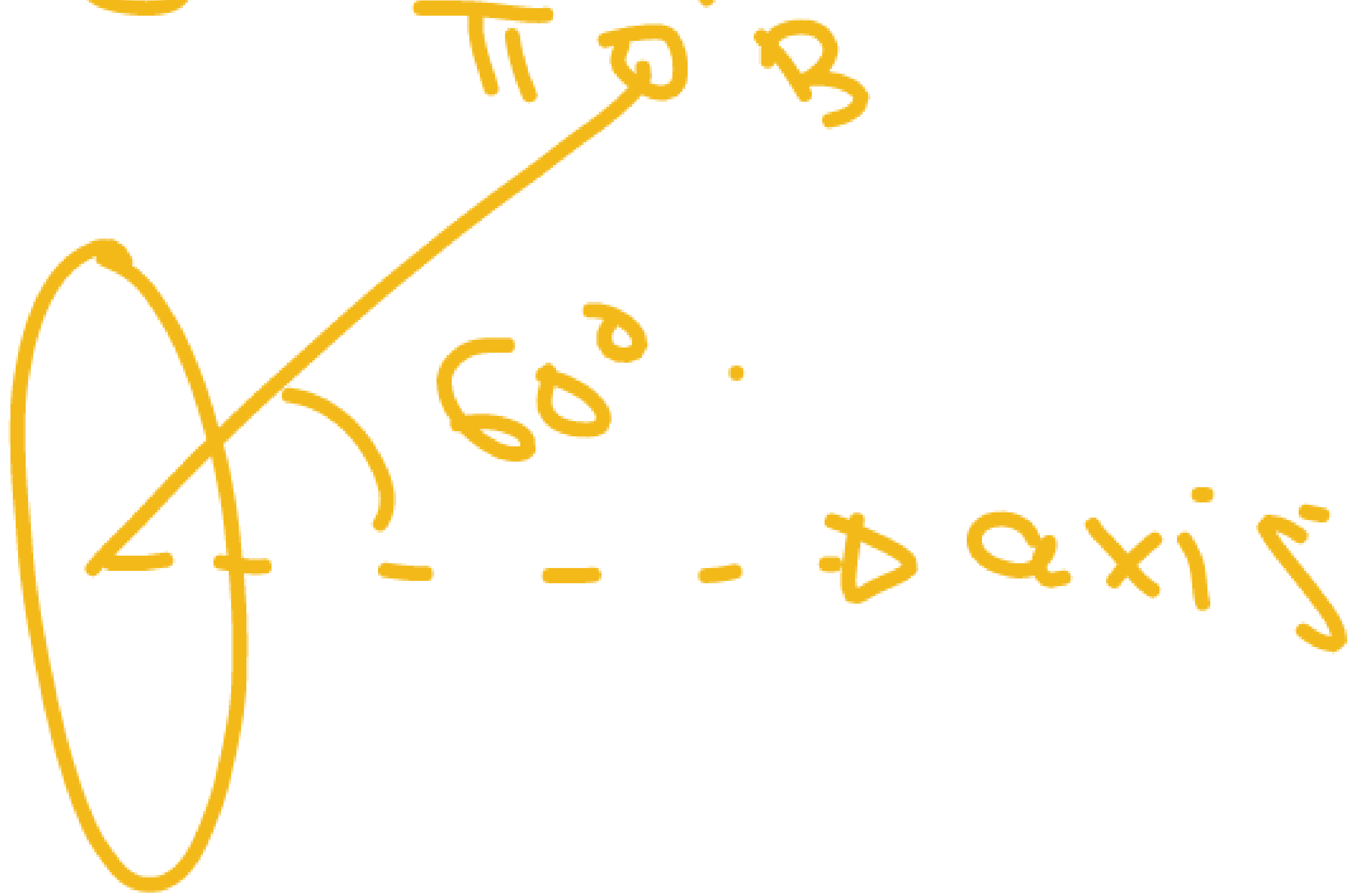
A circular disc of radius 0.2 meter is placed in a uniform magnetic field of induction $\frac{1}{\pi}\left(\frac{Wb}{m^2}\right)$ in such a way that its axis makes an angle of 60° with $\vec{B}$. The magnetic flux linked with the disc is

(a) 0.08 Wb (b) 0.01 Wb

(c) 0.02 Wb ✓ (d) 0.06 Wb

$r = 2\times10^{-1}\,m$

$B = \frac{1}{\pi}\,T$



$\phi = BA\cos\theta$

$= \frac{1}{\pi}\times\pi(2\times10^{-1})^2\cos 60° = 4\times10^{-2}\times\frac{1}{2}$

$= 0.02\,Wb$

ABLES® KOTA

A coil of resistance 400 Ω is placed in a magnetic field. If the magnetic flux ϕ (Wb) linked with the coil varies with time t (sec) as $\phi = 50t^2 + 4$. The current in the coil at $t = 2$ sec is

(a) 0.5 A (b) 0.1 A

(c) 2 A (d) 1 A

ⓒ −0.5 A ✓

$R = 400\,\Omega$

$\phi = 50t^2 + 4$

$t = 2$ sec.

$\varepsilon_{ind} = -\frac{d\phi}{dt} = -\left(\frac{d}{dt}(50t^2+4)\right)$

$= -(100t + 0)$

$\varepsilon_{in} = -100t$

$\varepsilon_{ind}\big|_{t=2} = -100 \times 2 = -200\,V$

$i_{ind} = \frac{\varepsilon_{ind}}{R} = \frac{-200}{400}$

$= -\frac{1}{2} = -0.5$ Amp

ABLES® KOTA

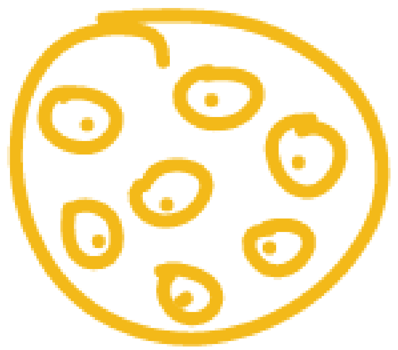
A conducting circular loop is placed in a uniform magnetic field, $B = 0.025$ T with its plane perpendicular to the loop. The radius of the loop is made to shrink at a constant rate of 1 mm s^{-1}. The induced emf when the radius is 2 cm, is

(a) 2π μV

(b) π μV ✓

(c) $\frac{\pi}{2}$ μV

(d) 2 μV



$B = 25\times10^{-3}$ T

$\frac{dR}{dt} = -1\,mm/s = -10^{-3}$ m/s

$R = 2\times10^{-2}$ m.

$\phi = BA$

$\phi = 25\times10^{-3}\,\pi R^2$

$\mathcal{E}_{ind} = -\frac{d\phi}{dt} = -\frac{d}{dt}\,25\times10^{-3}\pi R^2$

$\mathcal{E}_{ind} = -25\times10^{-3}\,\pi\,\frac{d}{dt}R^2$

$\mathcal{E}_{ind} = -25\pi\times10^{-3}\left[2R\frac{dR}{dt}\right]$

$\mathcal{E}_{ind} = -25\pi\times10^{-3}\times2\times2\times10^{-2}\times(-10^{-3})$

$= +100\pi\times10^{-6}\times10^{-2}$

$= +\pi\times10^{-6}$

$= \pi\,\mu V$

$$\frac{d}{dt}R^2 = 2R^{2-1} \times \frac{dR}{dt}$$

$$= 2R\frac{dR}{dt}$$

A 800 turn coil of effective area 0.05 m^2 is kept perpendicular to a magnetic field 5×10^{-5} T. When the plane of the coil is rotated by 90° around any of its coplanar axis in 0.1 s, the emf induced in the coil will be

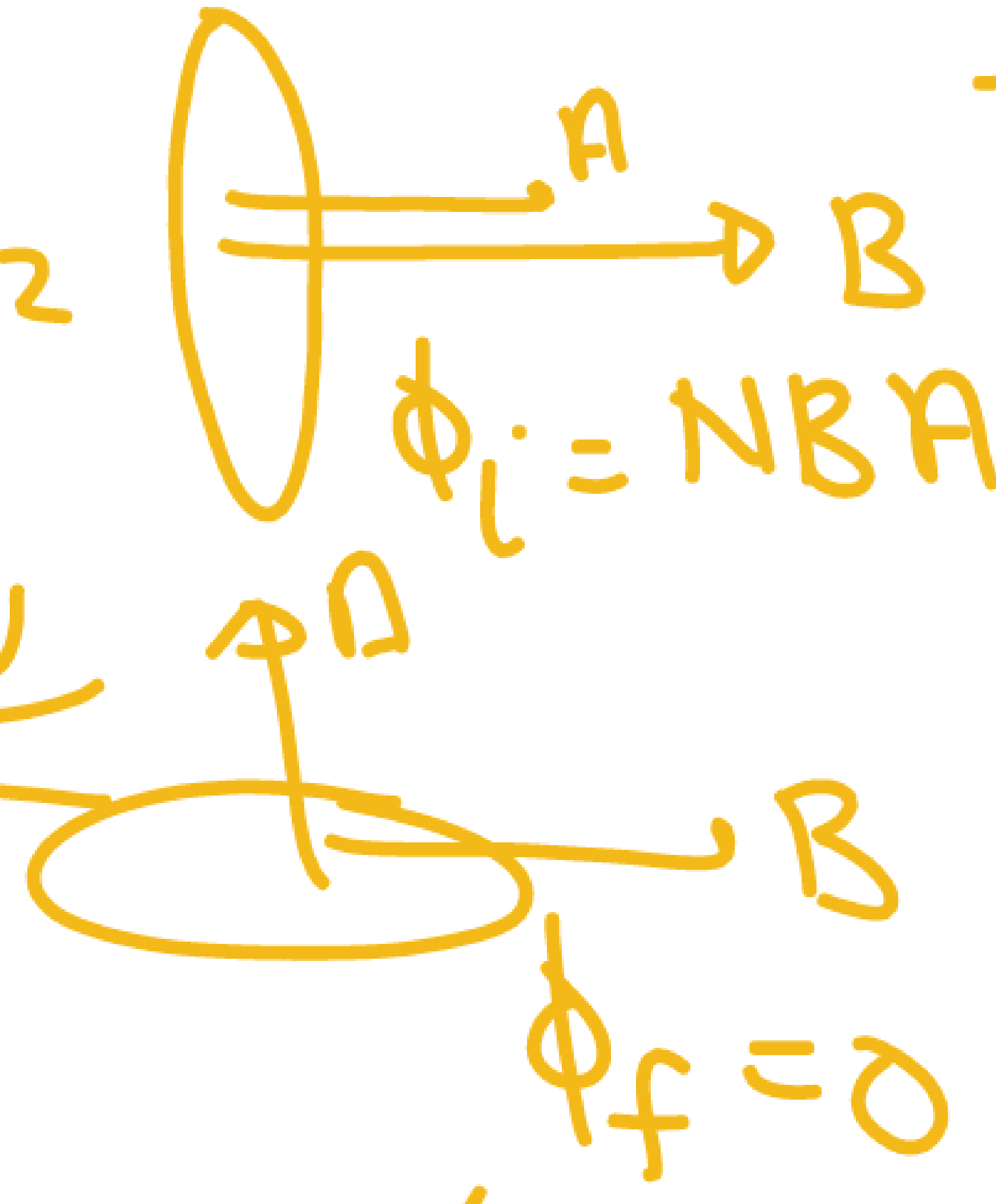
(a) 0.02 V ✓
(b) 2 V
(c) 0.2 V
(d) 2×10^{-3} V

$N = 800$

$A = 5\times10^{-2}\ m^2$

$B = 5\times10^{-5}$ T

$t = 0.1$ sec



$\varepsilon_{ind} = -\left[\frac{\phi_f - \phi_i}{\Delta t}\right] = 0.02V$

$= -\left[\frac{0 - NBA}{0.1}\right] = \frac{NBA}{t}$

$= \frac{800\times5\times10^{-5}\times5\times10^{-2}}{0.1}$

$\frac{90\times5\times10^{-5}}{10^{-1}} = 200\times10^{-4}$

$2\ V = 2\times10^{-2}$

A rectangular coil of 20 turns and area of cross-section 25 sq. cm has a resistance of 100 Ω. If a magnetic field which is perpendicular to the plane of coil changes at a rate of 1000 tesla per second, the current in the coil is

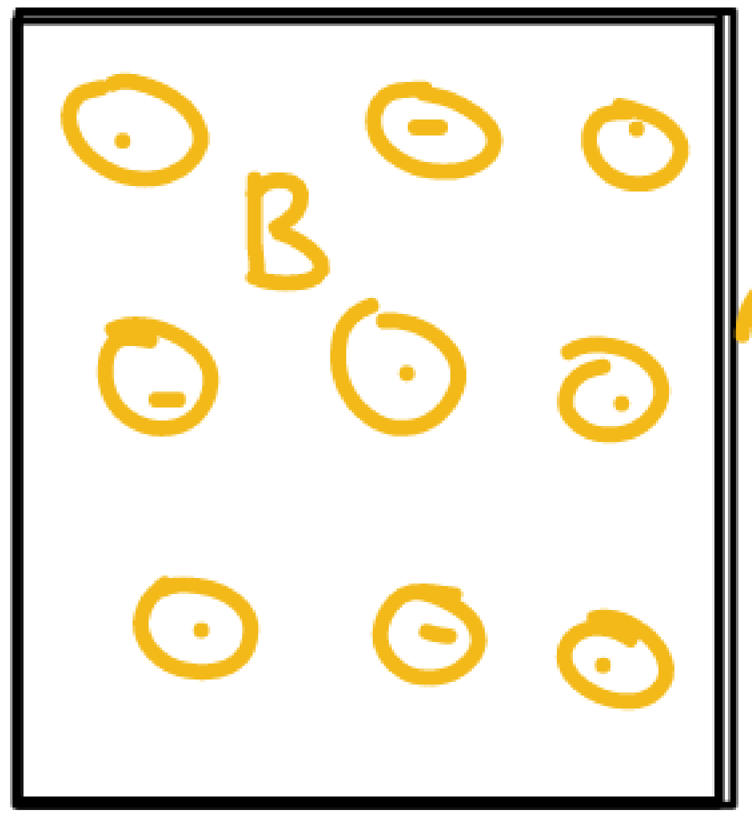
(a) 1 A (b) 50 A

(c) 0.5 A (d) 5 A

$N = 20$ Turn.

$A = 25 \times 10^{-4}\ m^2$.

$R = 100\ \Omega$.



$\frac{dB}{dt} = 10^3$ T.

$\phi = NBA$

$\varepsilon_{ind} = \left|\frac{d\phi}{dt}\right| = \frac{d}{dt} NBA = NA\frac{dB}{dt}$

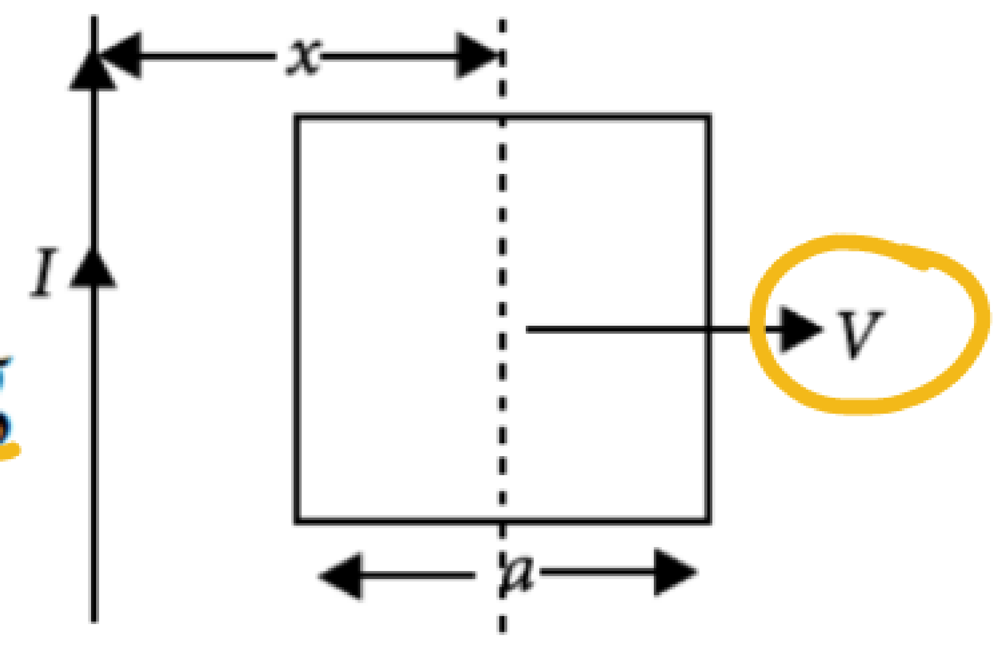
$= 20 \times 25 \times 10^{-4} \times 10^3$

$\varepsilon_{in} = 50V$

$i = \frac{\varepsilon_{ind}}{R} = \frac{50}{100}$

$= 0.5$ Amp

A conducting square frame of side 'a' and a long straight wire carrying current I are located in the same plane as shown in the figure. The frame moves to the right with a constant velocity 'V'. The emf induced in the frame will be proportional to

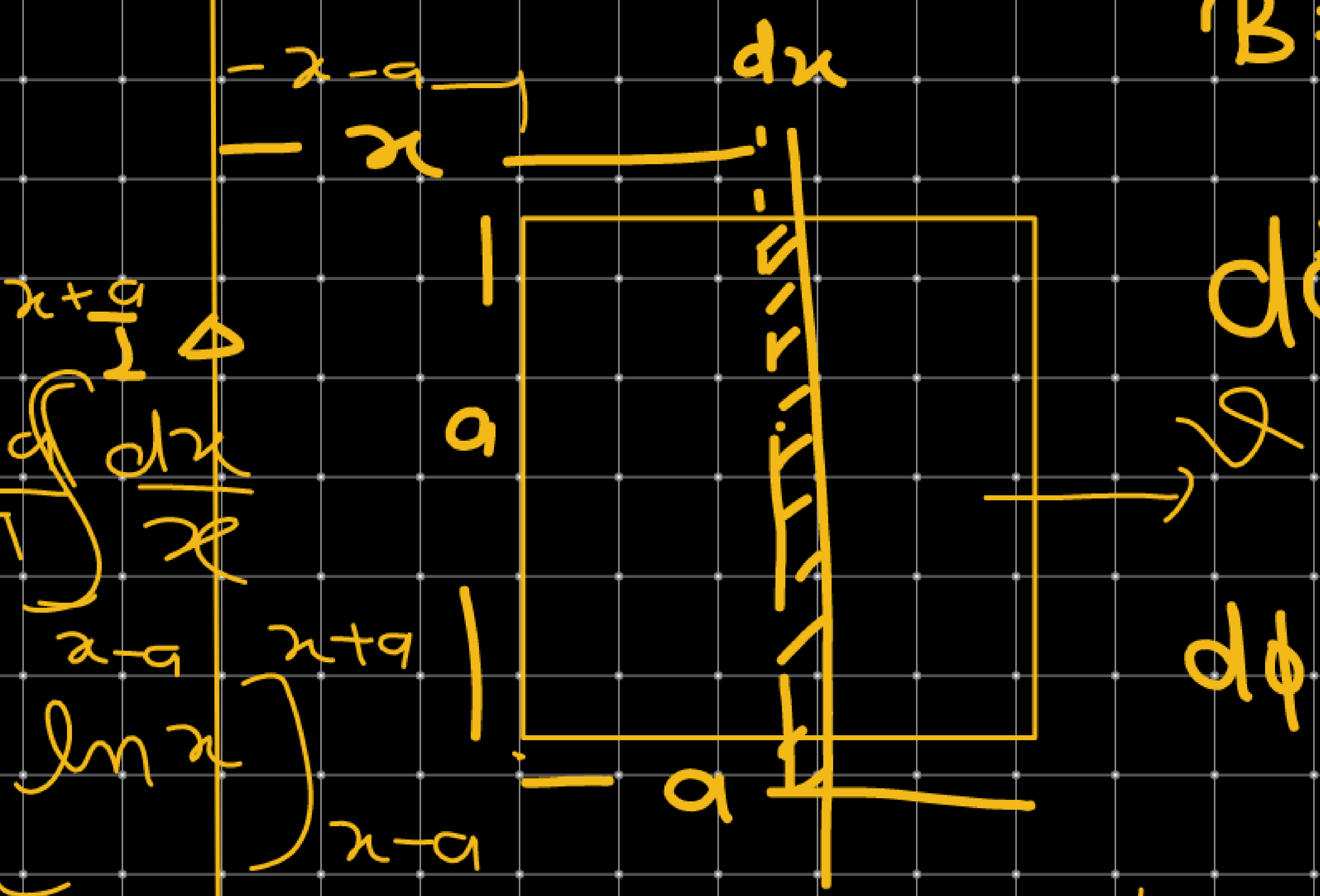


(a) $\dfrac{1}{(2x+a)^2}$

(b) $\dfrac{1}{(2x-a)(2x+a)}$

(c) $\dfrac{1}{x^2}$

(d) $\dfrac{1}{(2x-a)^2}$



$$B = \frac{\mu_0 I}{2\pi x} \qquad B \propto \frac{1}{x}$$

$$d\phi = BA$$

$$= \frac{\mu_0 I}{2\pi x} \times a\,dx$$

$$d\phi = \frac{\mu_0 I a\,dx}{2\pi x}$$

$$\int d\phi = \frac{\mu_0 I a}{2\pi} \int_{x-a}^{x+a} \frac{dx}{x}$$

$$\phi = \frac{\mu_0 I}{2\pi} \Big[\ln x\Big]_{x-a}^{x+a}$$

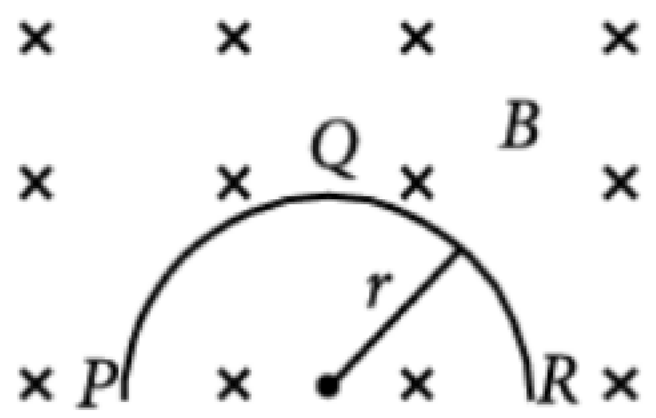
$$\phi = \frac{\mu_0 I}{2\pi} \Big[\ln(x+a) - \ln(x-a)\Big]$$

$$\phi = \frac{\mu_0 I}{2\pi} \ln\left(\frac{x+a}{x-a}\right)$$

A magnetic field of 2×10^{-2} T acts at right angles to a coil of area 100 cm^2, with 50 turns. The average e.m.f. induced in the coil is 0.1 V, when it is removed from the field in t sec. The value of t is

(a) 10 s
(b) 0.1 s
(c) 0.01 s
(d) 1 s

A thin semicircular conducting ring (PQR) of radius r is falling with its plane vertical in a horizontal magnetic field B, as shown in the figure.



The potential difference developed across the ring when its speed is v, is

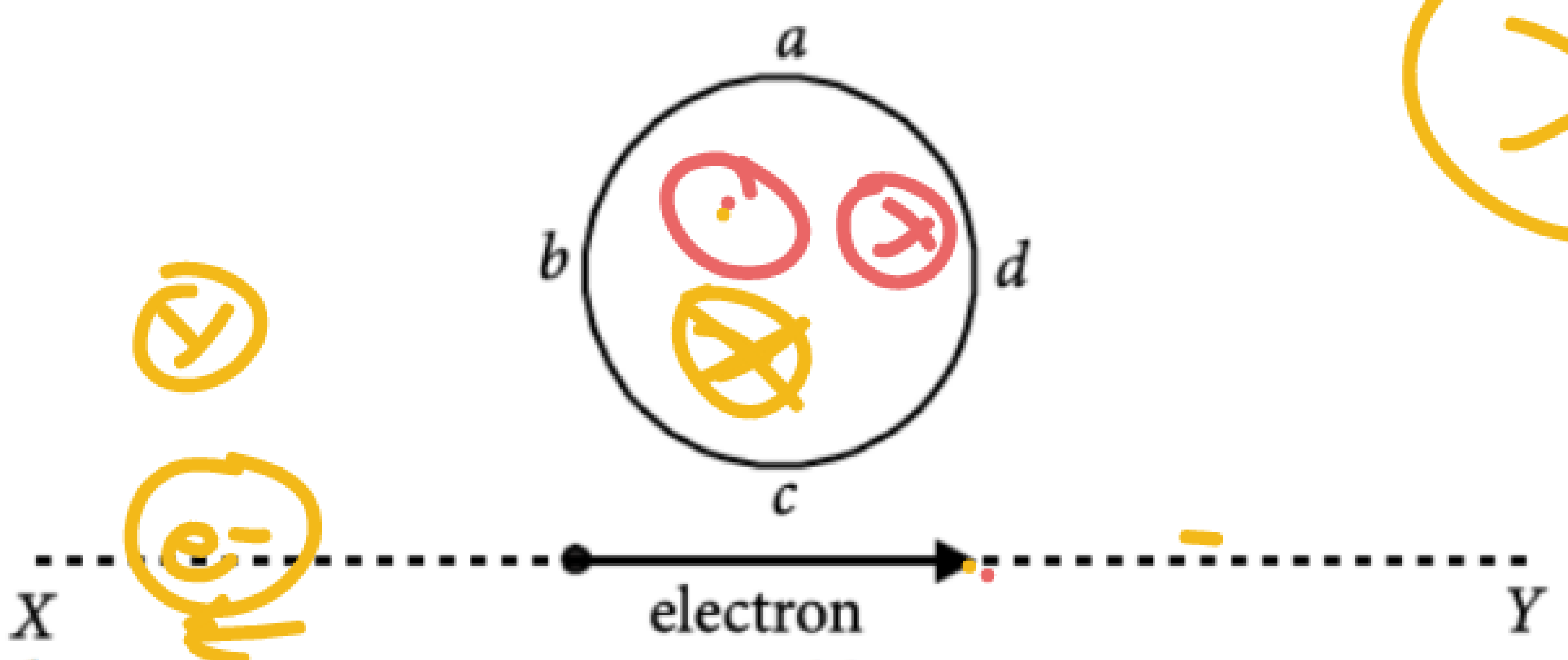
(a) zero

(b) $\frac{Bv\pi r^2}{2}$ and P is at higher potential

(c) πrBv and R is at higher potential

(d) $2rBv$ and R is at higher potential

An electron moves on a straight line path XY as shown. The $abcd$ is a coil adjacent to the path of electron. What will be the direction of current, if any, induced in the coil?



(a) The current will reverse its direction as the electron goes past the coil

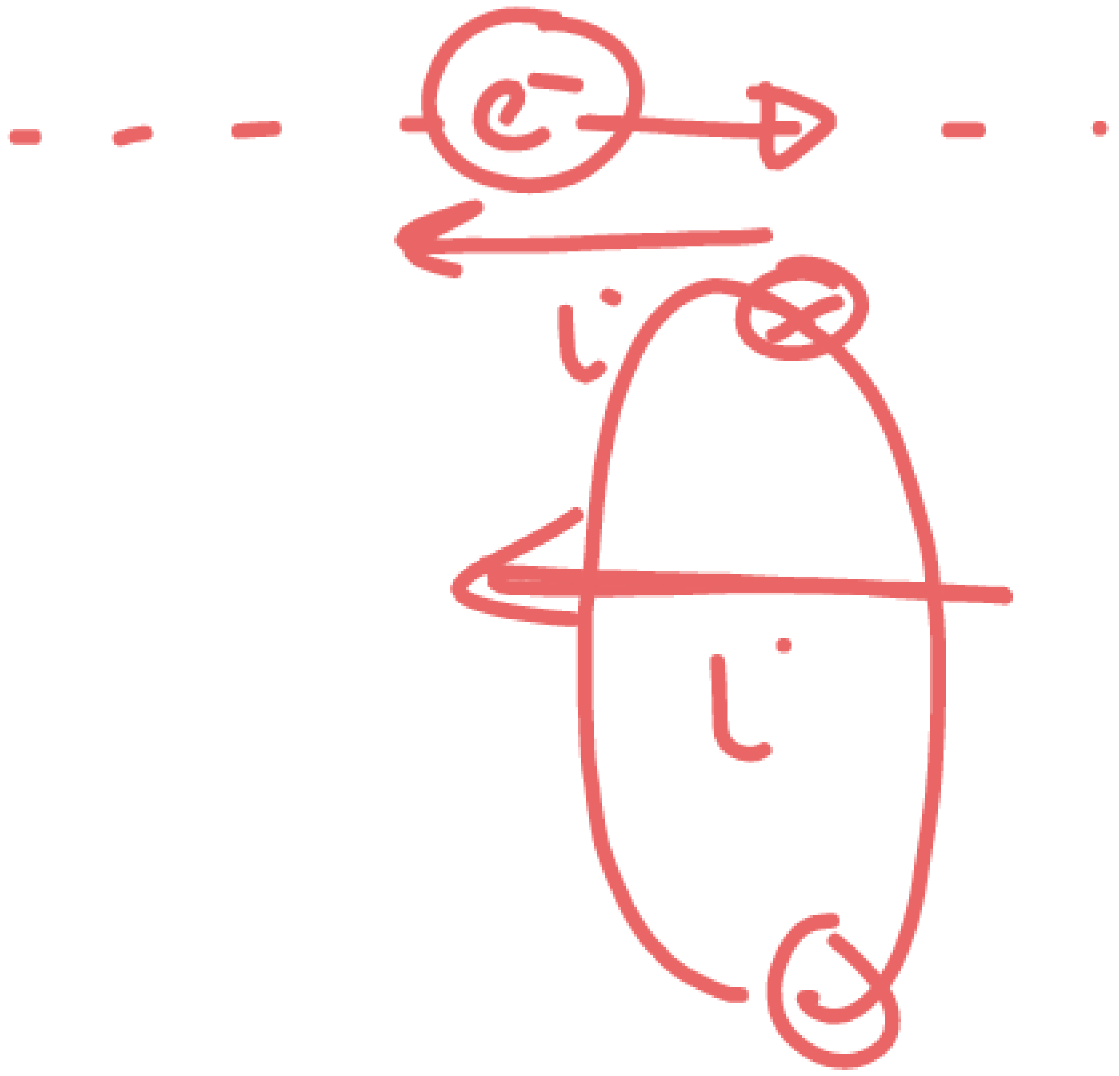
(b) No current induced

(c) *abcd*

(d) *adcb*

abcd → i induced.
adcb → i induced.


a
i
B
i
e⁻
i
i

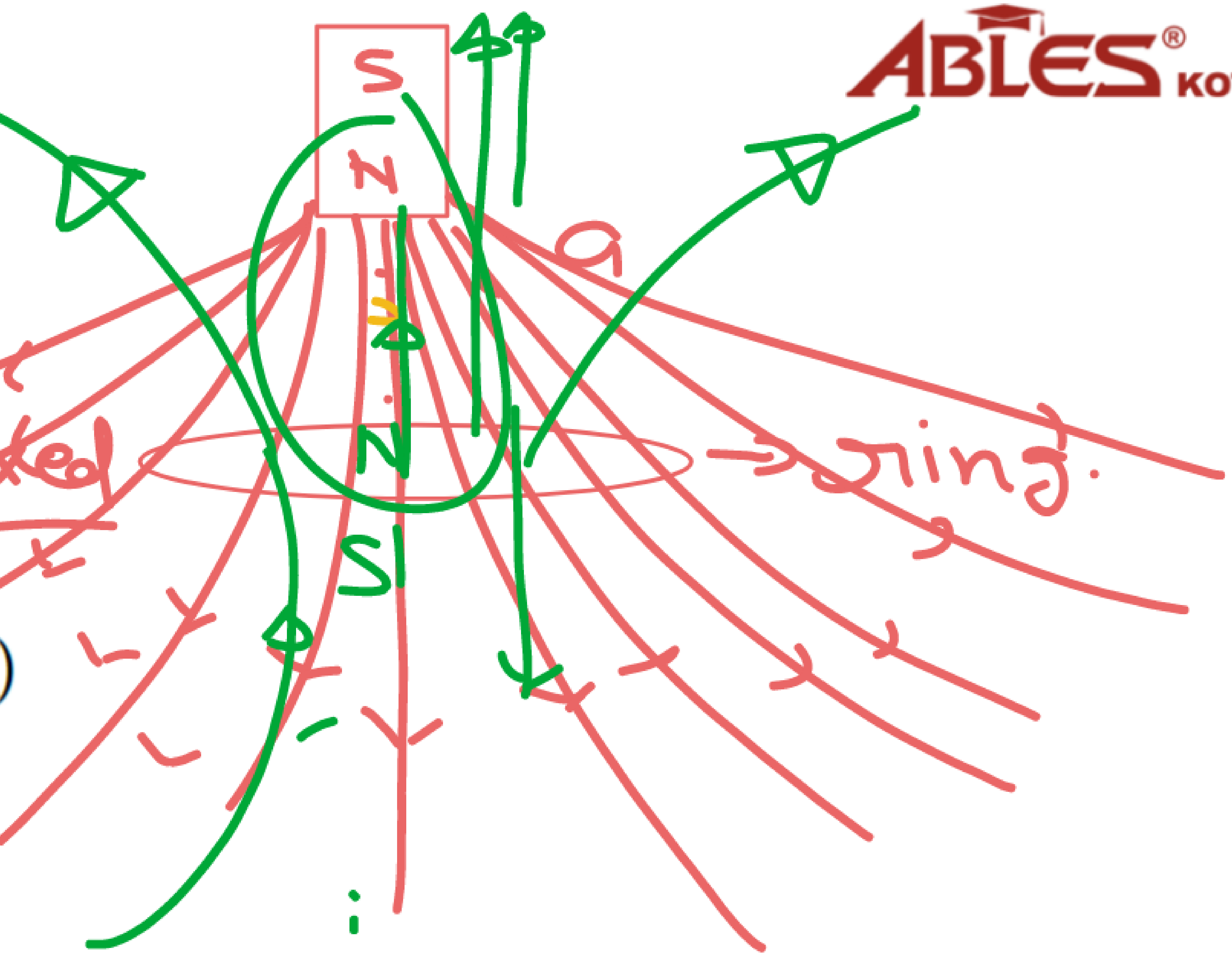


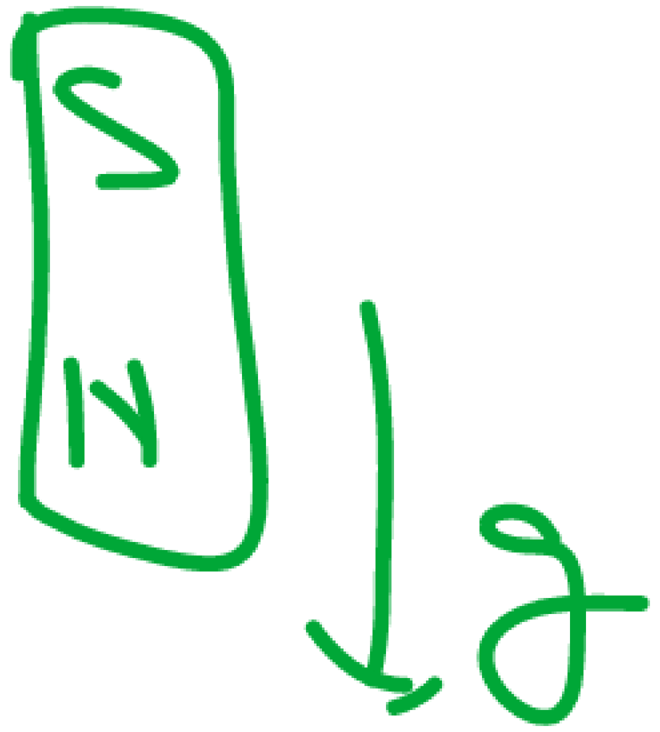
NEET/JEE(M)

A metal ring is held horizontally and bar magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet is

(a) more than g (b) equal to g

(c) less than g (d) either (a) or (c)

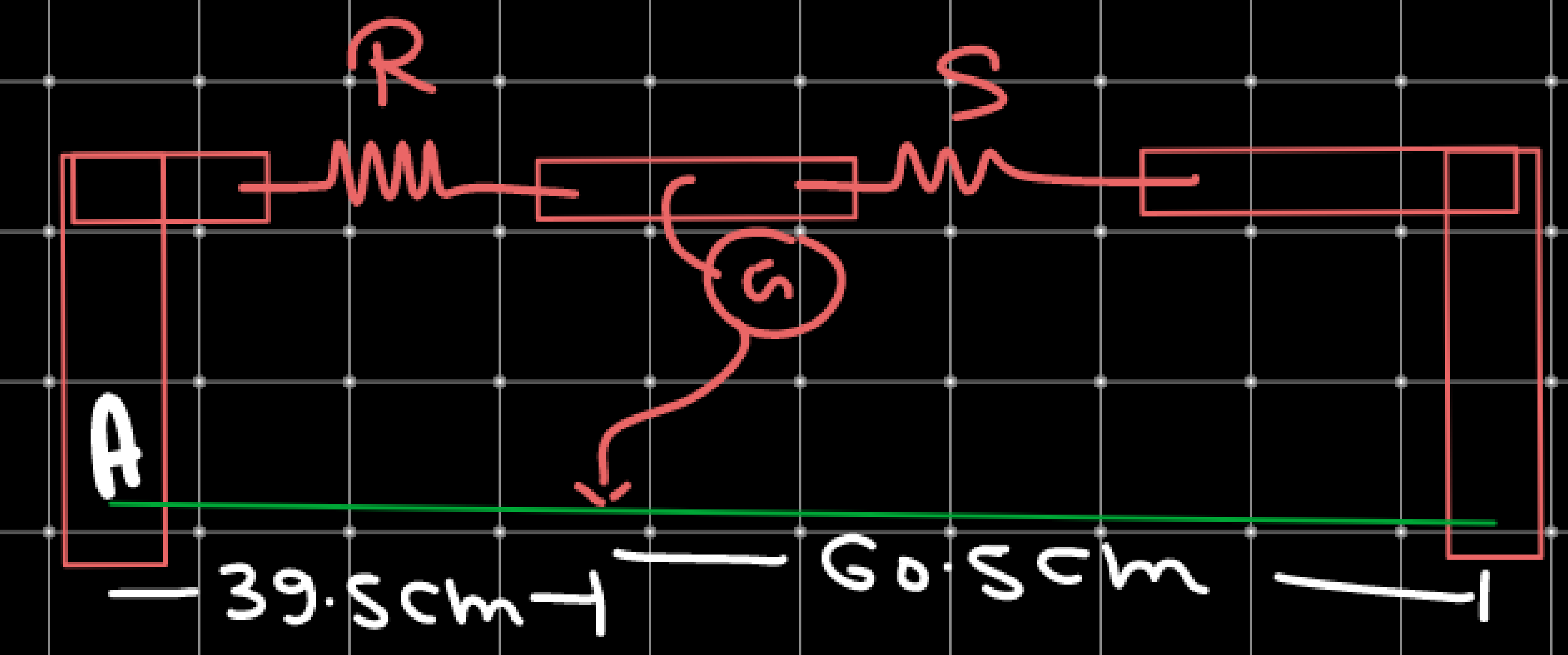




1	2	3	4	5	6	7	8	9	10
C	A	B	A	C	B	B	D	A	C

Emf = 1.9 volt.

r = 380 Ω.



$$\frac{R}{39.5} = \frac{S}{60.5}$$

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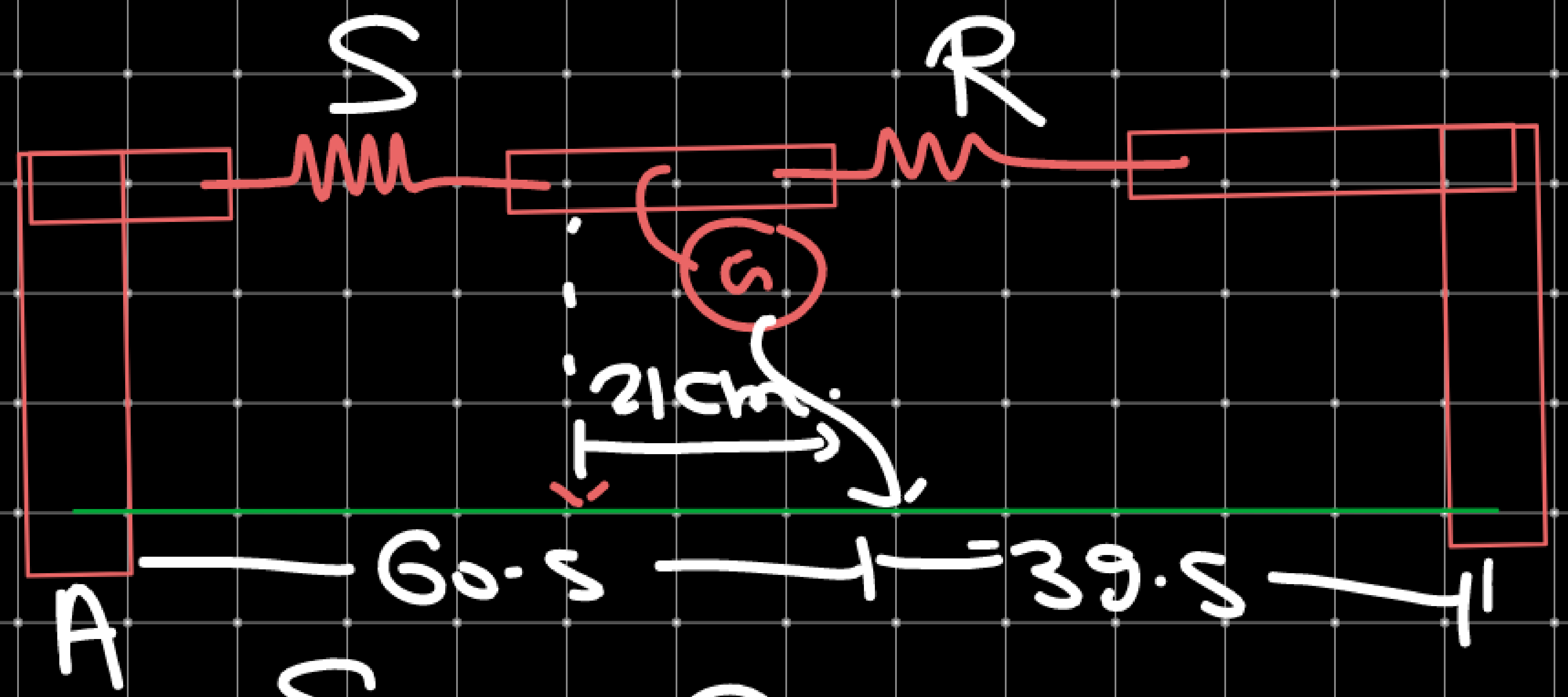
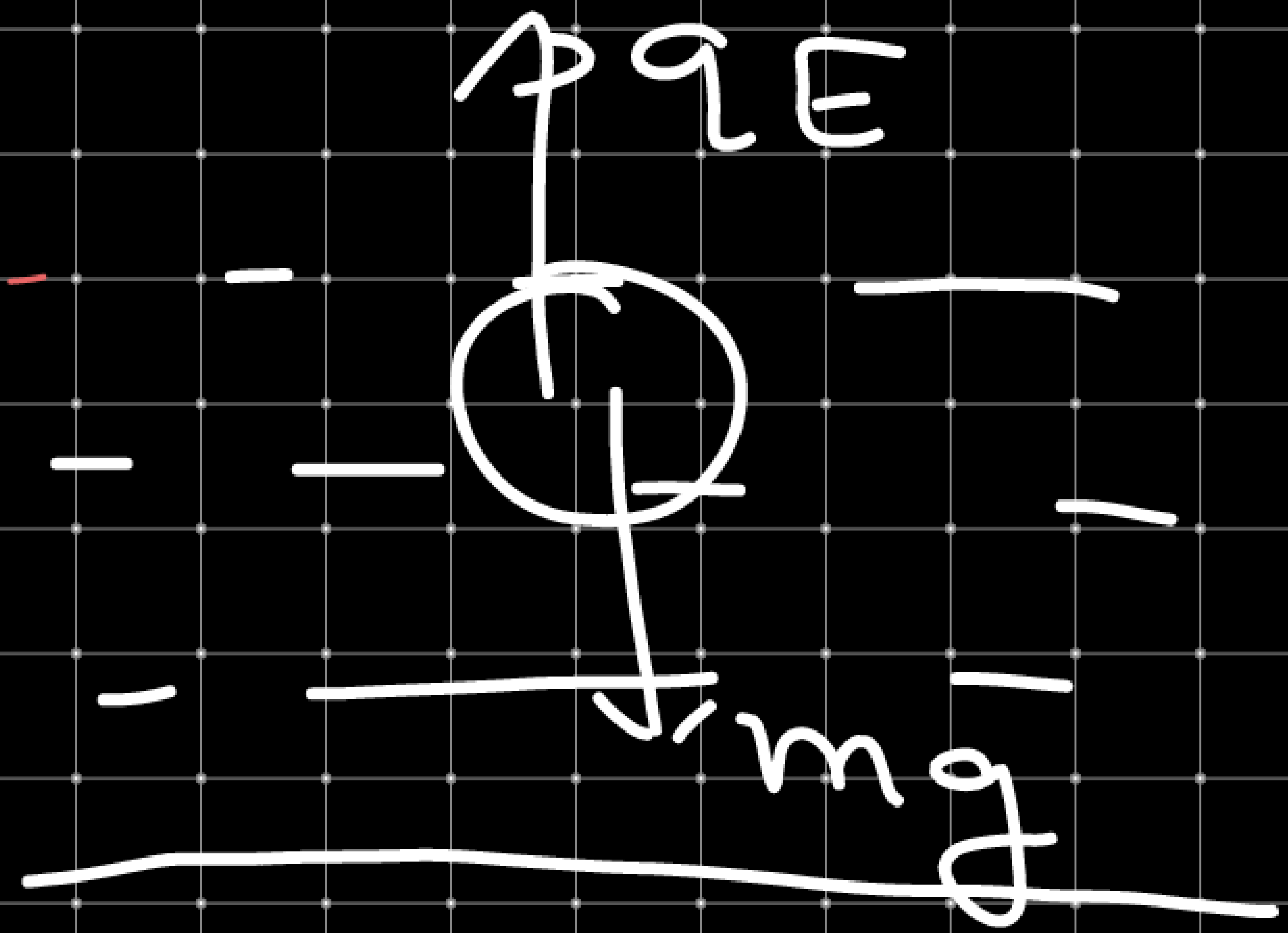
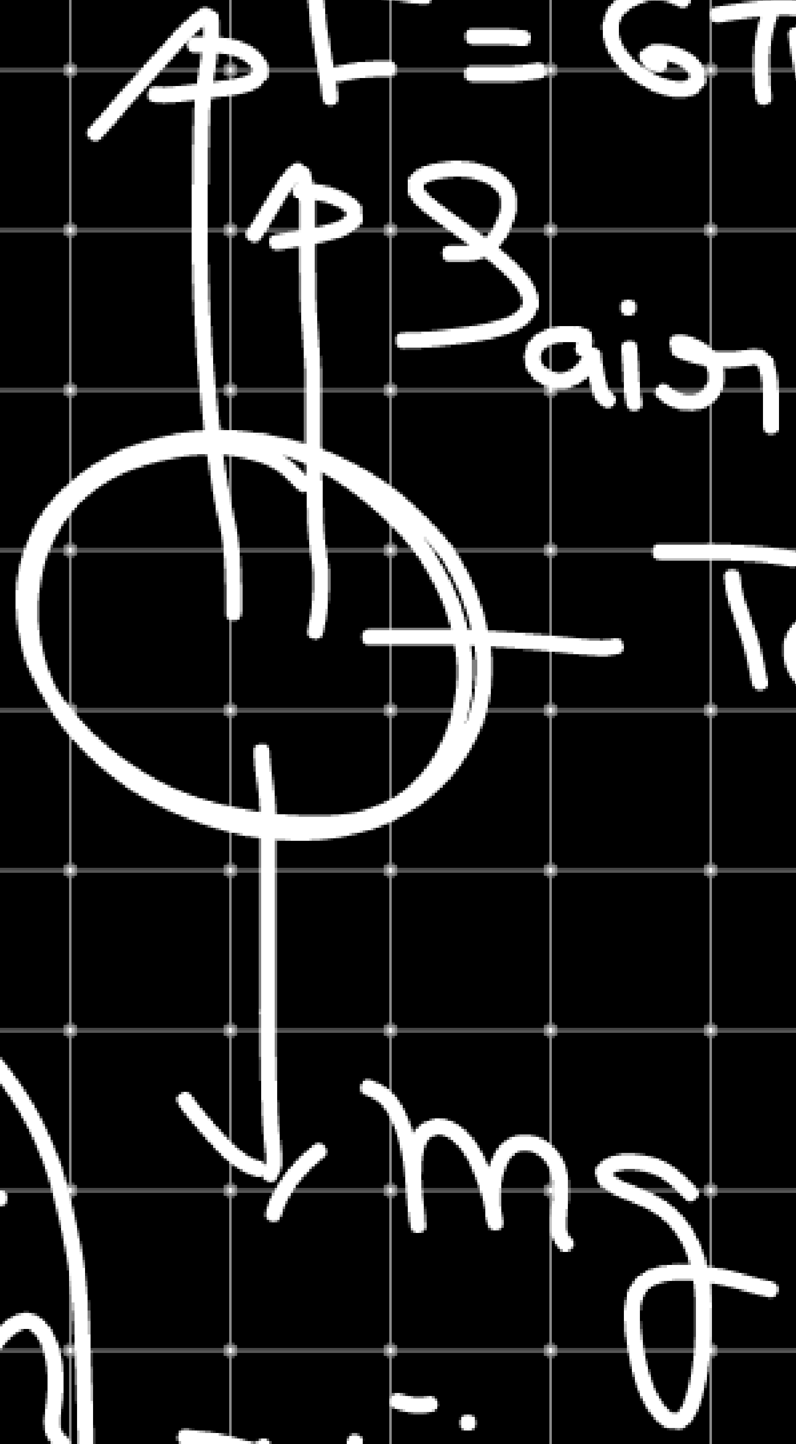


$$\frac{S}{60.5} = \frac{R}{39.5}$$



$qE = mg$



$$6\pi\eta r v + \rho_{air} g h = \rho_{ball} g h$$

$l_1 + l_2 = 100$