TRAINING FOR FINAL EXAM

GRADE 12 ADVANCE

2023-2024

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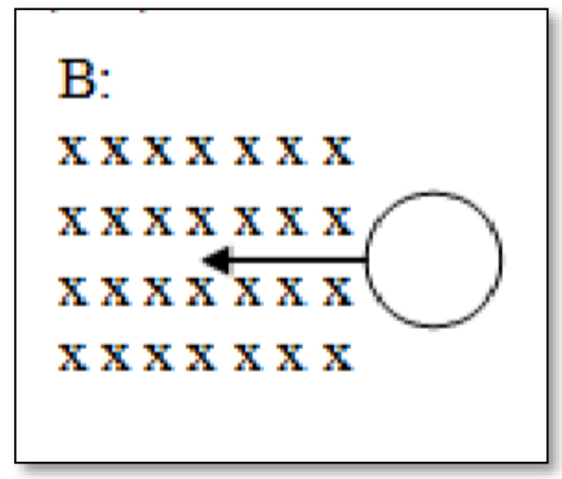
Class: 12AD-2

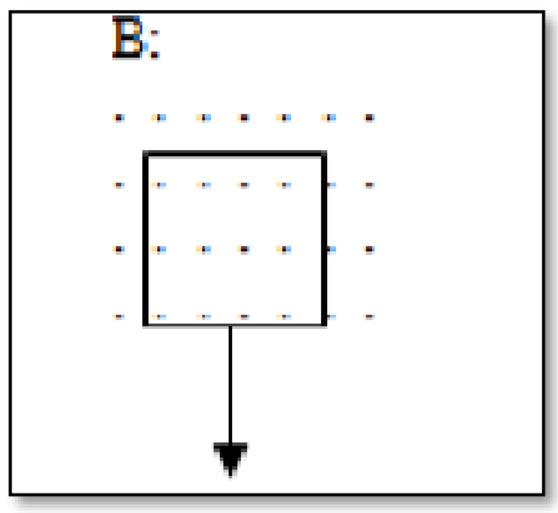
Chose the correct answer of the following questions.

1- What is the direction of the induced current that produced in the loop shown in the figure, at the instant that the loop Enters the constant magnetic field B.



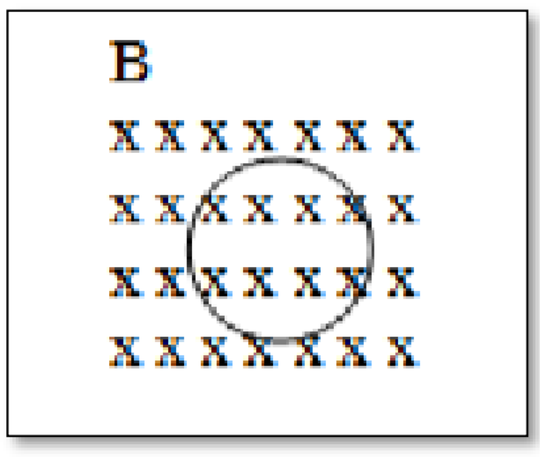
A. Clockwise.
B. Counterclockwise.
C. Out of the page.
D. No induced current will produce.

2- What is the direction of the induced current that produced in the rectangular loop shown in the figure, at the instant that the loop leaves the constant magnetic field B.



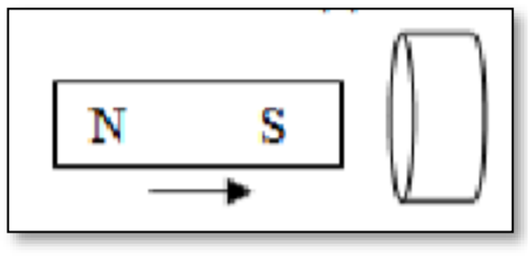
A. Clockwise.
B. Counterclockwise.
C. Out of the page plane.
D. Inside the page plane.

3- What is the direction of the induced magnetic field that produced in inside the loop shown in the figure, if the magnitude of the magnetic field B is increasing?



A. Inside the page plane.
B. Outside the page plane.
C. To the right of the page plane.
D. No induced magnetic field will produce.

4- What is the direction of the induced current produced in the loop shown in the figure?



5- **What is the direction of the induced current through the resistor R in circuit B, if the magnitude of the variable resistor in circuit A is decreased?**

$\downarrow R = \frac{\Delta V}{I} \uparrow$

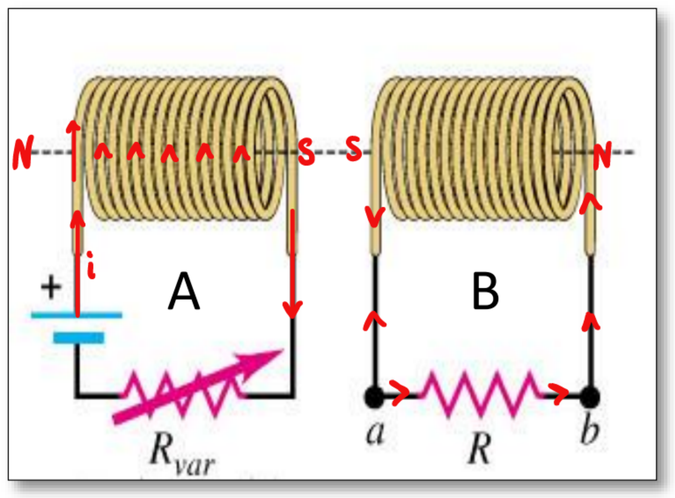
$\uparrow B = \mu ni \uparrow$

A. From a to b

B. From b to a

C. Oscillating between a and b

D. No induced current will produce.



6- **What is the direction of the induced current through the resistor in circuit B, at the instant of turning on circuit A.**

I increase

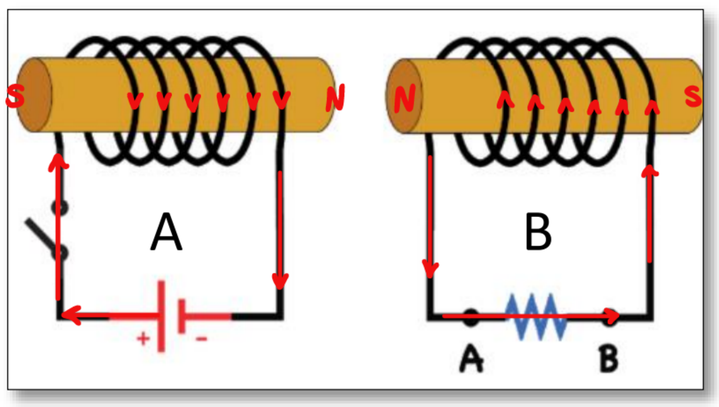
$\uparrow B = \mu_0 ni \uparrow$

A. From A to B

B. From B to A

C. Oscillating between A and B

D. No induced current will produce.



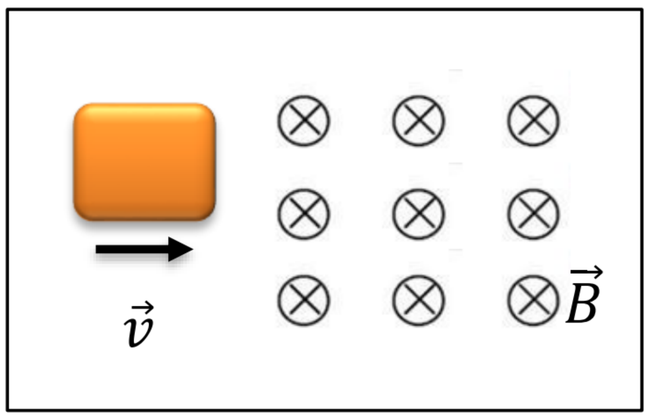
7- **Determine the direction of the eddy currents that produced in the rectangular piece of metal shown in the figure, at the instant of entering the constant magnetic field B.**

A. Inside the plane of page.

B. To the right of the plane of page

C. Counterclockwise

D. Clockwise



8- A magnetic field changing with time, $[B(t) = 6.2\,t^2]$ passing through a rectangular wire loop with (3 cm length and 2 cm width), if the angle between the magnetic field and the loop is 30 deg° what is the magnitude of the induced potential difference in that loop at t= 3 s?

A. 0.2 V

B. 1.3 V

C. 6.7 V

D. 0.01 V

$\Delta V_{ind} = -N \frac{d\phi}{dt}$

$\Delta V_{ind} = -NA\cos\theta \frac{dB}{dt}$

$\Delta V_{ind} = -N(\ell . w)\cos\theta \frac{dB}{dt}$

$\Delta V_{ind} = -(1)((3)(2)\times10^{-2})\cos(60)(37.2)$

$\Delta V_{ind} = -0.011\,V$

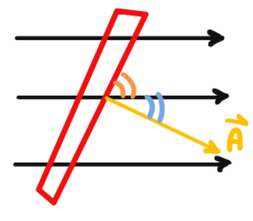
$|\Delta V_{ind}| = 0.011\,V$

$B(t) = 6.2t^2$

$\frac{dB}{dt} = 12.4t$

$\frac{dB}{dt}(3) = 12.4(3)$

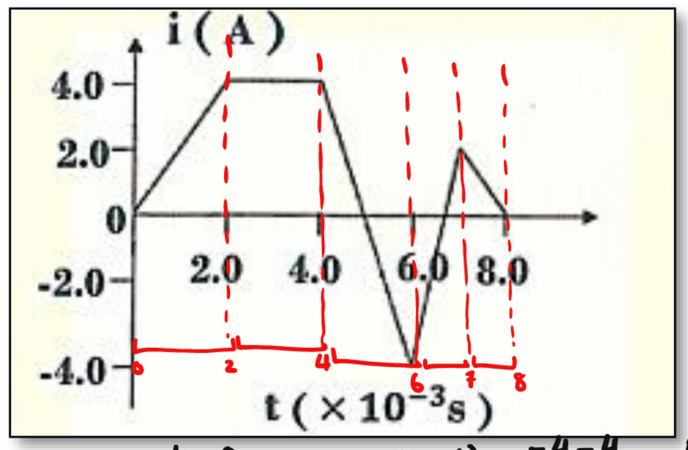
$\frac{dB}{dt}(3) = 37.2\,T$



$\theta = 90 - 30$

$\theta = 60^\circ$

9- The graph represents the changes of the current during a different time interval in an inductor with inductance of $10\ mH$, what is the magnitude of the maximum induced potential difference in the inductor during the intervals shown in the graph?



A. 20 V
B. 40 V
C. 60 V
D. 80 V

$$\Delta V_{ind} = -L\frac{dI}{dt}$$

$$\Delta V_{ind} = -(10\times10^{-3})\left(\frac{2-(-4)}{(7-8)\times10^{-3}}\right)$$

$$\Delta V_{ind} = -60V$$

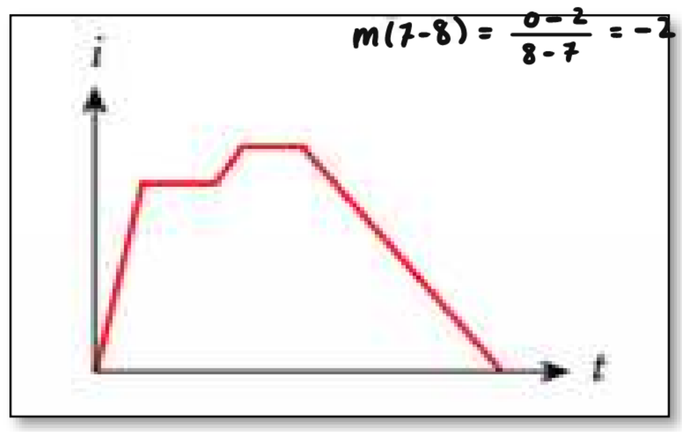
$$|\Delta V_{ind}| = 60V$$

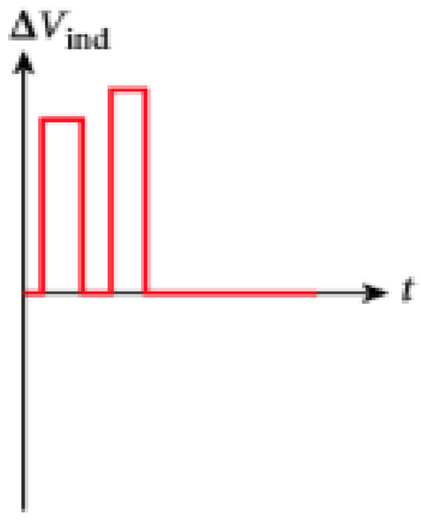
$m(0-2) = \frac{4-0}{2-0} = 2$ $\quad m(4-6) = \frac{-4-4}{6-4} = -4$

$m(2-4) = \frac{4-4}{4-2} = 0$ $\quad m(6-7) = \frac{2-(-4)}{7-6} = 6$ maximum slope

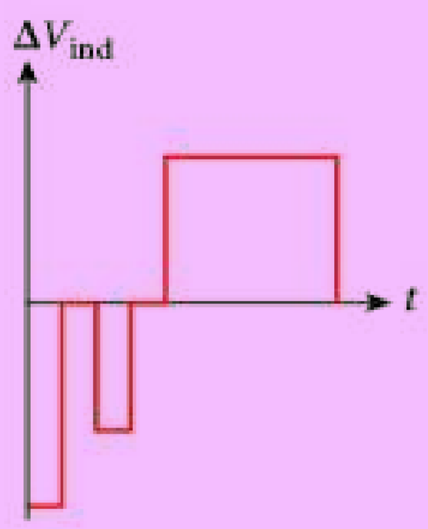
$m(7-8) = \frac{0-2}{8-7} = -2$

10- A graph of the current i through loop (A) as a function of time, t, is shown in the figure. Which graph best describes the induced potential difference as a function of time, in loop (B) located near loop A?

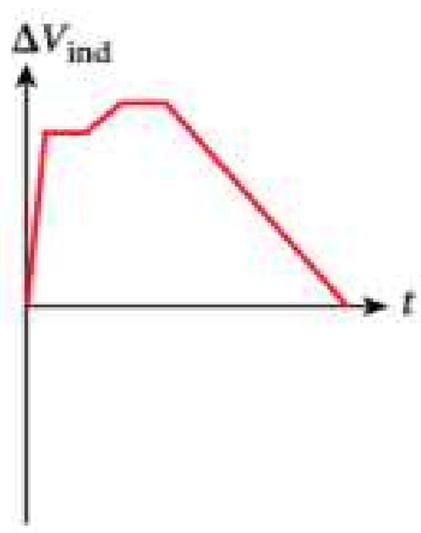




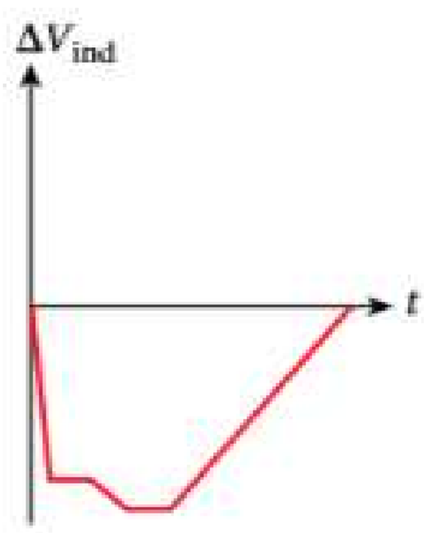
A



B



C



D

$B = 2t^2 - 3$

$\frac{dB}{dt} = 4t$

$\frac{dB}{dt}(3) = 4(3)$

$\frac{dB}{dt}(3) = 12T$

11- Find the magnitude of the induced current that flows through the resistor shown in the figure at t=3 s, if the magnetic field through the wire loop of 3.0 cm radius changing with time according to this equation $B = 2t^2 - 3$.

A. 1.7 mA
B. 2.9 mA
C. 6.8 mA
D. 9.1 mA

$$\Delta V_{ind} = -N\frac{d\phi}{dt}$$

$$\Delta V_{ind} = -NA\cos\theta\ \frac{dB}{dt}$$

$$\Delta V_{ind} = -N(\pi r^2)\cos\theta\ \frac{dB}{dt}$$

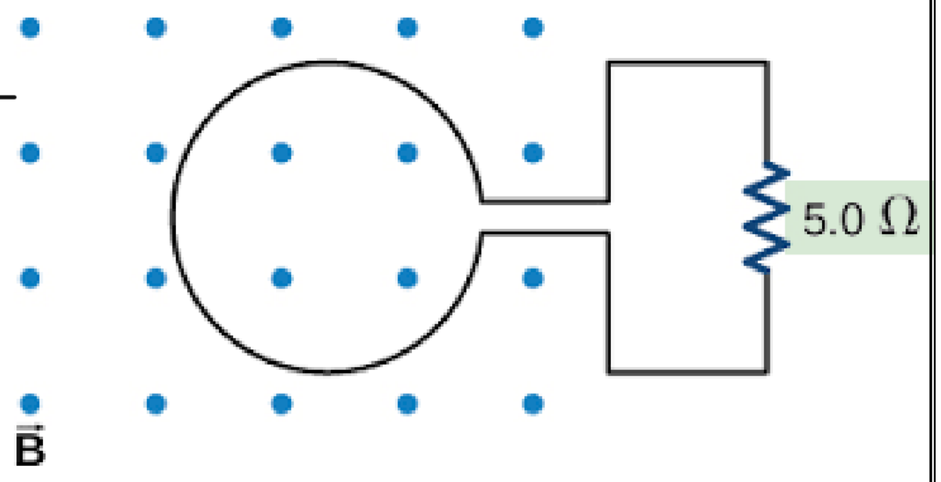
$$\Delta V_{ind} = -(1)(\pi(3\times10^{-2})^2)\cos(0)(12)$$

$$\Delta V_{ind} = -0.034V$$

$$I_{ind} = \frac{|\Delta V_{ind}|}{R}$$

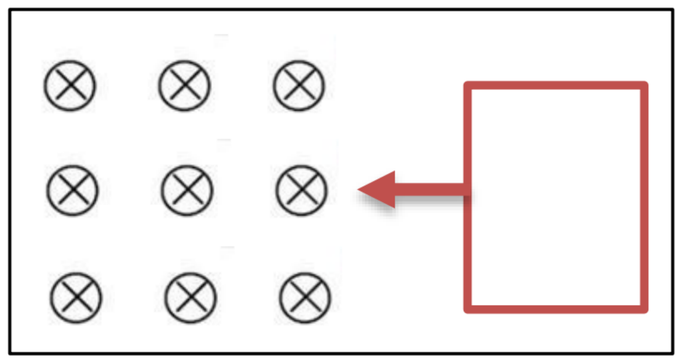
$$I_{ind} = \frac{|-0.034|}{5}$$

$$I_{ind} = 6.78\times10^{-3}A$$



12- A rectangular loop of wire is pulled with a constant acceleration from a region of zero magnetic field into a region of a uniform magnetic field. During this process, the current induced in the loop.

A. will be some constant value that is not zero.
B. will increase linearly with time.
C. will increase exponentially with time.
D. will increase linearly with the square of the time



13- An elastic loop expands at a constant rate over time such that its radius is given by $r(t) = 0.1 + 0.015t$. A loop of 12.0 Ω resistance is placed in a uniform magnetic field B= 0.750 T, perpendicular to the plane of the loop. Calculate the magnitude of the induced current, at t = 5.00 s.

$r = 0.015t + 0.1$

$\frac{dr^2}{dt} = \frac{d(0.015t+0.1)^2}{dt}$

$\frac{dr^2}{dt} = 2(0.015t+0.1)(0.015)$

$\frac{dr^2}{dt} = 0.03(0.015t+0.1)$

$\frac{dr^2}{dt}(s) = 0.03(0.015(s)+0.1)$

$\frac{dr^2}{dt}(s) = 5.25\times10^{-3}\,m$

A. 4 mA
B. 3 mA
C. 2 mA
D. 1 mA

$\Delta V_{ind} = -B\cos\theta\,\frac{dA}{dt}$

$\Delta V_{ind} = -B\cos\theta\,\frac{d\pi r^2}{dt}$

$\Delta V_{ind} = -\pi B\cos\theta\,\frac{dr^2}{dt}$

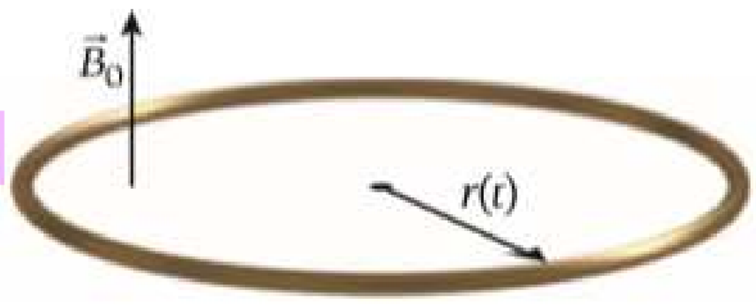
$\Delta V_{ind} = -\pi(0.75)(\cos(0))(5.25\times10^{-3})$

$\Delta V_{ind} = -0.0123V$

$I_{ind} = \frac{|\Delta V_{ind}|}{R}$

$I_{ind} = \frac{|-0.0123|}{12}$

$I_{ind} = 1.03\times10^{-3}A$



14- What is the inductance of solenoid with 50 cm length, 10 cm diameter and 700 turns?

$r = 5\times10^{-2}\,m$

A. 9.7 mH
B. 12.3 mH
C. 19.8 mH
D. 20.6 mH

$L = \frac{4N^2A}{\ell} = \frac{(4\pi\times10^{-7})(700)^2(\pi(5\times10^{-2})^2)}{50\times10^{-2}}$

$L = 9.67\times10^{-3}H \equiv 9.67\,mH$

15- A current flow through a 9.7 mH solenoid, if the current magnitude changes from 12 A to 27 A in 125 ms through the solenoid. What is the magnitude of the induced emf in the solenoid?

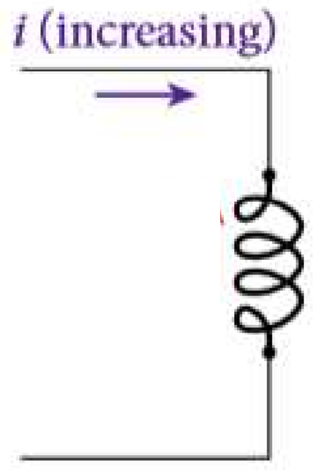
A. 3.6 V
B. 2.9 V
C. 1.7 V
D. 1.2 V

$\Delta V_{ind} = -L\frac{di}{dt}$

$\Delta V_{ind} = -(9.7\times10^{-3})\left(\frac{27-12}{125\times10^{-3}}\right)$

$\Delta V_{ind} = -1.164V$

$|\Delta V_{ind}| = 1.164V$



16- A solenoid with a cross-sectional area of $5.0\ cm^2$ has 1000 turns and 35 cm length, a second coil wrapped around it and has 400 turns with the same length and area. The mutual inductance is:

A. $0.44\ mH$

B. $0.72\ mH$

C. $1.2\ mH$

D. $12\ mH$

$$M = \mu_0 n_1 N_2 A = (4\pi \times 10^{-7})\left(\frac{1000}{35\times10^{-2}}\right)(400)(5\times10^{-4})$$

$$= 7.18\times10^{-4}\ H \equiv 0.72\ mH$$

17- Two coils of wire with 300 turns for the first one and 400 turns for the second one, are placed next to each other, the mutual inductance of each of them is $0.5\ mH$, if a constant current of 2.5 A flows through the first coil, what is the magnetic flux passes through the second coil?

A. 5.6×10^{-6} Wb

B. 4.9×10^{-6} Wb

C. 1.7×10^{-6} Wb

D. 3.1×10^{-6} Wb

$$M = \frac{N_2 \phi_2}{i_1}$$

$$0.5\times10^{-3} = \frac{(400)(\phi_2)}{(2.5)}$$

$$\phi_2 = 3.125\times10^{-6}\ Wb$$

18- A conducting rod of length 10 cm slides to the right with constant speed of 5.6 m/s over two parallel metal bars placed in a magnetic field with a magnitude of 1.6 T, as shown in the figure. What is the induced current flows through the resistor R?

A. 0.09 A

B. 0.9 A

C. 1.8 A

D. 18 A

$$\Delta V_{ind} = vlB$$

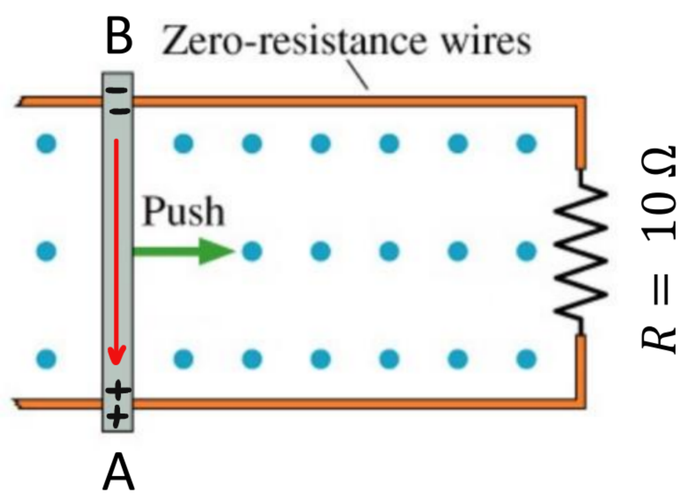
$$\Delta V_{ind} = (5.6)(10\times10^{-2})(1.6)$$

$$\Delta V_{ind} = 0.896\ V$$

$$I_{ind} = \frac{\Delta V_{ind}}{R}$$

$$I_{ind} = \frac{0.896}{10}$$

$$I_{ind} = 0.0896\ A$$



19- From the figure in the previous question, what is the polarity of each of points A, B when the wire moves through the magnetic field?

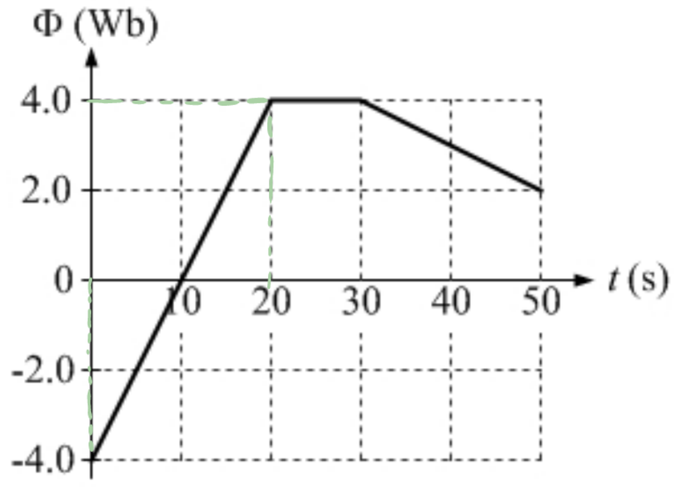
A. Point A positive, point B positive

B. Point A positive, point B negative

C. Point A negative, point B positive.

D. No polarity for point A, point B negative.

20- The graph shows the changing of magnetic flux with time. What is the induced potential difference in the loop during the first 20 seconds?



A. 0.4 V
B. 0.3 V
C. 0.2 V
D. 0.1 V

$$\Delta V_{ind} = -\frac{d\phi}{dt}$$

$$\Delta V_{ind} = -\frac{4-(-4)}{20}$$

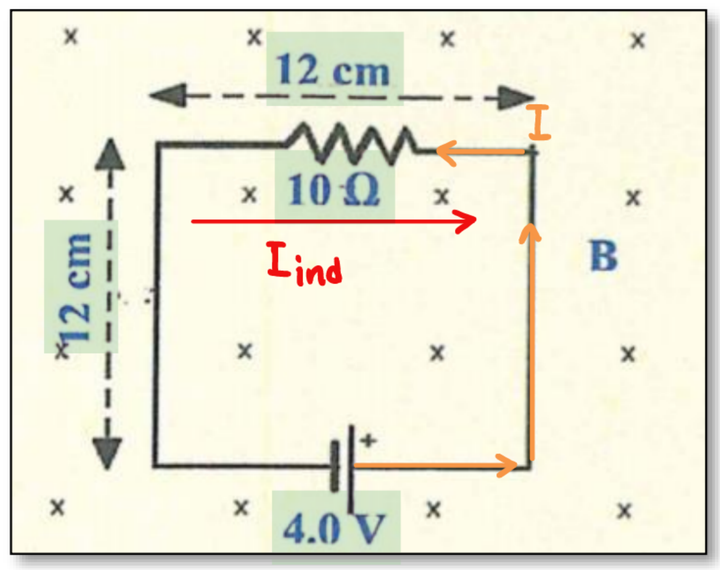
$$\Delta V_{ind} = -0.4V$$

$$|\Delta V_{ind}| = 0.4V$$

21- The magnetic field decreases through the circuit shown in the figure at a rate of 110 T/s, what is the current passes through the resistor during this changing in the magnetic field?

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

$$I = \frac{4}{10} = 0.4A$$



A. 0.24 A
B. 2.4 A
C. 1.6 A
D. 16 A

$$\Delta V_{ind} = -A\cos\theta \frac{dB}{dt}$$

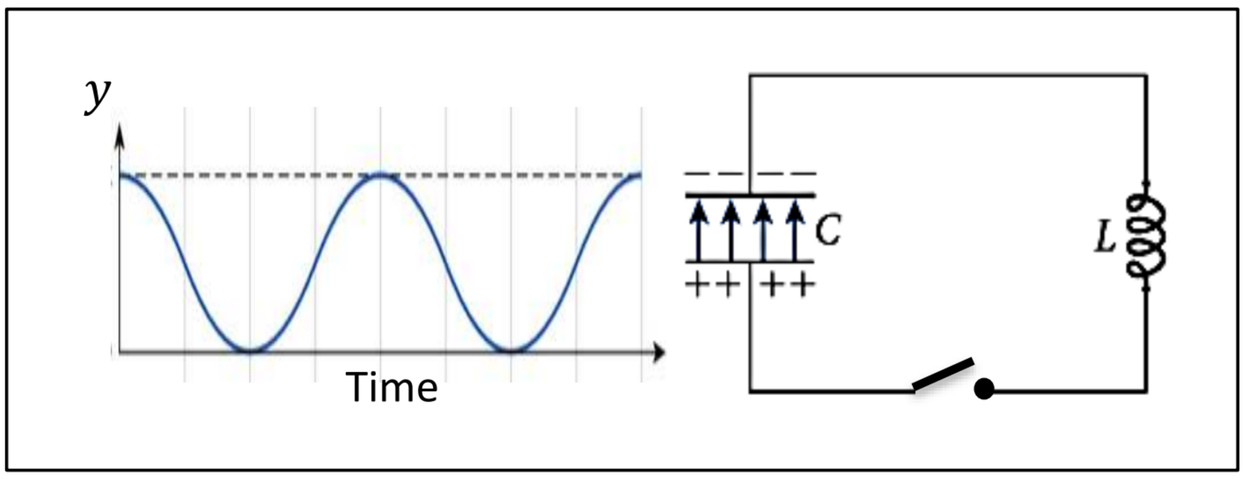
$$\Delta V_{ind} = -((12\times10^{-2})^2)(\cos(0))(-110)$$

$$\Delta V_{ind} = 1.584V$$

$$I_{ind} = \frac{\Delta V_{ind}}{R} = \frac{1.584}{10} = 0.1584A$$

$$I_{pass} = I - I_{ind} = 0.4 - 0.1584 = 0.2416A$$

22- When we close the switch of the circuit shown in the figure, the electric current and the potential difference will oscillate through the circuit, which physical quantity represented by axis Y in the graph that related to the same circuit?



A. The charge between the capacitor plates.
B. The current intensity that passes through the circuit.
C. The energy stored in the electric field,
D. The energy stored in the magnetic field.

23- What is the magnetic energy stored in a coil with 0.3 mH inductance when 2.3 A DC current passes through it?

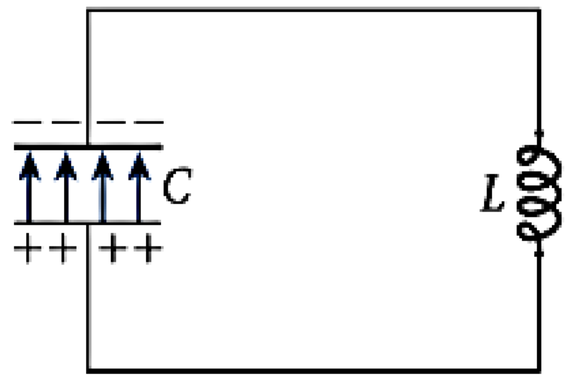
A. 1.5 J
B. 0.79 J
C. 3.6 J
D. Zero

$$U_B = \frac{1}{2}LI^2$$

$$U_B = \frac{1}{2}(0.3\times10^{-3})(2.3)^2$$

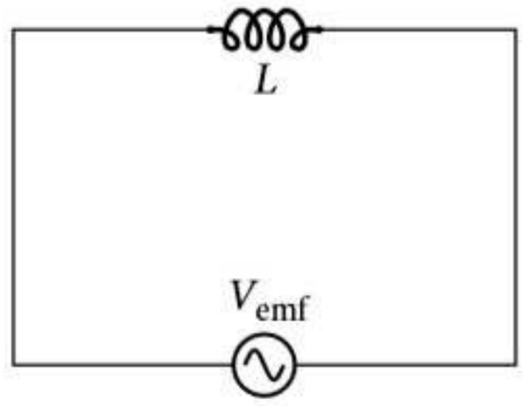
$$U_B = 7.935\times10^{-4}\ J$$

24- When does the current reache its maximum value In the LC circuit shown in the figure?



A. When the capacitor is fully charge.
B. When the capacitor is empty.
C. When the energy stored in the circuit is zero.
D. When the energy stored as a magnetic field is zero.

25- In the circuit with an inductor shown in the figure which of the following statements is correct about the phase difference between the current and the voltage?



A. The current lead the voltage with $\emptyset = \pi/2$
B. The current lags behind the voltage with $\emptyset = \pi/2$
C. The voltage lags behind the voltage with $\emptyset = \pi/2$
D. The voltage and the current are in phase.

29 - **A time varying emf source, with a voltage given as function of time by $V = 200\sin(2\pi\ 60\ t)$, connected to a resistor of $20\ \Omega$, what is the dissipated average power through the resistor?**

A. 4000 W
B. 3000 W
C. 2000 W
D. 1000 W

$$P_{max} = \frac{(V_{max})^2}{R}$$

$$P_{max} = \frac{(200)^2}{20} = 2000$$

$$P_{average} = \frac{1}{2} P_{max}$$

$$P_{average} = \frac{1}{2}(2000)$$

$$P_{average} = 1000\,W$$