BYJU'S Study Planner for Board Term I
(CBSE Grade 12)

Date: 21/11/2021

Subject: Physics

Topic : Electromagnetic Induction Class: Standard XII

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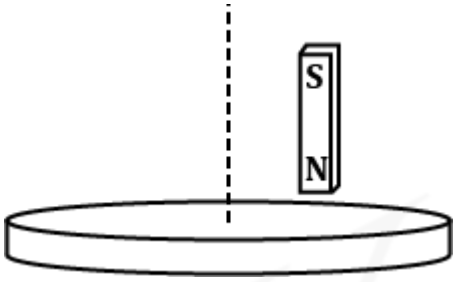
1. A light disc made of Aluminium (a nonmagnetic material) is kept horizontally and is free to rotate about its axis, as shown in the figure. A strong magnet is held vertically at a point above the disc away from its axis. On revolving the magnet about the axis of the disc, the disc will (figure is schematic and not drawn to scale)



A. Rotate in the direction opposite to the direction of magnet's motion

B. Rotate in the same direction as the direction of magnet's motion

C. Not rotate and its temperature will remain unchanged

D. Not rotate, but its temperature will slowly rise

2. A metal wheel with 8 metallic spokes, each $40\ \mathrm{cm}$ long, is rotated at a speed of $120\ \mathrm{rev/min}$ in a plane perpendicular to earth's magnetic field of $0.3 \times 10^{-4}\ \mathrm{T}$. Find the magnitude of the induced emf between the axis and the rim of the wheel (approximately).

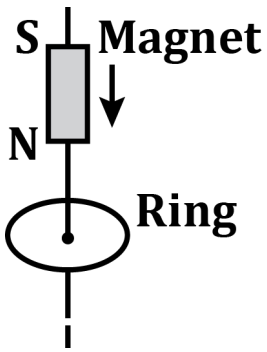
A. $3 \times 10^{-5}\ \mathrm{V}$

B. $24 \times 10^{-5}\ \mathrm{V}$

C. $0.37 \times 10^{-5}\ \mathrm{V}$

D. $6 \times 10^{-5}\ \mathrm{V}$

3. Consider a metal ring kept on a horizontal plane. A bar magnet is held above the ring with its length along the axis of the ring. If the magnet is dropped freely, the acceleration of the falling magnet is:
(g is acceleration due to gravity)



A. More than g

B. Equal to g

C. Less than g

D. Depend on mass of magnet

4. The ends of a coil, having 20 turns, area of cross-section $1\ \text{cm}^2$ and resistance $2\ \Omega$, are connected to a galvanometer of resistance $40\ \Omega$. The plane of coil is inclined at an angle 30° to the direction of a magnetic field of intensity $1.5\ \text{T}$. The coil is quickly pulled out of the field, to a region of zero magnetic field. Calculate the total charge that passes through the galvanometer, during this interval.

A. $35.7\ \mu\text{C}$

B. $357\ \mu\text{C}$

C. $3.57\ \mu\text{C}$

D. $375\ \mu\text{C}$

5. A conducting loop of area $5.0\ \mathrm{cm}^2$ is placed in a magnetic field which varies sinusoidally with time as $B = B_0 \sin \omega t$ where $B_0 = 0.20\ \mathrm{T}$ and $\omega = 300\ s^{-1}$. The normal to the coil makes an angle of 60° with direction of the field. Find the maximum emf induced in the coil.

   A. $1.5\ \mathrm{V}$

   B. $0.15\ \mathrm{V}$

   C. $0.015\ \mathrm{V}$

   D. $3\ \mathrm{V}$

6. A $10\ \mathrm{m}$ wide spacecraft moves through the interstellar space at a speed $3 \times 10^7\ \mathrm{ms}^{-1}$. A magnetic field of $B = 3 \times 10^{-10}\ \mathrm{T}$ exists in the space in a direction perpendicular to the spacecraft motion. Treating the spacecraft as a conductor, find the emf induced across its width.

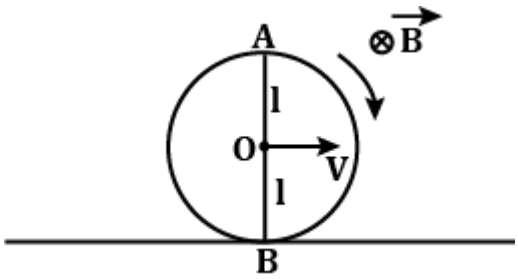
   A. $0.5\ \mathrm{V}$

   B. $0.09\ \mathrm{V}$

   C. $1\ \mathrm{V}$

   D. $2.05\ \mathrm{V}$

7. A wheel with a rod of length $2l$ attached along its diameter is rolling without slipping on a horizontal plane in a magnetic field B as shown in the figure. The velocity of the centre of the wheel is v. What is the emf developed across the ends of the rod AB ?



A. Bvl

B. $2Bvl$

C. $4Bvl$

D. 0

8. $\mathrm{Assertion}$: A bar magnet is dropped into a long vertical copper tube. Even taking air resistance as negligible, the magnet attains a constant terminal velocity. If the tube is heated, the terminal velocity gets increased.
Reason : The terminal velocity depends on the eddy current produced in the bar magnet.

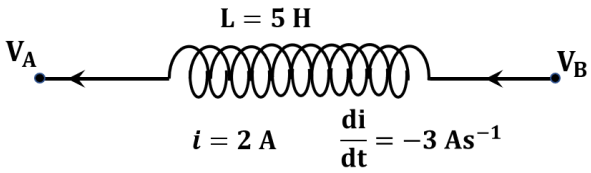
A. Both the assertion and reason are true and the reason is the correct explanation of the assertion.

B. Both the assertion and reason are true, but reason is not the correct explanation of the assertion

C. The assertion is true but reason is false.

D. The assertion and reason both are false.

9. Find $V_A - V_B$ in the given figure ?



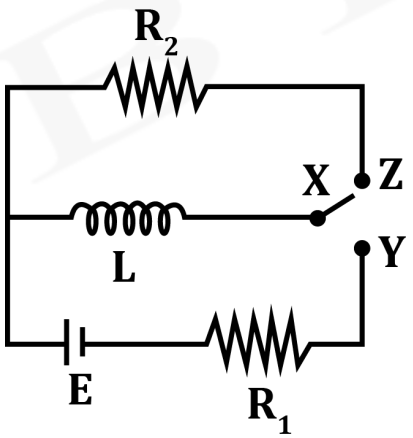
A. -15 V

B. 10 V

C. 30 V

D. 15 V

10. In the ideal inductor circuit shown, X is joined to Y for a long time, and then X is joined to Z. The total heat produced in R_2 is:



A. $\frac{LE^2}{2R_1^2}$

B. $\frac{LE^2}{2R_2^2}$

C. $\frac{LE^2}{2R_1R_2}$

D. $\frac{LE^2R_2}{2R_1^3}$

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11. Two coils X and Y are placed in a circuit such that when the current changes by $2\ \mathrm{A}$ in coil X the magnetic flux changes by $0.4\ \mathrm{Wb}$ in Y. The value of mutual inductance of the coils is-

    A. $0.2\ \mathrm{H}$

    B. $5\ \mathrm{H}$

    C. $0.8\ \mathrm{H}$

    D. $4\ \mathrm{H}$

12. Assertion (A): Self-inductance is called the inertia of electricity.

    Reason (R): Self-inductance is the phenomenon, according to which "an opposing induced e.m.f. is produced in a coil as a result of change in current (or) magnetic flux linked in the coil".

    A. Both (A) and (R) are true, and (R) is the correct explanation of (A)

    B. Both (A) and (R) are true, but (R) is not the correct explanation of (A)

    C. (A) is true but (R) is false

    D. (A) is false but (R) is true

13. Assertion (A): When two coils are wound on each other, the mutual induction between the coils in maximum.

    Reason (R): Mutual induction does not depend on the orientation of the coils.

    A. Both (A) and (R) are true, and (R) is the correct explanation of (A)

    B. Both (A) and (R) are true, but (R) is not the correct explanation of (A)

    C. (A) is true but (R) is false

    D. (A) is false but (R) is true

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14. Assertion (A): The quantity $\left(\frac{L}{R}\right)$ possesses dimension of time.

Reason (R): To reduce the rate of increase of current through a solenoid, we should increase the time constant $\left(\frac{L}{R}\right)$.

A. Both (A) and (R) are true, and (R) is the correct explanation of (A)

B. Both (A) and (R) are true, but (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

15. Assertion (A): The induced e.m.f. and current will be same in two identical loops of copper and aluminium when rotated with same speed in the same magnetic field.

Reason (R): Induced e.m.f. is proportional to rate of change of magnetic field while induced current depends on resistance of wire.

A. Both (A) and (R) are true, and (R) is the correct explanation of (A)

B. Both (A) and (R) are true, but (R) is not the correct explanation of (A)

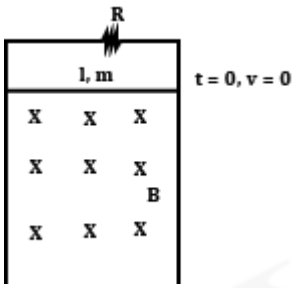
C. (A) is true but (R) is false

D. (A) is false but (R) is true

16. Comprehension:

A conducting rod of mass m and length l is released from rest on smooth metallic rails placed in vertical plane in a uniform horizontal magnetic field (B) as shown in figure.

When rod falls, it would cut magnetic field lines and motional emf will be induced. Velocity and acceleration of rod will change with time and after a long time rod will achieve a maximum velocity called as terminal velocity.



Answer the following question based on above discussion.

(i) The initial acceleration $(t = 0)$ of the rod will be

A. g downwards

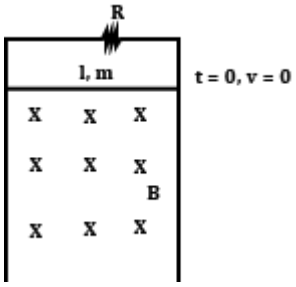
B. Less than g downwards

C. More than g downwards

D. Less than g upwards

17. Comprehension:

A conducting rod of mass m and length l is released from rest on a smooth metallic rails placed in vertical plane in a uniform horizontal magnetic field (B) as shown in the figure. When rod falls, it would cut magnetic field lines and motional emf will be induced. Velocity and acceleration of rod will change with time and after a long time rod will achieve a maximum velocity named as terminal velocity.



Answer the following question based on above discussion.

(ii) As the rod falls down, (well before achieving terminal velocity) Which of the given options is correct?

A. Acceleration increases, velocity increases

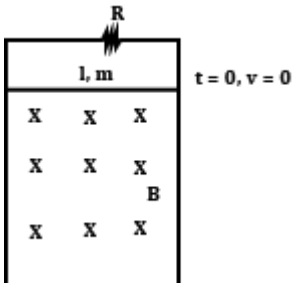
B. Acceleration decreases, velocity increases

C. Acceleration remains constant, velocity decreases

D. Acceleration decreases, velocity constant

18. Comprehension:

A conducting rod of mass m and length l is released from rest on a smooth metallic rails placed in vertical plane in a uniform horizontal magnetic field (B) as shown in the figure. When rod falls, it would cut magnetic field lines and motional emf will be induced. Velocity and acceleration of rod will change with time and after a long time rod will achieve a maximum velocity named as terminal velocity.



Answer the following question based on above discussion.

(iii) The velocity of the rod when it has achieved its terminal value.

A. $\frac{mgR}{Bl}$

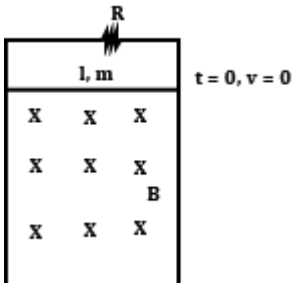
B. $\frac{mgR}{Bl^2}$

C. $\frac{mgR}{B^2l^2}$

D. $\frac{mgR}{2B^2l^2}$

19. Comprehension:

A conducting rod of mass m and length l is released from rest on a smooth metallic rails placed in vertical plane in a uniform horizontal magnetic field (B) as shown in the figure. When rod falls, it would cut magnetic field lines and motional emf will be induced. Velocity and acceleration of rod will change with time and after a long time rod will achieve a maximum velocity named as terminal velocity.



Answer the following question based on above discussion.

(iv) Which of the options is true for the above passage ?

A. When the rod has achieved terminal velocity, current in the resistor is zero.

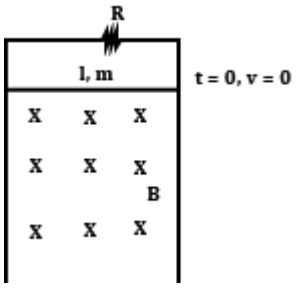
B. Current in the resister first increases, then decrease.

C. The acceleration - velocity graph of the motion of the rod will be a straight line.

D. The velocity-time graph of rod will be a parabola.

20. Comprehension:

A conducting rod of mass m and length l is released from rest on a smooth metallic rails placed in vertical plane in a uniform horizontal magnetic field (B) as shown in the figure. When rod falls, it would cut magnetic field lines and motional emf will be induced. Velocity and acceleration of rod will change with time and after a long time rod will achieve a maximum velocity named as terminal velocity.



Answer the following question based on above discussion.

(v) Thermal power in the resistor is plotted on y-axis, against speed on the x -axis, the graph will be a-

A. Straight line

B. Parabola

C. Exponential curve

D. None of the above