}t^1$

$= 1.5[2t^{2-1}] + 1t^{1-1}$

$= 1.5[2t] + 1t^0$

$\boxed{i = 3t + 1}$

$i = 3\times 2 + 1$

$i = \frac{dq}{dt} = \frac{d}{dt}(1.5t^2 + t)$

$= 1.5$

$i = 3t + 1$

$t = 2$ sec

$t^0 = 0$

$i = 3\times 2 + 1$

$= (6+1) = 7$ C/sec

$= 7$ Amp/sec

An electron (charge e) is revolving in a circular orbit of radius r round a nucleus of charge Ze with speed v. The equivalent current is

(A) Zero

(B) $\dfrac{ZeV}{2\pi r}$

(C) $\dfrac{e.2\pi r}{v}$

(D) $\dfrac{ev}{2\pi r}$

$i = \dfrac{ev}{2\pi r}$

for T

$i = \dfrac{q}{T}$

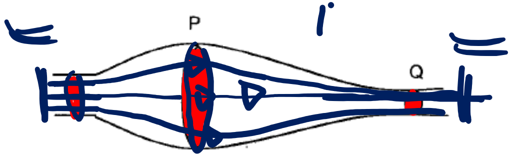
$T = \dfrac{2\pi r}{v} = \dfrac{2\pi r}{v}$

$i = \dfrac{\text{(charge) flow}}{\text{time}}$ $\dfrac{e\text{-flow}}{T}$

$i = \dfrac{e}{T} = \dfrac{e}{\frac{2\pi r}{v}}$

$i = \dfrac{ev}{2\pi r}$

A source of constant potential difference is connected across a conductor having irregular cross section as shown.



(A) Electric field intensity at P is greater than that at Q ×

(B) Rate of electrons crossing per unit area of cross-section at P is less than at Q.

(C) The rate of generation of heat per unit length at P is greater than at Q.

(D) Mean kinetic energy of free electrons at P is greater than at Q.

i = Constant

$i_P = i_Q$

$(\cancel{n}\cancel{e}Av_d)_P = (\cancel{n}\cancel{e}Av_d)_Q$

$A_P v_{d_P} = A_Q v_{d_Q}$

$v_{d_P} < v_Q$

$v_P < v_Q$

$\boxed{E_Q > E_P}$

P Q

The resistance of a wire is RΩ. What will its new resistance if it is stretched n times to its initial length.

(A) $R_1 = R$ (B) $R_1 = nR$

(C) $R_1 = n^2R$ (D) None of these

l, A

R - Ω

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

Now

$l' = nl$ A'

$l'A' = Al$

$n\cancel{l} \times A' = A\cancel{l}$

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

$R' = \frac{\rho l'}{A'} = \frac{\rho \times nl}{A/n}$

$= \frac{\rho l}{A} \times n^2$

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

$\boxed{R' = n^2R}$

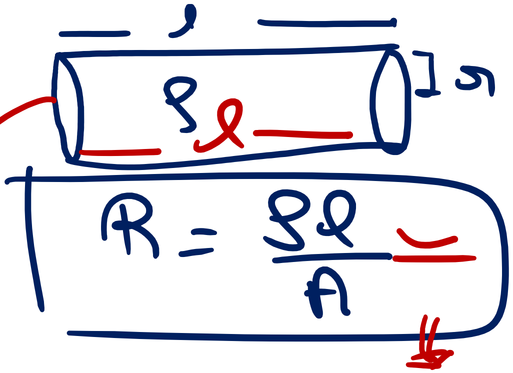
A wire of resistance R is stretched so that its radius decreases to, by a factor n, calculate its new resistance.

(A) $R_1 = n^2R$ ✗

(B) $R_1 = n^4R$

(C) $R_1 = nR$ ✗

(D) None of these ✓



$A = \pi r^2$

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

$Al = A'l'$

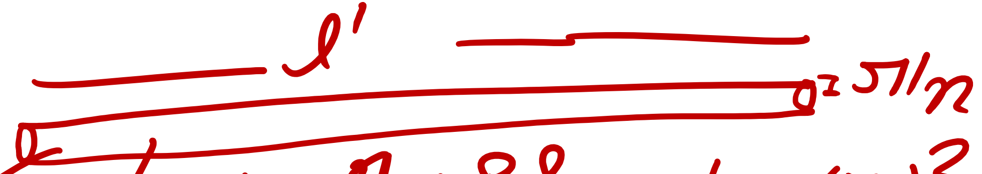
$Al = \frac{A}{n^2} \times l'$

$l' = n^2 l$

$R' = \frac{\rho \times n^2 l}{\frac{A}{n^2}}$

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

$R' = \frac{\rho l}{A} \times n^4$



$R' = n^4 \times \frac{\rho l}{A}$

$R' = n^4 R$

$A' = \pi\left(\frac{r}{n}\right)^2$

$A' = \frac{\pi r^2}{n^2} = \frac{A}{n^2}$

$A' = \frac{A}{n^2}$

A given piece of wire of length ℓ. Cross section area 'A' and resistance R is stretched uniformly to a wire of length 2ℓ. What is the new resistance.

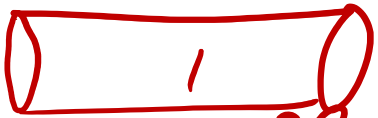
(A) 2R (B) 4R

(C) R/2 (D) Remain Same

n - times

$R = n^2$

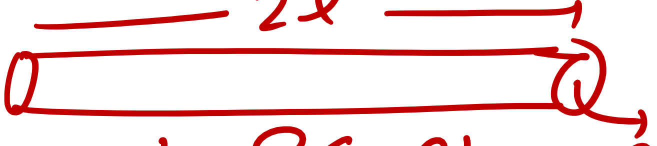
ℓ



A

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

2ℓ



$\frac{A}{2}$

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

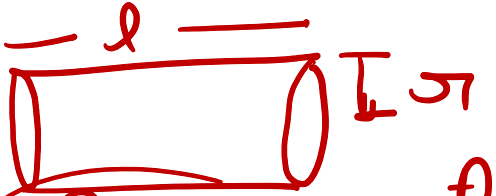
$R' = 4\frac{\rho \ell}{A}$

$R' = 4R$

A wire has length ℓ, radius r and resistance R. What will be its resistance if its radius is halved by stretching it uniformly.

(A) 2R (B) 4R

(C) 8R ~~(D)~~ 16R



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

$$A = \pi r^2$$

$$A' = \pi\left(\frac{r}{2}\right)^2$$

$$A' = \frac{A}{4}$$

$$Al = A'l'$$

$$Al = \frac{A}{4} \times l'$$

$$l' = 4l$$

$$R' = \frac{\rho(4l)}{A/4}$$

$$R' = \frac{\rho l}{A} \times 16$$

$$\boxed{R' = 16R}$$

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If a copper wire is stretched to made it 0.1% longer, what is the change in its resistance

(A) 0.2% (B) 0.4%

(C) 0.8% (D) 1.6%

#

$l \quad , \quad A$

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

$l_f = l + 0.001 l$

$l_f = (1.001) l$

$A_f = \frac{A}{1.001}$

$A_f l_f = l A$

$A_f = \frac{lA}{1.001 l}$

$R_f = \frac{\rho (1.001) l}{\frac{A}{1.001}} = \frac{\rho l}{A} \times (1.001)^2$

$R_f = (1.001)^2 R_i$

$\frac{\Delta R}{R} \times 100 =$

$\frac{R_f - R_i}{R_i} \times 100 = \left(\frac{(1.001)^2 \cancel{R_i} - \cancel{R_i}}{\cancel{R_i}} \right) \times 100$

$\left((1.001)^2 - 1^2 \right) \times 100$

$(1.001 - 1)(1.001 + 1) \times 100$

$= 0.001 \times 2.001 \times 100$

$.1 \times 2.001$

$0.1 \rightarrow \frac{0.1}{100} = .2\%$

$= 0.001 l$

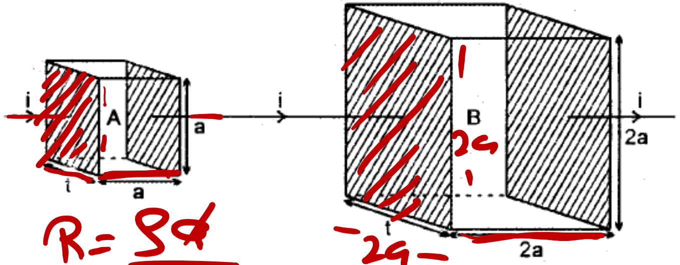
$n - 1m$

$$R_f = n^2 R_i$$

$$\frac{\Delta R}{R} \times 100 = 2 \frac{\Delta R_1}{R_1} \times 100$$

$$= 2 \times 0.1 = 0.2\%$$

There are two rectangle A and B of same thickness given in the fig.The arm of B is twice that of A.Then what will be value of $\frac{R_A}{R_B}$



$R = \frac{\rho a}{a^2}$

$R_A = \frac{\rho}{a}$

$R_B = \frac{\rho(2a)}{4a^2} = \frac{\rho}{2a}$

$\frac{R_A}{R_B} = \frac{\rho}{a \times \frac{\rho}{2a}} = 2:1$

(A) 1 (B) 2

(C) $\frac{1}{2}$ (D) 4

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If n, e, τ and m are representing electron density, charge, relaxation time and mass of an electron respectively, then the resistance of a wire of length ℓ and cross-sectional area A is given by

(A) $\dfrac{m\ell}{ne^2\tau A}$

(B) $\dfrac{2m\tau A}{ne^2\ell}$

(C) $\dfrac{ne^2\tau A}{2m\ell}$

(D) $\dfrac{ne^2 A}{2m\tau\ell}$

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

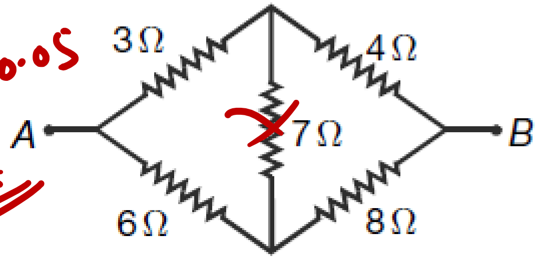
$\rho = \dfrac{m}{ne^2\tau}$

$R = \dfrac{ml}{Ane^2\tau}$

=

1	2	3	4	5	6	7	8	9	10
D	D	B	A	D	B	D	A	A	A

The net resistance of the circuit between A and B is

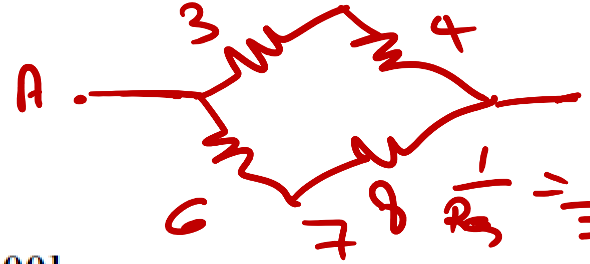


(a) 8/3Ω (b) 14/3 Ω

(c) 16/3 Ω (d) 22/3 Ω

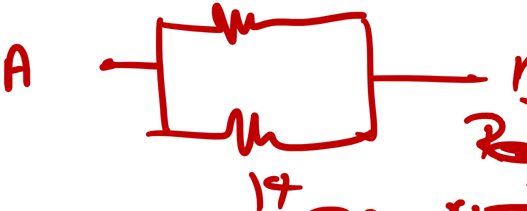
[AIPMT 2000]

– balance wheat stone bridge



$R_{eq} = \frac{14}{3}$

$\frac{1}{R_{eq}} = \frac{1}{7} + \frac{1}{14}$



$R_{eq} = \frac{14}{3}\,\Omega$

$R_{eq} = \frac{7 \times 14}{7 + 14} = \frac{7 \times 14}{21}$

A car battery of emf 12 V and internal resistance 5×10^{-2} Ω, receives a current of 60 amp, from external source, then terminal potential difference of battery is

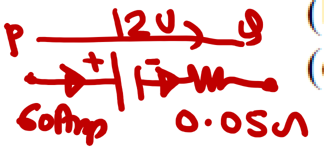
(a) 12 V (b) 9 V

(c) 15 V (d) 20 V

[AIPMT 2000]

T.P = $E + ir$
$= 12 + 60 \times 0.05$
$= 12 + 3$
$= 15$ Volt

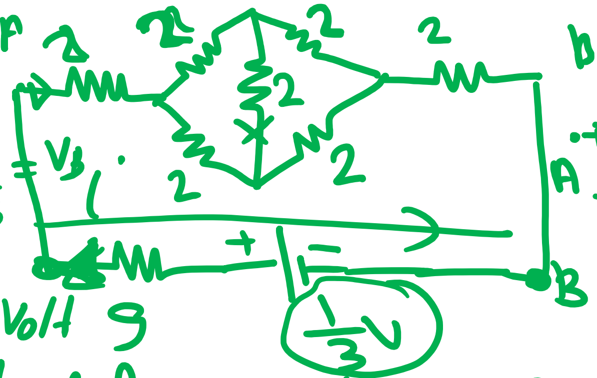
$V_P - V_Q$



$V_P - 12 - 60 \times 0.05 = V_Q$

$V_P - V_Q = 12 + 3 = 15$ volt

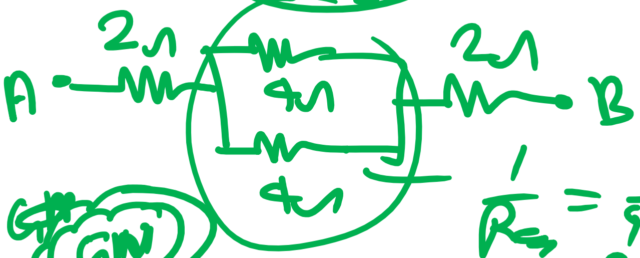
$\frac{1}{45}$ A



$V_A + \frac{1}{45}\times 9 - \frac{1}{3} = V_B$

$V_A - V_B = \frac{2}{15}$ Volt

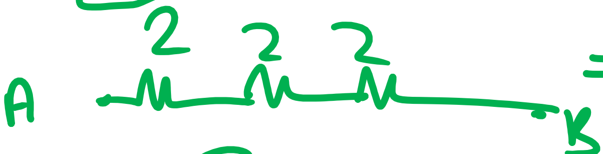
$\frac{1}{3}$ V



(a) total resistance of the ckt across the battery terminal

$\frac{1}{R_{eq}} = \frac{1}{4} + \frac{1}{4}$

$R_{eq} = 2\Omega$



6Ω

$R_{eq} = 6 + 9 = 15\Omega$

(b) Potential difference b/w A & B

$V_A - V_B = \frac{1}{45}\times 6 = \frac{2}{15}$ Volt

$i = \frac{\frac{1}{3}}{15}$

$i = \frac{1}{45}$ Amp

$\frac{2}{15}$ Volt