تجميعة أسئلة متنوعة وفق الهيكل الوزاري بريدج المسار 102-C

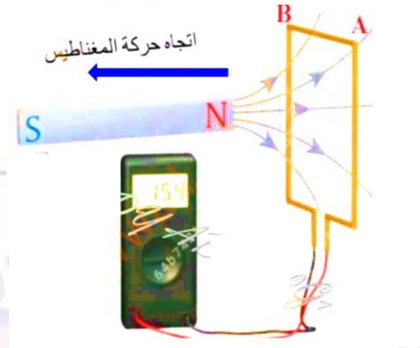
Academic Year العام الدراسي	2024/2025
Term الفصل	3
Subject المادة	Physics/Bridge C.102 الفيزياء/ بريدج C.102
Grade الصف	12
Stream المسار	Advanced المتقدم

Part (1) MCQ

@ABDALLA1972

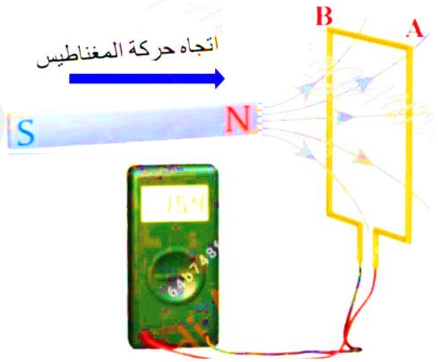
1. Describe Faraday's experiments to demonstrate that a changing magnetic field inside a conducting loop indicates a current in the loop.

1) Based on the adjacent figure, if the magnet is moved away from the loop, what is the direction of the current at the top of the loop?



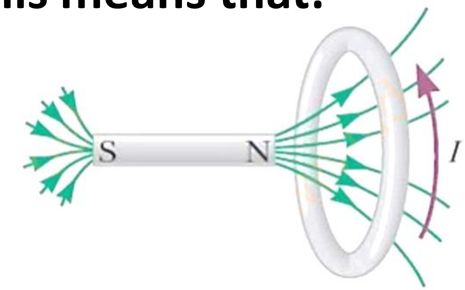
A. It can be in any direction:
B. Perpendicular to the plane of the loop
C. From point B to point A
D. From point A to point B

2) Based on the adjacent figure, if the magnet is moved toward the loop (approximately), what is the direction of the current at the top of the loop?



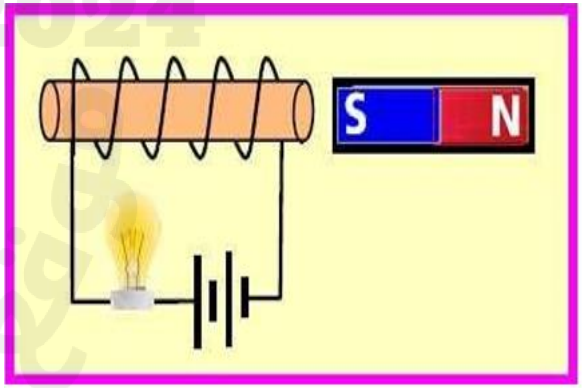
A. It can be in any direction:
B. Perpendicular to the plane of the loop
C. From point B to point A
D. From point A to point B

3) The adjacent figure shows a magnet placed in front of a loop. An induced current is observed in the conducting loop, as shown in the figure. This means that:



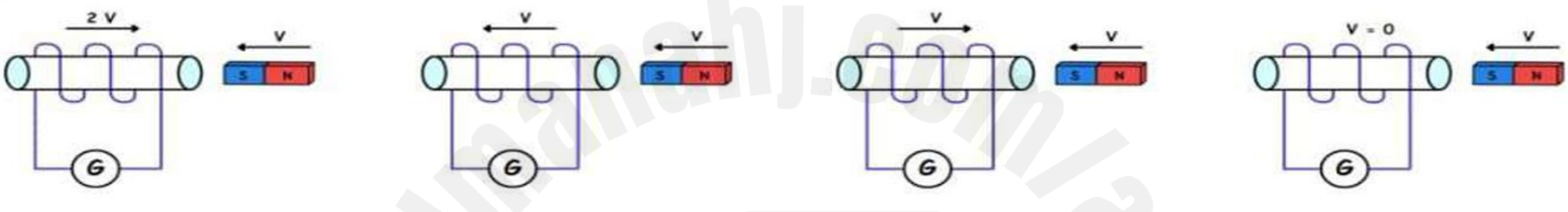
A. The magnet is moving away from the loop.
B. The magnet is approaching the loop.
C. The loop and magnet are stationary.
D. The loop and magnet are moving at the same speed and in the same direction.

4) In the figure, when the magnet was moved, the intensity of the bulb's light increased for a moment, then returned to its previous intensity. This means:



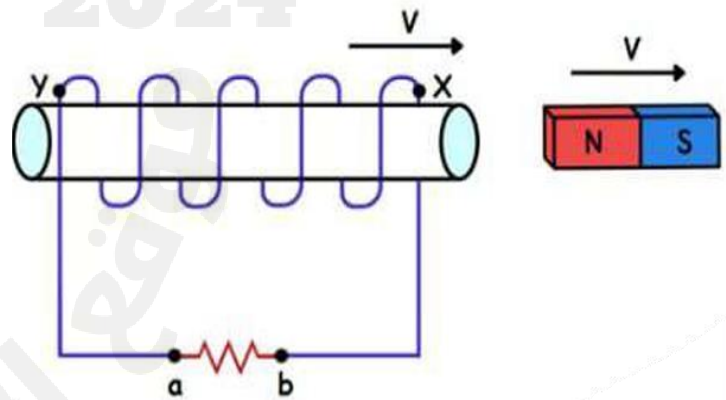
A. The magnet is moving away from the coil.
B. The coil is moving away from the magnet.
C. The magnet is approaching the coil.
D. The coil and magnet are stationary.

5) A magnet, a solenoid, and a galvanometer were used to achieve Faraday's law of electromagnetic induction. The experiment was carried out four times, where the magnet and the coil were moved at the speeds shown in the four figures. The galvanometer pointer had the largest deflection in the experiment.



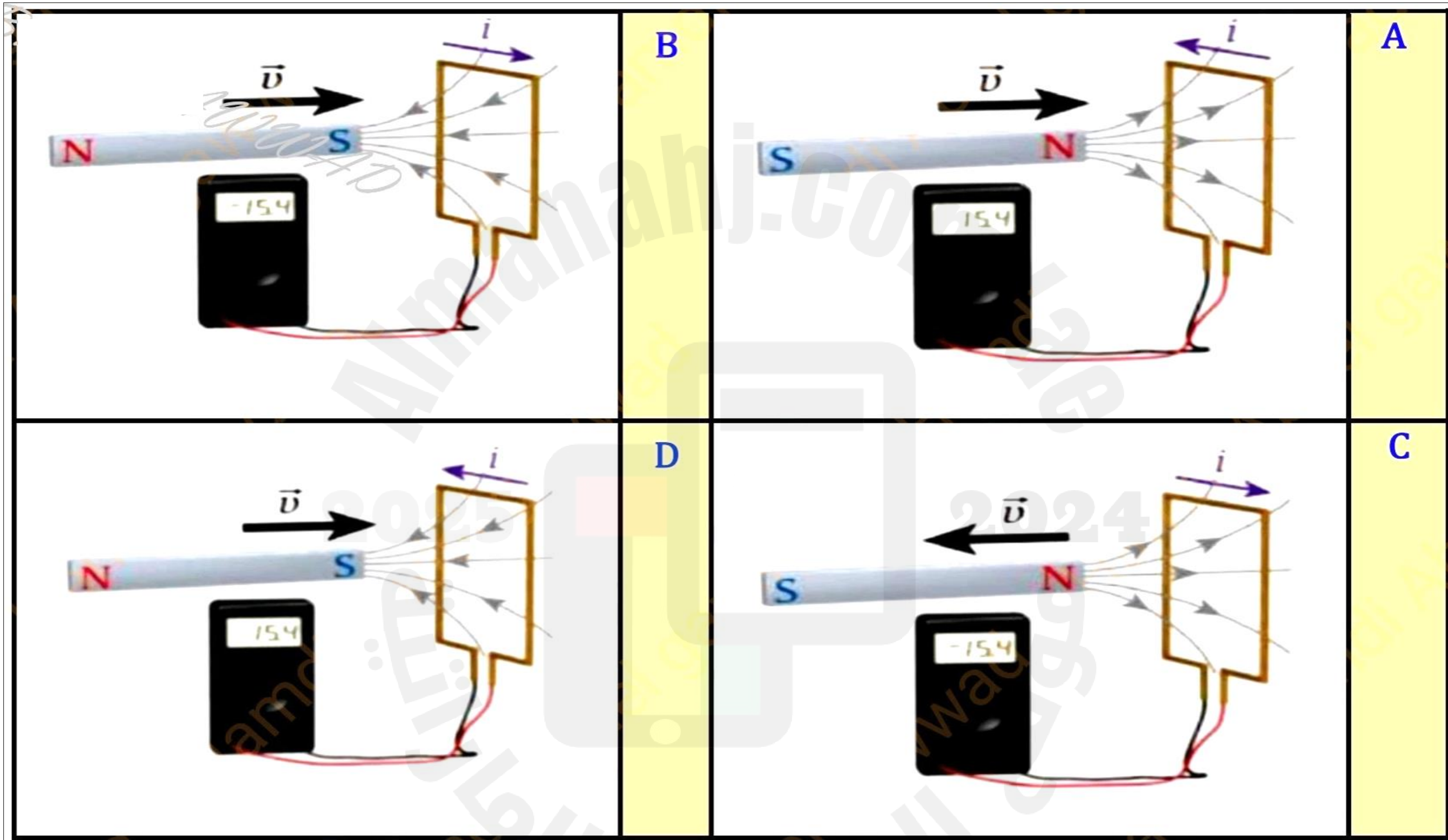
(A) (B) (C) (D)

6) The magnet and coil shown in the figure move at the same speed and in the same direction. Then……………..

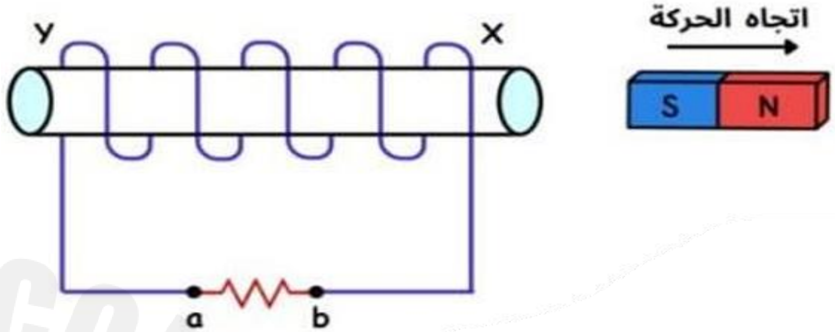


A. From point A to point B
B. From point B to point A
C. From a to b, then reverses direction from b to a
D. No current flows through the resistance.

7) Which of the following figures is incorrect based on Faraday's experiments?

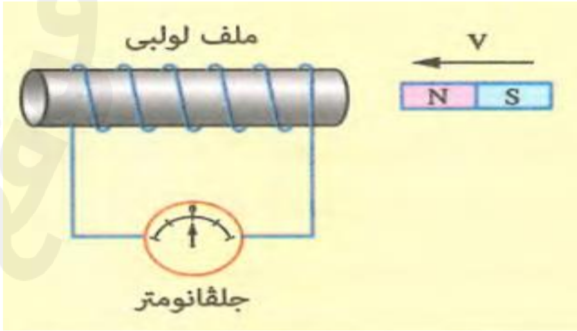


8) In the opposite figure, when the magnet moves in the direction shown, **which of the following is correct?**



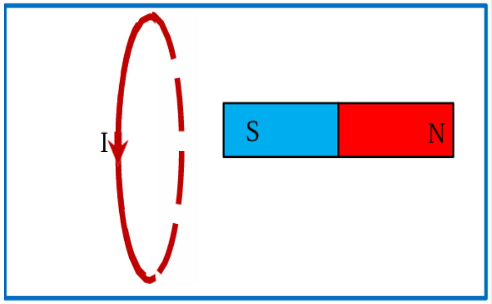
A. Terminal γ is north and the current is from a to b in the resistor.
B. Terminal γ is south and the current is from a to b in the resistor.
C. Terminal χ is north and the current is from b to a in the resistor.
D. Terminal χ is south and the current is from b to a in the resistor.

9) The figure shows a magnet moving at a speed of (V) to the left towards a moving solenoid connected to a galvanometer. However, no induced current is generated in the coil because the solenoid is moving at a speed of................



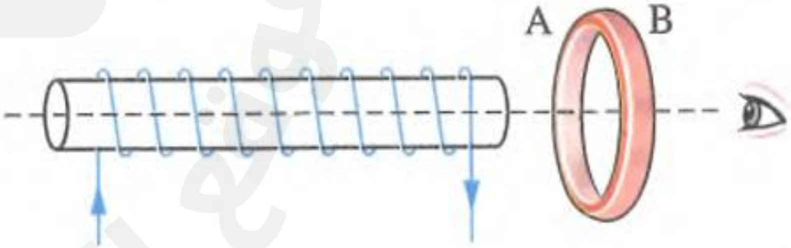
- ❑ (V) left
- ❑ (2 V) left
- ❑ (V) right
- ❑ (2 V) right

10) A ring whose plane is perpendicular to the plane of the page, an induced current passes through it, as shown in the adjacent figure, due to:



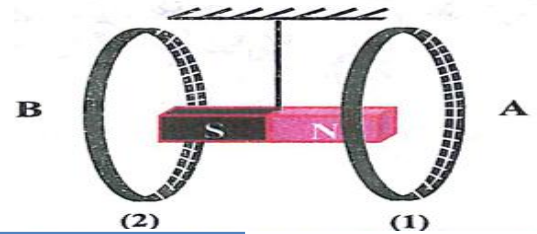
A. Movement of the magnet toward the plane of the ring (left)
B. Movement of the magnet toward the top of the page (up)
C. Movement of the magnet toward the bottom of the page (down)
D. Movement of the magnet away from the plane of the ring (right)

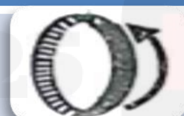
11) The opposite figure shows a current-carrying solenoid placed next to a metal ring, such that the axis of the coil is perpendicular to the plane of the ring and passes through its center. An induced current is generated in the ring, and its direction, when viewed from face B, is counterclockwise at...........



A. Decreasing the current intensity in the coil
B. Increasing the current intensity in the coil
C. Bringing the coil closer to the ring
D. Rotating the ring around an axis perpendicular to its plane

12) A magnet suspended from a string moves in simple harmonic motion between two circular rings, as shown in the figure. Which of the following is correct when the magnet begins its movement, moving from ring (1) to ring (2)?



	Current direction in the loop(2)	The pole at B	Current direction in the loop(2)	The pole at A
A.		northern		northern
B.		northern		northern
C.		southern		southern
D.		southern		southern

2. Describe, based on Faraday's law, the possibility of creating a potential difference in a loop by either varying the magnetic field 'B' with time (A and θ are constants), varying the loop area 'A' with time (B and θ are constants), or varying the angle θ between the magnetic field and the normal to the loop with time (A and B are constants). Prove using mathematical equations.
3. Calculate the magnetic flux ϕ B through a given surface.

13) When can we use the following relationship $\left(V_{ind} = -NA\cos\theta \frac{dB}{dt}\right)$

- ❑ (θ,A) are constants and θ is a variable
- ❑ (θ,A) are constants and θ is a variable
- ❑ (θ,B) are constants and θ is a variable
- ❑ (A,B,θ) are variables

14) When can we use the following relationship: $\Delta V_{ind} = \omega AB\sin(wt)$

- ❑ (B,A) are constants and θ is a variable
- ❑ (θ,B) are constants and A is a variable
- ❑ (A, θ) are constants and B is a variable
- ❑ (A,B,θ) are variables

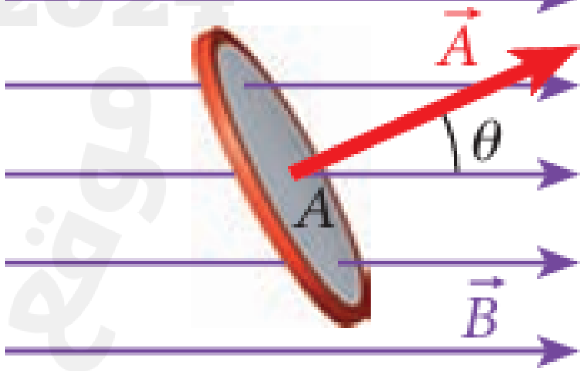
15) When can we use the following relationship $\left(V_{ind} = - B\cos\theta \frac{dA}{dt}\right)$

- ❑ (A, B) are constants and θ is a variable
- ❑ (A, θ) are constants and B is a variable
- ❑ (B, θ) are constants and A is a variable
- ❑ (A, B, θ) are variables

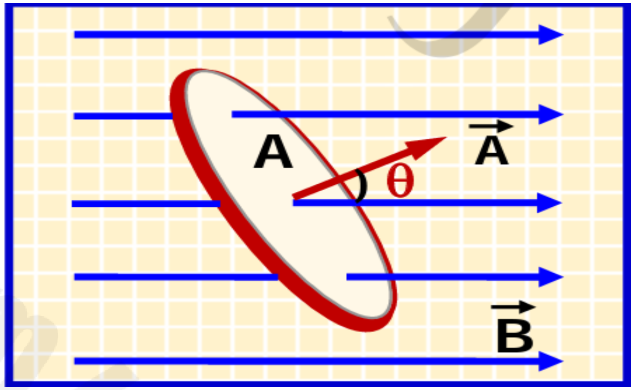
16) Based on the figure, which of the following is true regarding magnetic flux?

$\theta = 60^{\circ}$

- ❑ $\frac{\phi_A}{\phi_{mix}} = \frac{2}{1}$
- ❑ $\frac{\phi_A}{\phi_{mx}} = \frac{3}{5}$
- ❑ $\frac{\theta_A}{\phi_m} = \frac{1}{2}$
- ❑ $\frac{\phi_A}{\phi_{mt}} = \frac{5}{3}$

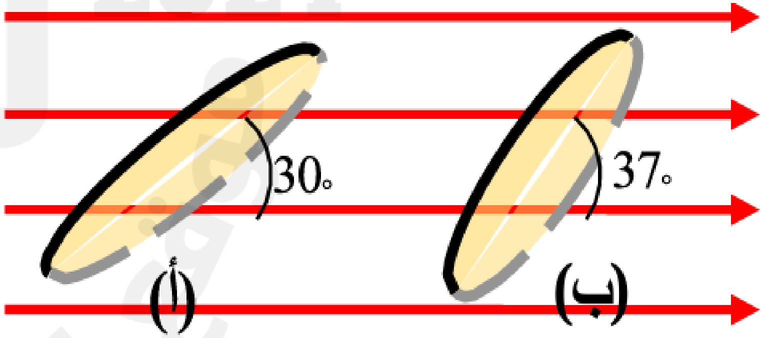


17) Based on the figure, at which angle (θ) will the magnetic flux be at its maximum value (AB=0 wb) at an angle?



- ❑ 90˚
- ❑ 30˚
- ❑ 0˚
- ❑ 45˚

18) The ring in position (A) has its surface inclined along the lines of a regular magnetic field. The flux passing through its surface was 2.0×10^{-4} Wb. The amount of magnetic flux passing through its surface in position (B) is equal to:



- ❑ 1.2×10^{-4}Wb
- ❑ 1.0×10^{-4} Wb
- ❑ 2.4×10^{-4} Wb
- ❑ 9.0×10^{-5} Wb

19) A coil consisting of (150) turns and a cross-sectional area of ($0.22\ m^2$) rotates at an angular velocity of (120 rad/s) about an axis of rotation perpendicular to a uniform magnetic field of (0.025 T). The maximum value of the induced electromotive force generated in the coil is equal to:

- ❑ $11\ V$
- ❑ $450\ V$
- ❑ $99\ V$
- ❑ $44.5\ V$

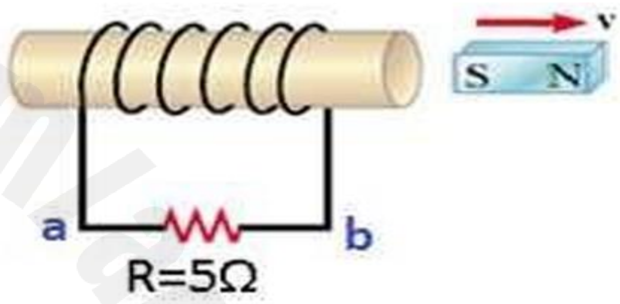
20) A rectangular metal ring, (4.0 cm) long and (2.0 cm) wide, is subjected to a magnetic field of unit (T) perpendicular to its surface, which changes with time according to the equation: $\{B_{(t)} = 7.0t^3\}$. What is the magnitude of the induced potential difference in the ring at (t = 5.0 s)?

- ❑ $0.6\ V$
- ❑ $0.14\ V$
- ❑ $0.06\ V$
- ❑ $1.4\ V$

مساعدة

$$\Delta V_{ind} = -\frac{d(ABcos\theta)}{dt}$$

21) The adjacent figure shows a solenoid with (500) turns connected to a resistor and near it a strong magnet that induces a magnetic flux of 4.0×10^{-5} Wb. Therefore, the magnet will be deflected to the right such that the magnetic flux passing through the coil decreases to 2.0×10^{-5} Wb within (0.10 S) . An electric current is induced during this period equal to ....



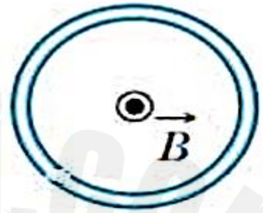
- ❑ 0.2A Its direction is from a to b
- ❑ 0.2A Its direction is from b to a
- ❑ 0.02A Its direction is from a to b
- ❑ 0.02A Its direction is from b to a

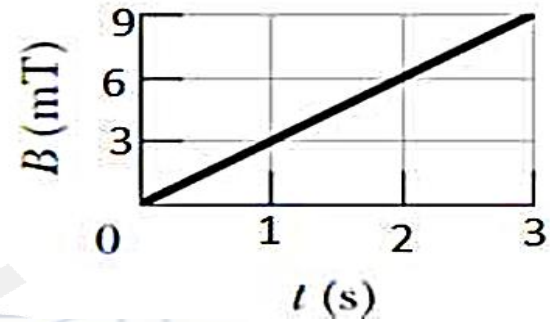
22) A metal ring with a diameter of 0.2 cm is subject to a uniform magnetic field perpendicular to the plane of the ring with a strength of 2.5 T. If the direction of the magnetic field passing through the ring is reversed within 30 seconds, the average potential difference induced in the ring is equal to ....

- ❑ 2.61×10^{-7} v
- ❑ 1.305×10^{-7} v
- ❑ 5.22×10^{-7} v
- ❑ 6.61×10^{-7}

23) The magnetic flux passing through the surface area of the stator loop is determined by the following relationship $\phi_B = 5t^2 - 2$, where ϕ_B is in mWb and t is in seconds. The magnitude of the induced emf at instant t = 2.0 s

- ❑ 1.8 mV
- ❑ 20 mV
- ❑ 9.0 mV
- ❑ 18 mV

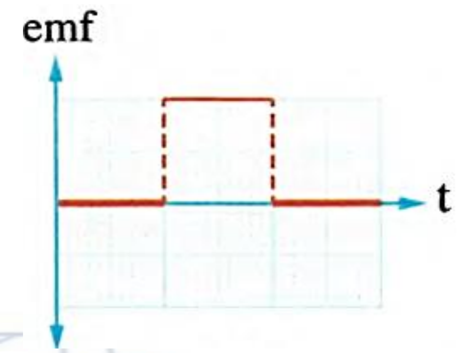


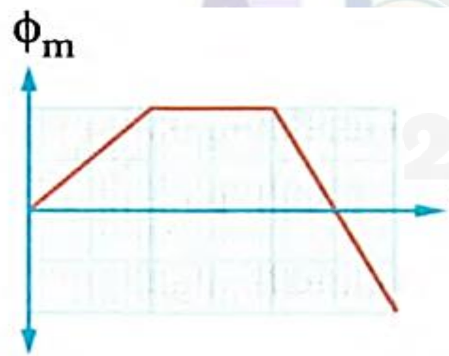


24) The adjacent figure shows a uniform magnetic field that increases steadily with time. It is perpendicular to the plane of a loop whose surface area is also shown in the figure. If the resistance of the loop's wire is 5 Ω,
what is the magnitude of the induced current in the loop after three seconds of the change in magnetic field?

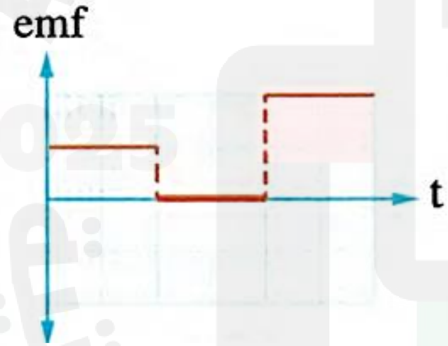
- ❑ 2.4 × 10^{-7} A clockwise
- ❑ 2.4 × 10^{-7} A counterclockwise
- ❑ 4.8 × 10^{-7} A counterclockwise
- ❑ 4.8 × 10^{-7} A clockwise

25) The opposite graph shows the relationship between the magnetic flux (ϕ_B) that penetrates a coil and time (t). Which of the following graphs represents the electromotive force induced in the coil during the same time period?

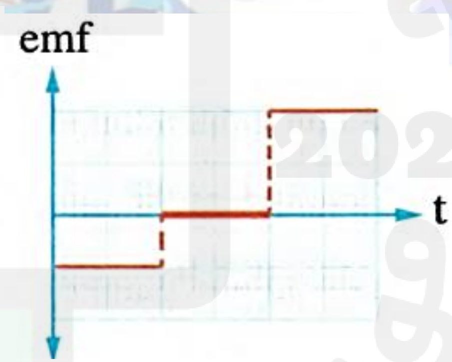




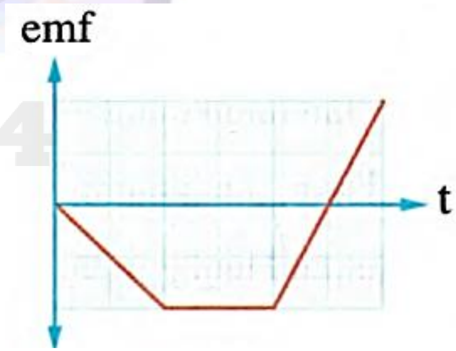
(A)



(B)

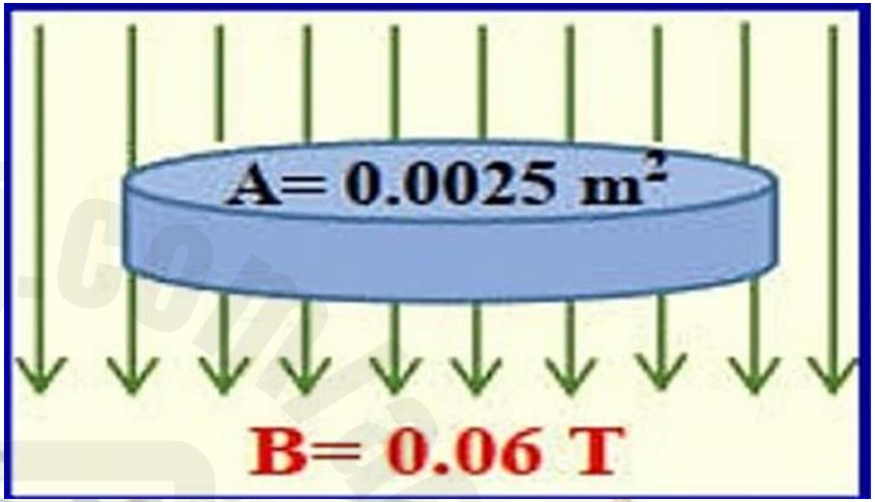


(C)



(D)

26) What is the magnitude of the magnetic flux passing through the upper surface of the disk shown in the adjacent figure?



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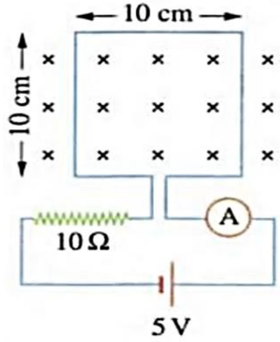
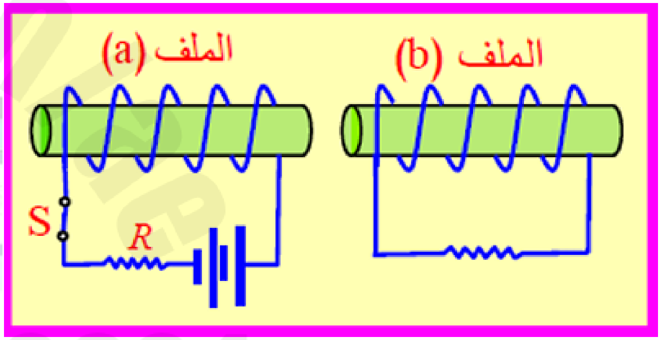
27) In the circuit shown, a single-turn coil of negligible resistance is placed in a magnetic field whose direction is perpendicular to the coil and into the page. If the flux density decreases at a regular rate of 150 T/s, the ammeter reading during the period of decreasing flux becomes ....



- ❑ 0.15 A
- ❑ 0.35 A
- ❑ 0. 5 A
- ❑ 0.65 A

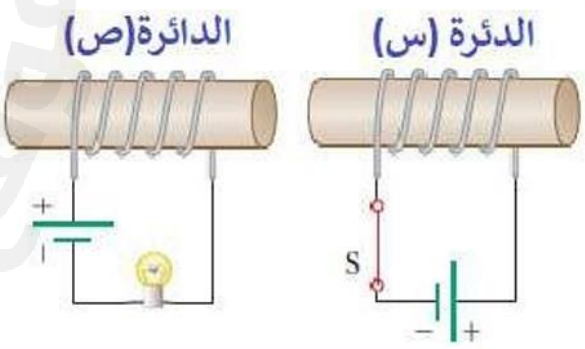
4. Formulate Lenz's law as follows: The induced current in a loop has a direction such that the magnetic field produced by the induced current opposes the change in the induced magnetic flux of the current.
5. The induced potential difference of a wire moving in a magnetic field.
Solve problems related to Lenz's law and electromotive force.

28) In the adjacent figure, an induced current is generated in coil (b) whose direction in the resistance of coil (b) is towards the left:



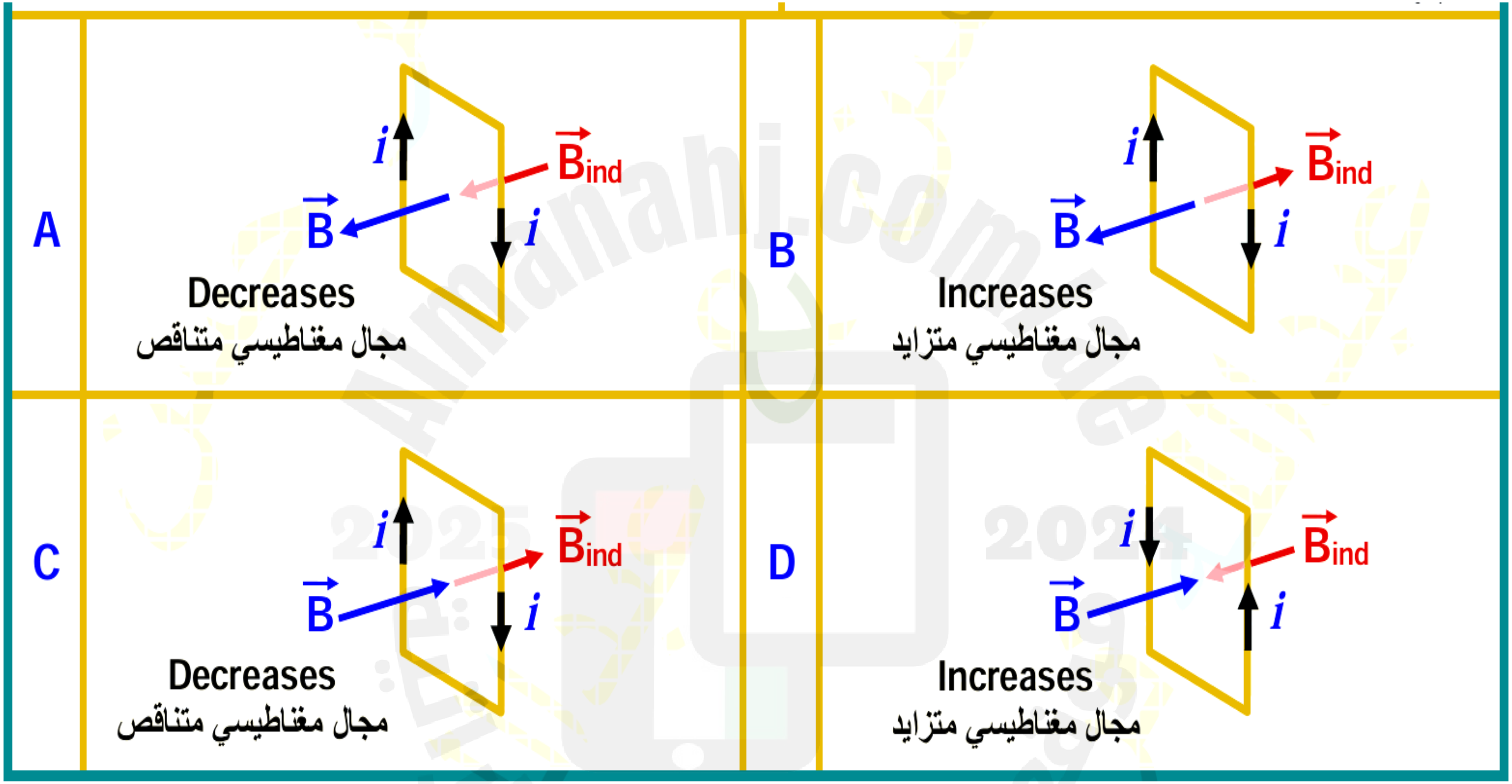
- ❑ While moving coil (a) away from coil (b)
- ❑ While increasing the value of R in coil (a)
- ❑ The moment the switch (s) in coil (a) opens
- ❑ While moving coil (a) closer to coil (b)

29) The adjacent figure shows two adjacent circuits. When circuit (S) is opened, the light of the bulb in circuit (Y)



- ❑ increases in light
- ❑ decreases in light
- ❑ turns off
- ❑ does not change in light

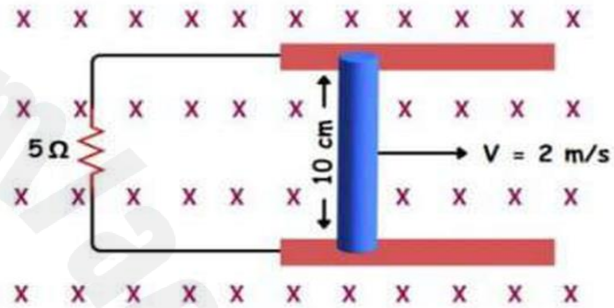
30) Which of the following figures is incorrect according to Lenz's law?



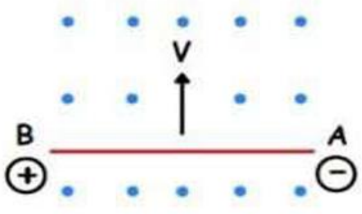
31) The opposite figure represents a wire moving perpendicular to a magnetic field with a flux density of 0.2 T . The current intensity passing through the resistor is equal to.................

Note that: (The ohmic resistance of both the wire and the frame is neglected)

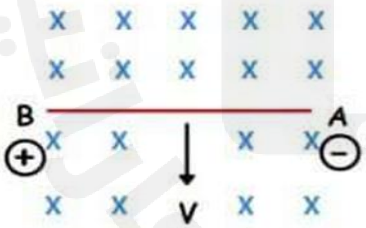
- ❑ 4 mA
- ❑ 6 mA
- ❑ 8 mA
- ❑ 2 mA



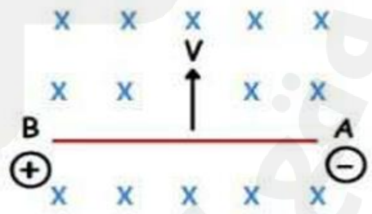
32) A copper wire AB of length L moves in the plane of the paper perpendicular to a uniform magnetic flux. Which of the following figures correctly expresses the polarity of the two ends of the wire?



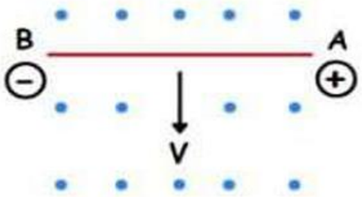
(A)



(B)



(C)

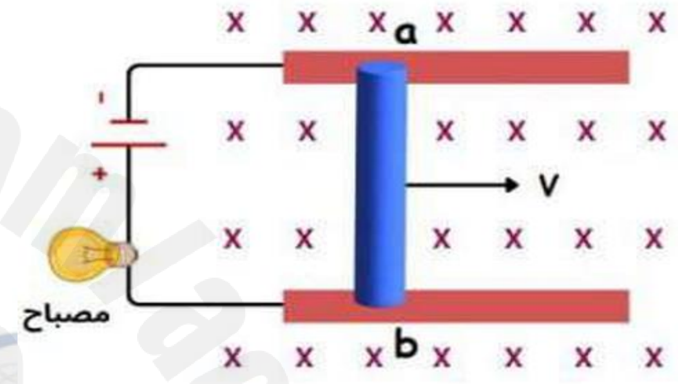


(D)

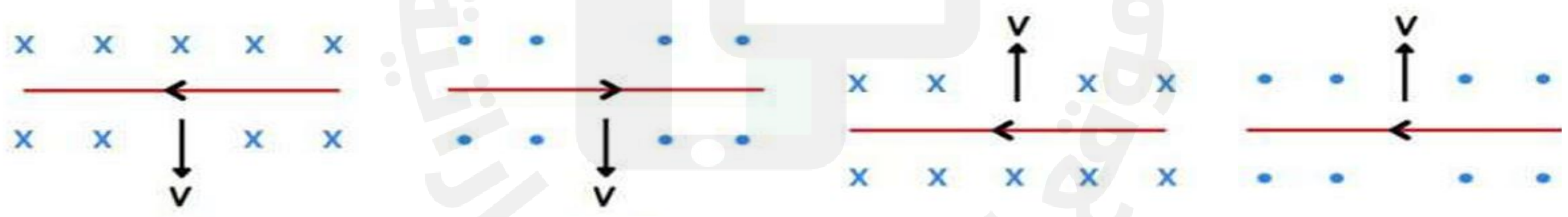
34) In the figure shown, while moving the rod ab to the right at a constant speed (V), the lamp lights up....

Note that: (The ohmic resistance of the rod and legs is neglected)

A. Is zero
B. Increases
C. Does not change
D. Decreases



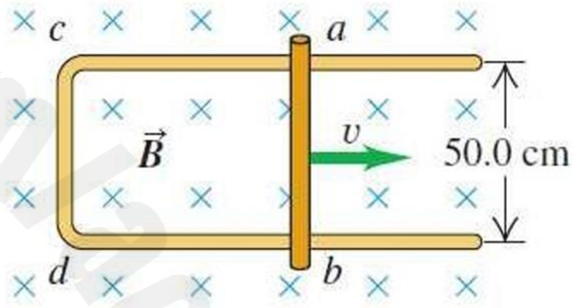
34) The following figures represent four straight wires, each connected in a closed circuit and moving at a speed V in a uniform magnetic field. Which of these figures shows the correct direction of the induced current in the wire?



(A) (B) (C) (D)

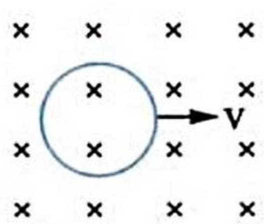
35) The adjacent figure shows conductors A and B sliding on two wires without friction at a constant speed of 7.50 m/s perpendicular to a uniform magnetic field of 0.8 T.

What is the magnitude and direction of the induced emf in the wire?

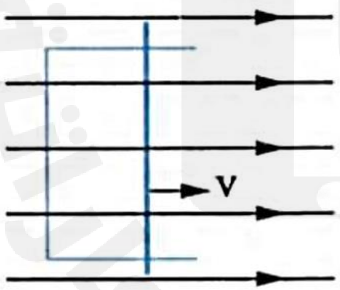


- ☐ $V_a > V_b$ و $3.0\ V$
- ☐ $V_a < V_b$ و $3.0\ V$
- ☐ $V_a > V_b$ و $0.15\ V$
- ☐ $V_a < V_b$ و $6.0\ V$

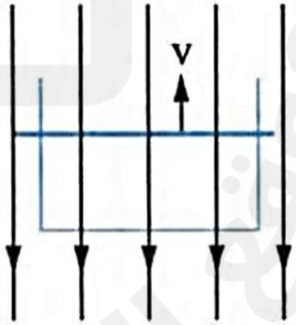
36) In which of the following forms is an induced current generated due to the movement of a conductor within a uniform magnetic field?



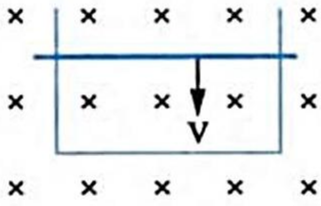
(A)



(B)

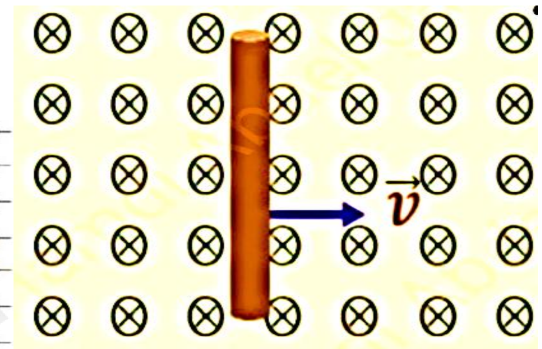


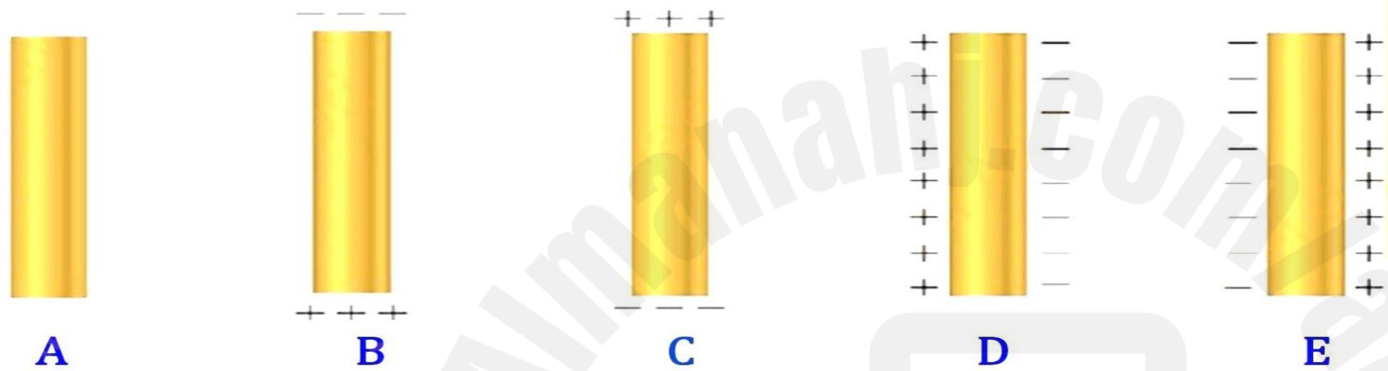
(C)



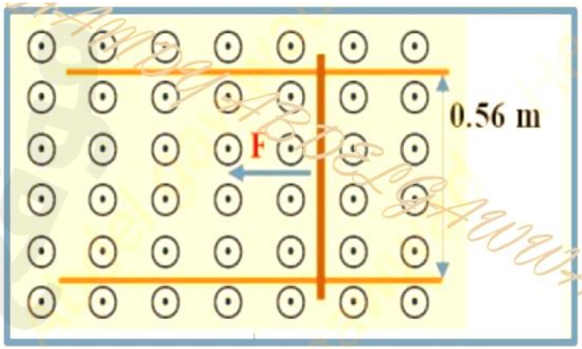
(D)

37) A copper rod moves at a speed of $\vec{v}$ inside a uniform magnetic field directed inward, as shown in the figure. **Which of the following represents the most accurate distribution of charges on the rod?**





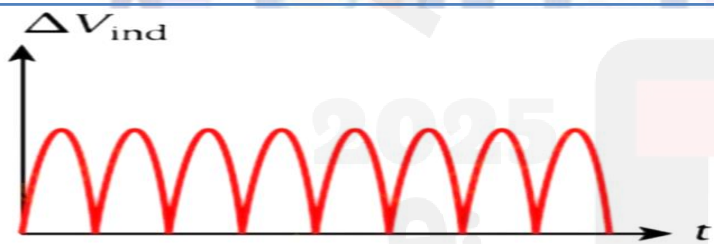
38) The figure shows a copper rod being pulled horizontally at a speed of 4.0 m/s by a constant force acting on a copper wire separated by a distance of 0.56 m within a uniform magnetic field of magnitude 0.60 t. **What is the magnitude of the induced potential difference between the ends of the loop?**

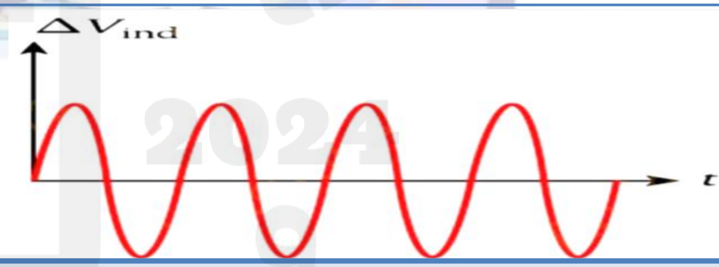


- ❑ 4.3 V
- ❑ 3.7 V
- ❑ 1.3 V
- ❑ 2.8 V

6. Identify electric generators and electric motors as everyday applications of electromagnetic induction and electromagnetic force.
Describe how direct and alternating voltage differences are induced in a DC generator and an AC generator **through various connections between the rotating ring and the external circuit.**
7. Describe the workings of **a DC generator** and **an AC generator.**
Describe the workings of **a DC motor.**

39. The figure shows two graphs representing the induced potential difference as a function of time for two electric generators. Which of the following rows identifies the correct type of electric generator below each graph?





A.	A simple direct current generator DC	A simple direct current generator DC
B.	A simple alternating current generator AC	A simple alternating current generator AC
C.	A simple alternating current generator AC	A simple generator AC
D.	A simple direct current generator DC	A simple DC alternator generator DC

40) Which of the following is not true for generators and motors?

A. Generators and motors: Applications of electromagnetic induction

B. Motors convert kinetic energy into electrical energy

C. AC generators produce alternating voltage and alternating current

D. Generators and motors contain loops within a magnetic field

41) At the instant the magnetic flux passing through the generator coil reaches its maximum value, the induced electromotive force (EMF) in the generator coil.

A. reaches Its positive maximum value.

B. It has a negative maximum value.

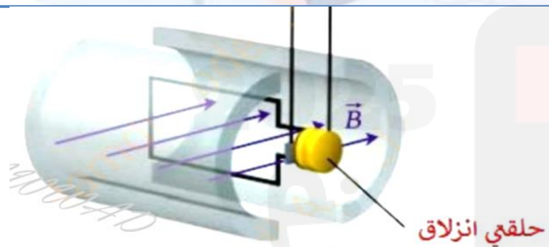
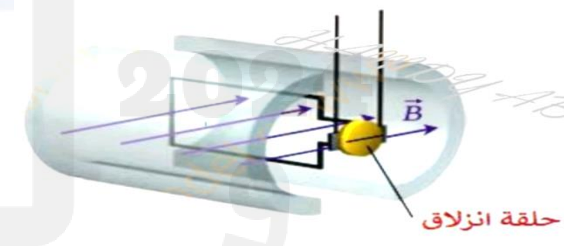
C. The induced emf is zero.

D. It is half its positive maximum value.

42) The rate at which the coil cuts the magnetic flux lines in an electric generator is **greatest** when ....

A. The area vector is perpendicular to the magnetic field lines.
B. The area vector is inclined at an angle to the magnetic field lines.
C. The area vector is parallel to the magnetic field lines.
D. The plane of the coil is parallel to the magnetic field lines.

43) The figure below shows the induced potential difference as a function of time for two generators. **Which of the following statements is correct based on the type of generator?**

		
A.	A simple direct current generator DC	A simple direct current generator DC
B.	A simple alternating current generator AC	A simple alternating current generator AC
C.	A simple alternating current generator AC	A simple direct current generator DC
D.	A simple direct current generator DC	A simple alternating current generator AC

44) Which of the following statements is true about generators, motors, and transformers?

A. A motor converts mechanical energy into electrical energy, while a generator converts electrical energy into mechanical energy.

B. A generator converts mechanical energy into electrical energy, while a motor converts electrical energy into mechanical energy.

C. A generator converts mechanical energy into electrical energy, while a transformer converts electrical energy into mechanical energy.

D. A generator converts mechanical energy into thermal energy, while a motor converts thermal energy into mechanical energy.

45) A generator is operated by rotating a coil containing a number (N) of turns in a constant magnetic field (B), where the coil rotates at a frequency (f).

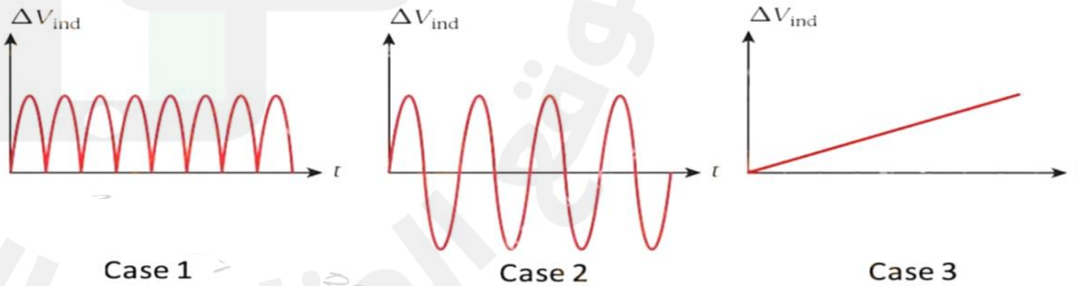
Which of the following curves shows the induced voltage as a function of time for a simple DC generator?

A. Case 1 only

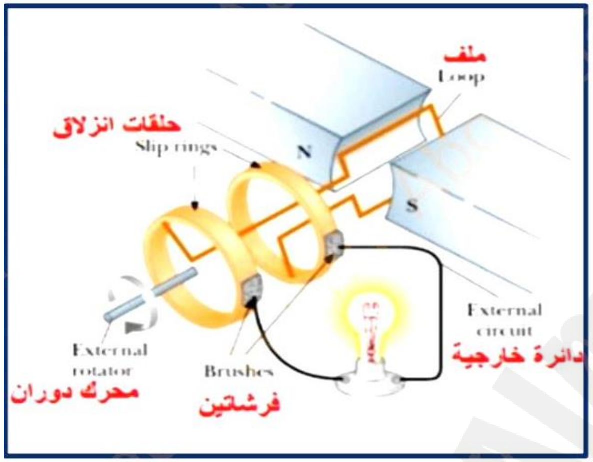
B. Case 2 only

C. Case 3 only

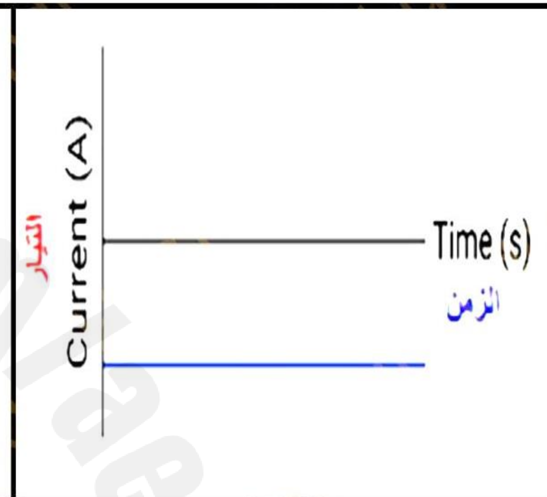
D. Case 1, 2



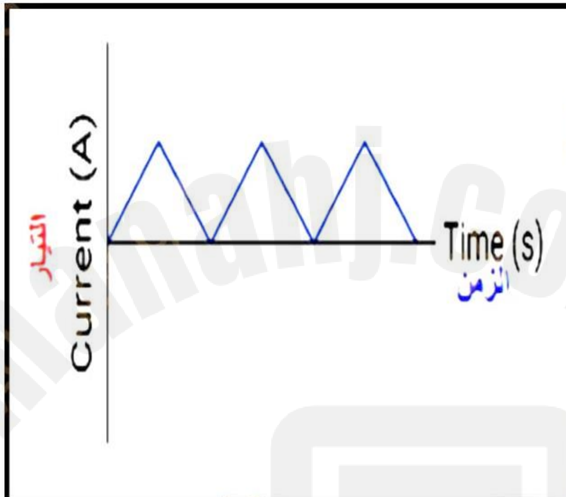
46) Which of the following curves represents the current flowing in the external circuit when the coil rotates, as shown in the following figure:



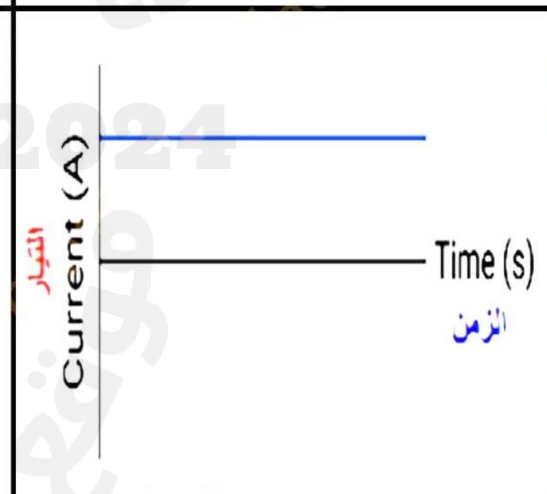
A



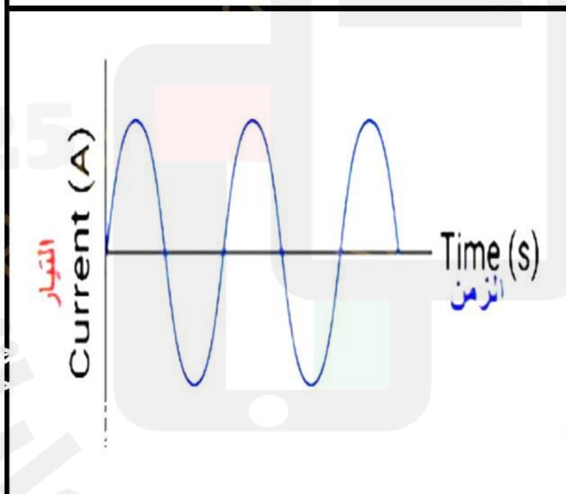
B



C



D



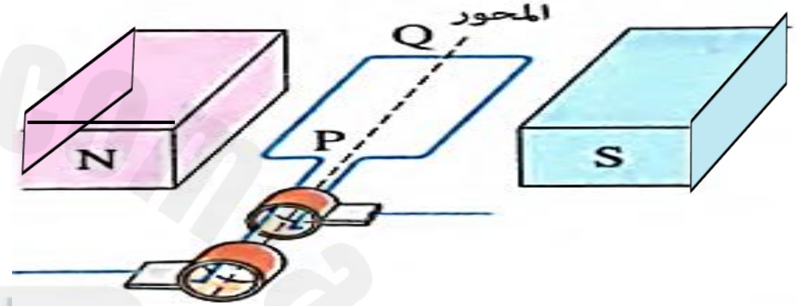
47) At the moment when the AC dynamo coil is parallel to the direction of the magnetic flux, the magnetic flux through the coil is (ϕ_m)and the electromotive force (emf) induced in the coil is ....

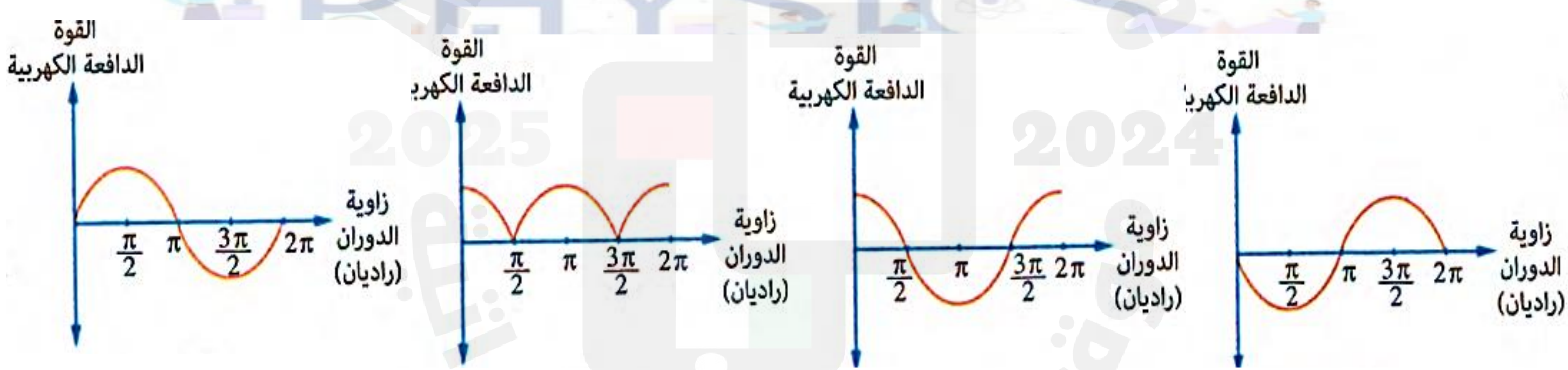
	ϕ_m	emf
A.	Maximum value	Zero
B.	Zero	Maximum value
C.	Maximum value	Maximum value
D.	Zero	Zero

48) In an AC dynamo, when the induced electromotive force is obtained, the plane of the magnetic coil is.................

A. Vertical
B. Parallel
C. Inclined at an angle of 45°
D. Inclined at an angle of 60°

49) A rectangular coil rotates between two magnetic poles. If the coil rotates around axis PQ from the position shown in the figure, which of the following hydraulic figures correctly represents the induced electrical force in the coil for one complete revolution?





(A) (B) (C) (D)

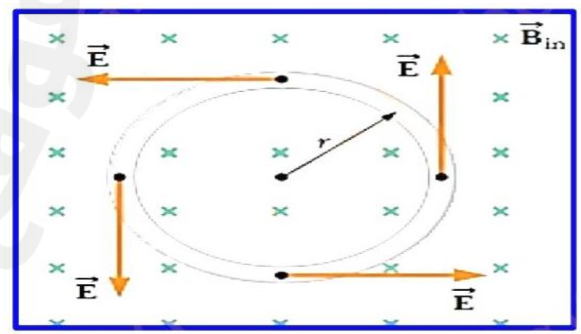
8. Apply Faraday's law and the work done on an electric charge in an electric field to relate the induced electric field along a **closed** path to the rate of change of magnetic flux surrounding the path.

50) One of the consequences of Faraday's law of electromagnetic induction is that an electric field is induced in the presence of a changing magnetic flux.

Which of the following equations represents this effect?

- ❑ $P=IV$
- ❑ $V=IR$
- ❑ $\oint \vec{E}.\vec{ds} = -\dfrac{d\Phi_B}{dt}$
- ❑ $F=ma$

51) A positive charge moves in a circular path with a radius of (r) within an electric field. The induced potential difference can be expressed by the equation $(\Delta V_{ind} = 2\pi XE)$، what does the symbol X represent?



A. Induced electric current
B. Magnitude of electric charge
C. Induced electric field
D. Radius of the circular path

52) The induced electric field along a closed path is related to the rate of change of magnetic flux enclosed by the path by the equation: $\oint \vec{E}.\vec{ds} = -\frac{d\phi_B}{d_t}$

Which of the following correctly describes the equation?

A. Changing the electric flux generates a magnetic field.
B. Changing the magnetic flux induces an emf.
C. Changing the magnetic flux generates an electric field.
D. Changing the electric flux induces an emf.

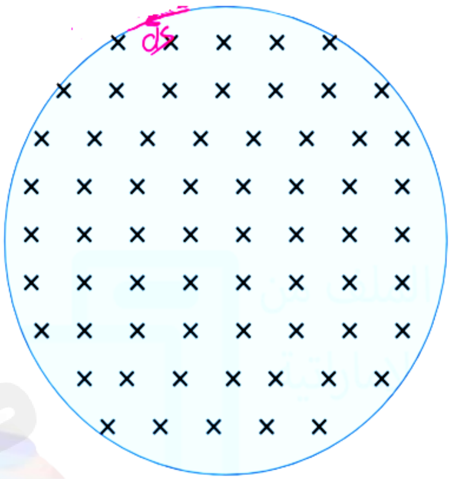
53) The electric current decreases from 3.0 A to 1 A in 0.1 s in a solenoid consisting of 500 turns, 20 cm long, and 2.0 cm radius.
Calculate the induced electric field inside the coil and 1.0 cm from its center.

$$\oint \vec{E} \bullet d\vec{s} = -\frac{d\Phi_B}{dt}.$$

$$\Delta V_{ind} = 2\pi r E.$$

54) The magnetic field inside a wire loop with a radius of 20 cm varies according to the equation $B(t) = 3t^2$.

What is the magnitude of the induced electric field in the loop at a time of 2 s?



55) A charge moves in a circular path with a radius of 2 m in a changing magnetic field. Therefore, the rate of change of the magnetic frequency is 0.4 Wb/s, and the amount of the induced electric field is equal to.....................

- ☐ $2\pi V/m$
- ☐ $\pi V/m$
- ☐ $\frac{1}{2\pi} V/m$
- ☐ $\frac{1}{\pi} V/m$

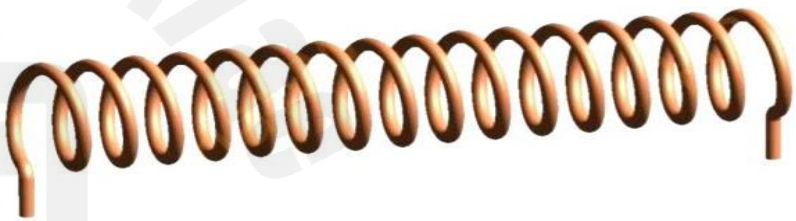
For help: $\oint \vec{E}.d\vec{s} = -\frac{d\phi_B}{dt}$

9. Determine that inductance is a measure of the flux bond produced by the solenoid per unit current, and express it in the form of an equation:

$$\left(L = \frac{N\phi_B}{i} = \frac{(\pi i)(\mu_o \eta i)(A)}{i} = \mu\_o\, \eta^2\, LA\right)$$

56) A solenoid has an inductance coefficient of 0.007H. Suppose the solenoid is lengthened to one-sixth its original length, and the average cross-sectional radius is increased to five times its original radius. The number of turns remains unchanged.

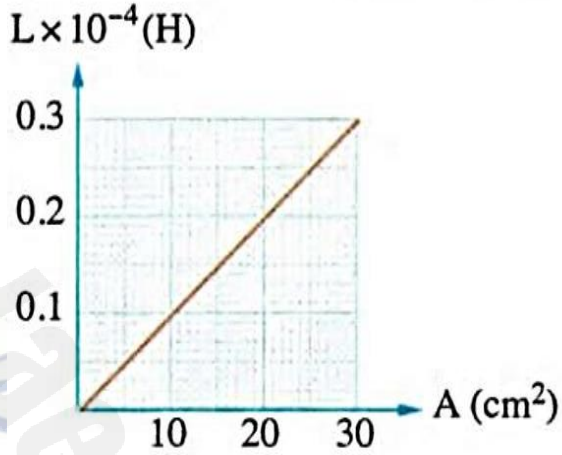
- ❑ 1.05 H
- ❑ 2.05 H
- ❑ 5 H
- ❑ 3. 5 H



57) A solenoid has a length of ℓ and 10 turns. If the number of turns increases to 30 turns over the same length of the coil, the self-inductance coefficient of the coil becomes...................

A. Three times what it was
B. Nine times what it was
C. One third of what it was
D. Nine times what it was

58) Several air-core solenoid coils of the same length (ℓ). The graph opposite shows the relationship between the inductance coefficient of each coil and its face area. If the number of turns in each coil is 100 turns, then the length (ℓ) is..............



- ❑ $0.1\ \pi m$
- ❑ $0.2\ \pi m$
- ❑ $0.4\ \pi m$
- ❑ $0.8\ \pi m$

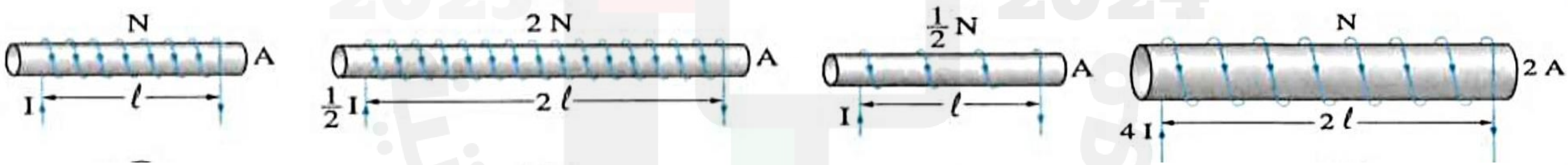
59) An inductor coil has a self-inductance coefficient. When the number of turns and its length are doubled, while keeping its cross-sectional area constant, its self-inductance coefficient becomes ....

- ❑ $\frac{L}{2}$
- ❑ L
- ❑ $2\ L$
- ❑ $4\ L$

60) Which of the following changes would cause the self-inductance coefficient of a solenoid with an iron leg to double, all other things being equal?

A. Doubling the number of turns
B. Doubling the length of the coil
C. Doubling the area of the coil
D. Removing the iron leg from the coil

61) In which of the following cases does the self-inductance coefficient of the coil have the largest value if the coil core is made of iron in all cases?



(A) (B) (C) (D)

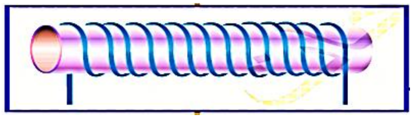
62) Two solenoid coils, the first coil has a length of ℓ, a face area of A, and the number of turns is N, and the second coil has a length of $\ell \frac{1}{2}$, a face area of $2A$, and the number of turns is $\ell \frac{1}{4}$. The ratio of their self-inductance coefficients $(\frac{L_1}{L_2})$ is equal to ………………

☐ $\frac{1}{1}$ ☐ $\frac{2}{1}$ ☐ $\frac{4}{1}$ ☐ $\frac{1}{4}$

63) A straight wire of length ℓ is wound in a circular coil twice, once as a coil (X) with a diameter of d and once as a coil (y) with a diameter of $2d$. The ratio of the self-inductance coefficients of the two coils $(\frac{L_X}{L_y})$ is equal to ………………

☐ $\frac{1}{1}$ ☐ $\frac{2}{1}$ ☐ $\frac{1}{2}$ ☐ $\frac{1}{4}$

64) A helical coil has an inductance of $(3.0 \times 10^{-3}$ H) . Suppose the length of the helical coil is increased to three times its original length and its average cross-sectional area is reduced to five times its original length while the number of turns remains unchanged.
Calculate what its inductance will become?



☐ 2×10^{-4} H ☐ 4×10^{-4} H ☐ 5×10^{-4} H ☐ 6×10^{-4} H

10. Define self-induction and reciprocal induction.

Solve problems related to self-induction and reciprocal induction.

65) A solenoid with a length of 10 cm has 100 turns wound around it, and its cross-sectional area is (4.0 cm^2). Its self-inductance coefficient is equal to ....

- ❑ 5.024×10^{-5} H
- ❑ 5.024×10^{-3} H
- ❑ 5.024×10^{-2} H
- ❑ 5.024×10^{-4} H

66) Which of the following is not a unit for measuring inductance?

- ❑ *Wb.S/C*
- ❑ *A/J*
- ❑ *V.s/A*
- ❑ *$T.m^2/A$*

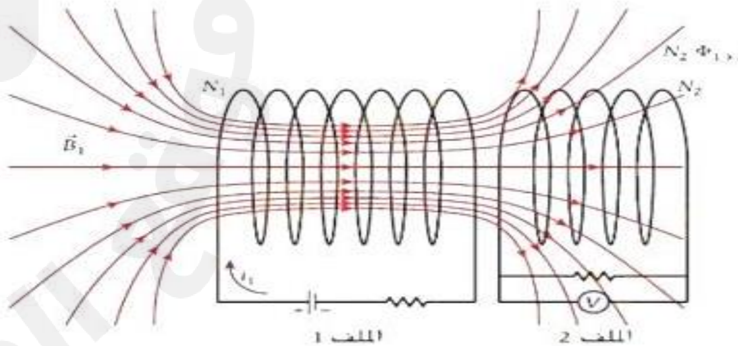
67) A helical coil has a self-inductance coefficient of (L) . Suppose the length of the helical coil is reduced to half its original length and its average cross-sectional radius is doubled (the number of turns per unit length changes).

What will its inductance coefficient become?

- ☐ $4\ L$
- ☐ $0.5\ L$
- ☐ $2\ L$
- ☐ L

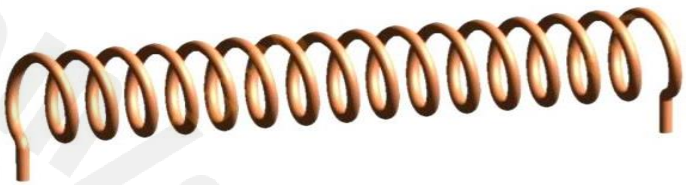
68) In the adjacent figure, the current $i1$ in coil 1 increased from zero to $(2\ A)$ in a time period of $(50\ ms)$. The self-inductance coefficient of coil 1 is (0.1 H), the self-inductance coefficient of coil 2 is $(0.2\ H)$, and the mutual inductance coefficient between the two coils is $(0.4\ H)$.

What is the induced potential difference in coil 12?



- ❑ 1,6 V
- ❑ - 1.6 V
- ❑ 3.2 V
- ❑ - 3.2 V

69) A helical coil has an inductance of (3.0 x 10^{-3} H) . Suppose the length of the coil is increased to three times its original length and its average cross-section is reduced to one-fifth its original length while the number of turns in the loop remains unchanged. Calculate what its inductance will become?



- ❑ 4×10^{-5} H
- ❑ 5×10^{-5} H
- ❑ 3×10^{-5} H
- ❑ 2.5×10^{-5} H

70) A positive charge moves in a circular path with radius *(r)* inside an electric field $\vec{E}$. The induced potential difference can be expressed by the equation $W= ZE(2\pi r)$ ،

What does the symbol *Z* represent?

A. Induced electric current
B. Induced electric field
C. Magnitude of electric charge
D. Circular path radius

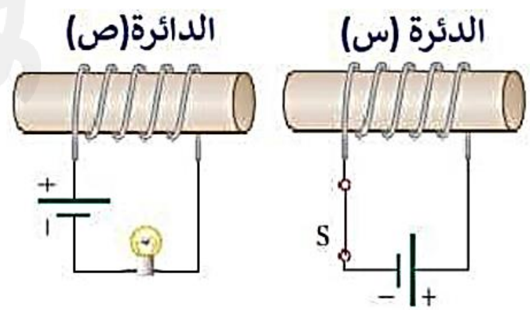
71) Assume that an electric current of (i=100 mA) is carried by a solenoid with a length of (ℓ=50.5 cm), a cross-sectional area of (A = 2.0 x 10^{-4} m^2), and a number of turns of (N = 4000). What is the self-inductance coefficient of the coil?

☐ 10.0 mH ☐ 25.0 mH ☐ 3.5 mH ☐ 8.0 mH

72) Two adjacent coils X, Y. The number of turns in coil Y is 2000 turns. If a current of 7 A passes through coil X and results in a flow of 2.5×10^{-4} Wb through coil Y, then the mutual inductance coefficient between the two coils is equal to ....

☐ 0.01 H ☐ 0.03 H ☐ 0.05 H ☐ 0.07 H

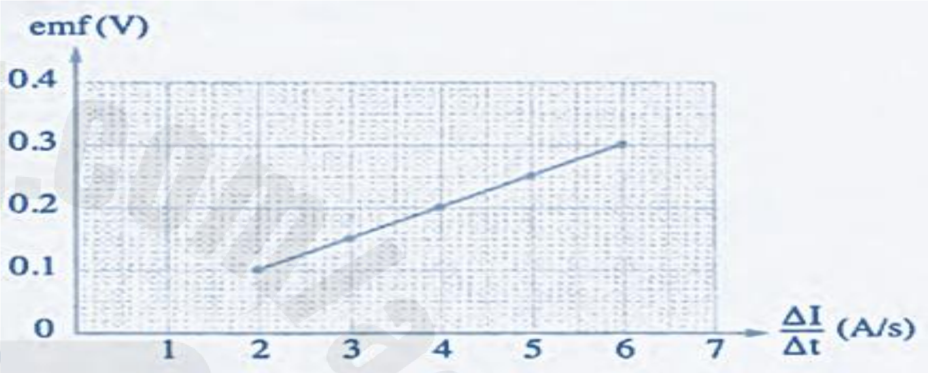
73) The adjacent figure shows two adjacent circuits. When circuit *(S)* is opened, the light of the bulb in circuit *(Y)*



☐ increases in light ☐ decreases in light

☐ turns off ☐ does not change in light

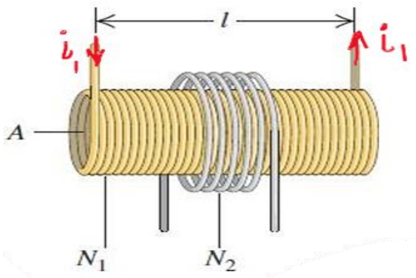
74) The opposite graph represents the relationship between the induced electromotive force (emf) in a secondary coil and the rate of change of current in a primary coil ($\frac{\Delta I}{\Delta t}$). The mutual inductance coefficient between the two coils is equal to..................



- ❑ 0.05 mH
- ❑ 50 mH
- ❑ 0.04 mH
- ❑ 40 mH

75) The adjacent figure shows a long solenoid with a length of $\ell = 0.5m$ A meter and the number of its turns ($N_1 =$ 1000 turns) and its cross-sectional area A=10 cm^2 and it passes a current at a constant rate and is surrounded by a circular coil with the number of turns ($N_2 =$ 10 turns) as in the adjacent figure.

The mutual inductance coefficient between the two coils (M) is equal to ....



- ❑ 12.25 mH
- ❑ 1.25 mH
- ❑ 25.12 mH
- ❑ 5.01 mH

76) A solenoid coil has 51 turns and a self-inductance coefficient of 0.5 H. If the coil is compressed so that its length becomes half its original length, the inductance coefficient becomes.......................

- ☐ 0. 125 H
- ☐ 0.25 H
- ☐ 0.5 H
- ☐ 1 H

77) A solenoid coil with a self-inductance coefficient of (L=5mH) passes through it a current of (i_o= 0.3 A). The current intensity changes with time in the coil according to the function $i_{(t)} = i_o(2 - 1.4t2)$ .What is the self-induced electromotive force generated in the coil at (= 3S)?

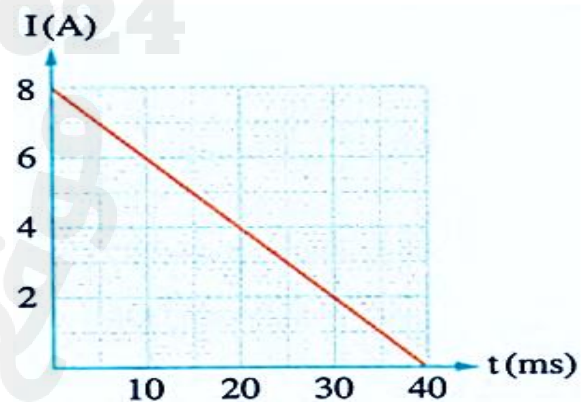
- ☐ +12. 6 mV
- ☐ -12.6 mV
- ☐ +30.02 mV
- ☐ -30.02 mV

78) A solenoid coil carries a current. When the current in the coil decreases at a constant rate of **8 A/S**, a self-induced electromotive force of **30 mV** is generated in the coil. The self-inductance coefficient of the coil is equal to:

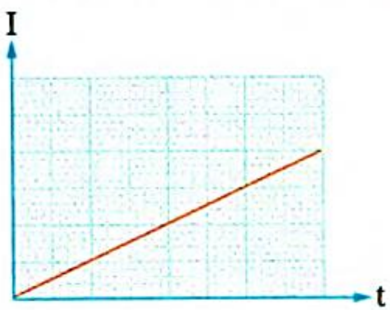
- ☐ 2. 66 mH
- ☐ 3.75 mH
- ☐ 2.40 mH
- ☐ 240 mH

79) The opposite graph represents the relationship between the intensity of the current **(I)** passing through a solenoid coil and the time **(t)**. If you know that the self-inductance coefficient of the coil is **60 mH**, then the electromotive force induced in it is equal to ....

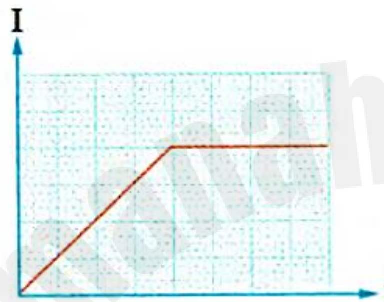
- ☐ 10 V
- ☐ 12 V
- ☐ 20 V
- ☐ 24 V



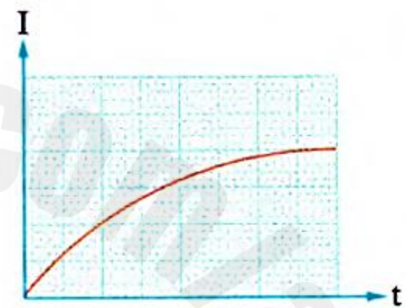
80) The opposite graph represents the relationship between the intensity of the current **(I)** passing through a coil and the time **(t)** when an electrical circuit consisting of a battery and a solenoid is closed. It is……………..



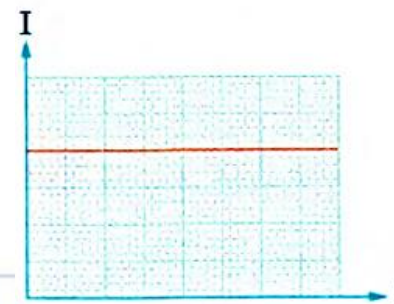
(A)



(B)



(C)



(D)

81) A solenoid coil with **500** turns, a length of **0.4 m**, and an area of **40 cm²** for each turn is connected to an electric current source. A current of **2 A** passes through it. If the current is interrupted within **0.1 s**, the induced electromotive force is equal to ....

- ❑ 10^{-2} V × 8.2
- ❑ 10^{-2} V × 6.28
- ❑ 10^{-3} V × 9.4
- ❑ 10^{-3} V × 6.28

82) A solenoid coil contains **300** turns and its self-inductance coefficient is 6×10^{-3}H If the current flowing through it changes at a rate of **2 A/s**, then the rate of change in the magnetic flux that arises through the coil is equal to ....

- ☐ 4×10^{-5} Wb/s
- ☐ 2×10^{-5} Wb/s
- ☐ 8×10^{-5} Wb/s
- ☐ 6×10^{-5} Wb/s

83) A coil with a self-inductance coefficient of **0.03** Henry consisting of **N** turns is passed through an electric current that generates a magnetic flux through it of 6×10^{-4} bar. If the current passing through the coil is eliminated in **0.02** seconds, then:

(1) The average induced electromotive force in the coil is equal to................

- ☐ 3V
- ☐ 6V
- ☐ 9V
- ☐ 12V

(2) The intensity of the current that was passing through the coil is equal to ....

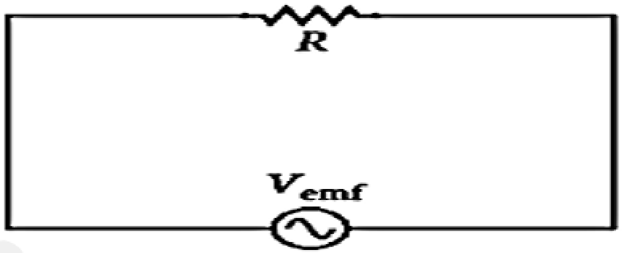
- ☐ 0.5A
- ☐ 1A
- ☐ 2A
- ☐ 5A

11. Describe an AC circuit as a circuit consisting of circuit elements and an electromotive force (EMF) source (power supply) that provides a time-varying voltage. Describe the sinusoidal AC current induced in a circuit containing a time-varying sinusoidal EMF source, where $i = I_{max}\sin(\omega t - \emptyset)$ is the amplitude of the current, ω is the angular frequency of the power source, and $\emptyset$ is the phase constant.

12. Describe the sinusoidal voltage supplied by a time-varying electromotive force where ω is the angular frequency of the electromotive force, and v_{max} is the amplitude or maximum output voltage. Derive an expression for the current (1) through the resistor, in a circuit consisting of a resistor and a time-varying electromotive force source, as follows:

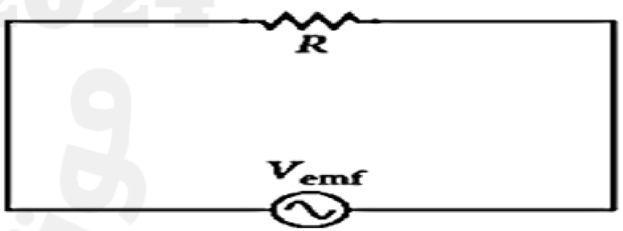
$\sin(\omega t) = I_R \sin(\omega t) \frac{V_R}{R} = \frac{V_R}{R} = I_R$ **where I_R is the amplitude of the current.**

84) A time-varying voltage source $V_{emf=20\,sin\,(30\pi t)}$, connected in series with a resistor of resistance 15Ω, what is the current flowing through the resistor at the moment $t = 2.3 \times 10^{-2} s$?



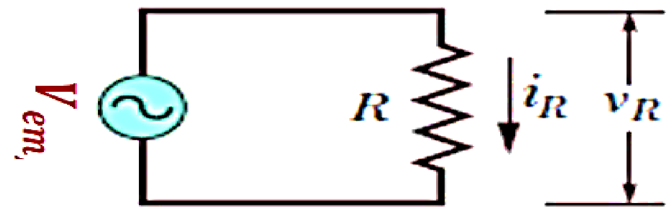
- ☐ 2.5 A
- ☐ 2.0 A
- ☐ 1.3 A
- ☐ 1.1 A

85) A time-varying voltage source $V_{emf=12\,sin\,(160t)}$ is connected in series with a resistor of 6.0Ω. What is the maximum value of the current in this circuit?



- ☐ 2.5 A
- ☐ 2.0 A
- ☐ 4.0 A
- ☐ 3.5 A

86) An AC circuit contains only an ohmic resistance, R = 200Ω. As shown in the adjacent figure, if:



The maximum voltage drop across the resistance is equal to:

$V_{max}=V_R=36V$ and the frequency is $60H_Z\ f$ Answer the following:

- Write the equation for the electric potential as a function of time ((t) U_R

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.... $U_R = 36 \sin(120\pi t)$

- Write the equation of the electric current as a function of time ((t)i_R

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.... $i_R = 0.18 \sin(120\pi t)$

87) An AC electromotive force source is connected to a 20Ω resistor.
If the potential difference across the resistor is expressed according to the following equation: $V_R = 100 \sin 20\pi t$

$V_R = V_R \sin \omega t$

$i_R = I_R \sin \omega t$

- What is the maximum potential difference of the source?

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- What is the angular frequency (angular velocity) of the source?

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- What is the frequency of the source (f)?

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Find an expression for the current flowing in the circuit

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- What is the magnitude of the current flowing through the resistor after (s = 5.0 t)?

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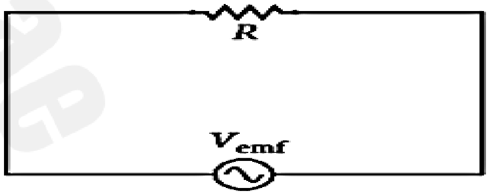
88) In the opposite circuit, the alternating voltage across the resistor (R) is ....

- ❑ In phase with the current
- ❑ Ahead of the current by a phase angle of 90°
- ❑ Lagging behind the current by $\frac{3}{4}$ cycles
- ❑ Numerically equal to the current

89) The circuit in the opposite figure shows a resistor (10Ω) connected to a source with a maximum electromotive force of (60 V) and a frequency of (60 Hz).



Calculate:

- ❑ Maximum current flowing through the resistor.

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- ❑ Write the equation for the current intensity as a function of time.

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- ❑ What happens to the resistance value when the source frequency is doubled?

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13. Recall Maxwell's equations that describe electromagnetic phenomena.

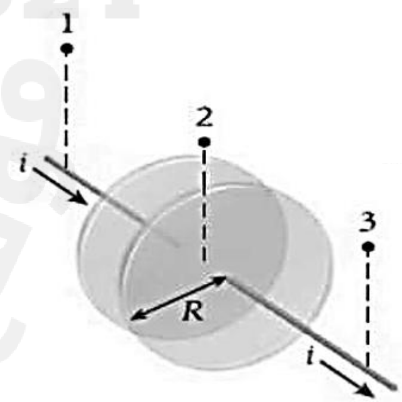
Table of Maxwell's equations describing electromagnetic phenomena

name	equation	Description
Gauss's law for electric fields	$\oiint \vec{E}\,.\,d\vec{A} = \frac{qenc}{\varepsilon_0}$	The total electric flux through a closed surface is proportional to the total electric charge enclosed.
Gauss's law for magnetic fields	$\oiint \vec{E}\,.\,d\vec{A} = 0$	The total magnetic flux through a closed surface is zero (there are no magnetic monopoles).
Faraday's law of induction	$\oiint \vec{E}\,.\,d\vec{s} = \frac{d\Phi_B}{dt}$	Production of a searching electric field through a changing magnetic flux.
Maxwell-Ampere law	$\oint \vec{B}.\,d\vec{s} = \mu_0\varepsilon_0 \frac{d\Phi_E}{dt} = \mu_0 i_{enc}$	Production of a magnetic field by induction through a changing electric flux or current.

90) Which of the following equations represents the **Maxwell-Ampere** equation?

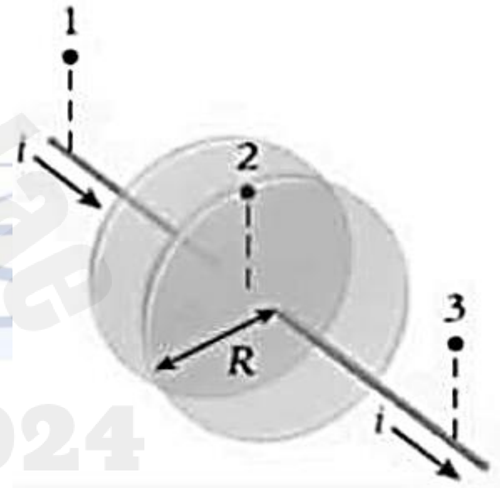
- ☐ $\oiint \vec{E}\,.\,d\vec{s} = \dfrac{d\Phi_B}{dt}$
- ☐ $\oiint \vec{E}\,.\,d\vec{A} = 0$
- ☐ $\oiint \vec{E}\,.\,d\vec{A} = \dfrac{q_{enc}}{\varepsilon_0}$
- ☐ $\oint \vec{B}.\,d\vec{s} = \mu_0\varepsilon_0 \dfrac{d\Phi_E}{dt} = \mu_0 i_{enc}$

91) The displacement current (i_d) of a circular capacitor with radius (R) shown in the figure is equal to the conduction current (i) in the wires. Points (1, 3) are located at a perpendicular distance (r) from the wires, and point (2) is located at the same perpendicular distance (r) from the center of the capacitor, such that $(r < R)$. Arrange the magnetic fields at the points in descending order **(from largest to smallest)**.



- ☐ $B_1 > B_2 > B_3$
- ☐ $B_3 > B_2 > B_1$
- ☐ $B_1 = B_2 = B_3$
- ☐ $B_1 = B_3 > B_2$

92) The displacement current (i_d) of a circular capacitor with radius **(R)** shown in the figure is equal to the conduction current (i) in the wires. Points **(1, 3)** are located at a perpendicular distance **(r)** from the wires, and point **(2)** is located at the same perpendicular distance **(r)** from the center of the capacitor, such that **(r > R)**. Arrange the magnetic fields at the points in descending order **(from largest to smallest)**.



- ❑ $B_3 > B_2 > B_1$
- ❑ $B_1 > B_2 > B_3$
- ❑ $B_3 = B_2 = B_1$
- ❑ $B_2 = B_3 > B_1$

14. Establish that all electromagnetic waves in a vacuum travel at the speed of light. Relate the wavelength, frequency, and speed of electromagnetic waves in a vacuum using the equation ($c=\lambda f$).
15. List the different types of electromagnetic waves that make up the electromagnetic spectrum and their special properties. Describe some applications of the different types of electromagnetic waves.

92) A gamma-ray source is a cosmic object that emits flashes of high-energy gamma rays. If the frequency of the high-energy flashes is $(3.0 \times 10^{21} HZ)$, what is the wavelength of these rays?

☐ 0.5 m ☐ 0.4 m ☐ 0.1 m ☐ 0.2 m

93) The wavelength range of visible light in air is between 400 nm and 700 nm.
What is the frequency range of visible light?

(A)	(B)	(C)	(D)
f1 = 4.3×10^{14} Hz f2 = 7.5×10^{14} Hz	f1 = 4.3×10^{16} Hz f2 = 7.5×10^{16} Hz	f1 = 6×10^{14} Hz f2 = 7×10^{14} Hz	f1 = 5×10^{14} Hz f2 = 8×10^{14} Hz

electromagnetic spectrum

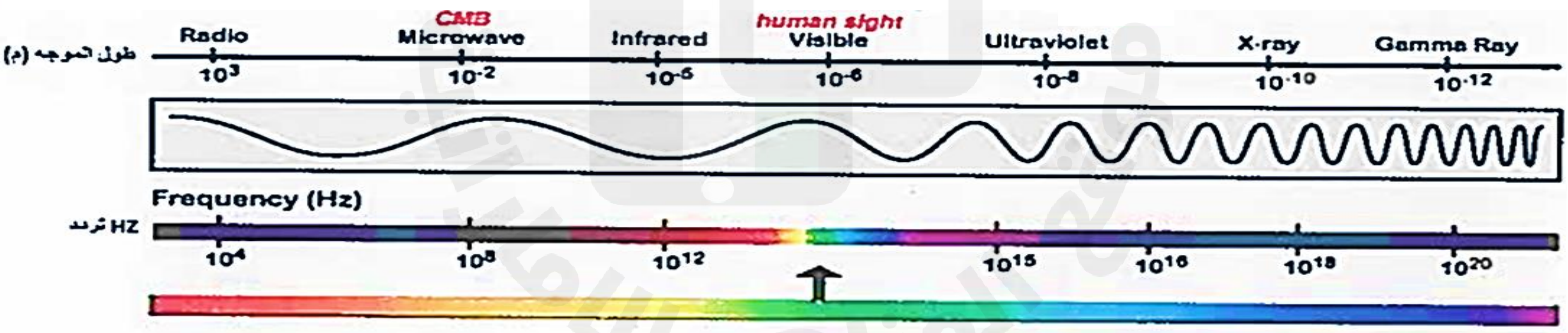
Non-ionizing electromagnetic radiation

- Rays in the visible range
- microwaves
- infrared rays
- radio waves

electromagnetic radiation ionizing

- gamma rays
- X-rays
- ultraviolet rays

The energy frequency increases... and the wavelength decreases.



Choose from column A the appropriate wave name to use in column B ((Low frequency waves))

A	usage	B	wave
1	Radio waves		It is used in polymer processing, instrument sterilization, semiconductor manufacturing, and etching patterns on silicon wafers.
2	microwaves waves		In cell phones, GPS systems, and food cooking.
3	infrared rays		It is used in information transmission, such as television and radio.
4	ultraviolet rays		Sensors, cameras, night vision goggles, and building heating.

Choose from column A the appropriate wave name to use in column B((High Frequency Waves)).

A	wave	B	Usage
1	$x - Ray$		It is used in imaging bones and teeth and eliminating cancer cells.
2	gamma rays $\gamma - Ray$		To detect hazardous materials and destroy cancer cells.

Carrier wave: A sine wave with a frequency equal to the frequency of the broadcasting station.
A radio or television station transmits a carrier signal on a specific frequency.

(1) For AM radio broadcasting, the carrier wave's amplitude is modulated according to the information being transmitted. The modulation carries the transmitted message and is received through an RLC circuit whose resonant frequency is equal to the carrier signal's frequency. The broadcast can be subject to interference and signal loss because the message is proportional to the signal's amplitude, which varies under different conditions.

(2) For FM radio broadcasting, the carrier wave's frequency is modulated according to the message to produce a modulated signal. This type of broadcasting is subject to less interference and signal loss because it relies on frequency changes rather than amplitude changes.

Part (2) FRQ

@ABDALLA1972

1. Describe, based on Faraday's law, that a potential difference can be induced in a loop by either varying the magnetic field 'B' with time (A and θ are constants), varying the loop area 'A' with time (B and θ are constants), or varying the angle ' θ ' between the magnetic field and the normal to the loop with time (A and B are constants), and prove this using mathematical equations.

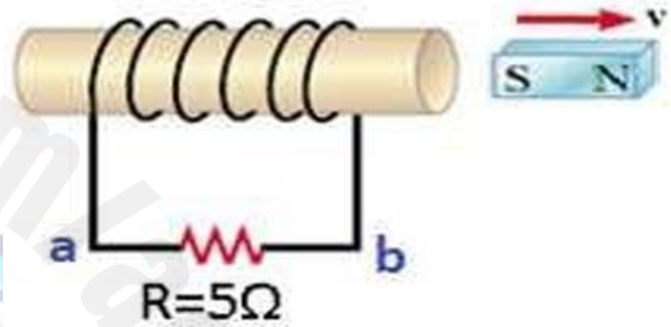
Solve problems related to the induced electric field by varying the magnetic flux.

1) A rectangular metal ring, 4.0 cm long and 2.0 cm wide, is subjected to a magnetic field of unit T perpendicular to its surface, which changes with time according to the equation: $\{B_{(t)} = 7.0t^3\}$

What is the magnitude of the induced potential difference in the ring at (t = 5.0 s)?

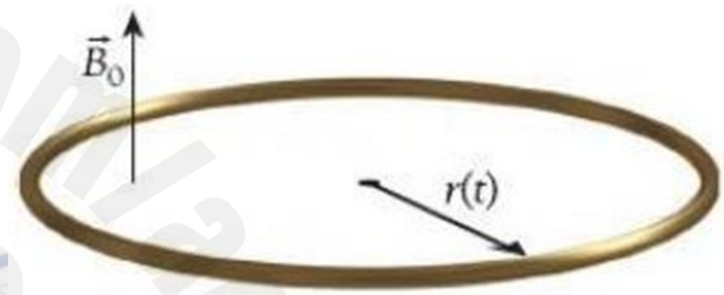
2) A coil of $10^4 \times 2$ turns was rotated around an axis of rotation perpendicular to a uniform magnetic field of 3.0 G and the radius of the loops is 40 cm. If the coil rotates at a frequency of 150 Hz, what is the maximum induced current flowing in a resistance of 1.5 kΩ?

3) The adjacent figure shows a solenoid with (500) turns connected to a resistor. Nearby is a strong magnet with a magnetic flux of 10-5 Wb × 4.0 induced in it. Therefore, the magnet will be deflected to the right, decreasing the magnetic flux passing through the coil to 10-5 Wb × 2.0 . Within (0.10 s), an electric current will be induced during this period equal to:

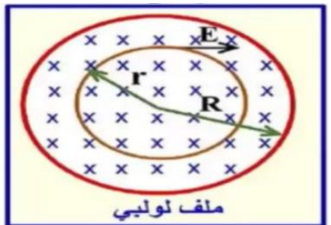


4) A metal ring with a diameter of 0.2 cm is subject to a uniform magnetic field perpendicular to the plane of the ring with a strength of 2.5 T. If the direction of the magnetic field passing through the ring is reversed within 30 seconds, the average potential difference induced in the ring is equal to:

5) A circular flexible conducting loop expands at a constant rate with time, such that its radius is determined by the function $B_{(t)} = 0.2 + 4vt$, and at a constant speed of $0.03\ m/s$ in a uniform magnetic field $B_0 = 0.8\ T$, perpendicular to the plane of the loop, as shown in the figure. What is the magnitude and direction of the induced current in the loop at $t = 2s$, given that the resistance of the loop wire is $5\ \Omega$?



6) The electric current decreases from 3.0 A to 1 A in 0.1 s in a solenoid consisting of 500 turns, 20 cm long, and 2.0 cm radius. Calculate the induced electric field inside the coil and 1.0 cm from its center.



$$\oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi_B}{dt}.$$

$$\Delta V_{ind} = 2\pi r E.$$

7) The magnetic field inside a wire loop with a radius of 20 cm varies according to the equation:$B(t)=3t^2$

What is the magnitude of the induced electric field in the loop at time 2 s?

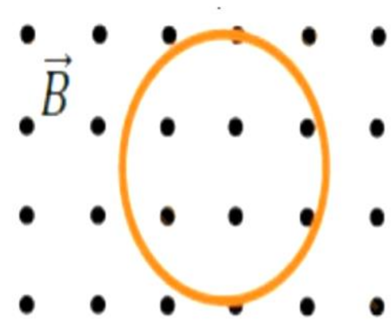
8) A charge moves in a circular path with a radius of $0.2\ m$ in a changing magnetic field. If the rate of change of magnetic flux is $0.4\ Wb/s$, the magnitude of the induced electric field is:

9) A coil of flexible metal wire with a radius of 0.12 m is perpendicular to a uniform magnetic field of intensity 0.15 T, as shown in Figure (a). If the sides of the coil are compressed until its area becomes 3×10^{-3} m^2, as shown in Figure (b), in a time of 0.2 s, calculate the average induced emf in the coil during that time period.

(a) (b)

10) A wire loop with a radius of 0.2 m is placed inside a magnetic field perpendicular to the surface. The field magnitude increases with time according to the equation: $\{ B_{(t)} = 7.0t^2 \}$

Calculate the magnitude of the induced field inside the loop at $t = 3.0\ s$ and determine its direction.



2. Define an **RL** circuit as a single-loop circuit containing an electromotive force source connected to a resistor and an inductor.

- Express the solution to the differential equation for the current as a function of time for the **RL** circuit. After the switch is closed,

$V(t)\frac{V_{emf}}{R}$ $(\text{l-e}^{\frac{-t}{\frac{L}{R}}})= I_{mex}$ $(\text{l-e}^{\frac{-t}{Z}})$ and check the current at the instant the switch is closed, t = 0, and after the switch is closed for a long time, t → ∞. V a f (1-4) = (1-4) R

- Define the time constant ta for an RI circuit. It is the inductance divided by the resistance.(T_{RL} = L/R)

- Express the solution to the differential equation for the current as a function of time for the RL circuit. When the switch is suddenly opened,

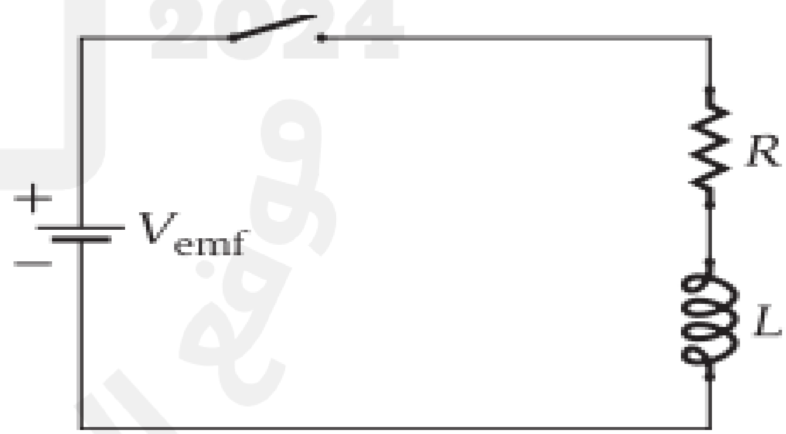
after it has been closed for a long time, where $i(t)\frac{V_{emf}}{R}$, and check the current at the moment the switch is opened, t = 0,

and after a long time, t → ∞.

Solving problems related to RL circuits.

11) Consider an inductor-resistor **(RL)** circuit with a resistance of **R = 1.00 MΩ** and an inductance of **1.00 LH**, powered by a **10.0 V** battery.
What is the time constant of the circuit?
If the switch is closed at time **t = 0**, what is the AC current immediately after that time?
And after **2.00 μs**? And after a long period of time?

12) In the circuit shown in the figure, **R= 120 Ω ،L = 3.00 H و= 40.0V V_{emf}**.
After the switch is closed, how long will it take for the current flowing through the inductor to reach **300 mA**



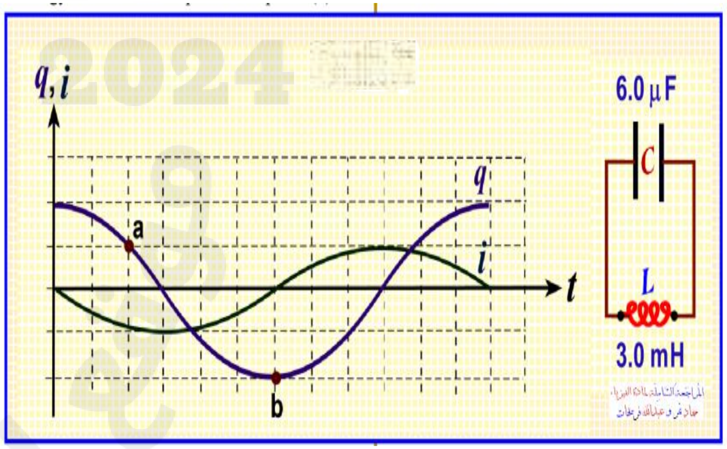
3. Solve problems related to the LC oscillator that illustrate changes in charge, current, energy stored in the electric field, and energy stored in the magnetic field.

Remember that the energy stored in the electric field of a capacitor of capacitance C, at any instant, is given by $U_C = \frac{1q^2}{2\,C}$

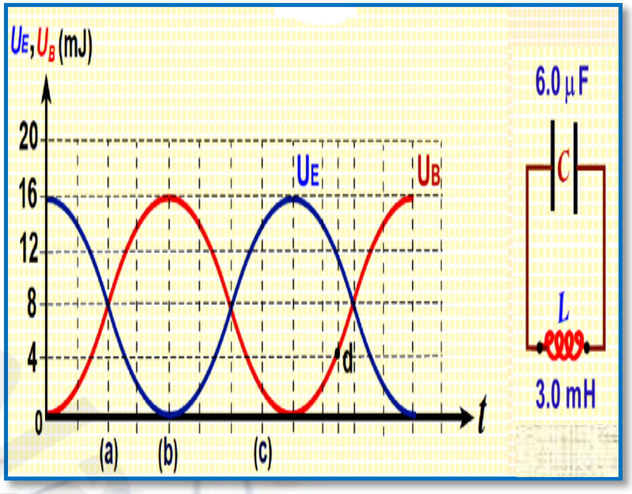
Remember that the energy stored in the magnetic field of an inductor of inductance L, at any instant, is given by $U_R = \frac{1}{2}L^2$

13) Based on the adjacent figure, the maximum charge of the capacitor is equal to (8.0μc). Answer the following:

- ❑ Total energy of the circuit
- ❑ Charge on the capacitor at point (a)
- ❑ Magnetic energy stored in the inductor and electrical energy stored in the capacitor at point (a)

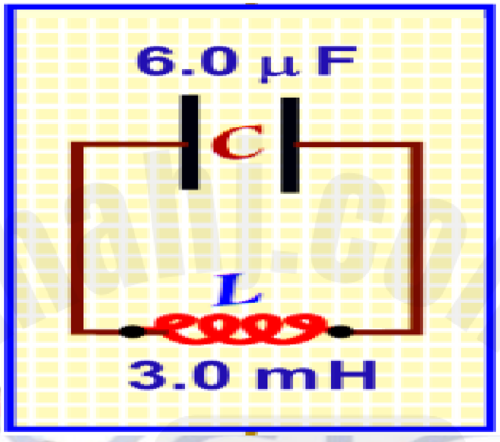


14) Based on the adjacent figure, answer the following:



- Find the total energy of the circuit and represent it in the figure.
- Find the maximum value of both the capacitor charge and the current.
- Find the current intensity at point (d).
- Find the capacitor charge and the current when the electric and magnetic energy are equal.

15) The following figure shows an inductor and capacitor circuit in an electromagnetic oscillation state. The maximum charge on the capacitor is (18. 0μc).



- ❑ Find the total energy stored in the circuit.
- ❑ Find the maximum current in the circuit.
- ❑ Find both the energy stored in the capacitor and the energy stored in the inductor when the charge on the capacitor is (8. 0μc)
- ❑ Calculate the charge on the capacitor and the current when the energy stored in the inductor equals the energy stored in the capacitor.

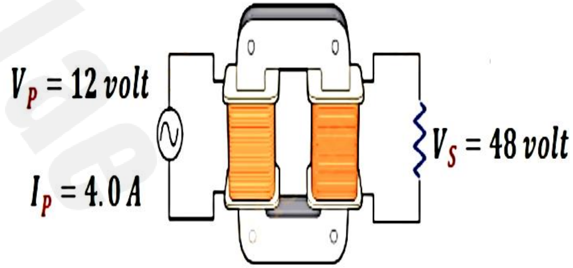
4. <u>Solve problems related to Lenz's Law.</u>

Distinguish between step-up transformers and step-down transformers.

Apply the ideal transformer equation ($\frac{N_P}{N_S} = \frac{V_P}{V_S} = \frac{I_X}{I_P}$) numerical problems.

16) A student is investigating the operation of an electrical transformer and collecting data as shown in the figure.

- ❑ **What type of transformer is shown in the figure?**

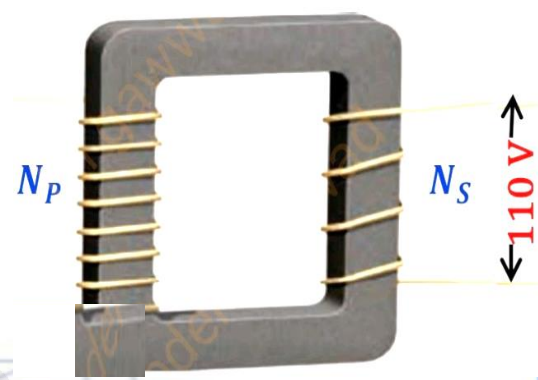


- ❑ **What type of potential difference is applied across the terminals of the primary coil?**

- ❑ **What is the current flowing through the secondary coil?**

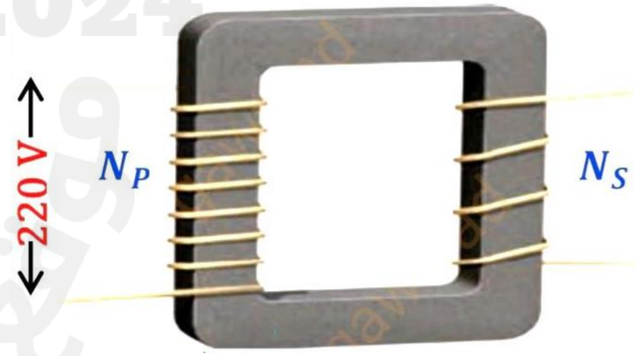
17) Based on the transformer shown in the adjacent figure and the data in the figure,

- ❑ what type of transformer is it?

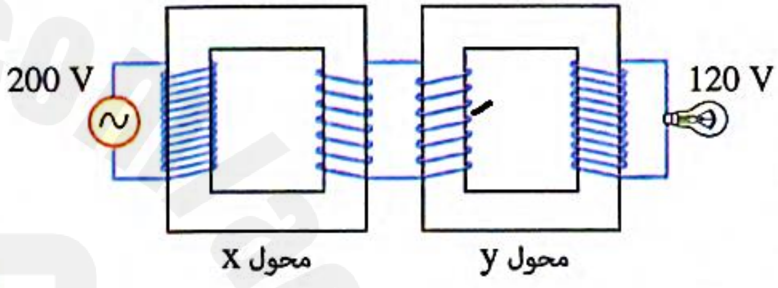


- ❑ What is the potential difference across the primary coil V_P?

18) According to the transformer shown in the adjacent figure and based on the data in the figure, what is the potential difference in the secondary coil N_S?



19) In the opposite figure, two ideal electrical transformers X and y are connected together. The primary coil of transformer X is connected to a $200\ V\ AC$ source, and the secondary coil of transformer y is connected to an electric lamp operating at a potential difference of $120\ V$. If the ratio of the number of turns in the coils of transformer X is: $\left(\frac{(N_{S})_x}{(N_{P})_x} = \frac{1}{3}\right)$

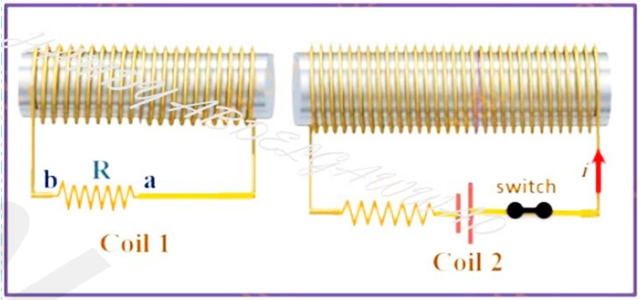


What type of transformer are X and y?

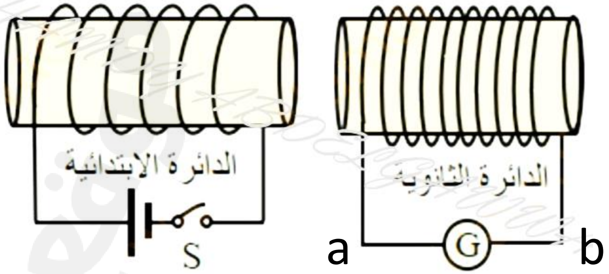
Calculate the value of each of V_{Sx} and V_{Py}

Calculate the value of $\frac{N_{Py}}{N_{Sy}}$

20) The figure shows two identical coils. Coil 2 has a current *i* passing through it, as shown in the figure. When the switch is opened in the coil 2 circuit, what happens in coil 1?

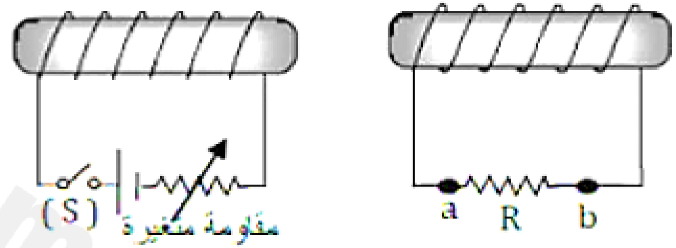


21) In the adjacent figure, when switch (S) is closed in the primary circuit, an induced electromotive force is generated in the secondary circuit.
Determine the direction of the induced current in the secondary circuit.



22) Determine the direction of the induced current in the resistance (R) in the secondary circuit in each of the following cases, with an explanation.

- ❑ **Moment of closing the primary circuit switch**



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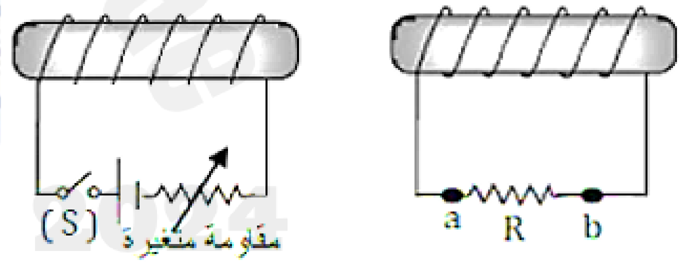
- ❑ **Moment of opening the primary circuit switch**



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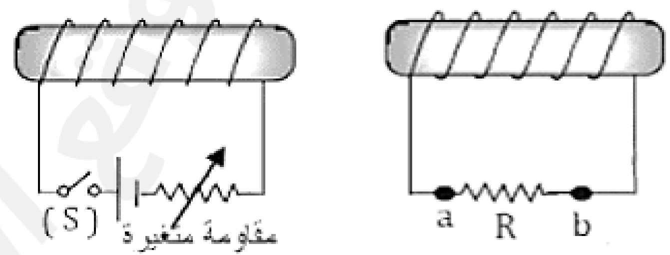
- ❑ **Moment of decreasing the resistance (R) in the primary circuit**



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