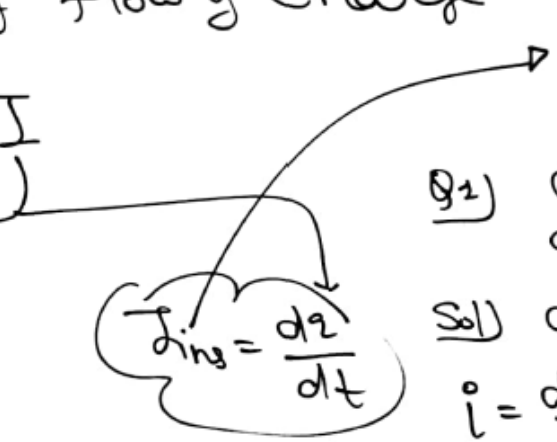
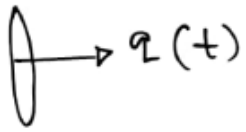
Current electricity

Defⁿ :- of Current :- Rate of flow of charge.





Q1) Charge flow in Conductor
$q = (2t^2 + 9t - 9)$ Coulomb

Sol) q → veriable (OR) Constant

$i = \frac{dq}{dt}$

Slope of q-t graph gives Current.

Current electricity

Q1) Charge in a conductor $q = (2t^2 + 4t - 5)$ C. find Current in conductor at t = 1 sec, 2 sec & 4 sec.

Sol) $i = \frac{dq}{dt} = \frac{d}{dt}(2t^2 + 4t - 5)$

$i = 2(2t^{2-1}) + 4 - 0$

$i = 4t + 4$ → Current as function of time.

$t = 1$ sec, $i_{t=1} = 4 \times 1 + 4 = 8$ Amp.

$t = 2$) $i_{t=2} = 4 \times 2 + 4 = 12$ Amp.

$t = 4$ & $i_{t=4} = 4 \times 4 + 4 = 20$ Amp.

$\frac{dx^4}{dx} = 4x^{4-1} = 4x^3$

Ex $\frac{d3x^4}{dx} = 3\frac{dx^4}{dx} = 3[4x^{4-1}] = 12x^3$

Q2) $Q = t^2 - 2t$. find Current at t = 1 sec & 2 sec. & also find time when current is zero.

Solve) $Q = t^2 - 2t$

$i = \frac{dQ}{dt} = \frac{d}{dt}(t^2 - 2t)$

$i = 2t^{2-1} - 2(1t^{1-1})$

$= 2t - 2t^0$

$i = 2t - 2$ → $i = 2t - 2$, $0 = 2t - 2$, $2 = 2t$, $t = 1$ sec

$t = 1$, $i_{t=1} = 2 \times 1 - 2 = 0$

($t = 2$ sec) $i_{t=2}$, $2 \times 2 - 2 = 2$ Amp

Charge flow in a Conductor — Current electricity

Q3) $Q = (t^3 - 6t^2 + 12)\ C$. Find i at $t = 0$, $t = 1$ sec & find time when $i = 0$.

Solve:- $Q = (t^3 - 6t^2 + 12)\ C$

$$i = \frac{dQ}{dt} = \frac{d}{dt}(t^3 - 6t^2 + 12)$$

$$i = 3t^{3-1} - 6(2t^{2-1}) + 0$$

$$i = 3t^2 - 12t$$

$t = 0$, $i = 0$ Amp

$t = 1$, $i = 3 - 12 = -9$ Amp

$$i = 3t^2 - 12t$$

$$0 = 3t(t - 4)$$

$t = 0$

$t - 4 = 0$

$t = 4$

Current electricity

Eqⁿ → Relation b/w i & q

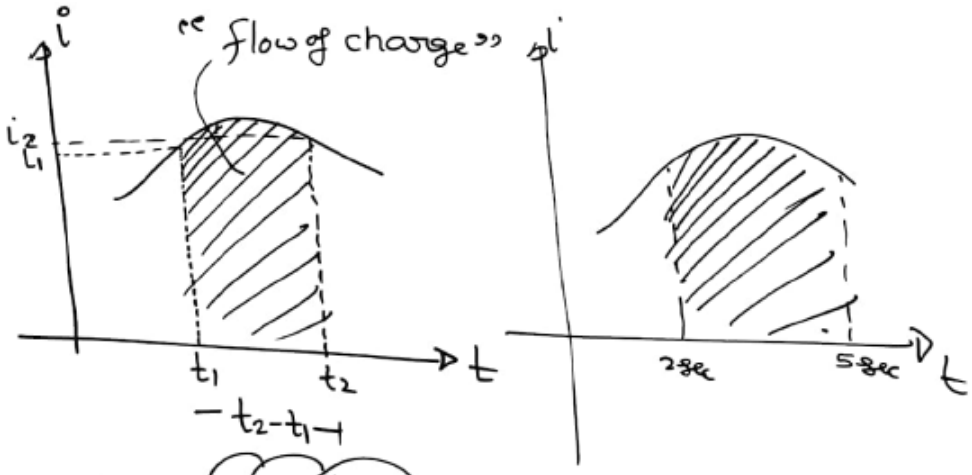
$$i = \frac{dq}{dt}$$

$$\int dq = \int_{t_1}^{t_2} i\,dt$$

$$\Rightarrow q_{flow} = \int_{t_1}^{t_2} i\,dt$$

(P area of i-t graph

area of current-time graph gives Total charge flow)



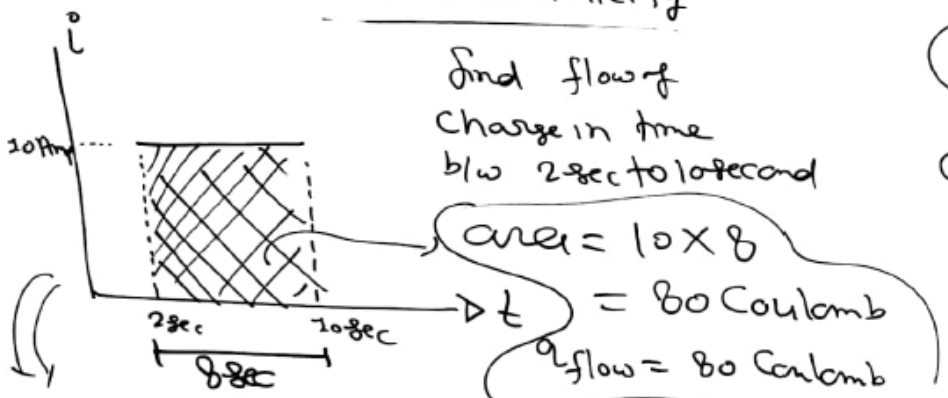
$i = \frac{dq}{dt}$

Slope of (q-t) graph gives current

$q = \int i\,dt$ ⇒ area of i-t graph gives total flow of charge

Current electricity

(a)



Find flow of Charge in time b/w 2sec to 10second

area = 10 × 8
= 80 Coulomb
q_{flow} = 80 Coulomb

Matlab

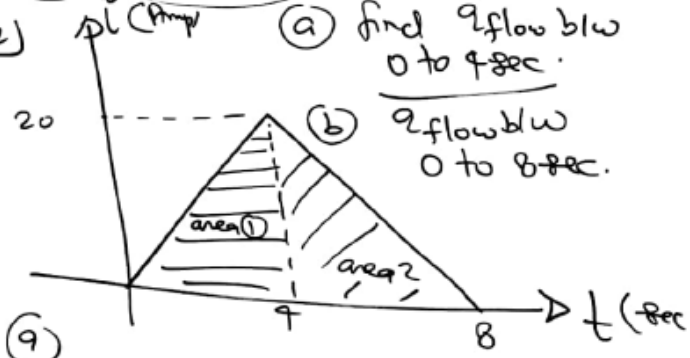
10 Amp = 10C/sec

$q = it$

$q_{flow} = 10_{C/sec} \times 8$
$= 80C$

$q_{flow} = \int i\,dt$

Q2)



(a) find q_{flow} b/w 0 to 4sec.

(b) q_{flow} b/w 0 to 8sec.

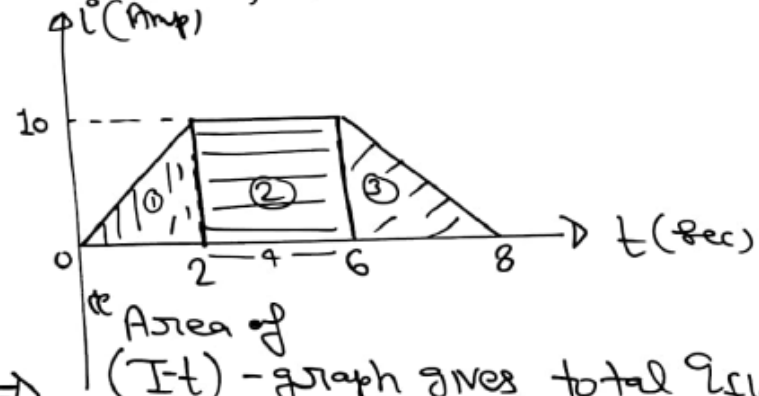
(a) $q_{flow(0-4)}$ = Area of (i-t) curve

$= \frac{1}{2} \times 4 \times 20 = 40C$

(b) $q_{flow(0-8)} = \frac{1}{2} \times 8 \times 20 = 80C$

Current electricity

(94) find q_{flow} b/w $t=0$ to $t=8$ sec.

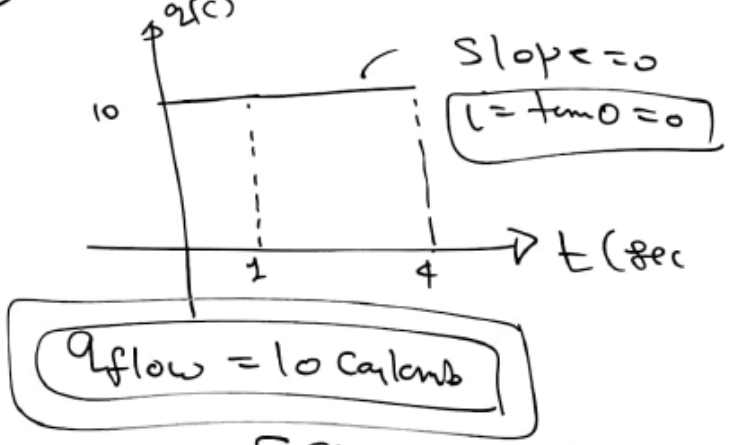


⇒ "Area of (I-t) - graph gives total q_{flow}"

$$\frac{1}{2}\times 2\times 10 + 4\times 10 + \frac{1}{2}\times 2\times 10$$

$$10 + 40 + 10 = 60\,C$$

(95) find q_{flow} b/w $t=1$ to 4 sec



$q_{flow} = 10$ Coulomb

$i = 0$ [Slope of q-t graph gives current]

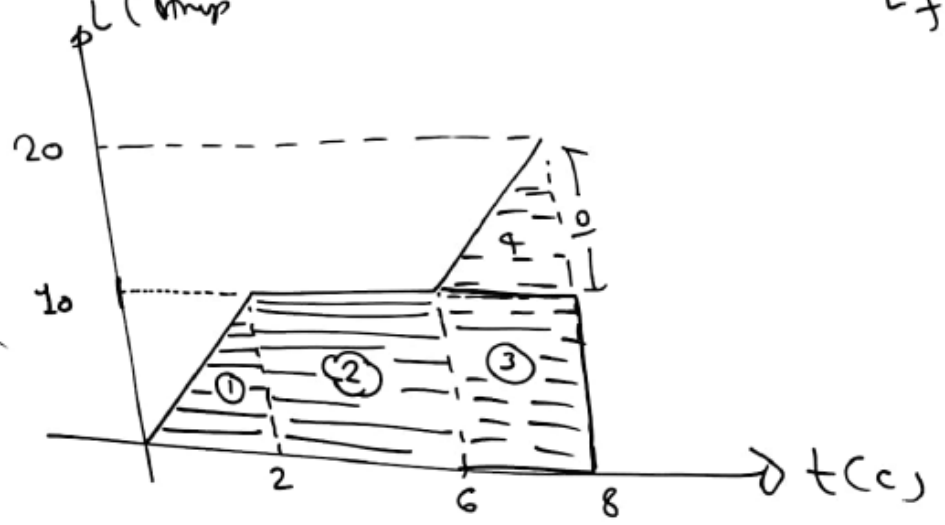
$q_{t=1} = 10C$

$q_{t=4\,sec} = 10C$

$\Delta\varepsilon = 0$

Current electricity

(11) Find q_{flow} b/w $t=0$ to $t=8$ sec.



$$q_{flow} = ① + ② + ③ + q$$

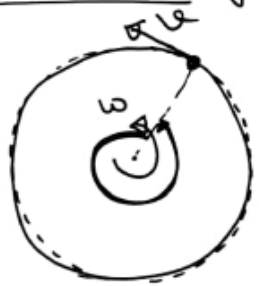
$$= \frac{1}{2} \times 2 \times 10 + 4 \times 10 + 2 \times 10 + \frac{1}{2} \times 2 \times 10$$

$$= 10 + 40 + 20 + 10$$

$$= \underline{80 \text{ Coulomb}}$$

⇒ Angular velocity (ω) = $\frac{\text{Angular displacement}}{\text{time}}$

$\omega = \frac{2\pi}{T} \Rightarrow T = \frac{2\pi}{\omega}$



ω → constant angular velocity

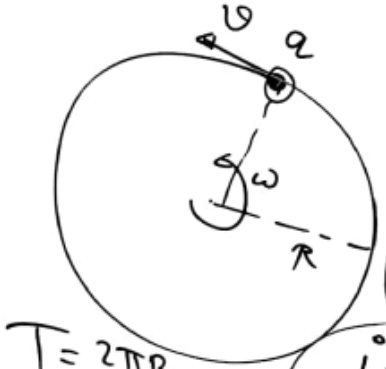
$\omega = \frac{2\pi}{T} = \frac{2\pi}{T} = 2\pi\left(\frac{1}{T}\right) = 2\pi f$

| — (10)

(100)

⇒ frequency (f) ⇒ $f = \frac{1}{T}$

$T = \frac{2\pi R}{v}$ $v = \omega R$



$T = \frac{2\pi R}{v}$

$i_{av} = \frac{q}{T} = \frac{q}{\quad}$

$i_{av} = q\left(\frac{1}{T}\right) = qf$

$i = \frac{q}{\frac{2\pi R}{v}} = \frac{qv}{2\pi R}$

$i = \frac{q}{T} = \frac{q}{\frac{2\pi}{\omega}} = \frac{q\omega}{2\pi}$

Current electricity

Q1) A charge $q = 2C$ move in circular conducting path. of. Radius 4m with angular velocity 4 rad/sec. Find Circuit in path.

$\omega = \frac{2\pi}{T}$

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

$i = \frac{q}{\frac{2\pi}{\omega}}$

$i = \frac{q\omega}{2\pi}$

$\omega = \frac{2\pi}{T} \Rightarrow T = \frac{2\pi}{\omega}$

$\therefore$

$i_{av} = \frac{q}{T} = \frac{q}{}$

$i_{av} = q\left(\frac{1}{T}\right) = qf$

$i = \frac{q}{\frac{2\pi R}{v}} = \frac{qv}{2\pi R}$

$i = \frac{q}{T} = \frac{q}{\frac{2\pi}{\omega}} = \frac{q\omega}{2\pi}$