# PHYSICS

# BOOKS - BETTER CHOICE PUBLICATION

# ELECTROMAGNETIC INDUCTION

## Very Short Answer Type Questions

**1.** Self-induction is called inertia of electricity. Explain why.

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**2.** What is one henry?

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**3.** Define S.I. unit of self inductance.

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**4.** what is the S.I. unit of magnetic flux and magnetic induction ?

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**5.** Why is a spark produced in the switch of a fan when it is put off?

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**6.** State Lenz's law of electromagnetic induction.

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**7.** State Lenz's law of electromagnetic induction.

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**8.** Define Weber unit of Magnetic flux.

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**9.** Define Weber unit of Magnetic flux.

Watch Video Solution

**10.** Define the term magnetic flux.

Watch Video Solution

**11.** What is meant by magnetic flux? State its S.I. unit.

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**12.** Define Fleming's right hand rule.

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**13.** Name the physical quantity which is measured in Weber $\text{ampere}^{-1}$

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**14.** What is the basic cause of induced e.m.f.?

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**15.** What factors govern the direction of e.m.f. ?

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**16.** What are eddy currents ?

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**17.** Weber is the unit of which physical quantity ?

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**18.** What is back emf ?

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**19.** What is meant by magnetic flux? State its S.I. unit.

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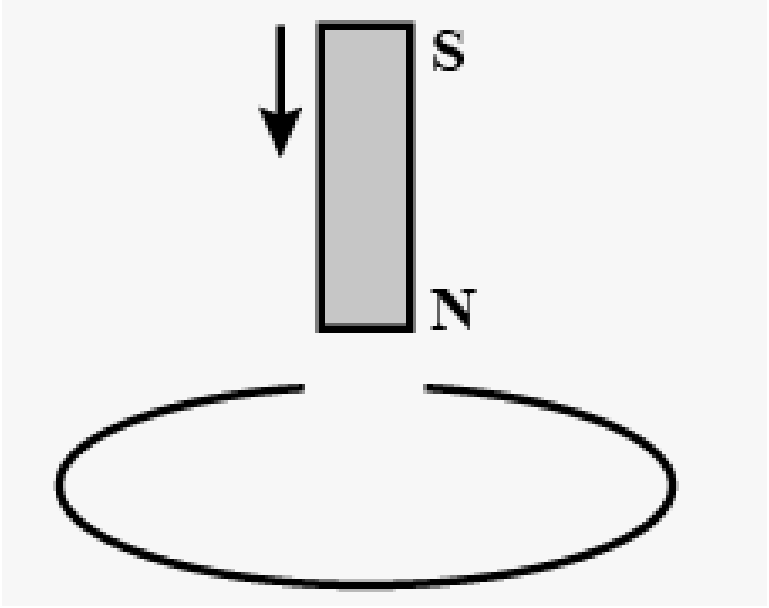
## Short Answer Type Questions

**1.** A copper ring is held horizontally and a bar magnetic is dropped through the ring with its length along the axis of the ring (shown in the figure) will the acceleration of the falling magnet be equal to , greater than or less than that due to gravity?



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**2.** Explain why resistance coils are usually double wound.

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**3.** Show that Lenz's law is a direct consequence of the law of conservation of energy

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**4.** Show that Lenz's law obeys the law of conservation of energy.

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**5.** What is electromagnetic induction ? Write its Faraday's laws ?

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**6.** What are eddy currents ? How are these produced ? How eddy currents can be minimized in a transformer.

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**7.** What are eddy currents ? How are these produced ? How eddy currents can be minimized in a transformer.

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**8.** An induced current has no direction of its own. Explain, why?

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**9.** Why is the coil of a dead beat galvanometer wound on a metal frame?

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**10.** Self-induction is called inertia of electricity. Explain why.

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## Short Answertype Questions

**1.** What is Lenz's law? prove that Lenz's law is in accordance with the conservation of energy principle.

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**2.** Explain the phenomenon of self induction?

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**3.** What is meant by mutual induction? Define coefficient of mutual induction. ALso define its S.I unit of mutual induction.

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**4.** What are eddy currents ?

Watch Video Solution

**5.** State Lenz's law.Give one example to illustrate it.

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**6.** State and explain Faraday's law of electromagnetic induction.

Watch Video Solution

**7.** Define co-efficient of mutual induction and find an expression for it.

Watch Video Solution

**8.** Show that Lenz's law obeys the law of conservation of energy.

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**9.** What is Lenz's law? prove that Lenz's law is in accordance with the conservation of energy principle.

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**10.** Define co-efficient of mutual induction and find an expression for it.

Watch Video Solution

**11.** What is meant by mutual induction? Define coefficient of mutual induction. ALso define its S.I unit of mutual induction.

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**12.** Show that energy stored in an inductor L, when a current is f established through it, is 1/2( LI ^2).

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**13.** State and explain Lenz's law of electromagnetic induction. Give one example to illustrate the law. How it can be verified experimentally ?

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## Long Answer Type Questions

**1.** What is Lenz's law? prove that Lenz's law is in accordance with the conservation of energy principle.

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**2.** What are eddy currents ?

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**3.** State and explain Faraday's law of electromagnetic induction.

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**4.** State explain Faraday's laws of electromagnetic induction. Give their mathematical form.

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**5.** What is self Inductance of a coil ? Define coefficient of self Induction.

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**6.** Derive expression for the coefficient of mutual inductance between two long solenoids.

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**7.** What is electromagnetic induction ? State its Faraday's laws. Find an expression for the e.m.f. induced due to change in the area of a coil lying in a uniform magnetic field.

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**8.** What is electromagnetic induction ? State its laws.

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## Most Expected Questions

**1.** Explain why resistance coils are usually double wound.

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**2.** Define mutual inductance and explain it?

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**3.** Sometimes, induced emf is known as back emf. Why ?

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**4.** Why does a metallic piece become very hot, when it is surrounded by a coil carrying high

frequency alternating current?

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**5.** How many maxwell are there in one weber ?

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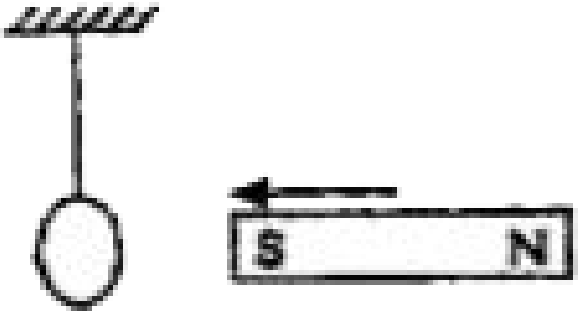
**6.** Give the directlon in which the induced curren1 flows in the wire loop, when the magnet moves towards it as shown in figure

below.

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**7.** Explain, whether an induced current will be developed in a conductor, if it is moved in a direction parallel to magnetic field.

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**8.** Give ihe disadvantages of eddy currents.

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**9.** What factors govern the magnitude of the e.m.f. induced in an electric circuit.

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## Numerical Problems

**1.** A magnetic field of $2 \times 10^{-2} T$ acts at right angles to a coil of area $100 cm^2$ with 50 turns. The average e.m.f. induced in the coil is 0.1 V, When it is removed form the field in the time t. The value of t is

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**2.** A small piece of metal wire is dragged across the gap

between this poles of a magnet in 10 s. The

magnetic flux between the pole pieces is $8 \times 10^{-4}$ wb. Find

The magnitude of induced emf.

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**3.** A copper rod of length 2 m fixed at one end is rotating with an angular speed $300 rads^{-1}$ about an axis normal to the rod and passing thorugh its fixed end. The other end of the end. The other end of the rod is in contact with a circulr metallic ring. A constant

magnetic field of 0.4 T parallel to the axis exists everywhere. calculate the e.m.f. developed between the centre and the ring.

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**4.** A brass rod of length 3.0 m fixed at one end is rotating with angular velocity 200 rad $s^{-1}$ about the fixed end in a uniform magnetic field of intensity 0-5 T. Find the induced emf between the centre and far end of the rod.

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**5.** A silver rod of length one metre fixed at one end is rotating with angular velocity 400 rad $s^{-1}$ about the fixed end in a uniform magnetic field of intensity 0:3 T. Find the induced emf between the centre and far end of the rod.

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**6.** An e.m.f. of $250\mu V$ is induced in a coil, when current in it changes from 10 A to 6 A in 0.4 s. What is the self inductance of the coil?

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**7.** A wire of length 0.1 m moves with a speed of 10 "m/s" perpendicular to a magnetic field of induction 1 $\mathrm{wb}/\mathrm{m}^2$. What is the value of induced emf?

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**8.** A coil of 100 turns and area 200 $\mathrm{cm}^2$ is placed at right angles to a magnetic field of $2 \times 10^{-2} \mathrm{wb/m}^2$. If the speed of rotation is 500 "rev/second", then what is

the maximum value of induced emf in the coil ?

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**9.** The magnetic flux passing through a coil changes from $6 \times 10^{-3} wb$ to $7.2 \times 10^{-3}$ wb

in $0.02\,\text{sec}\,ond$. Calculate the magnitude of emf induced.

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**10.** The magnetic flux passing through a coil changes from $5 \times 10^{-2}$ wb to $8 \times 10^{-2}$ wb in 0.15 second. Calculate the magnitude of emf induced in the coil.

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**11.** The magnetic flux through a coil changes from $4 \times 10^{-2}$ wb to $6 \times 10^{-2}$ wb in 0.04 second. Calculate the magnitude of emf induced in the coil.

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**12.** A magnetic ifeld $2 \times 10^{-2} \mathrm{wbm}^{-2}$ is acting at right angle to a coil of area $10^{3} \mathrm{cm}^{2}$ having $10^{2}$ turns. The coil is removed from the field in 0.2 second.

Calculate the magnitude of emf induced in the coil.

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**13.** A magnetic field of $4 \times 10^{-4} \mathrm{wbm}^{-2}$ is acting at right angle to a coil of area $8 \times 10^{2} \mathrm{cm}^{2}$ having 50 turns. The coil is removed from the field in 0.2 second, Calculate the magnitude of emf induced in the coil.

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**14.** A magnetic field $5 \times 10^{-4} \mathrm{wbm}^{-2}$ is acting at right angle to a coil of area $5 \times 10^{2} \mathrm{cm}^{2}$ having 150 turns. The coil is removed from the field in 0.4 seconds. Calculate the magnitude of emf induced in it.

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**15.** A magnetic flux of 5 microweber is linked with a coil when a current of 1 MA flows

through it.What is the self inductance of the coil ?

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**16.** A magnetic flux of 5 microweber is linked with a coil when a current of 1 MA flows through it.What is the self inductance of the coil ?

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**17.** The magnetic flux threading a coil changes from to $12x10(-3)$ Wb to $6x10(-3)$ Wb in $0.015$.Calculate the induced e.m.f.

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**18.** What will be the coefficient of mutual inductance of a pair of coil if a current of 3 ampere in one coil cause the flux in the second coil of 1000 turns to change by $10(-4)$Wb in each turn ?

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**19.** A wire is cut across a flux of $0.2x10(-2)$ weber in 0.12 seconds. What is the e.m.f. induced in the wire ?

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**20.** A railway track running North South has two parallel rails 1.0m apart. Calculate the value of induced e.m.f. between the rails when a train passes at a speed of $90kmh(-1)$.

Horizontal component of earth's field at that place is $0.3 \times 1O(-4)\ Wbm(-2)$ and angle of dip is $60^\circ$.

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**21.** The magnetic flux through a coil perpendicular to its plane and directed into the paper is varying according to the relatlon $\phi = \left(3t^3 + 2t^2 + 4t + 6\right)$ wb.

Calculate the emf induced in the coil at t = 1s.

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**22.** The magnetic flux through a coil perpendicular to its plane and directed into the paper is varying according to the relation, $\phi = \left(2t^3 - t^2 - 3t + 5\right)$ Wb. Calculate the e.m.f. induced in the coil at t = 2s.

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**23.** The magnetic flux through a coil perpendicular to its plane and directed into the paper is varying according to the equation

$\phi = (2t^3 - 6t^2 - t + 8)$ Wb. Calculate the e.m.f. induced in the coil at t = 3s.

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**24.** A wire 88cm long bent into a circular loop is placed perpendicular to the magnetic field of density 2.5 Wb $m^{-2}$. Within 0.5 s the loop is changed into square of each side 22 cm and the density is increased to $3Wbm - 2$. Calculate the value of e.m.f. induced.

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**25.** A rectangular coil having 200 turns and size $0.30 \times 0.05 m^2$ is placed perpendicular to a magnetic field. The field changes from $5x10^{-3}\ Wbm^{-2}$to $2x10(-3)\ Wbm(-2)$ in the time interval of 3 millisecond. Calculate the e.m.f. induced in the coil. If the resistance of the coil is $15\Omega$, find the value of current flowing through it.

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**26.** Find the e.m.f. induced in a coil of 100 turns and crosssectional area $0.4m^2$, when a magnetic field perpendicular to a plane of the coil changes from $0.5Wbm^{-2}$ to $0.1Wbm(-2)$ at a uniform rate over a period of 0.04 s. If the resistance of the coil is $3.2k\Omega$, find the value of current flowing through it.

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