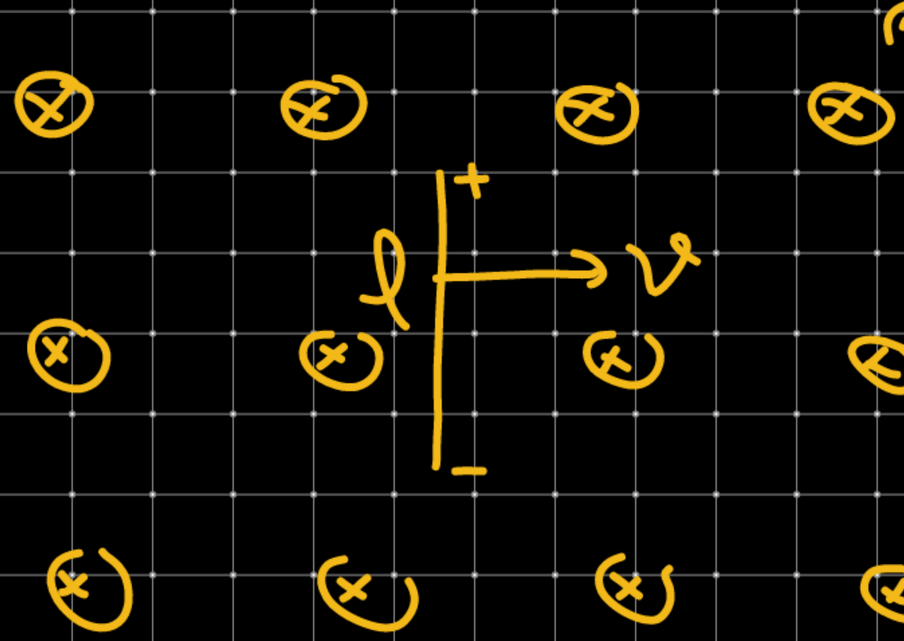
⇒ Motional Emf -1

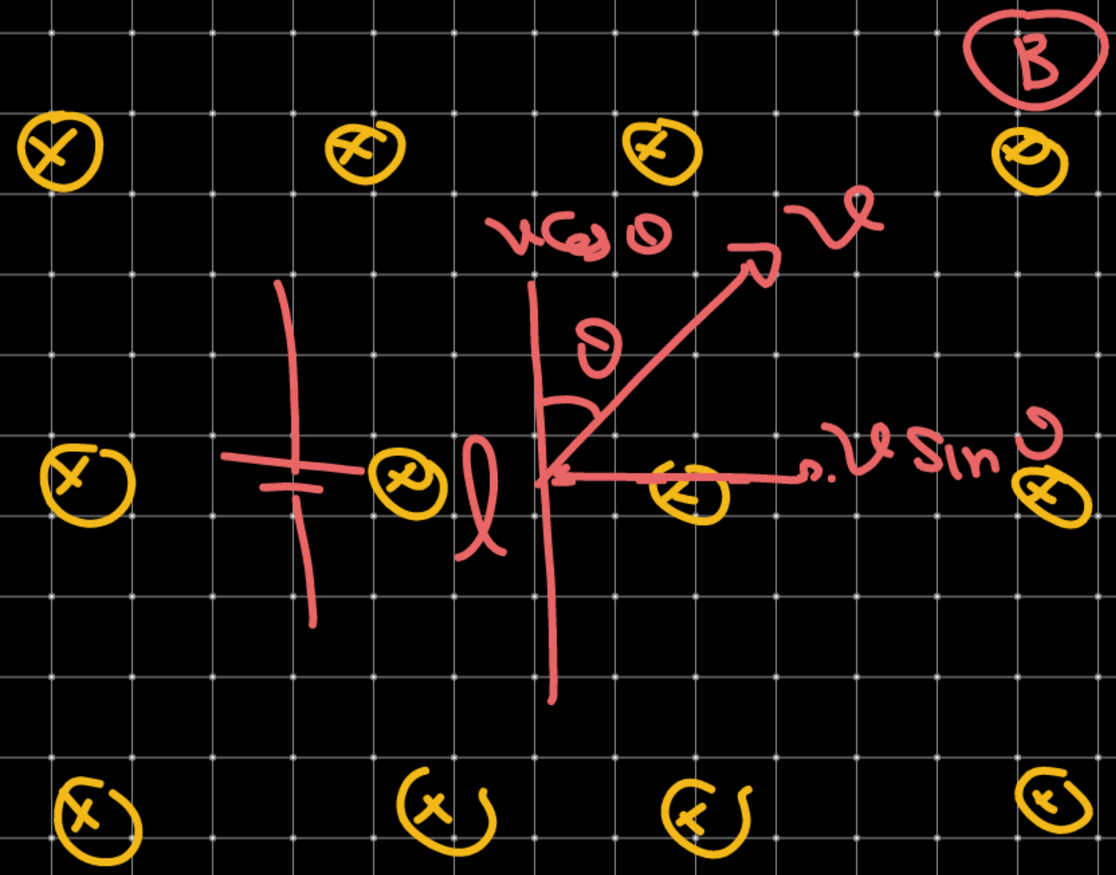


B l v l

$\mathcal{E}_{motion} = vBl$

$\mathcal{E} = vBl$

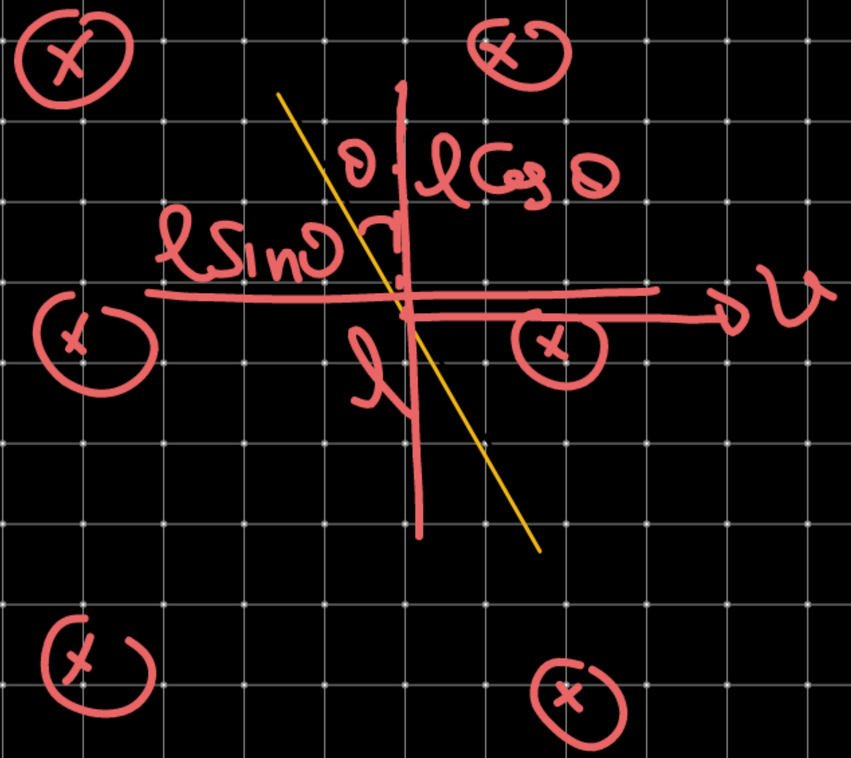
$F = q\bar{v} \times \bar{B}$



$$\mathcal{E}_m = B_1 v_1 l_1$$

$$= Bv\sin\theta\, l$$

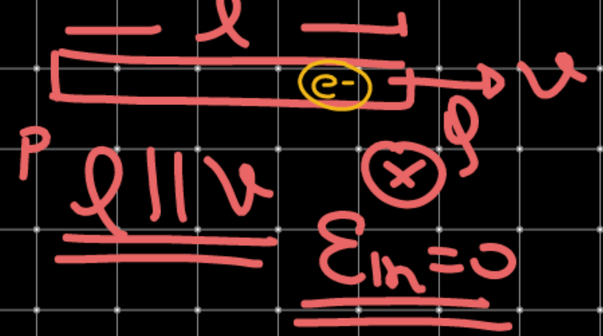
$$= \underline{vBl\sin\theta}$$



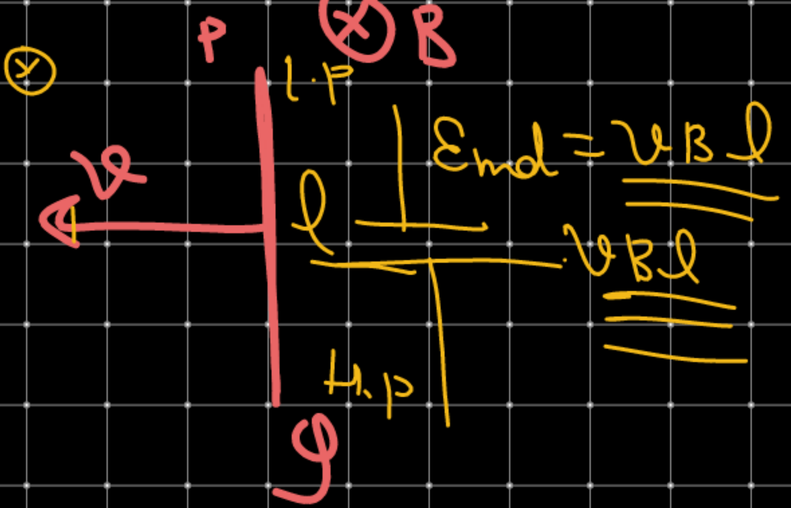
$$\mathcal{E} = vB\ell\cos\theta$$

Q1) These conducting rods(l) are moving in uniform field B as show. find ε_{ind} & polarity of +ive & -ive.

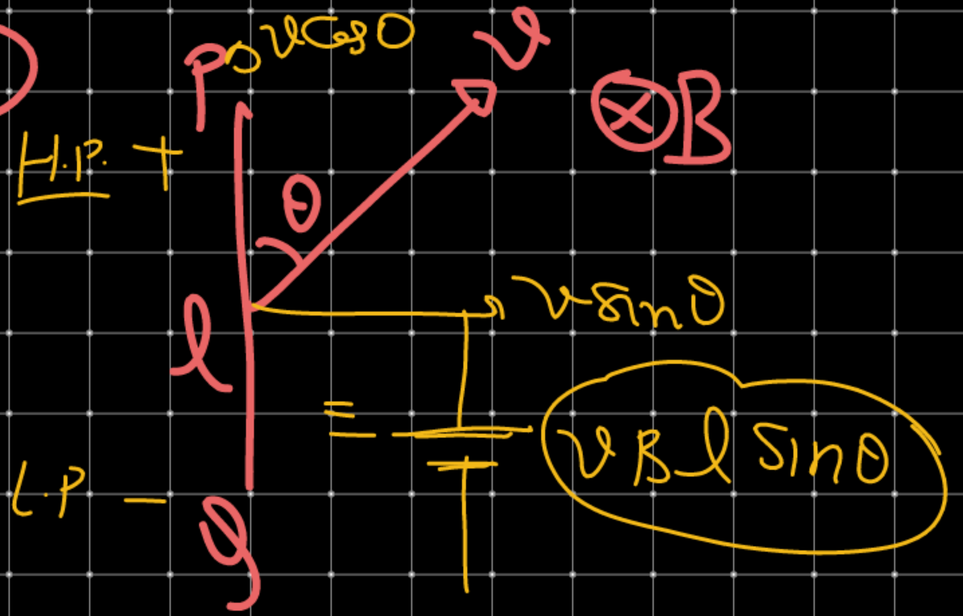
(I)



(II)



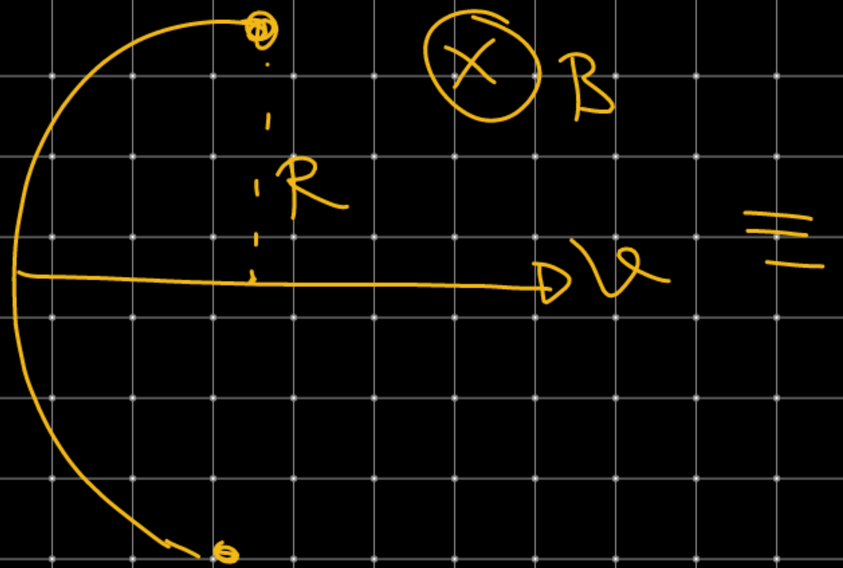
(III)



$\otimes\otimes$ l_{eff} -

Find induced emf.

$$\mathcal{E}_{ind} = v_1 B_1 l_1$$

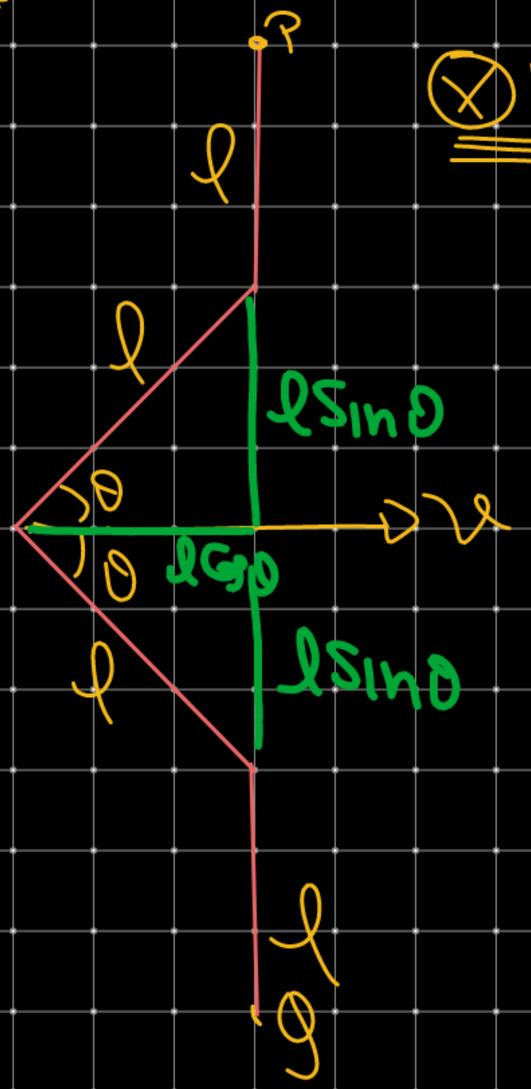


$\equiv$

$$v = \frac{1}{1} v B 2R$$

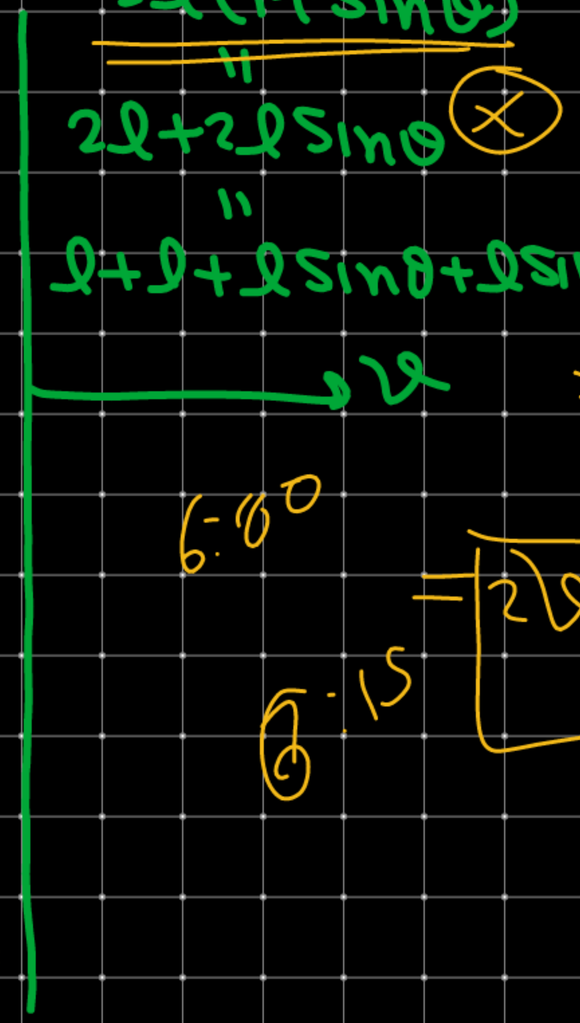
$$= 2vBR$$

Find $\mathcal{E}$ of given figure.



$\otimes B$

$\equiv$



$2l(1+\sin\theta)$

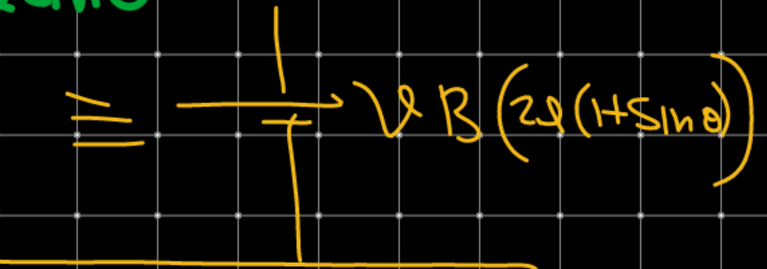
$=$

$2l+2l\sin\theta$ $\otimes$

$=$

$l+l+l\sin\theta+l\sin\theta$

$\equiv$

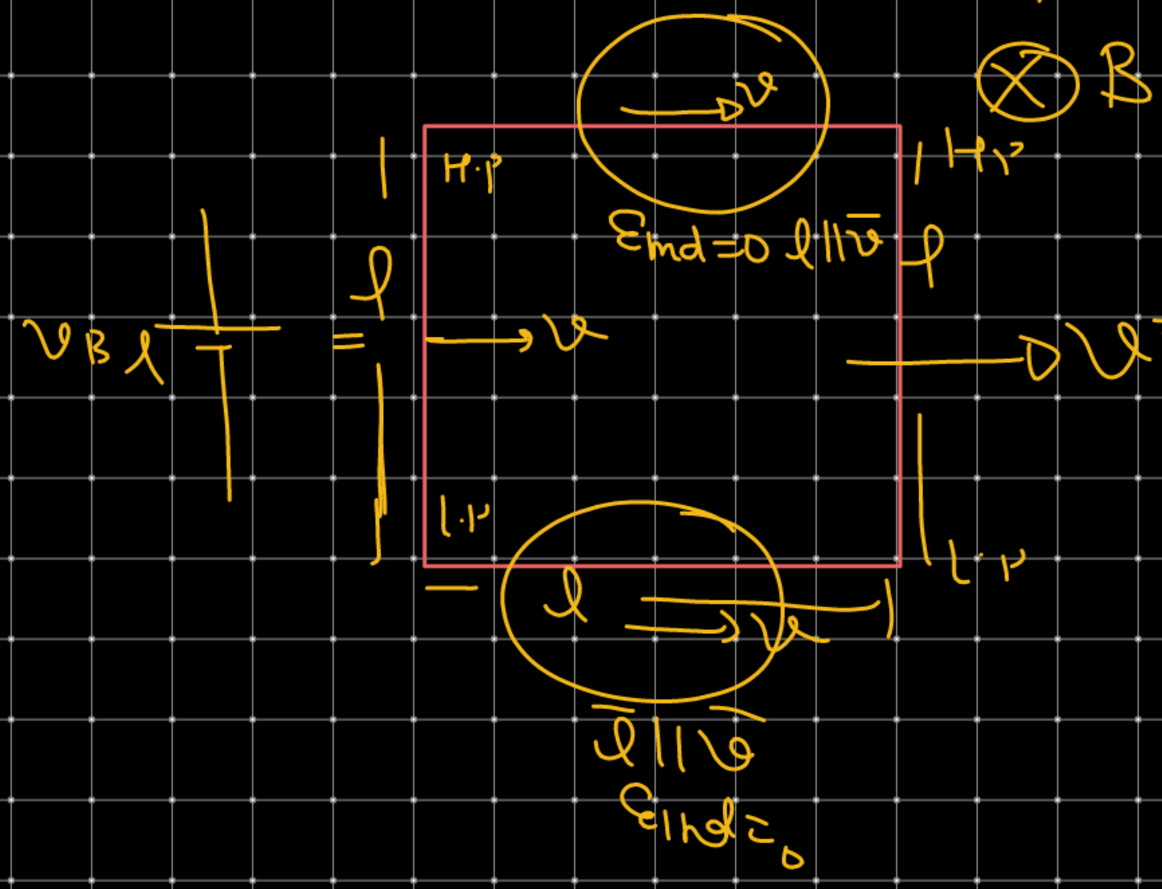


$\theta : 0^\circ$

$\theta : 15^\circ$

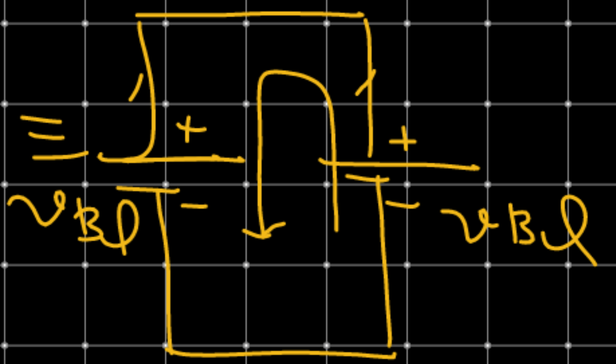
$= \boxed{2vBl(1+\sin\theta)}$

Q) Find induced Emf in loop.



$$v_B l \frac{1}{T} = \frac{l}{T} \rightarrow \Delta V = \frac{1}{T} v_B l$$

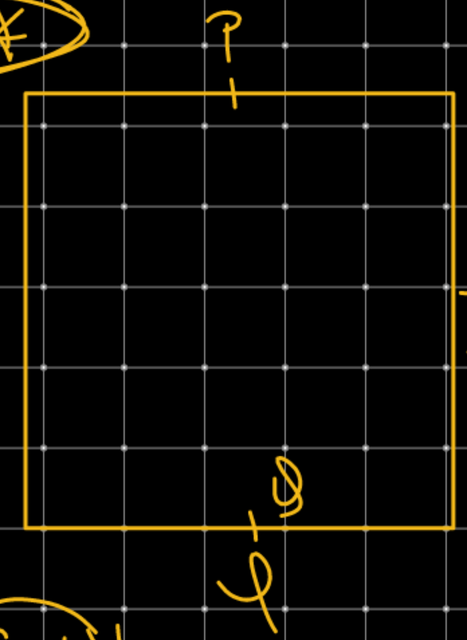
$$\vec{F} = q(\vec{v} \times \vec{B})$$



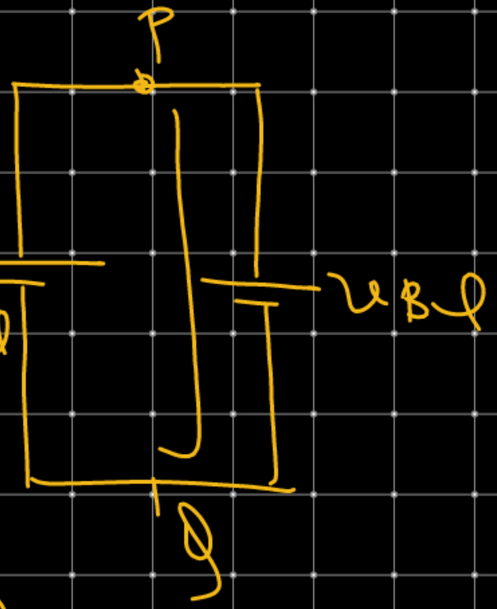
$v_B l - v_B l = 0$

$\varepsilon_{ind} = 0$

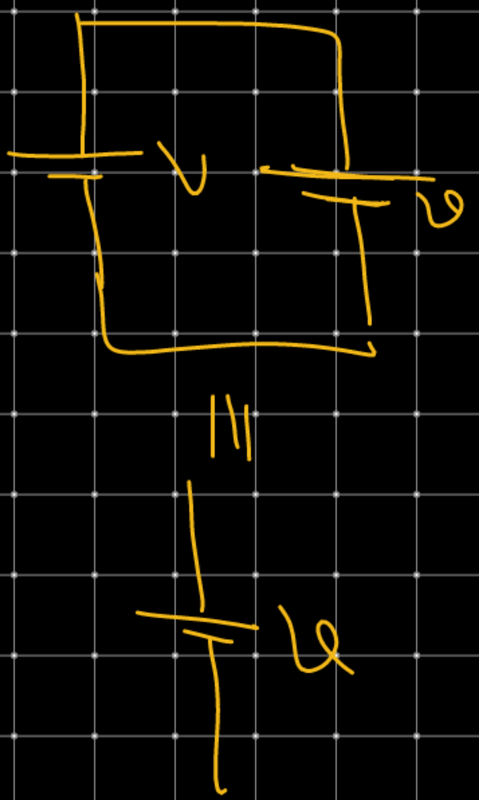
Find induced Emf b/w P & Q



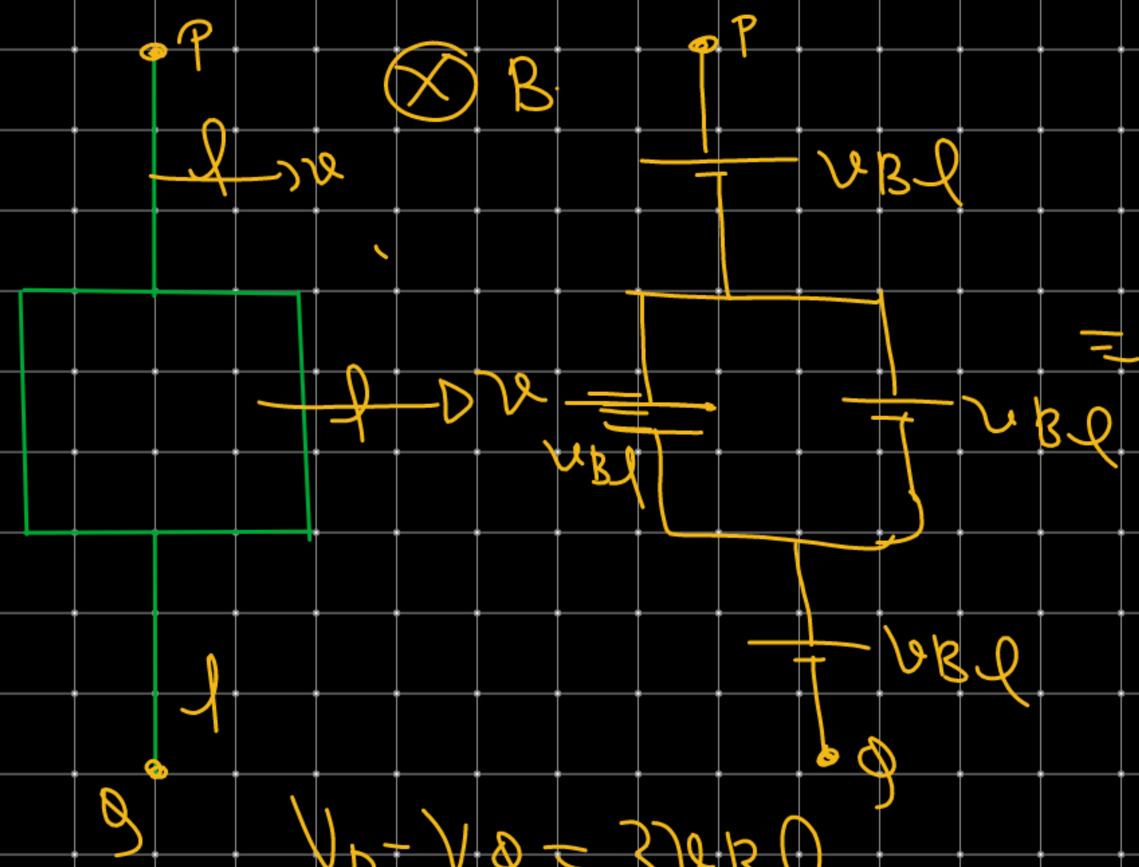
got it

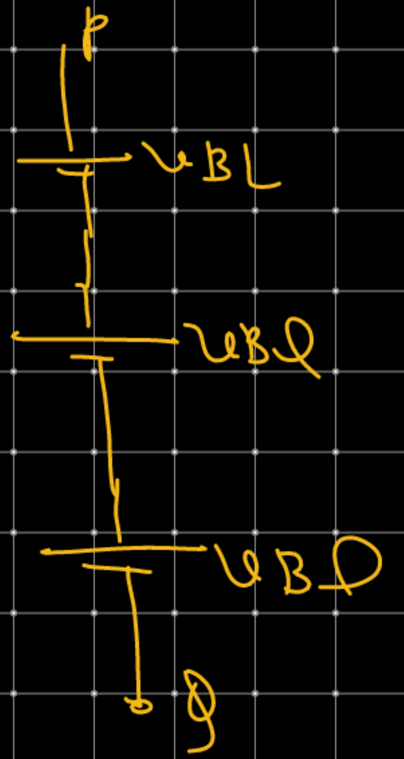


$$\varepsilon_{PQ} = vBl$$



8) Find P.D b/w P & Q.

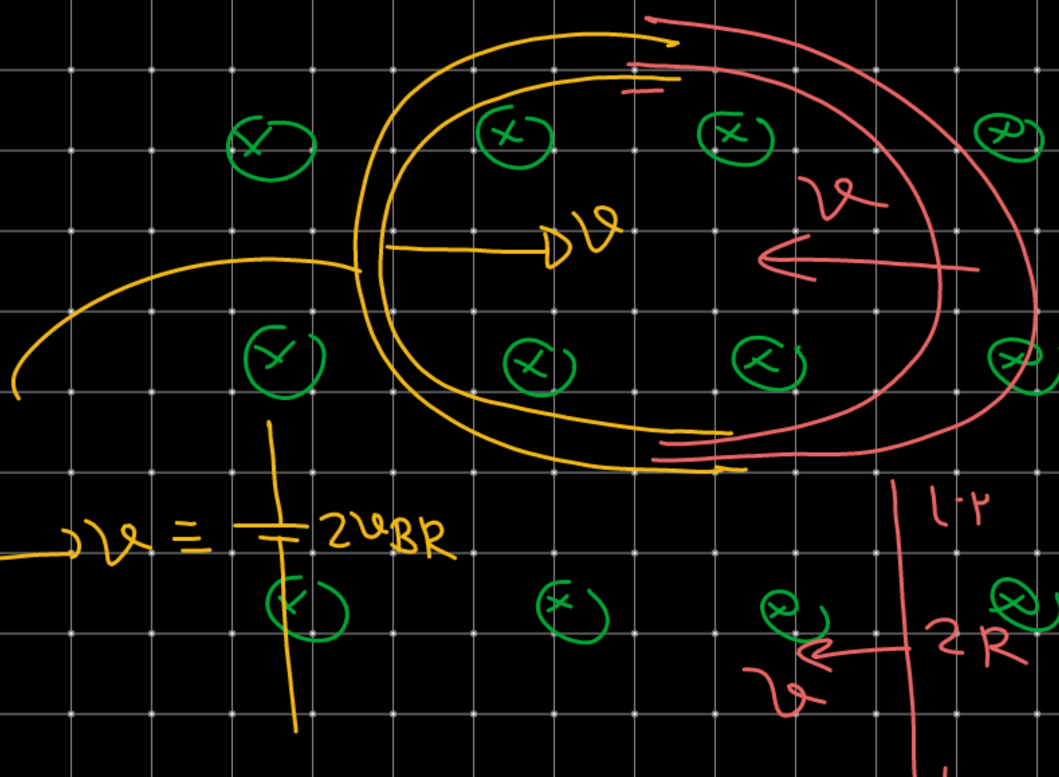


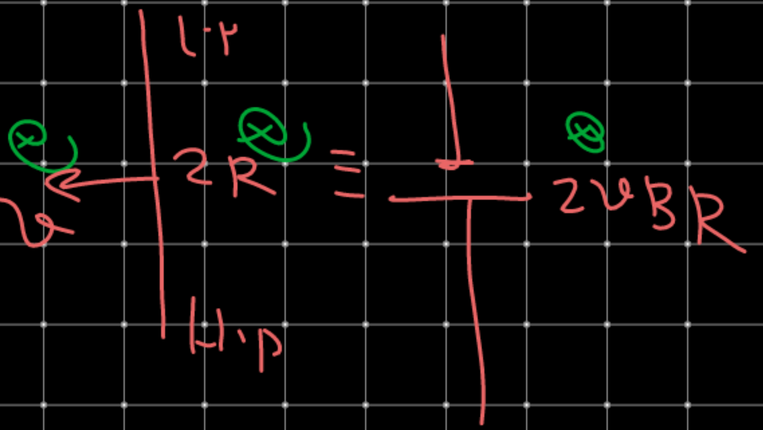


$V_P - V_Q = 3vBl$

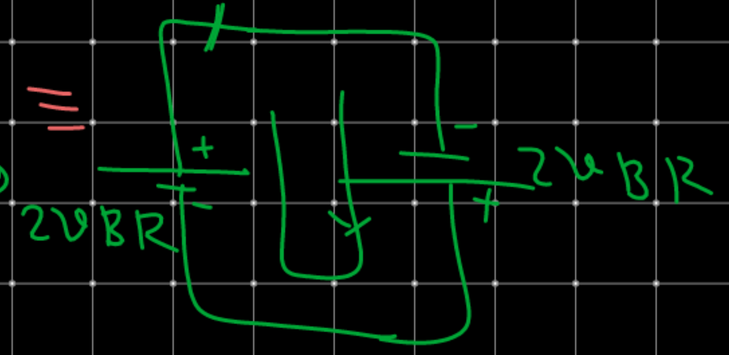
AIEEE(2005)

Radius = R





End emf in loop



2vBR + 2vBR

= 4vBR

Jmp 2020 Neet-1

ABLES KOTA

Motional Emf due to rotation of rod with (uniform velocity)

induced Emf due to small dx element

$d\varepsilon = vBdx = \omega x B dx$

ε_{ind} Emf due to complete rod:

$$\int d\varepsilon = \omega B \int_0^l x\,dx$$

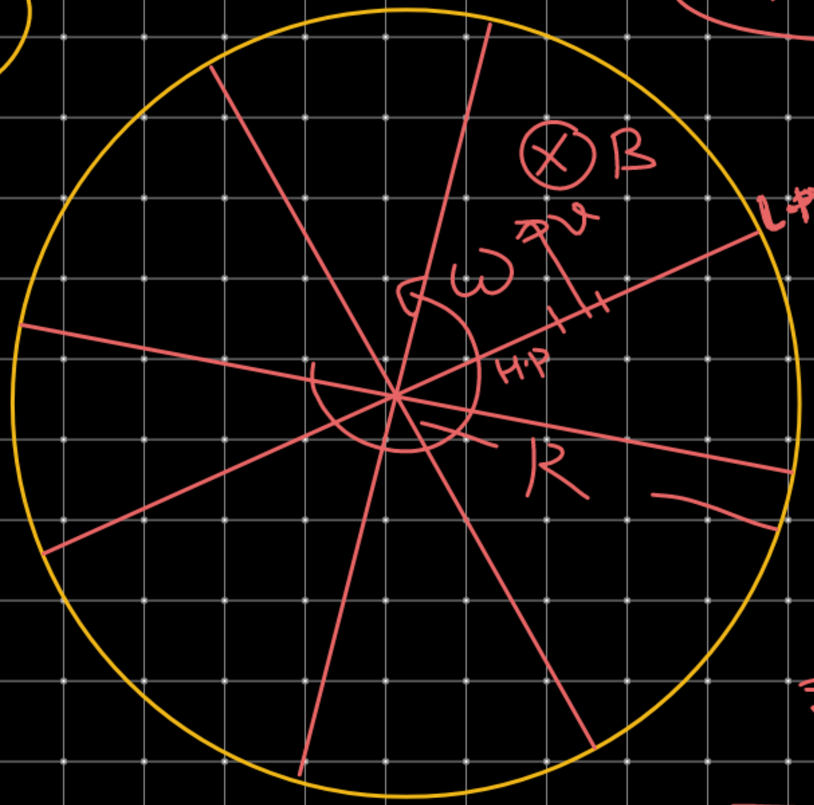
$$\varepsilon_{ind} = \omega B \left[\frac{x^2}{2}\right]_0^l$$

$$= \omega B \left[\frac{l^2}{2} - 0\right]$$

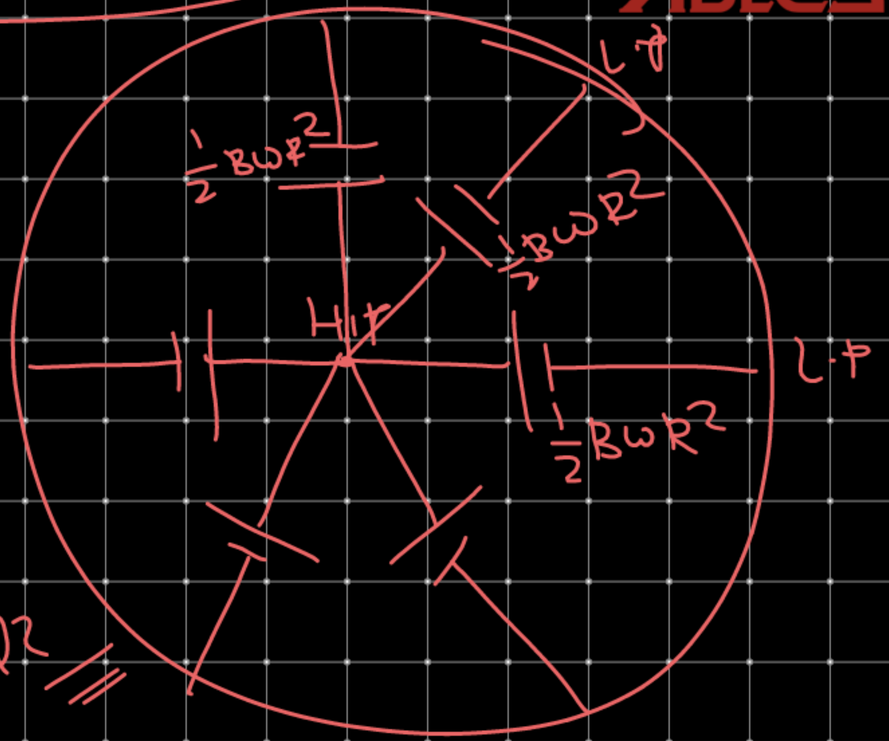
$$= \frac{1}{2}\omega B l^2 = \frac{1}{2} B \omega l^2$$

Rim

n-Spoke



≡

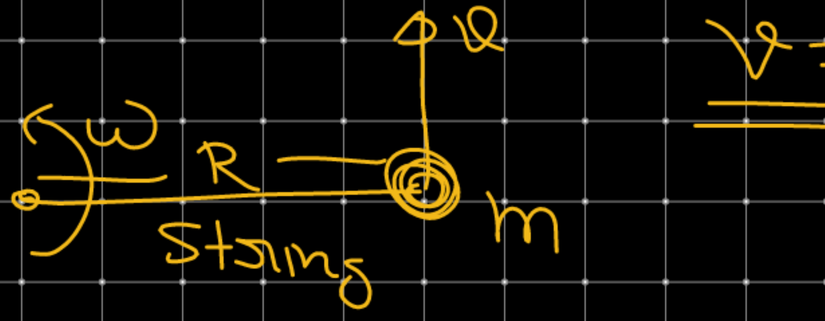


$\frac{1}{2}B\omega l^2$ ≡

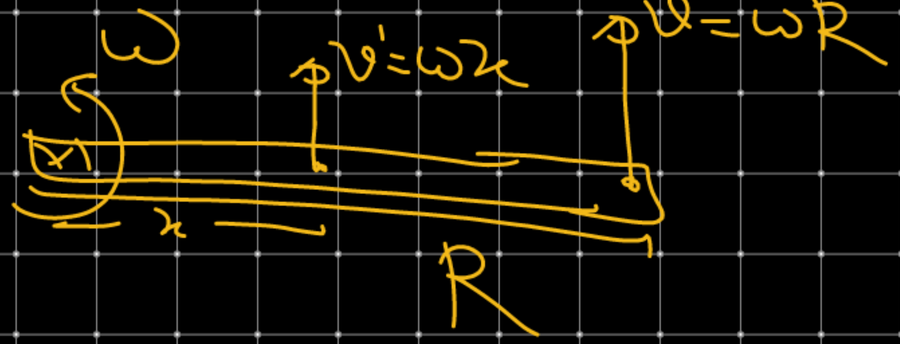
n-Parallel batteries

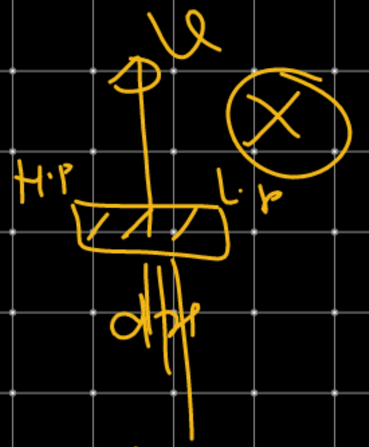
$\frac{1}{2}B\omega l^2$ ≡

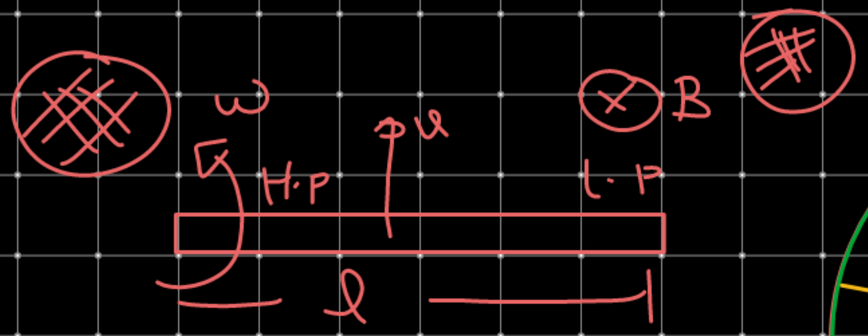
ω = angular velocity



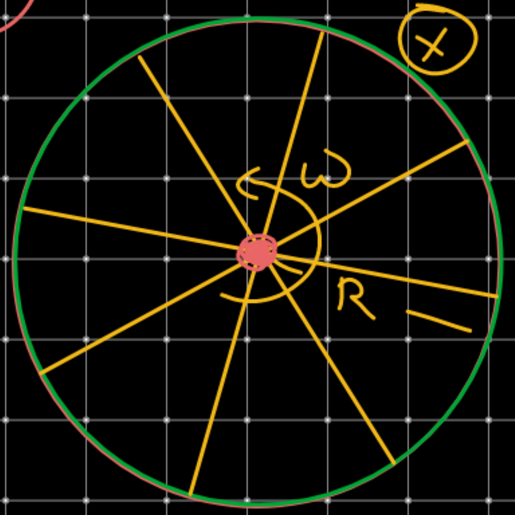
$v = \omega R$

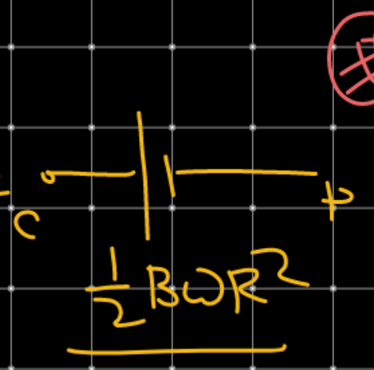




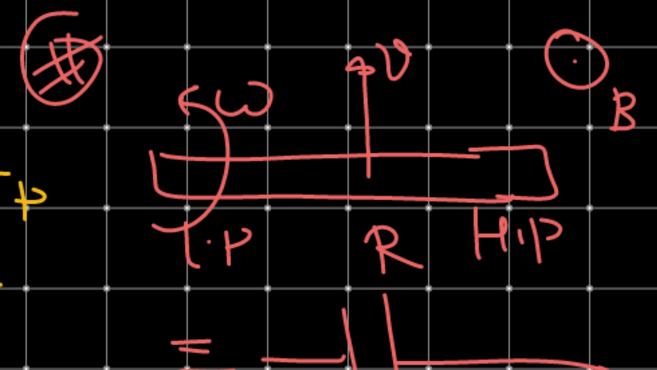


$$\frac{1}{2}B\omega l^2$$

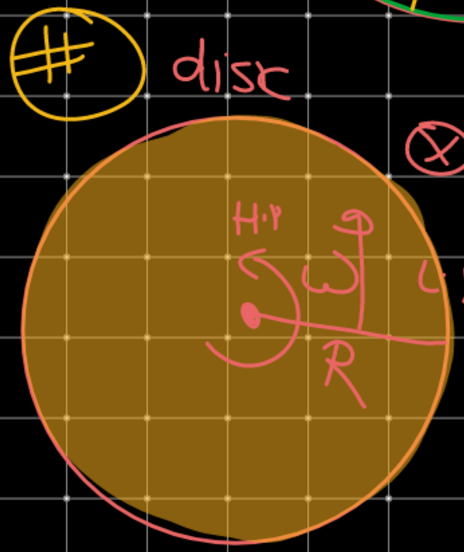


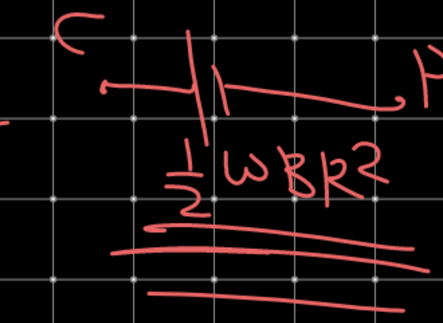


$$\frac{1}{2}B\omega R^2$$



$$\frac{1}{2}B\omega R^2$$





$$\frac{1}{2}\omega BR^2$$

NEET A wheel with 20 metallic spokes each 1m long is rotated a speed of 120 rpm in a plane perpendicular to magnetic field of 0.4G. The induced Emf b/w the axle & rim of the wheel will be:
[$1G = 10^{-4}T$]

(1) $2.51\times10^{-4}V$

(2) $2.51\times10^{-5}V$

(3) $4\times10^{-5}V$

(4) $2.51V$

$$\varepsilon_{ind} = \frac{1}{2}B\omega R^2$$

$$= \frac{1}{2}\times 0.4\times10^{-4}\times 1^2 \times \begin{cases} \omega = 120 \text{ round per min} \\ \omega = \frac{120}{60} \text{ per second} \\ \omega = 2 \text{ round/sec} \\ \omega = 2\times 2\pi \text{ rad/sec} \\ \omega = 4\pi \text{ rad/sec} \end{cases}$$

$$= \frac{1}{2}\times 0.4\times10^{-4}\times 1\times 4\pi$$

$$= 2\pi\times 4\times10^{-5}$$

$$= 8\pi\times10^{-5}\ \text{Volt}$$

8×3.14

$= 25.12\times10^{-5}$

$= 2.512\times10^{-4}$

$= 2.51\times10^{-4}V$

2019) NEET

A Cycle wheel of radius 0.5m is rotated with constant angular velocity of 10 rad/sec. in a region of magnetic field of 0.1T which is perpendicular to the Plane of wheel. Find emf b/w centre & rim.

(a) 0.25V.

(b) 0.125V.

(c) 0.5V.

(d) zero.

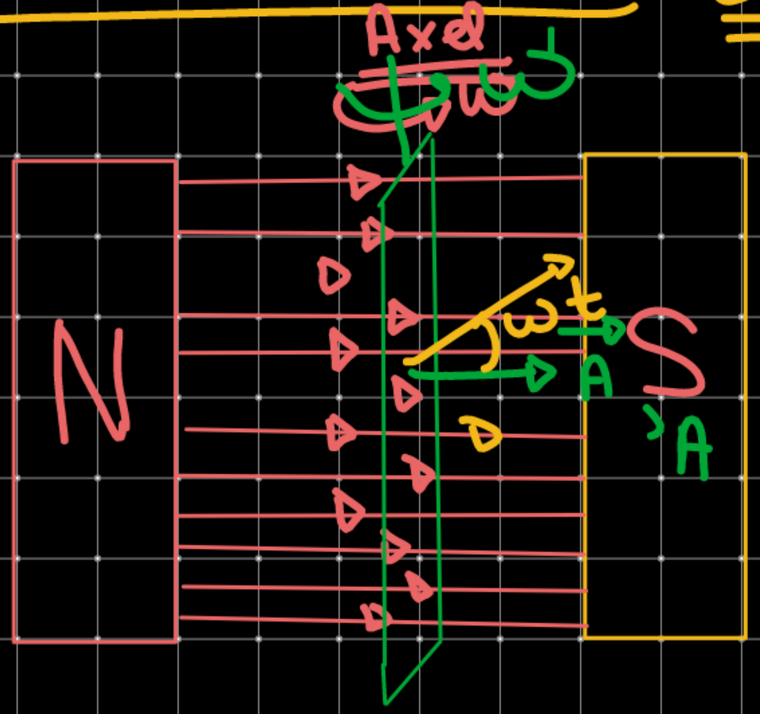
$$\varepsilon_{ind} = \frac{1}{2} B\omega l^2$$

$$= \frac{1}{2} \times (0.1 \times 10) \times \left(\frac{1}{2}\right)^2$$

$$= \frac{1}{2} \times 1 \times \frac{1}{4} = \frac{1}{8} = 0.125 \text{ Volt}$$

Periodic Induction :- [AC]

$\varepsilon_{ind} = BA\omega \sin\omega t$



$t = 0$ $\quad \phi = BA$

$t = \quad \theta = \omega t$

$\phi = \vec{B} \cdot \vec{A}$

$= BA\cos\theta$

$\phi = BA\cos\omega t$

$\varepsilon_{ind} = \frac{d\phi}{dt} = \frac{d}{dt}(BA\cos\omega t)$

$\varepsilon_{ind} = -BA(\sin\omega t) \times \omega$

$|\varepsilon_{ind}| = BA\omega \sin\omega t$

ω ⟶ SI unit radian per second

$\omega = 120$ round per min

$\omega = \frac{120}{60} 2$ round/second

$= 2 \times 2\pi$ rad/sec

$\boxed{\omega = 4\pi \text{ rad/sec}}$