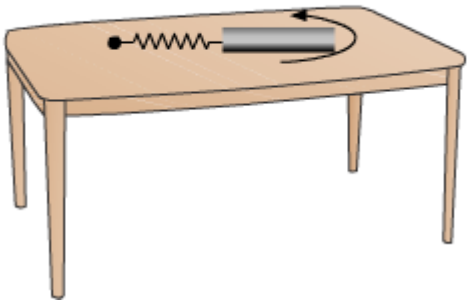
Electromagnetic Induction

Q.No.1:
A metallic rod of length 'l' is tied to a spring of length 2l and made to rotate with angular speed ω on a horizontal table with one end of the spring fixed. If there is a vertical magnetic field 'B' in the region, the e.m.f. induced across the ends of the rod is:



JEE 2013

A. $\frac{2B\omega l^2}{2}$

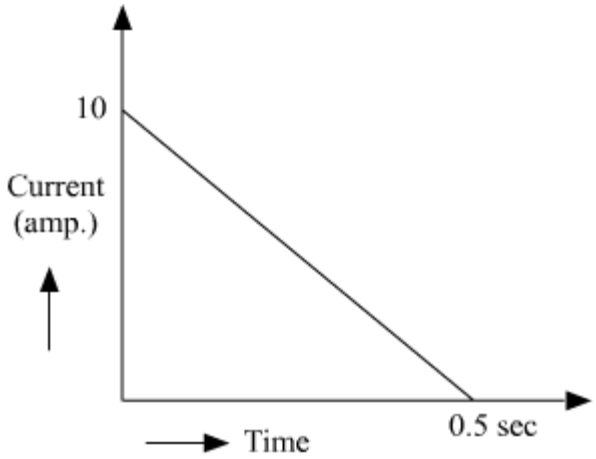
B. $\frac{3B\omega l^2}{2}$

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

D. $\frac{5B\omega l^2}{2}$

Q.No.2: In a coil of resistance 100 Ω, a current is induced by changing the magnetic flux through it as shown in the figure. The magnitude of change in flux through the coil is:

JEE 2017



A. 275 Wb
B. 200 Wb
C. 225 Wb
D. 250 Wb

Q.No.3: A solid metal cube of edge length 2 cm is moving in a positive *y*-direction at a constant speed of 6 m/s. There is a uniform magnetic field of 0.1 T in the positive *z*-direction. The potential difference between the two faces of the cube perpendicular to the *x*-axis, is: **JEE 2019**

A. 12 mV
B. 6 mV
C. 1 mV
D. 2 mV

Q.No.4: The self induced emf of a coil is 25 volts. When the current in it is changed at uniform rate from 10 A to 25 A in 1 s, the change in the energy of the inductance is: **JEE 2019**

A. 740 J
B. 437.5 J
C. 540 J
D. 637.5 J

Q.No.5: There are two long co-axial solenoids of same length *l*. The inner and outer coils have radii r_1 and r_2 and number of turns per unit length n_1 and n_2, respectively. The ratio of mutual inductance to the self-inductance of the inner-coil is: **JEE 2019**

A. $\frac{n_1}{n_2}$

B. $\frac{n_2}{n_1} \cdot \frac{r_1}{r_2}$

C. $\frac{n_2}{n_1} \cdot \frac{r_2^2}{r_1^2}$

D. $\frac{n_2}{n_1}$

Q.No.6: A copper wire is wound on a wooden frame, whose shape is that of an equilateral triangle. If the linear dimension of each side of the frame is increased by a factor of 3, keeping the number of turns of the coil per unit length of the frame the same, then the self inductance of the coil: **JEE 2019**

A. Decreases by a factor of 9

B. Increases by a factor of 27

C. Increases by a factor of 3

D. Decreases by a factor of $9\sqrt{3}$

Q.No.7: In a fluorescent lamp choke (a small transformer) 100 V of reverse voltage is produced when the choke current changes uniformly from 0.25 A to 0 in a duration of 0.025 ms. The self inductance of the choke (in mH) is estimated to be _____ **JEE 2020**

Q.No.8: A coil of inductance 2 H having negligible resistance is connected to a source of supply whose voltage is given by V = 3t volt. (where t is in second). If the voltage is applied when t = 0, then the energy stored in the coil after 4 s is _____ J. **JEE 2021**

Q.No.9: An aeroplane, with its wings spread 10 m, is flying at a speed of 180 km/h in a horizontal direction. The total intensity of earth's field at that part is 2.5×10^{-4} Wb/m^2 and the angle of dip is 60°. The emf induced between the tips of the plane wings will be _____ . **JEE 2021**

A. 108.25 mV

B. 88.37 mV

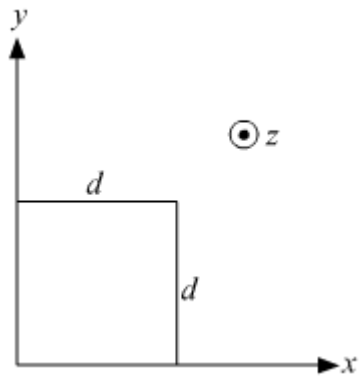
C. 62.50 mV

D. 54.125 mV

Q.No.10: The magnetic field in a region is given by $\overrightarrow{B} = B_0 \left(\frac{x}{a}\right)\hat{k}$. A square

loop of side d is placed with its edges along the x and y axes. The loop is moved with a constant velocity $\overrightarrow{v} = v_0\hat{i}$.The emf induced in the loop is:

JEE 2021



A. $\frac{B_0 v_0 d^2}{2a}$

B. $\frac{B_0 v_0 d^2}{a}$

C. $\frac{B_0 v_0 d}{2a}$

D. $\frac{B_0 {v_0}^2 d}{2a}$