⇒ **Ohm's Law :-** & Vector form of ohm's law

$V = IR$

$\vec{J} = \sigma \vec{E}$ $\vec{E} = \rho \vec{J}$

V = Potential difference across the resistor

I = Current in resistor

R = Resistance of Resistor.

$\vec{J}$ = current density

σ = Conductivity of material

$\vec{E}$ = Electric field inside the material

ρ = specific resistance or resistivity.

$\langle \vec{v}_T \rangle = 0$

NCERT Exempler Q6) Which of the following characteristics of electrons determines the current in a conductor

(a) drift velocity ✓ (b) thermal velocity

(c) both v_d & v_T (d) Neither drift nor thermal velocity

$i = neAv_d$

⇒ for conductor

We know $T\uparrow \quad R\uparrow$

Let at $0^\circ C \longrightarrow R_i$

at $t^\circ C \longrightarrow R_f$

$$R_f = R_i(1+\alpha\Delta T)$$

α = Thermal Co-efficient of Resistance

→ fraction change in resistance

$R_f = R_i + R_i\alpha\Delta T$

$R_f - R_i = R_i\alpha\Delta T$

$$\frac{\Delta R}{R_i} = \alpha\Delta T$$

⇒ α = +ive ⇒ Conductor

$T\uparrow R\uparrow$, $T\downarrow R\downarrow$

α = −ive → semiconductor

$T\uparrow R\downarrow$, $T\downarrow R\uparrow$

α = −ive → insulator

$$\% \ \frac{\Delta R}{R}\times 100 = \alpha\Delta T \times 100$$

*Q) Resistance of a wire at 0°C temperature is 1 Ω. its temperature co-efficient is 10^{-3} per/°C. find temperature at which resistance becomes 1.5 Ω.

$R_i = 1\,\Omega$

$\Delta T = (T - 0)$

$\alpha = 10^{-3}/°C$

$R_f = 1.5$

$R_f = R_i(1 + \alpha \times T)$

$1.5 = 1(1 + 10^{-3} \times T)$

$1.5 = 1 + 10^{-3}T$

$1.5 - 1 = 10^{-3}T$

$0.5 = 10^{-3}T$

$0.5 = 10^{-3}T$

$T = \frac{0.5}{10^{-3}}$

$T = .5 \times 10^{3} = 5 \times 10^{2}$

$T = 500°C$

In Conductor

$T\uparrow \quad R\uparrow \quad \rho\uparrow$

12:pm

$T\downarrow \quad R\downarrow \quad \rho\downarrow$

$R_f (t°C) = R_i (0°C) \cdot (1 + \alpha\Delta T)$

$\rho_f = \rho_i(1 + \alpha\Delta T)$

$R_i \Rightarrow$ at 0°C

$R_f \Rightarrow$ at t°C

AIEEE ****

$R_1 = 6\Omega$ at $100°C$

$R_2 = 5\Omega$ at $50°C$

Resistance of wire at $0°C$.

So) Resistance at $0°C = R_0$

$R_f = R_i(1+\alpha\Delta T)$ (at $0°C$)

$6 = R_0(1+\alpha\times(100-0))$ — (i)

$5 = R_0(1+\alpha\times(50-0))$ — (ii)

$$\frac{6}{5} = \frac{1+100\alpha}{1+50\alpha}$$

$6 + 300\alpha = 5 + 500\alpha$

$1 = 200\alpha$

$\alpha = \frac{1}{2\times100} = 0.5\times10^{-2} = 5\times10^{-3}/°C$

$6 = R_0(1+5\times10^{-3}\times10^{2})$

$6 = R_0(1+.5)$

$R_0 = \frac{6}{1.5} = 4\Omega$

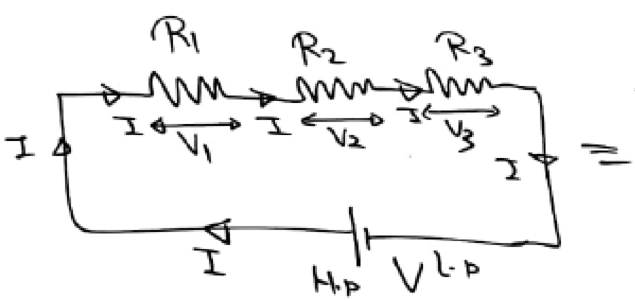
R_0 given

$R_f = R_0(1+\alpha\Delta T)$

⇒ Combination of resistance :-

① Series Combination :-

[Current must be same through all resistor]



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$$V = V_1 + V_2 + V_3$$

$$I R_{eq} = IR_1 + IR_2 + IR_3$$

$$\cancel{I} R_{eq} = \cancel{I}(R_1 + R_2 + R_3)$$

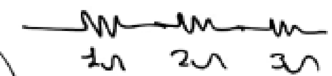
$$R_{eq} = R_1 + R_2 + R_3$$

$$I = \frac{V}{R_{eq}}$$

$R_{eq} > 1$

$R_{eq} > 3$

$R_{eq} > 2$



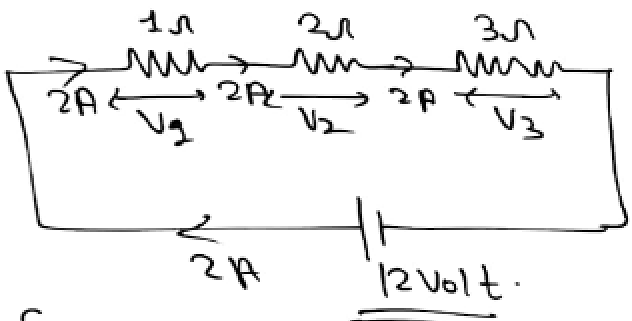
$R_{eq} = 1 + 2 + 3$

$R_{eq} = 6\Omega$

(i) In series combination current is same in all resistor.

(ii) : Equivalent Resistance is greater that ~~larger~~ largest Resistance

⇒ Combination of resistance :-



(a) find Req = ?

(b) I in circuit.

(c) Potential drop across each resistor.

(a) $R_{eq} = R_1 + R_2 + R_3$

$R_{eq} = 1 + 2 + 3$

$\boxed{R_{eq} = 6\Omega}$

(b) $I = \frac{V}{R_{eq}} = \frac{12}{6} = 2\ \text{Amp}$

$I = \frac{12\ \text{Volt}}{6\ \text{ohm}} = 2\ \text{Volt/ohm} = 2\ \text{Amp}$

(c) $V_1 = I R_1$
$V_1 = 2 \times 1$
$V_1 = 2\ \text{Volt}$

$V_2 = 2 \times 2$
$= 4\ \text{Volt}$

$V_3 = I R_3$
$= 2 \times 3$
$= 6\ \text{Volt}.$

Check

$V = V_1 + V_2 + V_3$

$V = 2 + 4 + 6 = 12\ \text{Volt}$

⇒ **Combination of resistance :-**

Parallel Connection of resistor :-

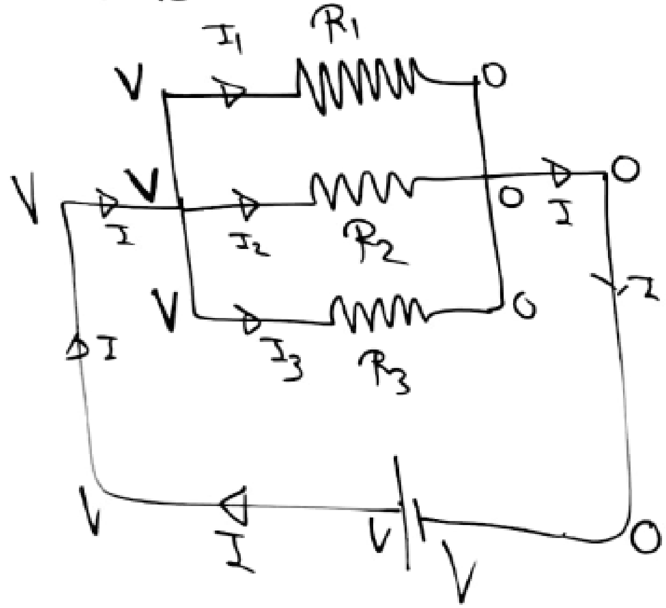
⇒ Potential difference ~~acro~~ across each resistance "must" be same.

$V = IR \qquad I = \frac{V}{R_{eq}}$

\# (I) "Potential across each resistance is same"

(II) R_{eq} is smaller than small Resistance

$R_{eq} < R_1$
$R_{eq} < R_2$
$R_{eq} < R_3$



$$I = I_1 + I_2 + I_3$$

$$I = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

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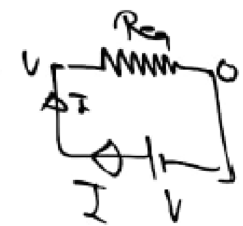
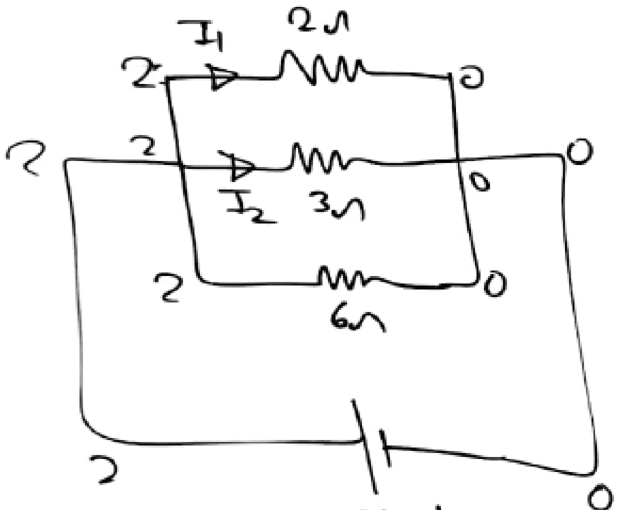


$$\frac{V}{R_{eq}} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

Combination of resistance-:

Q1)



(i) find Req.

(ii) I_1, I_2, & I_3, I

$I_1 = \frac{2}{2} = 1A$

$I_2 = \frac{2}{3} = 0.67$ Amp

$I_3 = \frac{2}{6} = \frac{1}{3} = 0.33$ Amp

$$I = I_1 + I_2 + I_3$$

#
$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_{eq}} = \frac{1}{2} + \frac{1}{3} + \frac{1}{6} = \frac{3+2+1}{6} = \frac{6}{6}$$

$$\frac{1}{R_{eq}} = \frac{1}{1} \Rightarrow R_{eq} = 1\Omega$$

$R_{eq} < R_1$

$R_{eq} < R_2$

$R_{eq} < R_3$

$1 < 2\Omega$

$1 < 3\Omega$

$1 < 6\Omega$