UNIT-2

CURRENT ELECTRICITY

Current Electricity

Charge → Moving → current (I)

$I = Q/t$ unit : Ampere (A)

I → current

Q → charge

t → taken time

Example 2.1

pg: 82

Solution

① Charge (Q) = 120 C

Copper wire (Cu)

time = 1 minutes

current I = ?

$I = \frac{Q}{t}$

$I = \frac{120}{1 \times 60} = \frac{120}{60} = \frac{12}{6} = 2A$

(Creative Question)

② charge (Q) = 120 C

copper wire (Cu)

time = 1 second

current I = ?

$I = \frac{Q}{t}$

$I = \frac{120}{1}$

$I = 120A$

Example : 2.4

pg: 86

3 mark

determine the number of electrons flowing per second through a conductor when a current of 32 A flows through it

solution :

$I = 32\ A$

$t = 1$ second

$n = ?$

n → number of electron = ?

$I = \frac{Q}{t}$ $\quad Q = q$

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

$I = \frac{ne}{t}$

$I \times t = ne$

$n = \frac{It}{e}$ $\quad e = 1.6 \times 10^{-19} C$

$n = \frac{32 \times 1}{1.6 \times 10^{-19}}$

$n = \frac{32}{1.6} \times 10^{+19}$

$n = 20 \times 10^{19}$

$n = 2 \times 10^{1} \times 10^{19}$

$n = 2 \times 10^{20}$ electron

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ohm's law

$I \propto V$

$V = IR$

Current increases

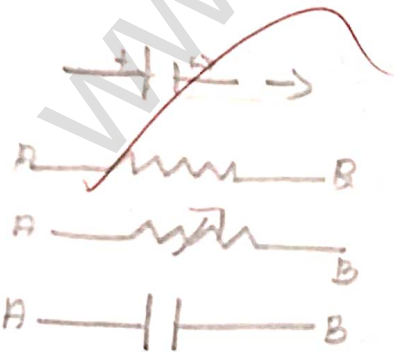
Potential difference increases

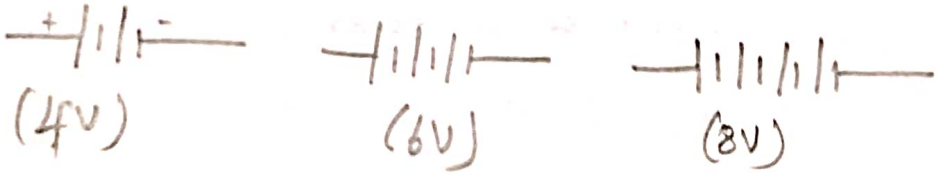
V → Potential difference → unit → volt (V)

I → current → unit → Ampere (A)

R → Resistance → unit → ohm (Ω)

$R \uparrow I \downarrow$ $\quad R \downarrow I \uparrow$



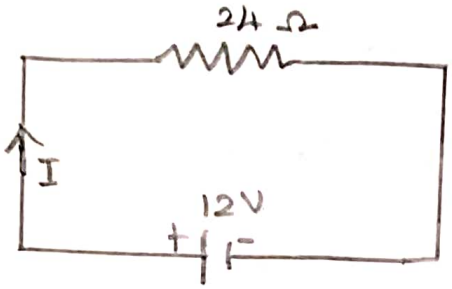


Pg: 88
2 mark

Example: 2.5

A potential difference across 24 Ω resistor is 12 V. What is the current through the resistor?

Solution:



Resistance $R = 24\ \Omega$

Potential difference $V = 12V$

current $I = ?$

Applying ohms law

$V = IR$

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

$I = \frac{12}{24}$

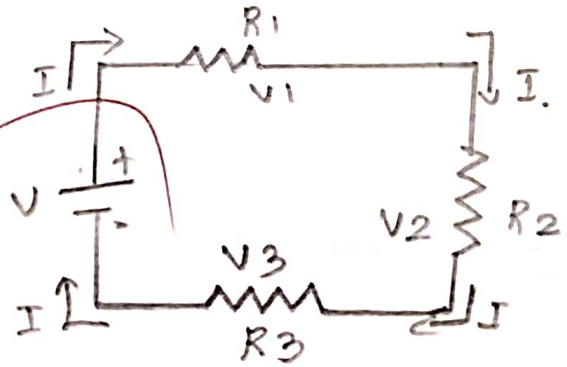
$I = \frac{12}{2 \times 12}$

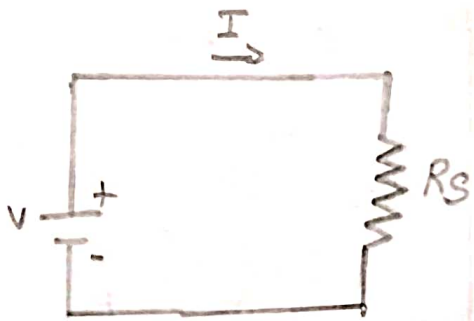
$I = 1/2$

$I = 0.5A$

Pg! 90
3 mark

Resistance in series connection





Applying ohm's law

$V = IR$

$V_1 = IR_1 \rightarrow (1)$

$V_2 = IR_2 \rightarrow (2)$

$V_3 = IR_3 \rightarrow (3)$

Total potential difference

$V = V_1 + V_2 + V_3$

$V = IR_1 + IR_2 + IR_3$

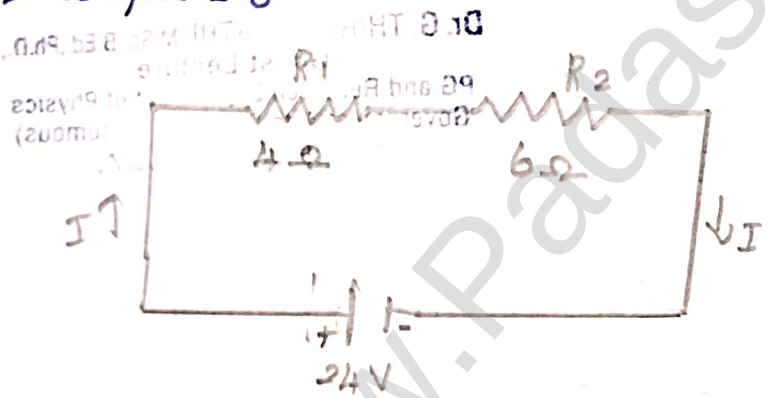
$V = I(R_1 + R_2 + R_3)$

$V = IR_S$

$IR_S = I(R_1 + R_2 + R_3)$

$\boxed{R_S = R_1 + R_2 + R_3}$

Example 2.8



i) R_S ii) I iii) V_1 iv) V_2

i) $R_S = R_1 + R_2$

$R_S = 4 + 6$

$\boxed{= 10\ \Omega}$

ii) $V = IR$

$I = \frac{R}{V} = \frac{V}{R_S} = \frac{24}{10} = \boxed{2.4\ A}$

iii) $V_1 = IR_1$

$V_1 = 2.4 \times 4$

$\boxed{V_1 = 9.6\ V}$

(iv) $V_2 = I R_2$

$V_2 = 2.4 \times 6$

$V_2 = 14.4$

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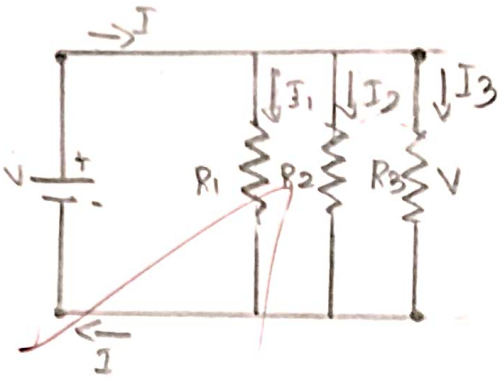
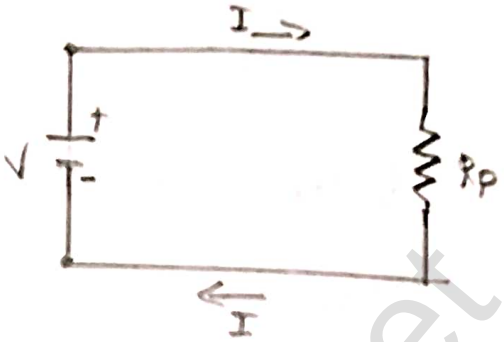
pg:91

Resistors in parallel connection





$$I = I_1 + I_2 + I_3$$

Applying Ohm's law

$$V = IR$$

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

$$I_1 = \frac{V}{R_1} \rightarrow (1)$$

$$I_2 = \frac{V}{R_2} \rightarrow (2)$$

$$I_3 = \frac{V}{R_3} \rightarrow (3)$$

Total current

$$I = I_1 + I_2 + I_3$$

$$I = \frac{V_1}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

$$I = V\left(1/R_1 + 1/R_2 + 1/R_3\right)$$

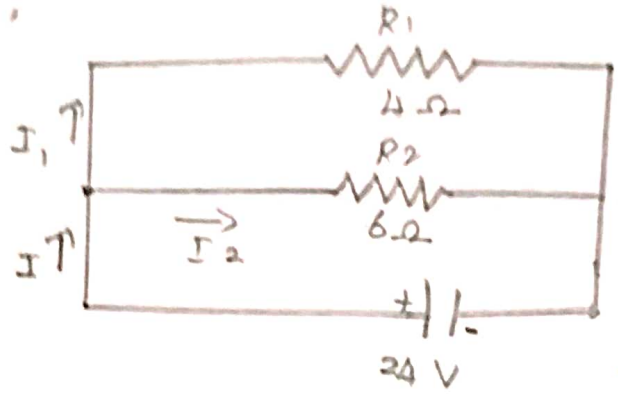
$$\boxed{I = \frac{V}{R_p}}$$

$$\frac{V}{R_p} = V\left(1/R_1 + 1/R_2 + 1/R_3\right)$$

$$\frac{1}{R_p} = 1/R_1 + 1/R_2 + 1/R_3$$

Example 2.9

Solution :



i) $1/R_p = ?$ ii) $I_1 = ?$ iii) $I_2 = ?$ iv) $I = ?$

i) $1/R_p$

$$1/R_p = 1/R_1 + 1/R_2$$

$$1/R_p = 1/4 + 1/6$$

$$1/R_p = \left(\frac{1\times3}{4\times3}\right) + \left(\frac{1\times2}{6\times2}\right)$$

$$1/R_p = \frac{3}{12} + \frac{2}{12} = \frac{3+2}{12}$$

$$1/R_p = \frac{5}{12}$$

$$R_p = \frac{12}{5}\ \Omega$$

ii) $I_1 = ?$

Applying ohm's law

$$V = IR$$

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

$$I_1 = \frac{V}{R_1}$$

$$I_1 = \frac{24}{4}$$

$$\boxed{I_1 = 6\ A}$$

iv) $I_2 = ?$

Applying ohm's law

$V = IR$

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

$I_2 = \frac{V}{R_2}$

$I_2 = \frac{24}{6}$

$\boxed{I_2 = 4A}$

iv) $I = ?$

$I = I_1 + I_2$

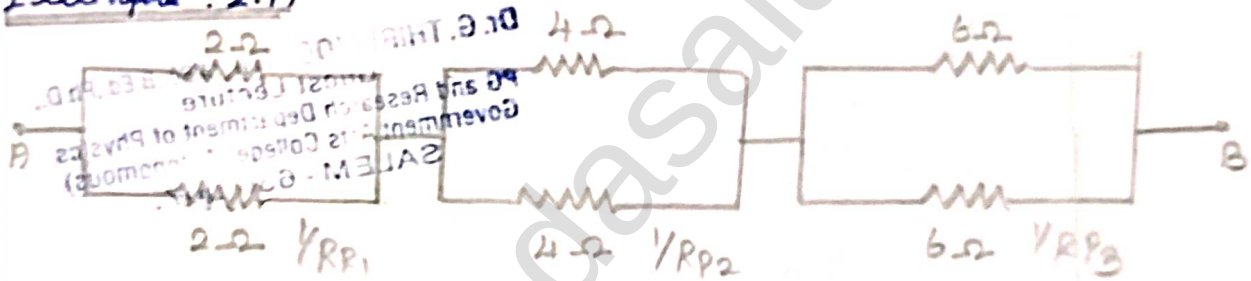
$I = 6 + 4$

$\boxed{I = 10A}$

Example : 2.11

pg:93

5mark



Solution :

1st - diagram

i) $\frac{1}{R_{P_1}} = \frac{1}{R_1} + \frac{1}{R_2}$

$\frac{1}{R_{P_1}} = \frac{1}{2} + \frac{1}{2}$

$\frac{1}{R_{P_1}} = \frac{1+1}{2}$

$\frac{1}{R_{P_1}} = \frac{2}{2} = 1$

$\boxed{R_{P_1} = 1\Omega}$

2nd -> diagram

ii) $\frac{1}{R_{P_2}} = \frac{1}{R_1} + \frac{1}{R_2}$

$1/R_{P_2} = 1/4 + 1/4$

$1/R_{P_2} = \frac{1+1}{4}$

$1/R_{P_2} = 2/4$

$R_{P_2} = 4/2$

$\boxed{R_{P_2} = 2\ \Omega}$

iii) 3rd → Diagram

$\frac{1}{R_{P_3}} = 1/R_1 + 1/R_2$

$\frac{1}{R_{P_3}} = 1/6 + 1/6$

$\frac{1}{R_{P_3}} = \frac{1+1}{6}$

$\frac{1}{R_{P_3}} = 2/6$

$R_{P_3} = 6/2$

$R_{P_3} = 3\ \Omega$

$R_S = R_{P_1} + R_{P_2} + R_{P_3}$

$R_S = 1 + 2 + 3$

$\boxed{R = 6\ \Omega}$