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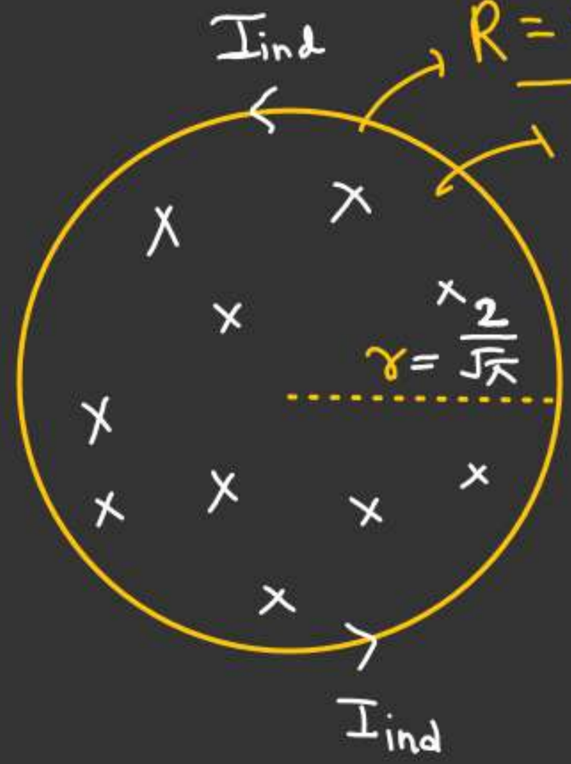
★4

Charge flow.

$$\Delta q = \left[\frac{\Delta\phi}{R}\right]$$

At $t=0$, Magnetic field is switch on, find charge flow in the loop in the interval $t = 1$ sec to $t = 2$ sec

(Flux → Weber)



$B = 2t^2 \uparrow$

$\phi_{ext} \uparrow$

$$\phi = B \cdot A \cdot \cos\pi$$

$$\phi = -BA = -(2t^2)\,\pi\left(\frac{2}{\sqrt{\pi}}\right)^2$$

$$\phi = -8t^2$$

$$\phi_{t=1sec} = -8(1) = -8$$

$$\phi_{t=2sec} = -8(2)^2 = -32$$

$$\Delta\phi = \phi_{t=2sec} - \phi_{t=1sec}$$
$$= -32 - (-8)$$
$$= -32 + 8$$
$$= -24$$

$$\Delta q = \frac{|\Delta\phi|}{R}$$

$$\Delta q = \left(\frac{24}{4}\right) = 6$$

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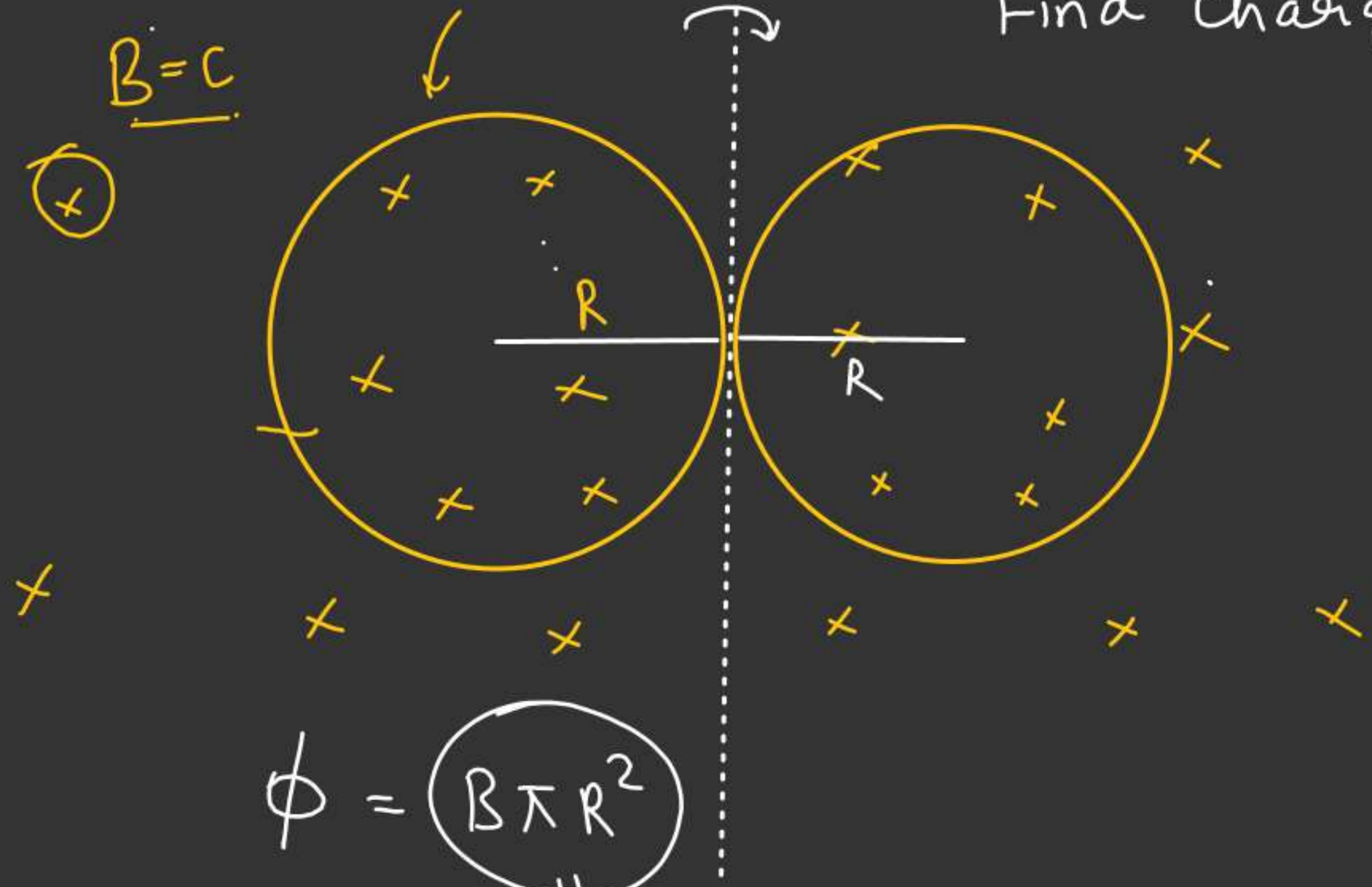
R = Resistance

Loop rotated by 180°
Find Charge flow.

$B = C$



$$\phi = \boxed{B\pi R^2} \Downarrow \text{Constant}$$

$$\left[\begin{array}{l} \varepsilon_{ind} = \frac{d\phi}{dt} = 0 \\ I_{ind} = 0 \end{array}\right.$$

$$\phi_i = BA\cos\pi$$
$$= -BA$$

$$\phi_f = BA\cos 0^\circ$$
$$= BA$$

$$\Delta\phi = \phi_f - \phi_i$$
$$= BA - (-BA)$$
$$= 2BA$$

$$\Delta q = \frac{\Delta\phi}{R} = \left(\frac{2BA}{R}\right)$$

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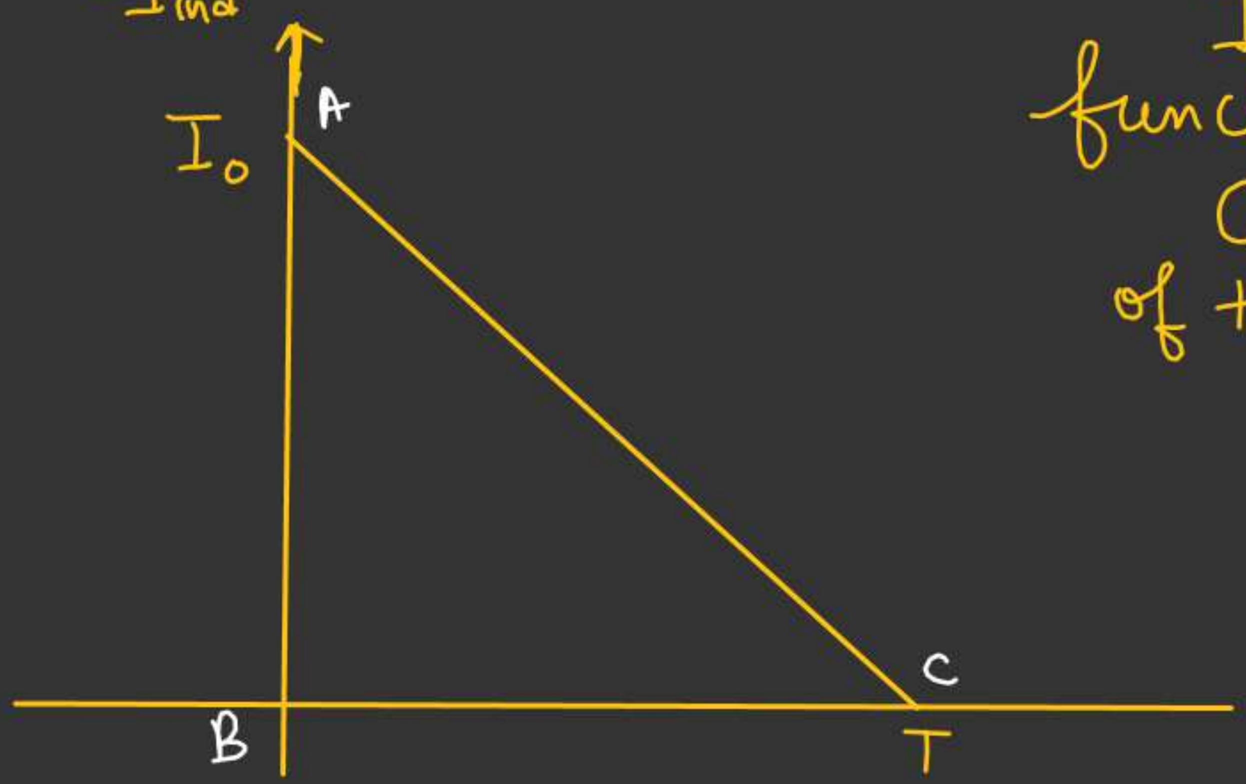

Induced Current in a loop as a function of time is given. find the Change in flux. if R is the resistance of the loop.

Sol^n:-

$$\Delta q = \frac{\Delta\phi}{R}$$

$$\Delta\phi = (\Delta q)R$$

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

$$\int_0^{\Delta q} dq = \int_0^T i\,dt$$

$\Downarrow$

Area under i Vs t curve.

Δq = Area of ΔABC

$= \frac{1}{2} \times T \times I_0$

$$\Delta\phi = \left(\frac{I_0 T R}{2}\right).$$

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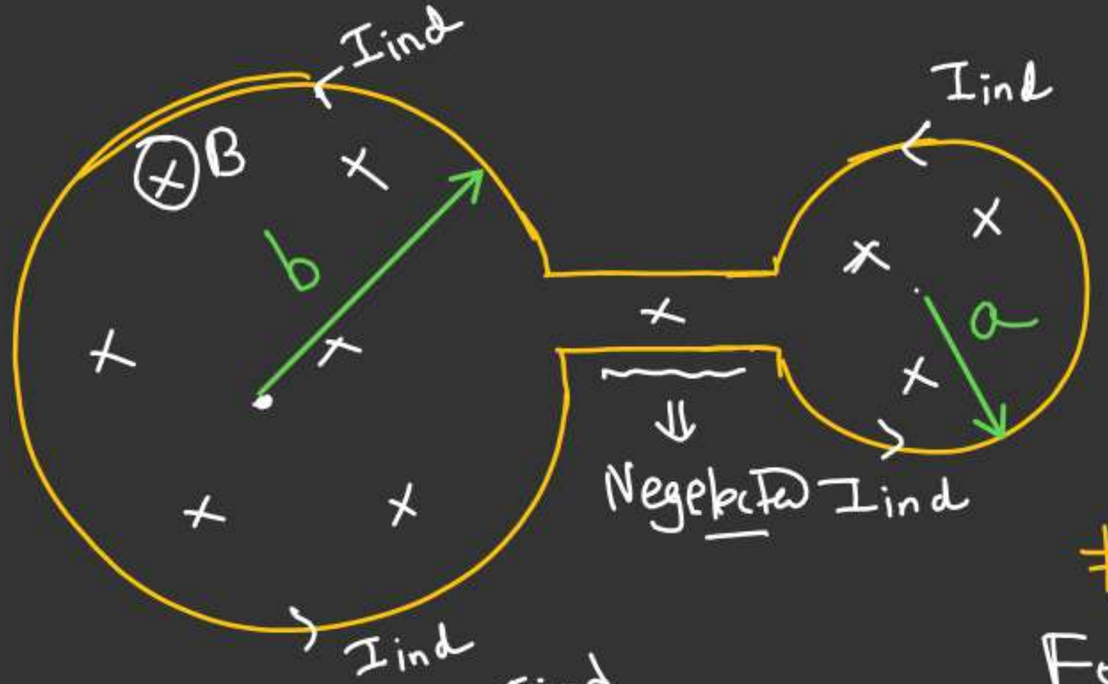
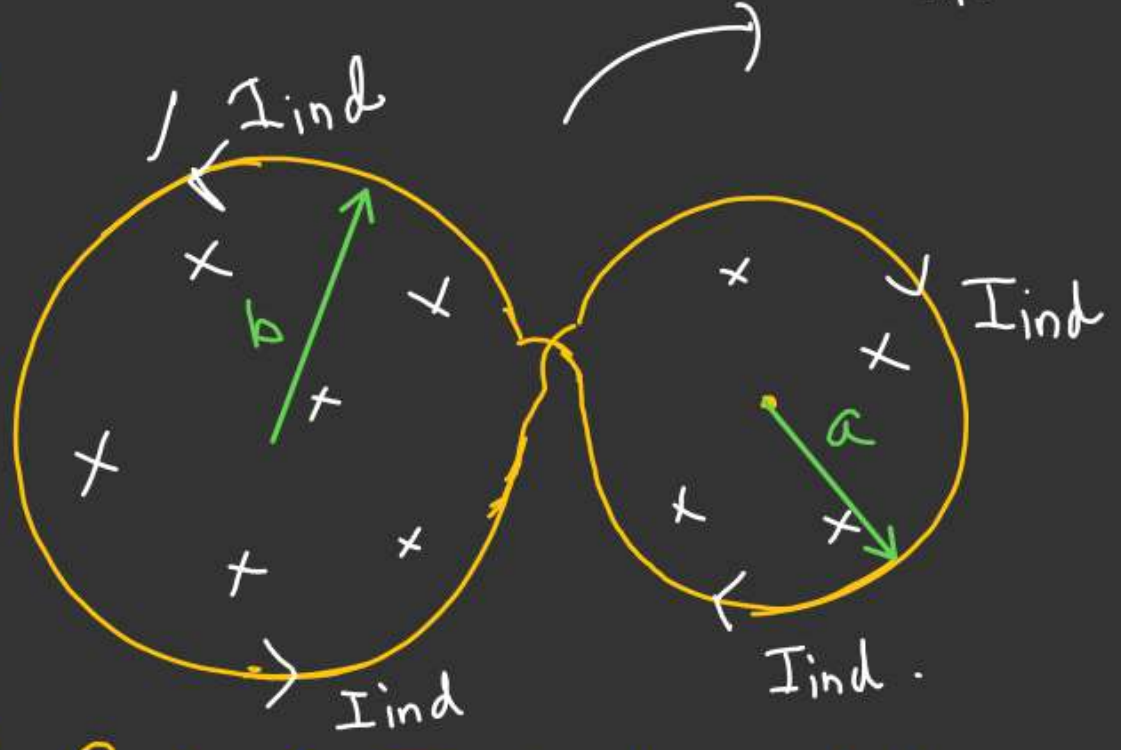
\# $\frac{dB}{dt} = K$; λ = Resistance per unit length of the wire

(1)



(3)



\# Find $\mathcal{E}_{ind}$ & I_{ind} in each loop.

For loop-1

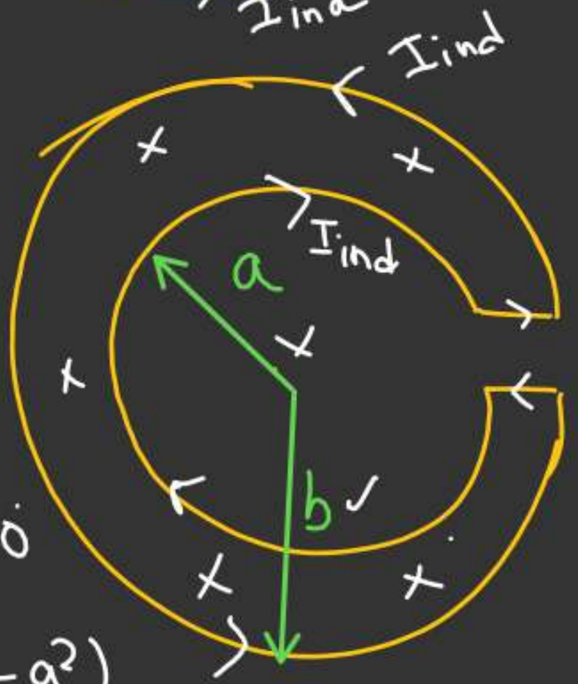
$$\phi = B\pi(b^2+a^2)$$

$$\mathcal{E}_{ind} = \frac{d\phi}{dt} = \pi(b^2+a^2)\left(\frac{dB}{dt}\right)$$

$$\mathcal{E}_{ind} = K\pi(b^2+a^2)$$

$$I_{ind} = \frac{\mathcal{E}_{ind}}{R} = \frac{K\cancel{\pi}(b^2+a^2)}{\lambda 2\cancel{\pi}(b+a)}$$

(2)



For loop-2

$$\phi_{net} = B\pi b^2\cos\pi + B\pi a^2\cos 0$$

$$\phi_{net} = -B\pi(b^2-a^2)$$

$$\mathcal{E}_{ind} = -\frac{d\phi_{net}}{dt} = \frac{dB}{dt}\pi(b^2-a^2) = \pi K(b^2-a^2)$$

$$I_{ind} = \cancel{\pi}K(b^2-a^2) = K(b-a)$$

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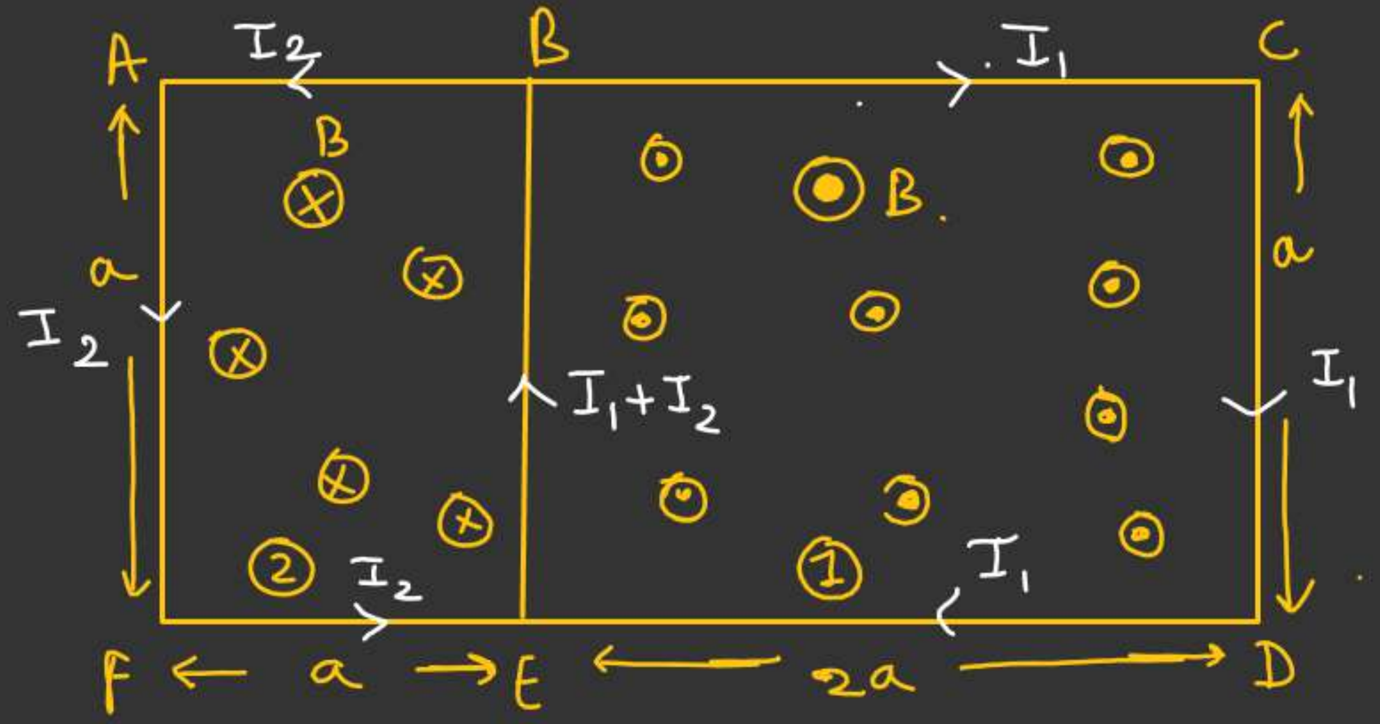
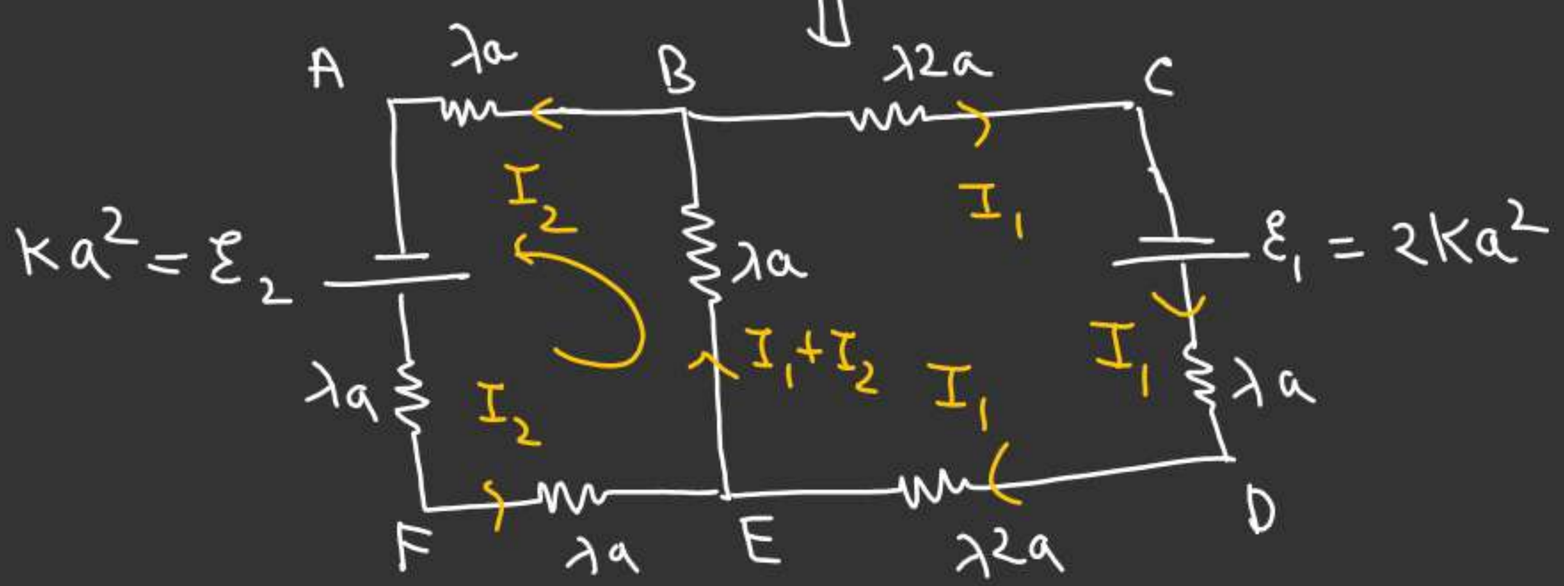
Find Current in BE.

λ = Resistance per Unit length of the wire.

$\frac{dB}{dt} = K$.





Sol^n

$$\phi_1 = B.(2a^2).\cos\pi$$

$$\phi_1 = -2Ba^2$$

$$\mathcal{E}_1 = -\frac{d\phi_1}{dt} = 2a^2\left(\frac{dB}{dt}\right) = 2Ka^2$$

$$\phi_2 = Ba^2\cos\pi = -Ba^2$$

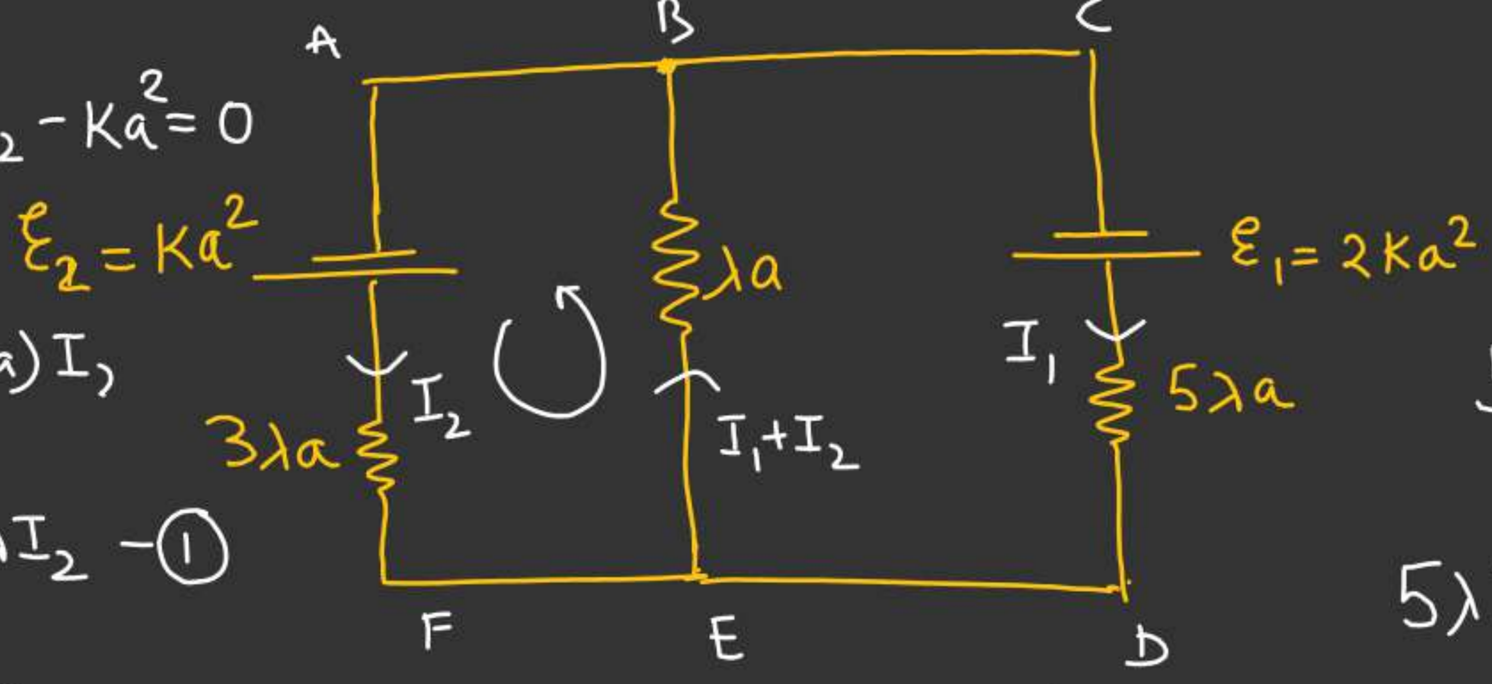
$$\mathcal{E}_2 = -\frac{d\phi_2}{dt} = a^2\left(\frac{dB}{dt}\right) = Ka^2$$

KVL in the loop ABCDEFA

$2Ka^2 - (5\lambda a)I_1 + (3\lambda a)I_2 - Ka^2 = 0$

$Ka^2 = (5\lambda a)I_1 - (3\lambda a)I_2$

$Ka = 5\lambda I_1 - 3\lambda I_2$ — (1)



KVL in loop AFEBA

$Ka^2 - 3\lambda a I_2 - (I_1+I_2)\lambda a = 0.$

$Ka^2 - 4\lambda a I_2 - \lambda a I_1 = 0$

$5\times\left[Ka = 4\lambda I_2 + \lambda I_1\right]$ — (2)

$5Ka = 20\lambda I_2 + 5\lambda I_1$

$-(1) + 2\times(5)$

$\Downarrow$

$4Ka = 23\lambda I_2$

$I_2 = \left(\frac{4Ka}{23\lambda}\right)$ ✓

$I_1 = ??$

$5\lambda I_1 = Ka - 3\lambda I_2$

$5\lambda I_1 = Ka - 3\lambda\left(\frac{4Ka}{23\lambda}\right)$

$5\lambda I_1 = \left(Ka - \frac{12Ka}{23}\right)$

$5\lambda I_1 = \frac{11Ka}{23}$

$I_1 = \left(\frac{11Ka}{115\lambda}\right)$