PRE MID-TERM EXAMINATION 2025-26

PHYSICS

MARKING SCHEME

Class: XII **Time: 1hr**
Date: 0.08.25 **Max Marks: 25**

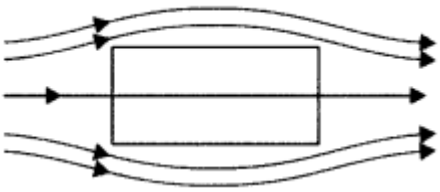
Section A

1. (a) Ferromagnetic material
2. (b) inertia
3. (c) a force and a torque
4. (d) -10 V
5. (c) If the Assertion is correct but Reason is incorrect.

Section B

6. (i) increases.
   (ii) decreases, because
   $M=\mu_0 n_1 n_2 Al$
   where [n_1 and n_2 are number of turns]

7. Behaviour of magnetic lines of force near
   (i) diamagnetic substances



   (ii) paramagnetic substances

   Justification : The field lines are repelled or expelled and the field inside the material is reduced near diamagnetic substances.

In the presence of magnetic field, the individual atomic dipoles can get aligned in the direction of the applied magnetic field. Therefore, field lines get concentrated inside the material and the field inside is enhanced near paramagnetic substances.

8.

$$\text{Time taken to travel along the width, } t = \frac{\text{Distance travelled}}{\text{Velocity}} = \frac{b}{v}$$

$$= \frac{0.02}{0.01} = 2 \text{ s}$$

Hence, the induced voltage is 2.4×10^{-4} V which lasts for 2 s.

(b) Emf developed, e = Bbv

$= 0.3 \times 0.02 \times 0.01 = 0.6 \times 10^{-4}$ V

$$\text{Time taken to travel along the length, } t = \frac{\text{Distance traveled}}{\text{Velocity}} = \frac{l}{v}$$

$$= \frac{0.08}{0.01} = 8 \text{ s}$$

Hence, the induced voltage is 0.6×10^{-4} V which lasts for 8 s.

9.

Magnetic material is diamagnetic, because susceptibility of a magnetic material is in negative.

Properties are:

(i) In a non-uniform magnetic field, it tends to move slowly from stronger to weaker parts of the field.

(ii) A freely suspended diamagnetic rod aligns itself perpendicular to the field.

(iii) They expel magnetic field lines.

(iv) Such substances are repelled by a magnet. [any two]

SECTION-C

10. If a rod length 'l' rotates with angular speed ω in the uniform magnetic field B,

$$\varepsilon = \frac{1}{2} B l^2 \omega$$

In case of earth's magnetic field $B_H = |B_e| \cos \delta$

and $B_v = |B_e| \sin \delta$

$$\varepsilon = \frac{1}{2} |B_e| \cos \delta l^2 \omega$$

$$= \frac{1}{2} \times 0.4 \times 10^{-4} \cos 60^\circ \times (0.5)^2 \times 2\pi v$$

$$= \frac{1}{2} \times 0.4 \times 10^{-4} \times \frac{1}{2} \times (0.5)^2 \times 2\pi \times \left(\frac{120 \text{ rev}}{60 \text{ sec}}\right)$$

$$= 10^{-5} \times 0.25 \times 2 \times 3.14 \times 2 = 3.14 \times 10^{-5} \text{ volt}$$

The induced emf will not change with the increase in the number of spokes.

11.

(a) According to Faraday's law of electromagnetic induction the magnitude of induced EMF is equal to the rate of change of magnetic flux linked with the closed circuit or coil.

Mathematically

$E=-N\frac{d\varphi_B}{dt}$

where N is the number of terms in the circuit and φ_B is the magnetic flux linked with each turn.

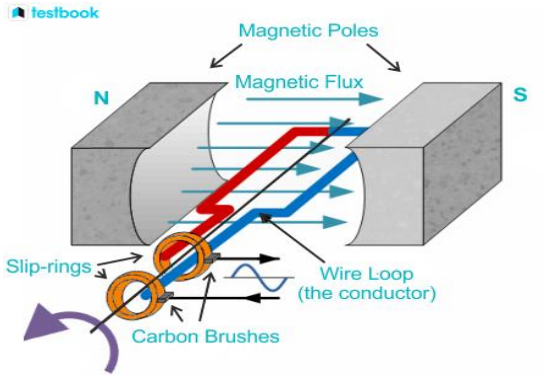
Supposed a conducting rod completes one revolution in time t then :

Change in flux $=B \times \text{Area}= B\times\pi l^2$

Induced Emf = Change in flux /Time

$\varepsilon=B\times\pi l^2\ T$ Or $T=2\pi\omega \therefore \varepsilon=B\times\pi l^2/\ 2\pi\omega= (1/2)\ Bl^2\omega$

12. An AC generator, converts mechanical energy into electrical energy using the principle of electromagnetic induction. It works by rotating a coil of wire within a magnetic field, which induces an electromotive force (EMF) or voltage. This induced voltage changes direction periodically, creating alternating current.



the flux at any time t is

$\Phi_B = BA\cos\theta = BA\cos\omega t$

From Faraday's law, the induced emf for the rotating coil of N turns is then,

$\varepsilon = -d\Phi/dt$

$\varepsilon = NBA\omega\sin\omega t$ (6.19)

where $NBA\omega$ is the maximum value of the emf, which occurs when $\sin\omega t = \pm 1$. If we denote $NBA\omega$ as ε_0, then

$\varepsilon = \varepsilon_0 \sin\omega t$

13.

Magnetic moment due to a circular coil,

$$NIA = NI\ (\pi R^2) \qquad \ldots(i)$$

Magnetic moment due to square coil,

$$NIA = NI\left(\frac{2\pi R}{4}\right)^2$$

$\because$ Circumference of a circle of radius is $2\pi R$, which makes 4 sides of a square

Hence one side of a square $= \frac{2\pi R}{4} = \frac{\pi R}{2}$

$$\text{Ratio} = \frac{(M)_{sq}}{(M)_{cir}} = \frac{\frac{NI(\pi^2R^2)}{4}}{NI(\pi R^2)}$$

$$= \frac{\pi}{4} = \frac{3.14}{4} = \frac{32}{40} = \frac{4}{5} = 4:5 \quad [\because 3.14 \approx 3.2$$

END OF THE MARKING SCHEME