

Electromagnetic Induction — Assignment 1

Class 12 Physics · Topic-wise question bank covering every concept of the chapter · Narayan Gurukul Academy

Instructions: (1) Attempt all questions. This worksheet walks through every concept of the chapter, topic by topic.
(2) The interactive MCQ version of these questions (with instant answer reveal) is available on the notes page.
(3) Universal values: $g = 10 \text{ m/s}^2$ unless stated. Give answers with correct SI units.

Magnetic Flux and Faraday's Law

MCQ Questions (choose the correct option)

- The SI unit of magnetic flux is the
 - weber
 - tesla
 - henry
 - gauss
- Faraday's law states that the induced emf equals the negative of the
 - rate of change of magnetic flux
 - magnetic flux
 - magnetic field
 - charge enclosed
- The induced emf in a coil of N turns is
 - $-N \frac{d\Phi}{dt}$
 - $-\frac{d\Phi}{dt}$
 - $N\Phi$
 - $-N\Phi^2$
- Magnetic flux through a surface is
 - $B \cdot A \cos\theta$
 - B/A
 - $B \times A$
 - $BA \sin\theta$

1 Mark Questions

- Define magnetic flux and give its SI unit.
- State Faraday's law of electromagnetic induction.
- Write the expression for the emf induced in a coil of N turns.

2 Mark Questions

- Define magnetic flux and state Faraday's laws of electromagnetic induction.
- The magnetic flux through a coil of 100 turns changes from 0.01 Wb to 0.05 Wb in 0.2 s. Find the induced emf. (Ans: 20 V)

3 Mark Questions

- State Faraday's laws of electromagnetic induction and derive the expression for the induced emf in a coil.
- A coil of area 0.1 m^2 in a magnetic field of 0.5 T is rotated so that the flux changes by its full value in 0.1 s. Find the average induced emf if the coil has 200 turns.

Lenz's Law

MCQ Questions (choose the correct option)

1. Lenz's law is a consequence of the conservation of
 - (A) energy
 - (B) charge
 - (C) momentum
 - (D) mass
2. Lenz's law states that the induced current opposes
 - (A) the change in magnetic flux
 - (B) the magnetic field always
 - (C) the electric field
 - (D) the current in the circuit
3. The negative sign in Faraday's law is due to
 - (A) Lenz's law
 - (B) Ohm's law
 - (C) Ampere's law
 - (D) Coulomb's law
4. When a magnet is pushed towards a coil, the induced current
 - (A) opposes the motion of the magnet
 - (B) aids the motion of the magnet
 - (C) has no effect on the magnet
 - (D) is zero

1 Mark Questions

1. State Lenz's law.
2. What does the negative sign in Faraday's law signify?
3. On which conservation principle is Lenz's law based?

2 Mark Questions

1. State Lenz's law and explain how it follows from the conservation of energy.
2. A bar magnet is moved towards a conducting coil. State the direction of the induced current and explain your answer.

3 Mark Questions

1. State Lenz's law and show that it is a consequence of the conservation of energy.
2. A metallic ring is dropped over a bar magnet with its plane horizontal. Explain, using Lenz's law, the direction of the induced current and the nature of the force on the ring.

Motional EMF

MCQ Questions (choose the correct option)

1. The motional emf induced in a rod of length l moving with velocity v perpendicular to a field B is
 - (A) Blv
 - (B) Blv^2
 - (C) Bv/l

- (D) Bl/v
2. The motional emf is induced because the rod
- (A) cuts the magnetic field lines
 - (B) has resistance
 - (C) carries a current
 - (D) has a magnetic moment
3. The force required to move the rod at constant velocity against the magnetic force is
- (A) $B^2 l^2 v/R$
 - (B) Blv
 - (C) Blv/R
 - (D) $B^2 l^2/R$
4. The power dissipated in the rod circuit equals the
- (A) mechanical power supplied
 - (B) magnetic energy stored
 - (C) half the mechanical power
 - (D) charge on the rod

1 Mark Questions

1. Write the expression for the motional emf induced in a conductor moving in a magnetic field.
2. Why is a motional emf induced in a rod moving through a magnetic field?
3. Write the expression for the current in a rail-rod circuit moving with velocity v .

2 Mark Questions

1. Derive the expression for the motional emf induced in a straight conductor moving perpendicular to a uniform magnetic field.
2. A rod of length 0.5 m moves at 2 m/s perpendicular to a field of 0.4 T. Find the emf induced. (Ans: 0.4 V)

3 Mark Questions

1. Derive the expression for the motional emf in a rod moving in a magnetic field and show that the mechanical power supplied equals the electrical power dissipated.
2. A conducting rod of length 1 m slides on rails 1 m apart connected to a $2\ \Omega$ resistor in a 0.5 T field, moving at 4 m/s. Find the emf, the current, and the force needed to keep it moving uniformly.

Self and Mutual Inductance

MCQ Questions (choose the correct option)

1. The SI unit of inductance is the
 - (A) henry
 - (B) weber
 - (C) tesla
 - (D) farad
2. The self-induced emf in a coil is
 - (A) $-L\,di/dt$
 - (B) $-L\,i$
 - (C) $-L\,di^2/dt$
 - (D) $L\,di/dt$

3. The mutual inductance of two coils depends on
 - (A) the geometry and separation of the coils
 - (B) only the current
 - (C) only the resistance
 - (D) the charge on the coils
4. The energy stored in an inductor carrying current I is
 - (A) $\frac{1}{2}LI^2$
 - (B) LI^2
 - (C) LI
 - (D) $\frac{1}{2}L^2I$

1 Mark Questions

1. Define self-inductance and give its SI unit.
2. Write the expression for the self-induced emf in a coil.
3. Write the expression for the energy stored in an inductor.

2 Mark Questions

1. Define self-inductance. On what factors does it depend?
2. The current in a coil of self-inductance 0.5 H changes at 2 A/s. Find the induced emf. (Ans: 1 V)

3 Mark Questions

1. Define self-inductance and derive the expression for the self-inductance of a long solenoid.
2. Define mutual inductance of two coils and derive the expression for the mutual inductance of two coaxial solenoids.

AC Generator and Transformer

MCQ Questions (choose the correct option)

1. An AC generator converts
 - (A) mechanical energy into electrical energy
 - (B) electrical energy into mechanical energy
 - (C) electrical energy into heat
 - (D) chemical energy into electrical energy
2. The peak emf of an AC generator is
 - (A) $NBA\omega$
 - (B) NBA/ω
 - (C) $NBA\omega^2$
 - (D) NBA
3. A transformer works on the principle of
 - (A) mutual induction
 - (B) self-induction
 - (C) electrostatic induction
 - (D) resonance
4. In a step-up transformer, the secondary voltage is
 - (A) greater than the primary voltage
 - (B) less than the primary voltage

- (C) equal to the primary voltage
- (D) zero

1 Mark Questions

1. State the principle of an AC generator.
2. Write the expression for the peak emf of an AC generator.
3. On what principle does a transformer work?

2 Mark Questions

1. State the principle of a transformer and give the relation between the primary and secondary voltages and turns.
2. A transformer has 100 turns in the primary and 500 turns in the secondary. If the primary voltage is 220 V, find the secondary voltage. (Ans: 1100 V)

3 Mark Questions

1. Describe the construction and working of an AC generator and derive the expression for the emf induced.
2. Describe the construction and working of a transformer and explain the relation $V_s/V_p = N_s/N_p$. State the sources of energy loss and how they are minimised.