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CLASS 12 | PHYSICS | EXTRA QUESTIONS

Class 12 Physics Chapter 6 Electromagnetic Induction – Extra Questions with Answers

From Faraday's and Lenz's laws to motional emf, AC generators, and self- and mutual inductance, Class 12 Physics Chapter 6 covers a lot of ground -- these questions revisit the key formulas and definitions.

Contents

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Very Short Answer Questions (1 mark)

Q1. State Faraday’s law of electromagnetic induction as an equation.
Ans: $E=-N(d\Phi/dt)$, i.e. the induced emf equals the negative rate of change of flux linkage.

Q2. What is the SI unit of self-inductance?
Ans: Henry (H).

Q3. What does the negative sign in Faraday’s law represent?
Ans: Lenz’s law — the induced emf always opposes the change in flux that produces it.

Q4. Write the formula for the motional emf of a rod of length l moving with velocity v perpendicular to a magnetic field B.
Ans: $\text{emf}=Blv$.

Q5. On what factors does the mutual inductance between two coils depend?
Ans: The number of turns and geometry (size/shape) of each coil, their relative orientation and separation, and the permeability of the medium between them.

Short Answer Questions (2–3 marks)

Q6. A coil of 100 turns and area 0.02m^2 is held perpendicular to a magnetic field that changes steadily from 0.2T to 0.5T in 2s. Find the induced emf.
Ans: $E=N\times A\times(dB/dt)=100\times0.02\times((0.5-0.2)/2)=100\times0.02\times0.15=$ **0.3V**.

Q7. Two coils have a mutual inductance of 2H. If the current in the primary coil changes at a steady rate of 5A/s, find the emf induced in the secondary coil.
Ans: $E=M(dI/dt)=2\times5=$ **10V**.

Q8. Distinguish between self-inductance and mutual inductance.
Ans: **Self-inductance** (L) is the property by which a coil opposes a change in its **own** current, relating the flux linked with a coil to the current flowing in that same coil. **Mutual inductance** (M) relates the flux linked with one coil to the current flowing in a **neighbouring** coil, and governs the emf induced in one coil due to a changing current in the other.

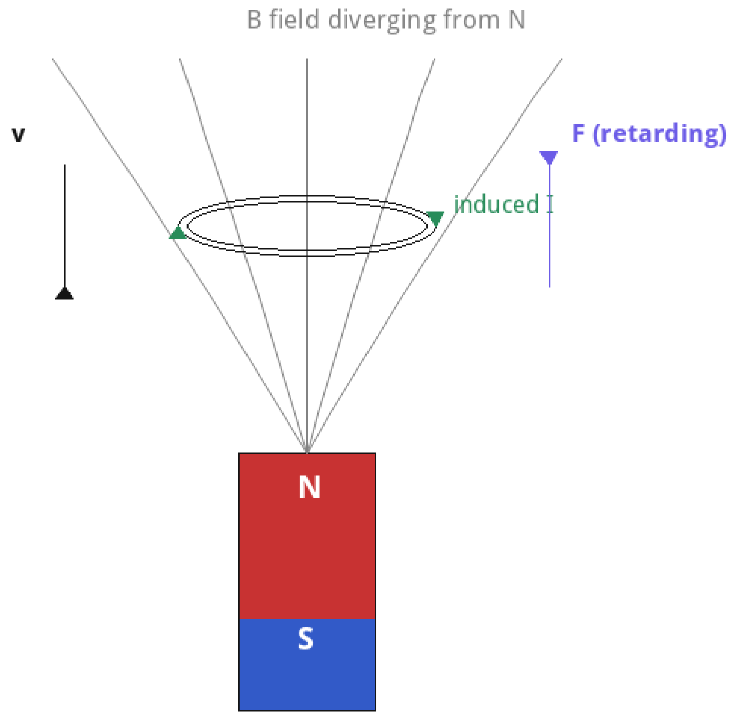
Higher-Order Thinking / Application Questions

Q9. Using Lenz’s law and the principle of conservation of energy, explain why an external agent must do work to move a conductor through a magnetic field so as to maintain an induced current, and why this does not violate any physical law.
Ans: By Lenz’s law, the induced current always flows in a direction that opposes the very motion causing it — so the magnetic force on the current-carrying conductor acts as a retarding force against the external agent’s motion. To keep the conductor moving at a steady speed against this retarding force, the external agent must continuously do mechanical work. This is not a violation of any law; rather, it is a direct requirement of energy conservation — the mechanical work done by the external agent is exactly what gets converted into electrical energy (and ultimately dissipated as heat in the circuit’s resistance). If Lenz’s law worked the other way (current aiding the motion instead of opposing it), the system would spontaneously gain energy with no external input, violating the conservation of energy — which is precisely why the

induced effects must always oppose their own cause.

Q10. A metal ring is released from rest above the pole of a strong bar magnet, so that it falls with its plane horizontal, coaxial with the magnet, through a field that is strongest near the pole and weaker farther away. Using Lenz's law, explain whether the ring's fall is retarded, and relate this to the principle behind eddy-current braking.

Ans: As the ring falls into the non-uniform field, the magnetic flux through it changes (it increases as the ring approaches the region of stronger field near the pole), so by Faraday's law a current is induced in the ring. By Lenz's law, this induced current flows in the direction that opposes the very change producing it — meaning it opposes the ring's approach to the magnet, so the ring experiences an upward retarding force in addition to gravity, and its fall is slowed compared to free fall. This is exactly the principle behind **eddy-current braking**: a conductor moving through a non-uniform (or changing) magnetic field has currents induced within it that always act, by Lenz's law, to oppose the relative motion, converting the conductor's kinetic energy into heat (I^2R losses) and producing a smooth, contactless braking force — used in practice in train brakes, industrial braking systems, and some roller-coaster designs.



Ring falling above a bar magnet's N pole: induced current opposes the approach (eddy-current braking).

Class 12 Physics Chapter 6 – Solutions and Notes

For complete step-by-step answers and a quick summary, check the [Class 12 Physics Chapter 6 Solutions] and [Class 12 Physics Chapter 6 Revision Notes].

See also: Chapter 1 | Chapter 2 | Chapter 3 | Chapter 4 | Chapter 5 | Chapter 6

Practice more: Chapter 1 | Chapter 2 | Chapter 3 | Chapter 4 | Chapter 5

Quick revision: Chapter 1 | Chapter 2 | Chapter 3 | Chapter 4 | Chapter 5