

MAGNETIC EFFECT OF CURRENT AND MAGNETISM

MINIMUM LEVEL OF LEARNING

ONE MARK QUESTIONS

Q1) State Biot Savart's Law.

A1) It states that magnetic field due to a small conductor of length dl , carrying a current I , at a point at distance r , is given by,

$$dB = \frac{\mu_0}{4\pi} \cdot I dl \sin\theta / r^2$$

where θ is the angle between the direction of flow of current and the line joining the small conductor to the observation point.

Q2) Write the dimensional formula of μ_0 .

A2) The dimensional formula of μ_0 is $[M L T^{-2} A^{-2}]$

Q3) What is the effect of increasing the number of turns on magnetic field produced to a circular coil?

A3) The magnetic field produced by a coil of n turns is n times the magnetic field produced by a coil of single turn.

Q4) An electric charge enters in an electric field at right angles to the direction of electric field. What is the nature of the path followed?

A4) The electric charge will move along a parabolic path.

Q5) An electron beam projected along +X- axis experiences a force due to a magnetic field along the +Y- axis. What is the direction of magnetic field?

A5) The electron (a negatively charged particle) moving along + X- axis experiences force along +Y- axis, then the magnetic field must be directed along **-Z- axis**.

Q6) Write an expression for the force experienced by a charged particle moving in a uniform magnetic field B .

A.6)

The magnitude of force is given by

$$F_m = B q v \sin \theta$$

Q7) Under which condition, an electron moving through a magnetic field experiences maximum force?

A7) An electron moving through a magnetic field experiences maximum force, when it moves perpendicular to the direction of magnetic field .

Q8) What is the work done by magnetic field on a moving charge and why?

A8) Work done by magnetic field on a moving charge is zero. It is because , force on the charge due to magnetic field is perpendicular to its path.

Q9) What is the nature of force, when the two parallel conductors carry currents in the (i) same direction (ii) opposite direction?

A9) i) Force is attractive. ii) Force is repulsive.

Q10) A circular coil of radius R carries a current I. Write the expression for the magnetic field due to this coil at centre.

A10) $B = \frac{\mu_0 I}{2R}$

Q11) What is the angle of dip at the magnetic equator?

A11) 0°

1. A jet plane is traveling west at 450m/s. If horizontal component of earth's magnetic field at that place is 4×10^{-4} T and angle of dip is 30° , find emf induced between ends of wings having a span of 30m.

Ans: $v = 450 \text{ m/s}$, $l = 30 \text{ m}$, $B = 4 \times 10^{-4} \text{ T}$

$$e = Bvl \sin \theta$$

$$= 4 \times 10^{-4} \text{ T} \times 450 \text{ m/s} \times 30 \text{ m} \times \sin 30^\circ$$

$$= 5.4 \text{ Volt}$$

2. Give expression of magnetic field due to circular coil (at its centre) and due to long straight wire, when these are carrying current.

A) The magnetic field due to circular coil at its centre,

$$B = \mu_0 \cdot 4\pi \cdot \frac{2 \pi n I a^2}{(a^2 + x^2)^{3/2}}$$

And magnetic field due to a long straight wire,

$$B = \mu_0 \cdot 4\pi \cdot \frac{2I}{a}$$

- Q3) What is the nature of force, when the two parallel conductors carry currents in the (i) same direction (ii) opposite direction?

A3) i) Force is attractive. ii) Force is repulsive.

- Q4) Give two factors by which the current sensitivity of a moving coil galvanometer can be increased.

A4) Current sensitivity = $n B A/k$,

Where the letters have their usual meanings. Since n and A cannot be increased beyond a limit, the current sensitivity may be increased by (i) by increasing B (ii) by decreasing k .

- Q5) Give two factors by which voltage sensitivity of a moving coil galvanometer can be increased.

Q1) Using Biot Savart Law, derive an expression for the magnetic field at the centre of a circular coil of radius R, number of turns N, carrying current I.

A1) Derivation.

Derive the expression using diagram.

$$B = \mu_0 I / 2R$$

Q2) Using Ampere's circuit Law, obtain an expression for the magnetic field along the axis of a current solenoid of length L carrying current I and having N number of turns.

A2) Derivation.

Derive the expression using diagram.

$$B = \mu_0 NI / L$$

Q 3) Describe qualitatively, the path of a charged particle moving in a uniform electrostatic field with initial velocity (i) parallel to the field (ii) perpendicular to the field, (iii) at an arbitrary angle with the field direction.

A3) (i) The force due to uniform electrostatic field will act along the direction of the field and hence path will be a straight line.

(ii) It will follow a parabolic path, as the force acts along a direction perpendicular to initial velocity.

(iii) It will follow parabolic path. The velocity of the charged particle may be resolved into two components.

4) Write three magnetic elements of earth. Define them

Ans Definition of angle of dip, angle of declination, Earth's horizontal component

5) Which of the following will describe the smaller circular path and when projected with same velocity perpendicular to magnetic field and why

Ans $r = mv / qB$

Q5) Give two factors by which voltage sensitivity of a moving coil galvanometer can be increased.

A5) Voltage sensitivity = $n B A / k R$,

Where the letters have their usual meanings. For higher voltage sensitivity; n B and A should be large, while k and R should be small. Since n and A cannot be increased beyond a limit, the voltage sensitivity may be increased by

(i) increasing B **(ii)** decreasing k and **(iii)** decreasing R .

Q6) Steel is preferred for making permanent magnet whereas soft iron is preferred for making electromagnets. Give one reason.

A6) High retentivity and high coercivity in case of steel.

Low retentivity and low coercivity in case of soft iron.