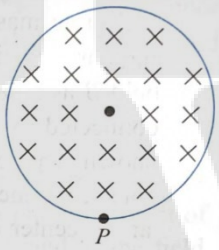
Ch—06 Electromagnetic Induction

Daily Practice Problem 05

Q1. A thin non-conducting ring of mass m carrying a charge q can freely rotate about its axis. At the initial moment, the ring was at rest and no magnetic field was present. Then a uniform magnetic field was switched on, which was perpendicular to the plane of the ring and increased with time according to a certain law: $\frac{dB}{dt} = k$

Find the angular velocity ω of the ring as a function of k.

Q2. A uniform magnetic field of induction B is confined to a cylindrical region of radius R. The magnetic field is increasing at a constant rate of $dB/dt\ T\ s^{-1}$. An electron placed at the point P on the periphery of the field, experiences an acceleration



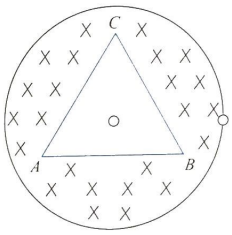
(a) $\frac{1}{2}\frac{eR}{m}\frac{dB}{dt}$ towards left

(b) $\frac{1}{2}\frac{eR}{m}\frac{dB}{dt}$ toward right

(c) $\frac{eR}{m}\frac{dB}{dt}$ toward left

(d) $zero$

Q3. A triangular wire frame (each side = $2\ m$) is placed in a region of time variant magnetic field $dB/dt = \sqrt{3}\ T/s$. The magnetic field is perpendicular to the plane of the triangle and its centre coincides with the centre of triangle. The base of the triangle AB has a resistance $1\ \Omega$ while the other two sides have resistance $2\ \Omega$ each. The magnitude of potential difference between the points A and B will be



(a) 0.4 V

(b) 0.6 V

(c) 1.2 V

(d) None

Q4. A conducting loop of radius R is present in a uniform magnetic field B perpendicular to the plane of the ring. If radius R varies as a function of time t, as $R = R_0 + t$. The emf induced in the loop is

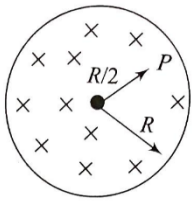
(a) $2\pi(R_0 + t)B\ clockwise$

(b) $\pi(R_0 + t)B\ clockwise$

(c) $2\pi(R_0 + t)B\ anticlockwise$

(d) zero

Q5. A uniform but time varying magnetic field $B = (2t^3 + 24t)\,T$ is present in a cylindrical region of radius $R = 2.5\,cm$ as shown in the figure. The force on an electron at P at $t = 2.0\,s$ is



(a) $96 \times 10^{-21} N$

(b) $48 \times 10^{-21} N$

(c) $24 \times 10^{-21} N$

(d) Zero

Q6. Discuss the application of Eddy Current in the following:

(a) Electromagnetic damping

(b) Electric brakes

(c) Induction furnace

ANSWERS

1. $\omega = \frac{kq}{2m}t$

2. a

3. a

4. c

5. b