PHYSICS

BOOKS - BITSAT GUIDE

ELECTROMAGNETIC INDUCTION

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1. Lenz's law of electromagnetic induction corresponds to the

A. law of conservation of change

B. law of conservation of energy

C. law of conservation of momentum

D. law of conservation of angular momentum

Answer: B

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2. A toroidal solenoid with an air core has an average radius of 15 cm , area of cross-section $12\mathrm{cm}^2$ and 1200 turns . Ignoring the field variation across the cross-section of the toroid the self-inductance of the toroid is

A. 4.6 mH

B. 6.9 mH

C. 2.3 mH

D. 9.2 mH

Answer: C

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3. A coil of inductance L is carrying a steady current I. what is the nature of its stored energy ?

A. Magnetic

B. Electrical

C. Both magnetic and electrical

D. Heat

Answer: A

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4. If emf induced in a coil is 2V by changing the current in it from 8 A to 6 A in 2×10^3 s . Then , the coefficient of self -induction is

A. $2 \times 10^{-3} H$

B. 10^{-3} H

C. 0.5×10^{-3} H

D. 4×10^{-3} H

Answer: A

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5. If in a triode valve amplification factor is 20 and plate resistance is $10k\Omega$, then its mutual conductance is

A. 2 milli mho

B. 20 milli mho

C. (1/2) milli mho

D. 200 milli mho

Answer: A

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6. The induction coil works on the principle of

A. self-induction

B. mutual induction

C. Ampere's rule

D. Fleming's right hand rule

Answer: B

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Others

1. The magnetic flux ϕ (in waber) in a closed circult of resting 10Ω varies with t (in second) according to equation $\phi = 6t^2 - 5t + 1$. The magnitude of induced at $t = 0.25s$.

A. $1.2A$

B. $0.8A$

C. $0.6A$

D. $0.2A$

Answer: D

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2. A metaillic circular loop of radius r is placed in unfirom magnetic field B acting perpendicular to the plane of the loop . A naughty boy pulls dimetrically oppsite corner so that after sometime, the loop changes into an ellipse of major and minor radius a and b . It total resistance of loop is R and it remains

constant during the puilling . Find average change flowing through loop during pulling .

A. $\frac{B(\pi ab)}{R}$

B. $\frac{B\left(\pi ab-\pi r^2\right)}{R}$

C. $\frac{B\pi r^2}{R}$

D. $\frac{B\pi rb}{R}$

Answer: B

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3. Three resistances of magniute R each are connected in the from of an equilateral traingle of side a . The combinates is placed in a magnetic field $B = B_0 e^{-\lambda t}$ perpendicular to the plane . The induced current in the circult is given by.

A. $\left(\frac{a^2\lambda}{2\sqrt{3R}}B_0\right)e^{-\lambda t}$

B. $\left(\frac{a^2\lambda}{4\sqrt{(3)R}}B_0\right)e^{-\lambda t}$

C. $\left(\frac{a^2\lambda}{\lambda 4\left(\sqrt{3}R\right)}B_0\right)e^{-\lambda t}$

D. $\left(\frac{a^2 B_0 R}{\lambda 4\left(\sqrt{3}\right) B_0}\right) e^{-\lambda t}$

Answer: B

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4. A helicopter rise verticaly with a speed of $10ms^{-1}$. If helicopter has a length of 10 m and the horizontal component of the earth's magentic field is $1.5 \times 10^{-3} Wbm^2$, the emf induced between the tip of the nose and the tail of the helicopter, is

A. $0.15V$

B. $125V$

C. $130V$

D. $5V$

Answer: A

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5. An air- conred solectioid with length 30 cm,area of cross-section $25cm^2$ and number of turns 500, carries a curent is suddenly

switched off in a brief time of $10^{-3}s$. How much is the average back emf induced across the ends of the opne switch in the circuit ? lgnore the variation inmagnetic field near the of the solenoid .

A. 6.5 V

B. 7.4 V

C. 8.2 V

D. 9.3 V

Answer: A

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6. A fan blade of length 2 a rotates with frequency f cycle' per second perpendicular to magnetic field B . Then, potenial difference between centre and end of blade is

A. $\pi Ba^2 f$

B. $4\pi Baf$

C. $4\pi a^2 Bf$

D. $2\pi aBf$

Answer: A

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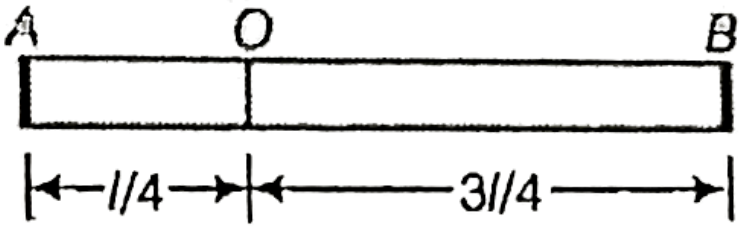
7. A mental rod AB of length l is rotated with a constant angular velocity ω about an axis passing through O and normal to its length . Potenial difference between ends of rod in absence of external magnetic field (Where , e

= electric change)



A. zero

B. $\frac{m\omega^2 l^2}{4e}$

C. $\frac{m\omega^2 l^2}{2e}$

D. $\frac{m\omega^2 l^2}{8e}$

Answer: B

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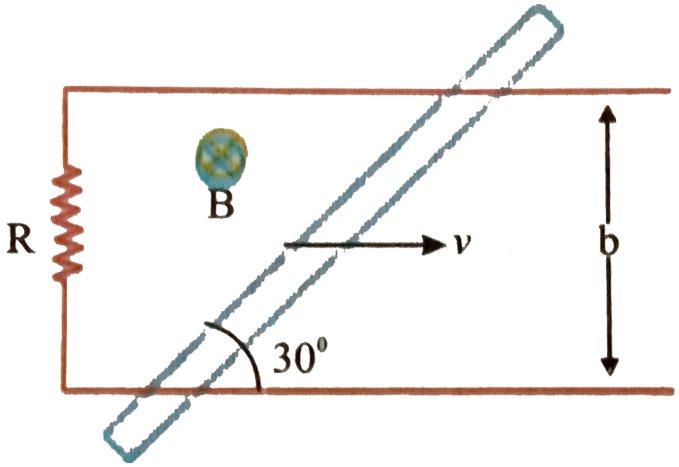
8. A wire is sliding as shown in Figure. The angle between the acceleration and the velocity of the wire is



A. 30°

B. 40°

C. 120°

D. 90°

Answer: C

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9. A fan blade of length $1/\sqrt{\pi}$ metre rotates with frequncy 5 cycle per second perpendicular to a magnetic field 10 tesla. What is potential diffrence between the centre and the end of blade ?

A. $-50V$

B. $+50V$

C. $-2.0V$

D. $+0.02V$

Answer: A

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10. A coil has an area of $0.05m^2$ and has 800 turns . After placing the coil in a magnetic field of strenght $4 \times 10^{-5} Wbm^{-2}$, perpendicualar

to the field , the coils id rotated by 90° in $0.1s$. The value of average emf induced is

A. zero

B. 0.016 V

C. 0.01 V

D. 0.032 V

Answer: B

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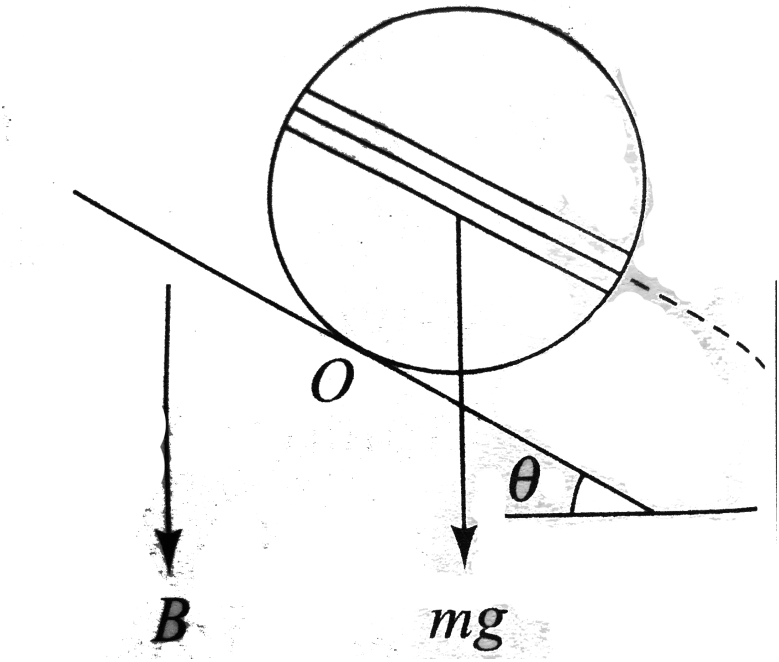
11. In Fig. a coil of single turn is wound on a sphere of radius r and mass m. The plane of the coil is parallel to the inclined plane and lies in the equatorial plane of the sphere. If the sphere is in rotational equilibrium, the

value of B is [Current in the coil is i]



A. $\frac{mg}{\pi lr}$

B. $\frac{mg\sin\theta}{\pi l}$

C. $\frac{mgr\sin\theta}{\pi l}$

D. none of these

Answer: A

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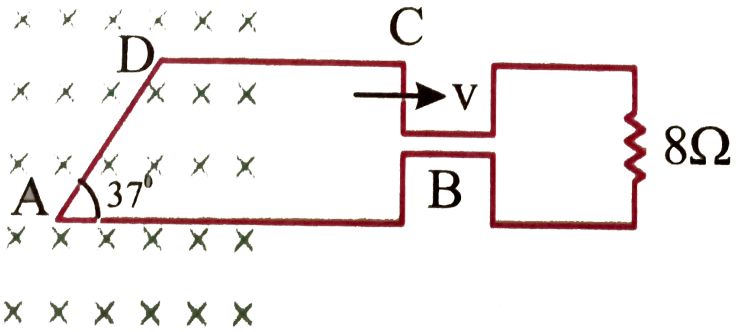
12. The loop $ABCD$ is moving with velocity $'v'$ towards right. The magnetic field is $4T$. The loop is connected to a resistance of 8Ω. If steady current of $2A$ flows in the loop then value of $'v'$ if loop has a resistance of 4Ω, is :

(Given $AB = 30cm$, $AD = 30cm$)



A. $\frac{50}{3} m/s$

B. $20 m/s$

C. $10 m/s$

D. $\frac{100}{3} m/s$

Answer: D

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13. Calcualte the self-inducatance of the air cored solined of length 80 cm and has 500 turns and its cicular cross- section has diamter of 2 cm.

A. $150.6\mu H$

B. $162.2\mu H$

C. $123.3\mu H$

D. $102.5\mu H$

Answer: C

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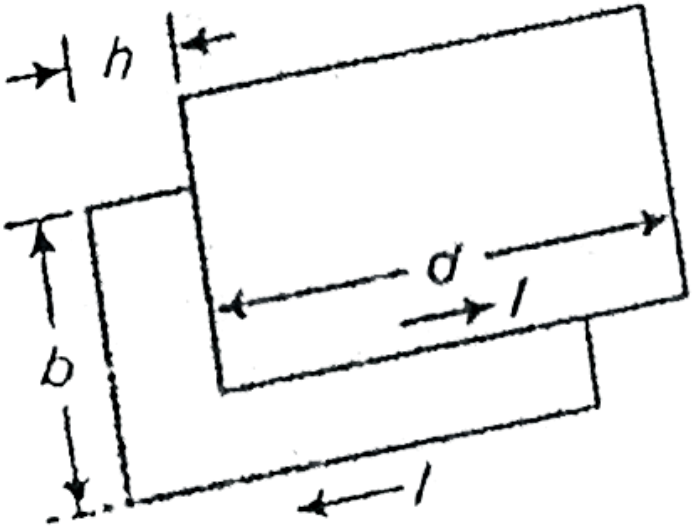
14. The inductance per unit length of a double tape line as shown in the figure



A. $\frac{\mu_0 h}{b}$

B. $\frac{b}{\mu_0 h}$

C. $\frac{\mu_0 b}{h}$

D. $\frac{hb}{\mu_0}$

Answer: A

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15. What is the mutual inductance of coil and solenid if a has a radius 4 cm and coil of 700 turns is would on the middle part of the solenoid ?

A. 44.17 mH

B. 48.94 mH

C. 34.34 mH

D. 36.73 mH

Answer: A

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16. When the current changes from $+2A$ to $-2A$ in $0.05s$, and emf of $8B$ is induced in a

coil. The coefficient of self-induction of the coil is

A. 0.1H

B. 0.2H

C. 0.4H

D. 0.8H

Answer: A

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17. A closed circuit consits of a source of constant and E and a choke coil of inductance L connected in series. The active resistance of the whole circuit is equal to R. At the moment $t = 0$ the choke coil inductance was decreased abrupty η times. FInd the current in the circuit as a function of time t.

A. zero

B. E/R

C. $\frac{nE}{R}$

D. $\frac{E}{nR}$

Answer: C

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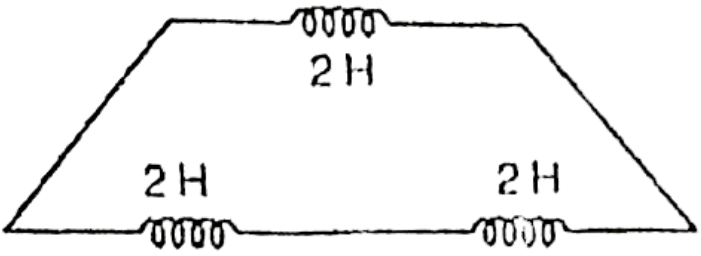
18. Three pure inductors each of 2H are connected as shown in the figure. The equivalent inductance of the circuit is



A. 8H/6

B. 6H

C. 2H

D. none of these

Answer: A

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19. The sum and difference of self-inductances of two coils are $13mH$ and $5mH$ respectively.

What is the maximum value of mutual inductance (im milli henry) of the two coil ?

A. 6H

B. 5H

C. $\sqrt{65}H$

D. 18H

Answer: A

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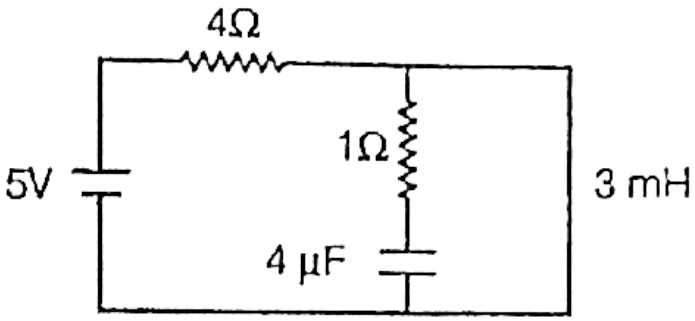
20. In the figure, the steady state current through the inductor will be



A. zero

B. 1A

C. 1.25A

D. Cannot be determined

Answer: C

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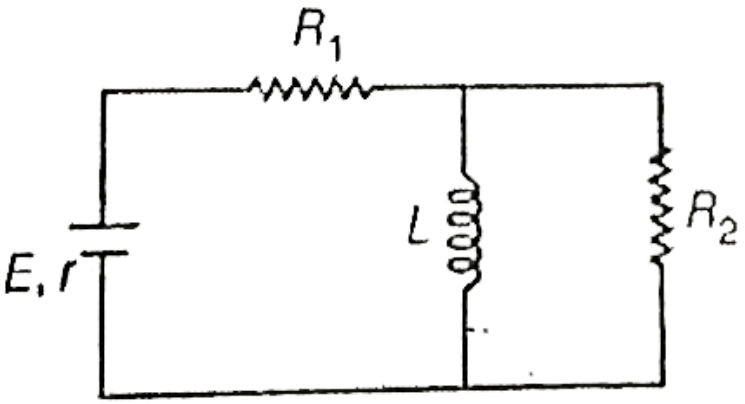
21. Determine thte valur of time constan for the given circuit



A. $\frac{L}{R_1 + r + R_2}$

B. $\frac{L}{(R_1 + r)}$

C. $\frac{L(R_1 + R_2 + r)}{(R_1 + r)R_2}$

D. none of these

Answer: C

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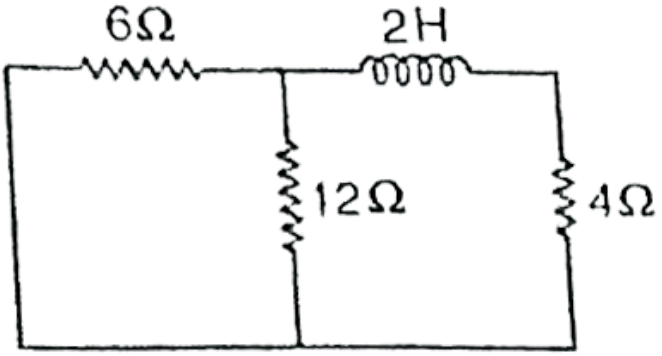
22. The time constant for the given circuit is



A. 4s

B. 1/4s

C. 2s

D. 1/2s

Answer: B

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23. With usual notations, the energy dissipation in an ideal inductor is given by

A. LI

B. $\frac{1}{2}LI$

C. $\frac{1}{2}LI^2$

D. none of these

Answer: D

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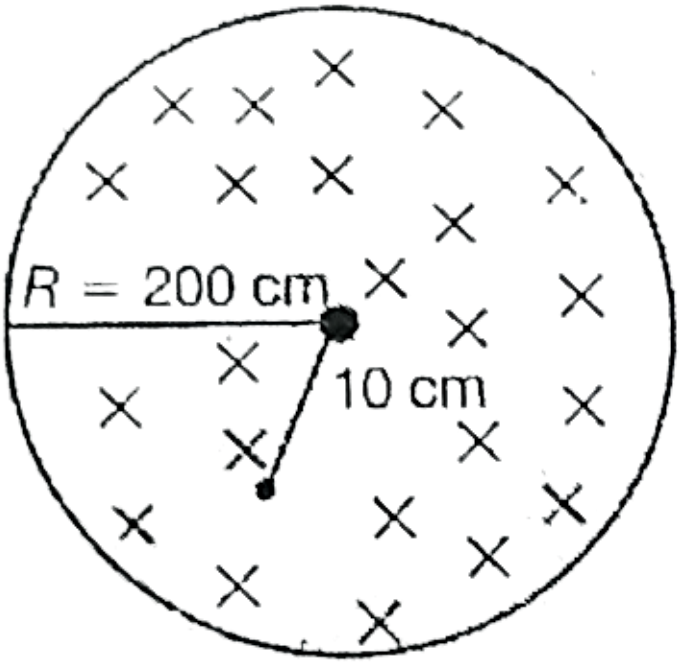
24. A non-conducting ring of radius r has charge per unit length λ. A magnetic field perpendicular to plane of the ring changes at rate Db/dt. Torque experienced by the ring is



A. $\lambda \pi r^3 \frac{dB}{dt}$

B. $\lambda 2\pi r^3 \frac{dB}{dt}$

C. $\lambda^2 (2\pi r)^2 \frac{dB}{dt}$

D. zero

Answer: A

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25. Figures show a uniform magnetic field B condfirned to ta cylinderical bolume of radius R. If B is increasing aty constant rate of 0.01T/s.

Instantaneous acceleration experienced by electron at r=10cm (ltR) as shown in the figure.

A. $8.79 \times 10^{-12} m/s^2$

B. v$8.79 \times 10^{-11} m/s^2$

C. $8.79 \times 10^{-10} m/s^2$

D. $8.79 \times 10^{-09} m/s^2$

Answer: D

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26. Find the energy stored in the magnetic field if current of 5A produces a magnetic flux of 2×10^{-3} Wb through a coil of 500 turns.

A. 2.5J

B. 0.25J

C. 250J

D. 1.5J

Answer: A

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27. The inductance of a coil in which a current of 0.1 A increasing at the rate of 0.5A/s represents a power flow of $\frac{1}{2}$ watt ,is

A. 2H

B. 8H

C. 20H

D. 10H

Answer: D

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