Code: Phy/ EM-4/MEC/003

Electromagnetism: Magnetic Effect of Electric Current

Typical Questions (Set-3)

No of Questions: 91 **Time Allotted: 9 Hours**

All questions are compulsory

[Note: a. Figures are conceptual only and not to the scale**]**

[b. It is advised to attempt question under examination conditions in two parts – Parts I: Qns 1 to 30 in 3 Hours, Qns 31 to 60 in 3 Hours and Qns 61 to 91 **]**

Important Note: 1. Capacitors are implementation aspect of concepts of electrostatics. The capacitors are integral part of any electrical system or circuit and any kind of application of electricity.

2. A student at a stage to refer to these questions and illustrations is expected to have attained a reasonable understanding of concepts and visualization. Moreover, forward journey involves integration of concepts on a wider canvas. Therefore, illustrations have been made a bit crisp. This would help students to harness their understanding at a faster rate.

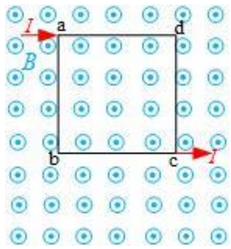
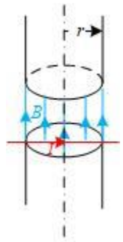
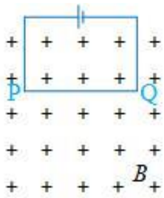
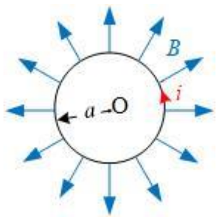
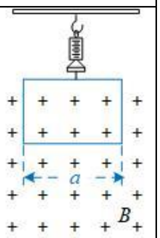
3. Avoid fatigue due to long and continuous sitting in solving such problems. Take a reasonable break to refresh before taking next part. Gradually, capability to withstand fatigue will grow to enable you to take up bigger challenges.

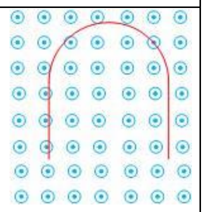
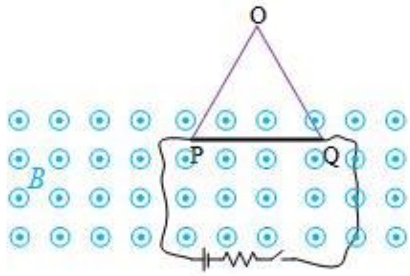
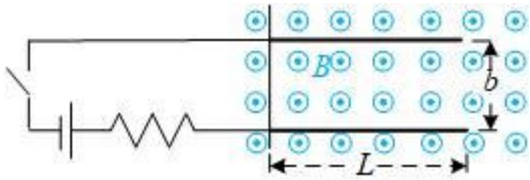
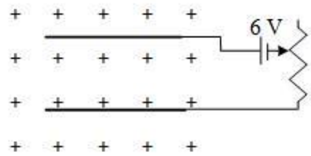
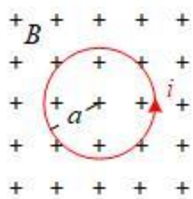
4. Electromagnetism is a subject so closely intertwined that discretization of problems on Magnetism and Magnetic Effect of Electric Current fails as one goes ahead. This is brought out in footnote of illustration of such problems.

Q-01	Suppose a charged particle moves with a velocity v near a wire carrying an electric current. A magnetic force, therefore, acts on it. If the same particle is seen from a frame moving with a velocity v in the same direction, the charge will be found at rest. (a) Will the magnetic force become zero? (b) Will the magnetic field become zero in this frame?
Q-02	Can a charged particle be accelerated by a magnetic field? Can the speed be increased?
Q-03	Will a current loop placed in a magnetic field always experience zero force
Q-04	The free electrons in a conducting wire are in constant thermal motion. If such a wire, carrying no current is placed in a magnetic field, is there a magnetic force on each free electron? Is there a magnetic force on wire?
Q-05	Assume that the magnetic field is uniform in a cubical region and is zero outside. Can you project a charged particle from outside into the field so that the particle describes a complete circle in the field?
Q-06	An electron beam projected along the positive X-axis deflects along positive Y-axis. If this deflection is caused by a magnetic field, what is the direction of the field? Can we conclude that the field is parallel to Z-axis?
Q-07	Is it possible for a current loop to stay without rotating in a uniform magnetic field? If yes, what should be the orientation of the loop?
Q-08	The net charge on a current carrying wire is zero. Then why does a magnetic field exerts a force on it?
Q-09	The torque on a current loop is zero if the angle between the positive normal and the magnetic field is either $\alpha = 0$ or $\alpha = 180^0$. In which of the two orientations the equilibrium is stable?

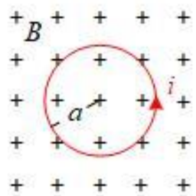
Q-10	Verify that the units weber and volt second are the same.
Q-11	A positively charged particle projected towards east is deflected towards north by a magnetic field. The field may be (a) Towards east (b) Towards south (c) Upward (d) Downward
Q-12	A charged particle is whirled in a horizontal circle on a frictionless table by attaching it to a string fixed at one point. If a magnetic field is switched on the vertical direction, the tension in the string – (a) Will increase (b) Will decrease (c) Will remain same (d) May increase or decrease
Q-14	Which of the following particles will describe the smallest circle when projected with the same velocity perpendicular to the magnetic field? (a) Electron (b) Proton (c) He^+ (d) Li^+
Q-15	Which of the following particles will have minimum frequency of revolution when projected with the same velocity perpendicular to the magnetic field? (a) Electron (b) Proton (c) He^+ (d) Li^+
Q-16	A circular loop of area 1 cm^2, carrying a current of 10 A, is placed in a magnetic field of 0.1 T perpendicular to the plane of the loop. The torque on the loop due to the magnetic field is (a) Zero (b) 10^{-4} Nm (c) 10^{-2} Nm (d) 1 Nm
Q-17	A beam consisting of protons and electrons moving at the same speed goes through a thin region in which there is a magnetic field perpendicular to the beam. The protons and electrons (a) Will go un-deviated (b) Will be deviated by the same angle and will not separate (c) Will be deviated by different angle and hence separated (d) Will be deviated by the same angle but will no separate
Q-18	A charged particle moves in a uniform magnetic field. The velocity of the particle at some instant, makes an acute angle with magnetic field. The path of the particle will be, (a) A straight line (b) Circle (c) A helix with uniform pitch (d) A helix with non-uniform pitch
Q-19	A particle moves in a region having a uniform magnetic field and a parallel, uniform electric field. At some instant, the velocity of the particle is perpendicular to the field direction. The path of the particle will be, (a) A straight line (b) Circle (c) A helix with uniform pitch (c) A helix with non-uniform pitch
Q-20	An electric current i enters and leaves a uniform circular wires of radius a through diametrically opposite points. A charged particle q moving along axis of the circular wire passes through its center at speed v. The magnetic force acting on the particle when it passes through the center has a magnitude $qv\frac{\mu_0 i}{2a}$ (b) $qv\frac{\mu_0 i}{2\pi a}$ (c) $qv\frac{\mu_0 i}{a}$ (d) Zero
Q-21	If a charged particle at rest experiences no electromagnetic force (a) The electric field must be zero (b)The magnetic field must be zero (c) The electric field may or may not be zero (d) The magnetic field may or may not be zero
Q-22	If a charge particle kept at rest experience an electromagnetic force (a) The electric field must not be zero (b)The magnetic field must not be zero (c) The electric field may or may not be zero (d) The magnetic field may or may not be zero
Q-23	If a charged particle projected in a gravity-free room deflects. (a) There must be an electric field (b)The magnetic field must not be zero (c) The electric field may or may not be zero (d) The magnetic field may or may not be zero

Q-24	A charged particle moves in a gravity-free space without change in velocity. Which of the following is/are possible? (a) $E = 0, B = 0$ (b) $E = 0, B \neq 0$ (c) $E \neq 0, B = 0$ (d) $E \neq 0, B \neq 0$
Q-25	A charged particle moves along a circle under the action of possible constant electric and magnetic fields. Which of the following are possible? (a) $E = 0, B = 0$ (b) $E = 0, B \neq 0$ (c) $E \neq 0, B = 0$ (d) $E \neq 0, B \neq 0$
Q-26	A charged particle goes undeflected in a region containing electric and magnetic fields. It is possible that (a) $\vec{E} \| \| \vec{B}, \vec{v} \| \| \vec{E}$ (b) $\vec{E}$ is not parallel to $\vec{B}$ (c) $\vec{v} \| \| \vec{B}$ but $\vec{E}$ is not parallel to $\vec{B}$ (d) $\vec{E} \| \| \vec{B}$ but $\vec{v}$ is not parallel to $\vec{E}$
Q-27	If a charged particle goes un-accelerated in a region containing electric field and magnetic fields, (a) $\vec{E}$ must be perpendicular to $\vec{B}$ (b) $\vec{v}$ must be perpendicular to $\vec{E}$ (c) $\vec{v}$ must be perpendicular to $\vec{B}$ (d) E must be equal to vB
Q-28	Two ions have equal masses but one is single-ionized and the other is doubly-ionized. They are projected from the same place in a uniform magnetic field with the same velocity perpendicular to the field. (a) Both ions will go along circle of equal radii (b) The circle described by the single-ionized charge will have a radius double that of the other circle (c) The two circles do not touch each other (d) The two circles touch each other
Q-29	An electron is moving along the positive X-axis. You want to apply a magnetic field for a short time so that the electron may reverse its direction and move parallel to the negative X-axis. This can be done by applying the magnetic field along (a) Y-axis (b) Z-axis (c) Y-axis only (d) Z-axis only
Q-30	Let $\vec{E}$ and $\vec{B}$ denote electric and magnetic fields in a frame S and $\vec{E}'$ and $\vec{B}'$ in another frame S' moving w.r.t. S with a velocity $\vec{v}$. Two of the following equations are wrong. Identify them (a) $B_y' = B_y + \frac{vE_z}{c^2}$ (b) $B_y' = E_y - \frac{vB_z}{c^2}$ (c) $B_y' = B_y + vE_z$ (d) $B_y' = E_y + vB_z$
Q-31	An alpha particle is projected vertically upward with a speed of 3.0×10^4km/s in a region where magnetic field of magnitude 1.0 T exists in the direction south to north. Find the magnetic force that acts on the particle.
Q-32	An electron is projected horizontally with a kinetic energy of 10 keV. A magnetic field of strength 1.0×10^{-7}T exists in the vertically upward direction. (a) Will the electron deflect towards right or towards eft of its motion? (b) Calculate the sideways deflection of the electron in travelling through 1m. Make appropriate approximation.
Q-33	A magnetic field of $(4.0 \times 10^{-3})\hat{k}$ exerts a force $(4.0\hat{\imath} + 3.0\hat{\jmath}) \times 10^{-10}$N on a particle having a charge of 1.0×10^{-9} C and going in the x-y plane. Find the velocity of the particle.
Q-34	An experimenter's diary reads as follows: "a charged particle is projected in a magnetic field of $(7.0\hat{\imath} - 3.0\hat{\jmath}) \times 10^{-3}$T. The acceleration of the particle is found to be $(x\hat{\imath} + 7.0\hat{\jmath}) \times 10^{-6}$m-s^{-2}". The value of x in the expression is not readable. What can this number be?
Q-35	A 10 g bullet having a charge 4.00mC is fired at a speed 270 m/s in a horizontal direction. A vertical magnetic field of 500 μT exists in the space. Find the deflection of the bullet due to the magnetic field as it travels through 100 m. Make appropriate approximations.

Q-36	When a proton is released from rest in a room, it starts with an initial acceleration a_0 towards the west. When it is projected towards north with a speed v_0 , it moves with an initial acceleration $3a_0$ towards west. Find the electric field and maximum possible magnetic field in the room.
Q-37	Consider a 10 cm long portion of a straight wire carrying a current of 10 A placed in a magnetic field of 0.1 T making an angle of 53^0 with the wire. What magnetic force does the wire experience?
Q-38	A current of 2 A enters at the corner d of a square frame abcd of side 20 cm and leaves at the opposite corner b. A magnetic field $B = 0.1$ T exists in the space in a direction perpendicular to the plane of the frame as shown in the figure. Find the magnitude and direction of the magnetic force on the four sides of the frame. 
Q-39	A magnetic field of strength 1.0 T is produced by a strong electromagnet in a cylindrical region of radius 4.0 cm as shown in the figure. A wire, carrying a current of 2.0 A, is placed perpendicular to and intersecting the axis of the cylindrical region. Find the magnitude of the force acting on the wire. 
Q-40	A wire of length l carries a current I along the X-axis. A magnetic field exists which is given as $\vec{B} = B_0(\hat{\imath} + \hat{\jmath} + \hat{k})$ T. Find the magnitude of the magnetic force acting on the wire.
Q-41	A current of 5.0 A exists in the circuit shown in the figure. The wire PQ has a length of 50 cm and magnetic field in which it is immersed has a magnitude of 0.20 T. Find the magnetic force acting on the wire PQ. 
Q-42	A circular loop of radius a, carrying a current i, is placed in a two-dimensional magnetic field. The center of the loop coincides with the center of the magnetic field as shown in the figure. The strength of the magnetic field at the periphery of the loop is B. Find magnetic force on the wire. 
Q-43	A hypothetical magnetic field existing in a region is given by $\vec{B} = B\vec{e}_r$, where $\vec{e}_r$ denotes unit vector along the radial direction. A circular loop of radius a, carrying a current i, is placed with its plane parallel to the X-Y plane and the center at $(0,0,d)$. Find the magnitude of the magnetic force acting on the loop.
Q-44	A rectangular wire-loop of width a is suspended from the insulated pan of a spring balance is shown in figure. A current i exits in the anticlockwise direction in the loop. A magnetic field B exists in the lower region. Find the change in the tension of the spring if current in the loop is reversed. 
Q-45	A current loop of arbitrary shape lies in a uniform magnetic field B. Show that the net magnetic force acting on the loop is zero.
Q-46	Prove that the force on a current-carrying wire, joining two fixed points a and b in a uniform magnetic field, is independent of the shape of the wire.

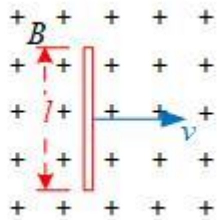
Q-47	A semicircular wire of radius 5.0 cm carries a current of 5.0 A. A magnetic field $B = 0.50$ T exists along the perpendicular to the plane of the wire. Find the magnitude of the magnetic force acting on the wire.
Q-48	A wire carrying current I, is kept in the X-Y plane along the curve $y = \sin\left(\frac{2\pi}{\lambda}x\right)$. A magnetic field B exists in Z-direction. Find the magnitude of the magnetic force on the portion of wire between $x = 0$ and $x = \lambda$.
Q-49	A rigid wire consists of a semicircular portion of radius R and two straight sections as shown in the figure. The wire is partially immersed in a perpendicular magnetic field B as shown in the figure. Find the magnetic force on the wire if it carries a current I. 
Q-50	A straight horizontal wire of mass 10 mg and length 1.0 m carries a current of 2.0 A. What minimum magnetic field B should be applied in the region so that the magnetic force on the wire may balance its weight?
Q-51	Figure shows that a rod PQ of length 20.0 cm and mass 200 g suspended through a fixed point O by two threads of length of length 20.0 cm each. A magnetic field of strength 0.500 T exists in the vicinity of the wire PQ as shown in the figure. The wires connecting PQ with the battery are loose and exert no force on PW. (a) Find the tension in the threads when switch S is open. (b) A current of 2.0 A is established when the switch S is closed. Find the tension in the threads now. 
Q-52	Two metal strips, each of length L, are clamped parallel to each other on a horizontal floor with a separation b between them. A wire of mass m lies on them perpendicularly as shown in the figure. A vertically upward magnetic field of strength B exists in the space. The metal strips are smooth but coefficient of friction between the wire and the floor is μ. A current i is established when switch S is closed at the instant $t = 0$. Discuss the motion of wire after switch is closed. How far away from the strp will the wire reach? 
Q-53	A metal wire LM of mass 10 g lies at rest on two horizontal metal rails separated by 4.90 cm. A vertically downward magnetic field of magnitude 0.800 T exists in the space. The reistance of the circuit is slowly decreased and it is found that when the resistance goesbelow 20.0 Ω, the wire PQ starts sliding on the rails. Find coefficient of friction. 
Q-54	A straight wire of length l can silde on two parallel plastic rails kept in a horizontal plane with a separation l. The coefficient of friction between the wire and the rails is μ. If the wire carries a current i, what minimum magnetic field should exist in the space in order to slide the wire on the rails,
Q-55	Figure shows a cirular wire-loop of a radius a, carrying a current i, placed in a parpendicular magnetic field B. (a) Consider a small part Δl of the wire. Find the force on this paet of the wire exerted by the magnetic field. (b) Find the force of compression in the wire. 

Q-56 Figure shows a cirular wire-loop of a radius a, carrying a current i, placed in a parpendicular magneticfield B. Suppose that radius of cross-section of the wire is r. Find the incease in the radius of the loop if magnetic field is switcedoff. The Young Modulus of the material of the wire is Y.



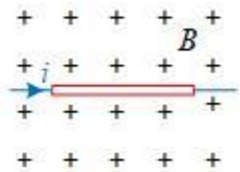
Q-57 The magnetic field existing in a region is given by $\vec{B} = B_0\left(1 + \frac{x}{l}\right)\hat{k}$. A square loop of edge l carrying a current i, is placed with its edges parallel to the x-y axes. Find the magnitude of the net magnetic force experienced by the loop.

Q-58 A conductor wire of length l, lying normal to a magnetic field B, moves with a velocity v as shown in the figure.



(a) Find the average magneticforce on a free electron of the wire.
(b) Due to this magnetic force electron concentrate at one end resulting in electric field inside the wire. The redistribution stops when the electricforce on the freeelectrons balances the magnetic force. Find the electric field developed inside the wire when redistribution stops.
(c) What potential difference is developed between the ends of the wire?

Q-59 A current i is passed through a silver strip of width d and area of cross-section A. The number of free eectrons per unit volume is n.



(a) Find the drft velocity of the electrons.
(b) If a magnetic field B exists in the region as shown in the figure, what is the average magnetic force on the free electrons?
(c) Due to the magnetic force, the free electrons get acculumulated on one side of the conductor along its length. This produces a transverse electricfield in the conductor which opposes the magnetic force on the electrons. Find the magenitude of the electric field which will stop further accumulation of electrons.
(d) What will be the potential difference developed across the width of the conductor due to the electron-accumulation? The appearance of a transerse emf, when a current-carrying wire is placed in a magnetic field, is called Hall effect.

Q-60 A particle having a charge of 2.0×10^{-8} C and a mass of 2.0×10^{-10}g is projected with a speed of 2.0×10^3 m/s in a region having a uniform magneticfield of 0.10 T. The velocity is perpendicular to the field. Find radius of the circle formed by the particle and also the time period.

Q-61 A proton describes a circle of radius 1 cm in a magnetic field of strength 0.10 T. What would be the radius of the circle by an α-particle moving with the same speed in the same magnetic field?

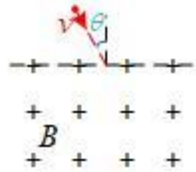
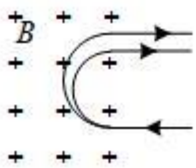
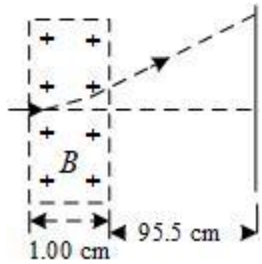
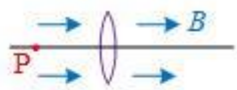
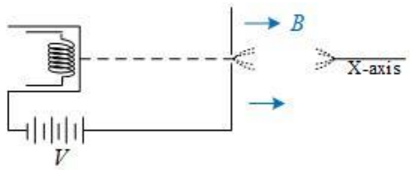
Q-62 An electron having kinetic energy of 100 eV circulates in a path of radius 10 cm in a magnetic field. Find the minimum magnetic field and the number of revolutions per second made by the electron.

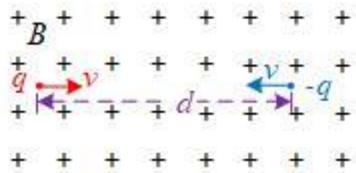
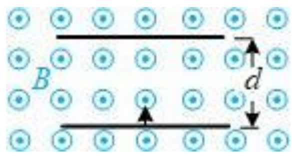
Q-63 Protons having kinetic energy K emerges from an accelerator as a narrow beam. The beam is bent by a perpendicular magnetic field so that it just misses a plane target kept at a distance l in front of the accelerator. Find the magnetic field.

Q-64 A charged particle is accelerated through a potential difference of 12 kV and acquires a speed of 1.0×10^6m/s. It is then injected perpendicularly into a magnetic field of strength 0.2 T. Find radius of the circle described by it.

Q-65 Doubly ionized helium ions are projected with a speed of 10 km/s in a direction perpendicular to uniform magnetic field of magnitude 1.0 T. Find –

(a) The force acting on an ion,
(b) The radius of the circle in which it circulates,

	(c) Time taken by an ion to complete the circle
Q-66	A proton is projected with a velocity of 3×10^6 m/s perpendicular to a uniform magnetic field 0.6 T. Find the acceleeration of the proton.
Q-67	(a) An electron moves along a circle of radius 1 m in a perpendicular magnetic field of strength 0.50 T. What would be its speed? Is it reasonable? (b) If a proton moves along a circle of the same radius in the same magnetic field, what would be its speed?
Q-68	A particle of mass m and positive charge q moving wth a uniform velocity v, enters a magnetic field B as shown in the figure.  (a) Find the radius of the circular arc it descrbes in the magnetic field. (b) Find the angle subtended by the arc at the center. (c) How long does the particle stay inside the magnetic field? (d) Solve the three parts of the above problem if charge q on the particle is negative.
Q-69	A particle of mass m and charge q is projected into a region having a perpendicular magnetic field B. Find the angle of deviation of the particle, as shown in the figure, as it comes out of the magnetic field if the width d if the region is very slightly smaller than – (a) $\frac{mv}{qB}$ (b) $\frac{mv}{2qB}$ (c) $\frac{2mv}{qB}$ 
Q-70	A narrow beam of singly-charged carbon ions, moving with a constant velocity of 6.0×10^4 m/s, is sent perpndicularly in a rectangular region having a uniform magnetic field $B = 0.5$ T as shown in the figure. It is found that two beams emerge from the field in the backward direction., the separation from the incident beam being 3.0 cm and 3.5 cm. Identify the carbon isotopes present in the ion beam. Take the mass of the ions $= A(1.6 \times 10^{-27})$ kg where A is the mass number. 
Q-71	Fe^{+} ions are acelerated through a potential difference of 500 V and are injected normally into a homogeneous magnetic field $B = 20.0$ mT. Find the radius of the circular path followed by the isotopes with mass numbers 57 and 58. Take the mass of an ion $m = A(1.6 \times 10^{-27})$ kg where A is the mass number.
Q-72	A narrow beam of singly charged potassium ions of kinetic energy 32 keV is injected into a region of width 1.00 cm having a magnetic field $B = 0.500$ T as shown in the figure. The ions re-collected at a screen 95,5 cm away from the field region. If the beam contains isotopes of atomic weights 39 and 41, find the separation between the points where these isotopes strike the screen. Take the mass of a potassium ion $m = A(1.6 \times 10^{-27})$ kg where A is the mass number. 
Q-73	Figure shows a convex lens of focal length 12 cm lying in a uniform magnetic field $B = 1.2$ T parallel to its principal axis. A particle having a charge 2.0×10^{-3} C and mass 2.0×10^{-5}kg is projected perpendicular to the plane of the diagram with a speed of 4.8 m/s. The particle moves along a circle with its center on the principal axis at a distance of 18 cm from the lens. Show that the image of the particle goes along a circle and find the radius of that circle. 
Q-74	Electrons emitted with negligible speed from an electron gun are accelerated thriugh a potential difference V along the X-axis. These electrons emerge from a narrow hole into a uniorm magnetic field B directed along this axis. However, some of the electrons emerging from the hole make slightly divergent angle as shown in the figure. Show that these paraxial electrons are refocussed on the X-axis at a distance $\sqrt{\frac{8mV}{eB^2}}$. 

Q-75	Two particles, each having a mass m are placed at a separation d in a uniform magnetic field B as shown in the figure. They have opposite charges of equal magnitude q. At time $t = 0$, the particles are projected towards ach other, each with a speed v. Suppose the Coulomb's force between the two charges is switched off  (a) Find the maximum value v_m of the projection speed so that the two electrons do not collide. (b) What would be the minimum and maximum separation between the particles if $v = \frac{v_m}{2}$? (c) At what instant will a collision occur if $v = 2v_m$? (d) Suppose $v = 2v_m$ and collision between the particles is completely inelastic. Describe the motion after the collision.
Q-76	A uniform magnetic field of magnitude 0.20 T exists in space from east to west. With what speed should a particle of mass 0.020 g, having a charge 1.0×10^{-5} C be projected from south to north so that it moves with a uniform velocity.
Q-77	A particle moves in a circle of diameter 1.0 cm under the action of a magnetic field of 0.40 T. An electric field of 200V/m makes the path straight. Find the charge/mass ratio of the particle.
Q-78	A proton goes undeflected in a crossed electric and magnetic field (the fields are perpendicular to each other) at a speed of 2.0×10^5m/s. The velocity is perpendicular to both the fields. When the electric field is switched off, the proton moves along a circle of radius 4.0 cm. Find the magnitudes of the electric and magnetic fields. Take the mass of the proton $m = 1.6 \times 10^{-27}$kg.
Q-79	A particle having a charge 5.0 μC and a mass $m = 5.0 \times 10^{-12}$ kg is projected with a speed of 1.0 km/s in a magnetic field of magnitude 5.0 mT. The angle betweeen the magnetic field and the velocity is $\sin^{-1}(0.90)$. Show that the path of the particle will be a helix. Find diameter and pitch of the helix.
Q-80	A proton projected in a magnetic field of 0.020 T travels along a helical path of radius 5.0 cm and pitch 20 cm. Find the component of the velocity of proton along and perpendicular to the magnetic field. Take mass of the proton = 1.6×10^{-27}.
Q-81	A particle having mass m and charge q is released from the origin in a region in which electric and magnetic fields are given by $\vec{B} = (-)B_0\hat{j}$ and $\vec{E} = E_0\hat{k}$. Find the speed of the particle as a function of its z-coordinate.
Q-82	An electron is emitted with negligible speed from the negative plate of a parallel plate capacitor charged to a potential difference V. The separation between the plates is d and magnetic field B exists in the space as shown in the figure. Show that the electron will fail to strike the upper plate if $d > \left(\frac{2m_eV}{eB_0^2}\right)^{\frac{1}{2}}$. 
Q-83	A rectangular coil of 100 turns has length 5 cm and width 4 cm. it is placed with its plane parallel to a uniform magnetic field and a current of 2 A is sent through the coil. Find the magnitude of the magnetic field B, if the torque acting on the coil is 0.2 Nm.
Q-84	A 50-turn circular coil of radius 2.0 cm carrying a current of 5.0 A isrotated in a magnetic field of strength 0.20 T. (a) What is the maximum torque that acts on the coil? (b) In a perpendicular position of the coil, the torque acting on it is half of this maximum. What is the angle between the magnetic field and the plane of the coil.
Q-85	A rectangular loop of sides 20 cm and 10 cm carries a current 5.0 A. A uniform magnetic field of magnitude 0.20 T exists parallel to the longer side of the loop. (a) What is the force acting on the loop? (b) What is the torque acting on the loop?

Q-86	A circular coil of radius 2.0 cm has 500 turns in it and carries a current of 1.0 A. Its axis makes an angle of 30^0 with the uniform magnetic field of magnitude 0.40 T that exists in the space. Find torque acting on the coil.
Q-87	A circular loop carrying a current i has wire of total length L. A uniform magnetic field B exists parallel to the plane of the loop. (a) Find the torque on the loop. (b) If the same length of the wire is used to form a square loop, what would be the torque? Which is larger?
Q-88	A square coil of edge l having n turns carries a current i. It is kept on a smooth horizontal plate. A uniform magnetic field B exists in a direction parallel to an edge. The total mass of the coil is m. What should be the minimum value of B for which coil will start tipping over?
Q-89	Consider a non-conducting ring of radius r and mass m which has a total charge q uniformly distributed on it. The ring is rotated about its axis with an angular speed ω. (a) Find the equivalent electric current in the ring. (b) Find the magnetic moment μ of the ring. (c) Show that $\mu = \frac{q}{2m} L$, where L is the angular moment of the ring about its axis of rotation.
Q-90	Consider a non-conducting plate of radius r and mass m which has a charge q distributed uniformly over it. The plate is rotated about its axis with an angular speed ω. Show that the magnetic moment μ and angular momentum L of the plate are related as $\mu = \frac{q}{2m} L$.
Q-91	Consider a solid sphere of radius r and mass m which has a charge q distributed uniformly over its volume. The sphere is rotated about its diameter with an angular speed ω. Show that the magnetic moment μ and angular momentum L of the plate are related as $\mu = \frac{q}{2m} L$.

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