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CLASS 12 PHYSICS · NCERT CHAPTER 6 · IMU CET PRACTICE

Electromagnetic Induction

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Questions: 44 MCQs

Each question has exactly one correct option. Attempt all questions first, then check the Answer Key and Solutions at the end.

- 1 The SI unit of magnetic flux is
(A) gauss (B) henry
(C) weber (D) tesla
- 2 Faraday's law states that the induced emf is equal to
(A) the product of flux and time
(B) the rate of change of current
(C) the magnetic flux
(D) the negative rate of change of magnetic flux
- 3 Lenz's law is a consequence of the law of conservation of
(A) mass (B) charge
(C) energy (D) momentum
- 4 The magnetic flux through a coil changes from 5 Wb to 1 Wb in 2 s. The induced emf is
(A) 8 V (B) 4 V
(C) 3 V (D) 2 V
- 5 A coil of 100 turns has its flux changed by 0.02 Wb in 0.1 s. The induced emf is
(A) 20 V (B) 0.2 V
(C) 200 V (D) 2 V
- 6 A rod of length l moves with velocity v perpendicular to a uniform field B . The motional emf is
(A) Bv/l (B) Bl/v
(C) Blv (D) B^2lv
- 7 A 1 m rod moves at 5 m/s perpendicular to a 0.2 T field. The emf induced is
(A) 1 V (B) 0.04 V
(C) 5 V (D) 25 V
- 8 A metal rod of length l rotates with angular speed ω about one end in a perpendicular field B . The emf between its ends is
(A) $2B\omega l^2$ (B) $\frac{1}{2}B\omega l^2$
(C) $B\omega l^2$ (D) $B\omega l$



- 9 Eddy currents are produced when
(A) an insulator is placed in a field
(B) a metal is heated
(C) a metal body is placed in a changing magnetic flux
(D) a metal is at rest in a steady field
- 10 Eddy currents are reduced in transformer cores by using
(A) laminated cores
(B) air cores of large size
(C) solid iron cores
(D) copper cores
- 11 An application of eddy currents is
(A) electric bulbs
(B) electromagnetic braking in trains
(C) capacitor charging
(D) dry cell
- 12 The SI unit of self-inductance is
(A) henry
(B) weber
(C) farad
(D) tesla
- 13 Self-inductance of a long solenoid of N turns, length l and area A is
(A) $\mu_0 N A^2 / l$
(B) $\mu_0 N^2 A / l$
(C) $\mu_0 N A / l$
(D) $\mu_0 N^2 l / A$
- 14 If the number of turns of a solenoid is doubled (same length and area), its self-inductance becomes
(A) half
(B) unchanged
(C) double
(D) four times
- 15 The emf induced in a coil of self-inductance 2 H when current changes at 5 A/s is
(A) 2.5 V
(B) 10 V
(C) 7 V
(D) 0.4 V
- 16 The energy stored in an inductor L carrying current I is
(A) LI^2
(B) $\frac{1}{2}LI$
(C) $L^2I/2$
(D) $\frac{1}{2}LI^2$
- 17 An inductor of 0.5 H carries a current of 4 A . The energy stored is
(A) 4 J
(B) 8 J
(C) 1 J
(D) 2 J
- 18 Two coils have mutual inductance 0.1 H . If the current in one changes at 20 A/s , the emf in the other is
(A) 0.2 V
(B) 20 V
(C) 2 V
(D) 200 V
- 19 The mutual inductance of two coaxial solenoids depends on
(A) number of turns, area and length (geometry) and medium
(B) rate of change of current
(C) resistance of the coils
(D) current in the primary



- 20 A magnet is dropped through a vertical copper tube. Its acceleration is
(A) zero immediately (B) less than g
(C) greater than g (D) equal to g
- 21 The north pole of a magnet is moved towards a coil. Seen from the magnet side, the induced current in the coil is
(A) clockwise (B) zero
(C) alternating (D) anticlockwise
- 22 A coil of area A rotates with angular velocity ω in a uniform field B (N turns). The maximum emf induced is
(A) NBA (B) $NBA\omega$
(C) NBA/ω (D) $BA\omega/N$
- 23 An AC generator works on the principle of
(A) electrostatic induction (B) magnetic effect of current
(C) heating effect of current (D) electromagnetic induction
- 24 A conducting loop is pulled out of a uniform magnetic field at constant velocity. The work done by the external agent appears as
(A) kinetic energy of the loop (B) Joule heat in the loop
(C) nothing — no work is needed (D) increase in magnetic field energy
- 25 The magnetic flux through a coil is $\Phi = 5t^2 + 3t$ (Wb). The induced emf at $t = 2$ s is
(A) 26 V (B) 10 V
(C) 23 V (D) 13 V
- 26 A rectangular loop moves with constant velocity inside a uniform magnetic field (entirely within it). The induced emf is
(A) maximum (B) zero
(C) Blv (D) $2Blv$
- 27 The coefficient of coupling between two coils is maximum ($= 1$) when
(A) all flux of one coil links the other (B) coils are far apart
(C) coils are perpendicular (D) coils have no turns
- 28 The self-induced emf in a coil is also called back emf because
(A) it opposes the change in current (B) it acts only at the back of a battery
(C) it acts behind the coil (D) it aids the current
- 29 Inductance plays the role of ___ in electrical circuits.
(A) momentum (B) force
(C) friction (D) inertia
- 30 When the current in a coil changes from 2 A to 6 A in 0.05 s, an emf of 8 V is induced. The self-inductance is
(A) 0.2 H (B) 0.1 H
(C) 0.01 H (D) 1 H



- 31 The induced charge flowing through a coil of resistance R when its flux changes by $\Delta\Phi$ is
(A) independent of $\Delta\Phi$ (B) $\Delta\Phi/R$
(C) $\Delta\Phi/Rt$ (D) $R\Delta\Phi$
- 32 A horizontal wire 10 m long lying east-west falls with speed 5 m/s in the Earth's horizontal magnetic field 0.3×10^{-4} T. The emf induced is
(A) 15 mV (B) 0.15 mV
(C) 150 mV (D) 1.5 mV
- 33 Which of the following does NOT produce an induced emf in a stationary coil?
(A) A steady current in a nearby wire (B) Changing current in a nearby coil
(C) Moving a magnet near the coil (D) Rotating a magnet near the coil
- 34 The dimensions of L/R (inductance/resistance) are those of
(A) velocity (B) time
(C) frequency (D) charge
- 35 Two identical coaxial coils carry equal currents in the same direction. If they move towards each other, the currents in them will
(A) reverse (B) increase
(C) decrease (D) remain unchanged
- 36 A circular loop of radius 0.1 m is placed perpendicular to a field that decreases from 1 T to 0 in 0.5 s. The average emf is
(A) 0.0314 V (B) 0.5 V
(C) 0.031 V (D) 0.063 V
- 37 The direction of induced current is given by
(A) Lenz's law / Fleming's right-hand rule (B) Coulomb's law
(C) Fleming's left-hand rule (D) Ampere's swimming rule only
- 38 The energy density of a magnetic field B in vacuum is
(A) $\mu_0 B^2/2$ (B) $B^2\mu_0$
(C) $B^2/2\mu_0$ (D) $B/2\mu_0$
- 39 When a bar magnet falls through a closed coil, the induced current is such that
(A) it attracts the magnet on entering
(B) it repels the magnet on leaving
(C) the coil opposes the motion of the magnet both on entering and leaving
(D) it does nothing
- 40 A coil of 50 turns and area 0.02 m^2 rotates at 50 rad/s in a field of 0.4 T. The peak emf is
(A) 20 V (B) 0.4 V
(C) 40 V (D) 10 V
- 41 The emf induced in a coil is independent of
(A) the area of the coil (B) the rate of change of flux
(C) the number of turns (D) the resistance of the coil

- 42** Two inductors L_1 and L_2 are connected in series far apart (no mutual coupling). The equivalent inductance is
- (A) $L_1 L_2 / (L_1 + L_2)$ (B) $\sqrt{L_1 L_2}$
(C) $|L_1 - L_2|$ (D) $L_1 + L_2$
-
- 43** A coil of inductance 0.2 H and resistance 4 Ω is connected to a 12 V battery. The steady current and energy stored are
- (A) 3 A and 1.8 J (B) 48 A and 230 J
(C) 3 A and 0.9 J (D) 0.33 A and 0.01 J
-
- 44** Magnetic flux linked with a coil is maximum when the plane of the coil is
- (A) parallel to the field (B) at 60° to the field
(C) perpendicular to the field (D) at 45° to the field
-

Answer Key

1	2	3	4	5	6	7	8	9	10
C	D	C	D	A	C	A	B	C	A
11	12	13	14	15	16	17	18	19	20
B	A	B	D	B	D	A	C	A	B
21	22	23	24	25	26	27	28	29	30
D	B	D	B	C	B	A	A	D	B
31	32	33	34	35	36	37	38	39	40
B	D	A	B	C	D	A	C	C	A
41	42	43	44						
D	D	C	C						

Hints & Solutions

- (C) $\Phi = BA \rightarrow T m^2 = \text{weber (Wb)}$.
- (D) $\varepsilon = -d\Phi/dt$ (for N turns, $\varepsilon = -N d\Phi/dt$).
- (C) The induced current opposes the change causing it; otherwise energy would be created.
- (D) $|\varepsilon| = \Delta\Phi/\Delta t = 4/2 = 2 V$.
- (A) $\varepsilon = N \Delta\Phi/\Delta t = 100 \times 0.02/0.1 = 20 V$.
- (C) $\varepsilon = Blv$.
- (A) $\varepsilon = 0.2 \times 1 \times 5 = 1 V$.
- (B) $\varepsilon = \int B\omega r dr$ from 0 to l = $\frac{1}{2}B\omega l^2$.
- (C) Changing flux induces circulating currents in bulk conductors.
- (A) Thin insulated laminations increase resistance to eddy current paths.
- (B) Eddy currents oppose motion, providing smooth braking; also used in induction furnaces and speedometers.
- (A) $L = \Phi/I \rightarrow Wb/A = \text{henry}$.
- (B) $\Phi_{\text{total}} = N(\mu_0 NI/l)A \rightarrow L = \mu_0 N^2 A/l$.
- (D) $L \propto N^2$.
- (B) $|\varepsilon| = L di/dt = 2 \times 5 = 10 V$.
- (D) $U = \frac{1}{2}LI^2$.
- (A) $U = \frac{1}{2} \times 0.5 \times 16 = 4 J$.
- (C) $\varepsilon = M di/dt = 0.1 \times 20 = 2 V$.
- (A) $M = \mu_0 n_1 n_2 Al$ depends on geometry and permeability, not on current.
- (B) Induced eddy currents oppose the motion (Lenz's law), reducing acceleration.
- (D) The coil face near the approaching N pole becomes a north pole to repel it $\rightarrow$ anticlockwise current as seen from the magnet.
- (B) $\varepsilon = NBA\omega \sin \omega t \rightarrow \varepsilon_0 = NBA\omega$.

23. (D) Rotating a coil in a magnetic field changes flux, inducing emf.
24. (B) The induced current dissipates energy as heat; mechanical work supplies it.
25. (C) $|\varepsilon| = d\Phi/dt = 10t + 3 = 23 \text{ V}$.
26. (B) The flux through the loop does not change, so no emf is induced.
27. (A) $k = M/\sqrt{L_1 L_2} = 1$ for perfect flux linkage.
28. (A) By Lenz's law, the self-induced emf opposes changes in the current.
29. (D) An inductor opposes changes in current, analogous to mass opposing change in velocity.
30. (B) $L = \varepsilon/(dI/dt) = 8/(4/0.05) = 8/80 = 0.1 \text{ H}$.
31. (B) $q = \int I dt = \int (\varepsilon/R) dt = \Delta\Phi/R$ (for one turn), independent of time taken.
32. (D) $\varepsilon = Blv = 0.3 \times 10^{-4} \times 10 \times 5 = 1.5 \times 10^{-3} \text{ V}$.
33. (A) Steady current gives constant flux, so $d\Phi/dt = 0$.
34. (B) L/R is the time constant of an LR circuit.
35. (C) Approach increases mutual flux; induced emfs oppose this increase, reducing the currents.
36. (D) $\Delta\Phi = \pi(0.01)(1) = 0.0314 \text{ Wb} \rightarrow \varepsilon = 0.0314/0.5 \approx 0.063 \text{ V}$.
37. (A) Fleming's right-hand rule (generator rule) and Lenz's law give the direction of induced current.
38. (C) $u_B = B^2/(2\mu_0)$.
39. (C) On entry the coil repels; on exit it attracts — both oppose the relative motion.
40. (A) $\varepsilon_0 = NBA\omega = 50 \times 0.4 \times 0.02 \times 50 = 20 \text{ V}$.
41. (D) $\varepsilon = -N d\Phi/dt$; resistance affects the current but not the emf.
42. (D) Like resistors in series, inductances add when there is no mutual inductance.
43. (C) $I = 12/4 = 3 \text{ A}$; $U = \frac{1}{2} \times 0.2 \times 9 = 0.9 \text{ J}$.
44. (C) $\Phi = BA \cos \theta$, maximum when the area vector is parallel to B , i.e., the plane is perpendicular to B .

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