ABHINAV ACADEMY

UDUPI

CET25P4 MOVING CHARGES AND MAGNETISM

Class 12 - Physics

Time Allowed: 1 hour and 30 minutes **Maximum Marks: 75**

1. A steel wire of length l has a magnetic moment M. It is then bent into a semicircular arc. The new magnetic moment is **[1]**

   a) Ml
   b) M / l
   c) $\frac{2M}{\pi}$
   d) M

2. The resistance of an ammeter is 13 Ω and its scale is graduated for a current up to 100 A. After an additional shunt has been connected to this ammeter, it becomes possible to measure currents upto 750 A by this meter. The value of shunt resistance is: **[1]**

   a) 20Ω
   b) 2KΩ
   c) 2Ω
   d) 0.2Ω

3. A galvanometer can be changed into an ammeter by providing: **[1]**

   a) low resistance in series
   b) high resistance in parallel
   c) low resistance in parallel
   d) high resistance in series

4. Two infinitely long wires carry currents in opposite directions. Then the field at a point P lying midway between them is **[1]**

   a) twice the field due to each wire alone
   b) square of the field due to each wire alone
   c) zero
   d) half of the field due to each wire alone

5. A current of 5 A is flowing from east to west in a long straight wire kept on a horizontal table. The magnetic field developed at a distance of 10 cm due south on the table is: **[1]**

   a) 2×10^{-5} T acting upwards
   b) 2×10^{-5} T acting downwards
   c) 1×10^{-5} T acting downwards
   d) 1×10^{-5} T acting upwards

6. A proton and an alpha particle enter in a uniform magnetic field with the same velocity. The time period of rotation of the alpha particle will be: **[1]**

   a) three times that of the proton
   b) four times that of the proton
   c) same as that of the proton
   d) two times that of the proton

7. A finite straight wire carries a current of 3 A, where it is a 2 m long and weighs around 240 g. If it is suspended in the mid-air by a uniform magnetic field then calculate the field B. [Acceleration due to gravity = 9.8 m/s^2] **[1]**

   a) 0.42 T
   b) 0.39 T
   c) 0.61 T
   d) 0.57 T

8. A vertical straight conductor carries a current vertically upwards. A point P lies to the east of it at a small distance and another point Q lies to the west in the same direction. The magnetic field at P is: **[1]**

a) greater or less than at Q, depending upon the strength of the current

b) greater than at Q

c) less than at Q

d) same as at Q

9. A straight conducting rod of length l and mass m is suspended in a horizontal plane by a pair of flexible strings in a magnetic field of magnitude B. To remove the tension in the supporting strings, the magnitude of the current in the wire is **[1]**

a) $\frac{l\,\mathrm{B}}{mg}$

b) $\frac{mgB}{l}$

c) $\frac{mg}{lB}$

d) $\frac{mgl}{\mathrm{B}}$

10. The radius of the circular path of an electron moving in magnetic field perpendicular to its path is equal to: **[1]**

a) $\frac{me}{B}$

b) $\frac{mv}{Be}$

c) $\frac{mE}{B}$

d) $\frac{Be}{mv}$

11. A tape-recorder records sound in the form of **[1]**

a) magnetic energy

b) the magnetic field on the tape

c) electrical energy

d) variable resistance on the tape

12. A current carrying wire kept in a uniform magnetic field, will experience a maximum force when it is **[1]**

a) at an angle of 60^{o} to the magnetic field

b) parallel to the magnetic field

c) at an angle of 45^{o} to the magnetic field

d) perpendicular to the magnetic field

13. The deflecting torque acting on the coil of a galvanometer is **[1]**

a) inversely proportional to number of turns.

b) inversely proportional to area of the coil.

c) inversely proportional to current flowing.

d) directly proportional to the magnetic field strength.

14. A proton and an alpha particle both enter a region of uniform magnetic field B, moving at right angles to the field B. If the radius of circular orbits for both the particles is equal and the kinetic energy acquired by the proton is 1 MeV, the energy acquired by the alpha particle will be: **[1]**

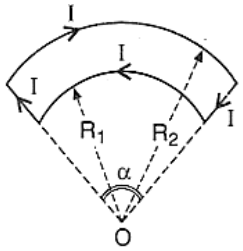
a) 1 MeV

b) 0.5 MeV

c) 4 MeV

d) 1.5 MeV

15. The magnetic induction at the centre O of the current carrying bent wise shown in the adjoining figure is: **[1]**



a) $\frac{\mu_0 I\alpha}{4\pi}\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

b) $\frac{\mu_0 I\alpha}{4\pi}\left(\frac{1}{R_1}+\frac{1}{R_2}\right)$

c) $\frac{\mu_0 I}{4\pi R_1}\alpha$

d) $\frac{\mu_0 I}{4\pi R_2}\alpha$

16. A circuit contains an ammeter, a battery of 30 V and a resistance of 40.8 ohm all connected in series. If the ammeter has a coil of resistance 480 ohm and a shunt of 20 ohm, the reading in the ammeter will be: **[1]**

a) 2 A
b) 0.25 A
c) 0.5 A
d) 1 A

17. Current sensitivity of a moving coil galvanometer is 5 div/mA and its voltage sensitivity (angular deflection per unit voltage applied) is 20 div/V. The resistance of the galvanometer is: **[1]**

a) 250 Ω
b) 40Ω
c) 25Ω
d) 500Ω

18. A circular current loop of magnetic moment M is in an arbitrary orientation in an external magnetic field B. The work done to rotate the loop by 30° about an axis perpendicular to its plane is **[1]**

a) zero
b) $\frac{MB}{2}$
c) MB
d) $\sqrt{3}\frac{MB}{2}$

19. Tesla is the unit of: **[1]**

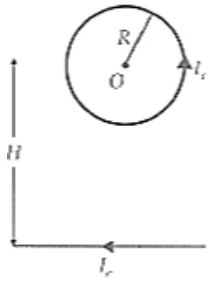
a) magnetic flux
b) magnetic induction
c) electric field
d) electric flux

20. If electron velocity is $2\hat{i} + 3\hat{j}$ and it is subjected to magnetic field of $4\hat{k}$, then its **[1]**

a) path will not change
b) speed will change
c) both path will change and speed will change
d) path will change

21. Circular loop of a wire and a long straight wire carry currents I_0 and I_e respectively as shown in the figure. **[1]**

Assuming that these are placed in the same plane, the magnetic



fields will be zero at the centre O of the loop, when separation H is

a) $\frac{I_c R}{I_e \pi}$
b) $\frac{I_e R}{I_c \pi}$
c) $\frac{I_c \pi}{I_c R}$
d) $\frac{I_e R}{I_c \pi}$

22. The magnetic moment of a current (l) carrying circular coil of radius (r) and number of turns (n) varies as **[1]**

a) $\frac{1}{r^2}$
b) r
c) $\frac{1}{r}$
d) r^2

23. In a mass spectrometer used for measuring the masses of ions, the ions are initially accelerated by an electric potential V and then made to describe semicircular paths of radius R using a magnetic field B. If V and B are kept constant, the ratio $\left(\frac{\text{charge on the ion}}{\text{mass of the ion}}\right)$ will be proportional to **[1]**

a) $\frac{1}{R}$
b) R^2

c) $\frac{1}{R^2}$ d) R

24. A ring of radius r is uniformly charged with charge q. It is rotated with angular velocity ω, then magnetic moment developed by the ring is **[1]**

a) $\frac{2}{qr^2\omega^2}$ b) $\frac{q\omega}{2r^2}$

c) $\frac{q}{r^2\omega^2}$ d) $\frac{qr^2\omega}{2}$

25. An electron having charge 1.6×10^{-19} C and mass 9×10^{-31} kg is moving with 4×10^6 m/s speed in a magnetic field of 2×10^{-1} tesla in a circular orbit. The force acting on an electron and the radius of circular orbit will be **[1]**

a) 1.28×10^{15} N, 1.2×10^{-12} m b) 1.28×10^{-13} N, 1.1×10^{-4} m

c) 1.28×10^{-14} N, 1.1×10^{-3} m d) 1.28×10^{16} N, 1.2×10^{-10} m

26. If a number of turns in the moving coil galvanometer becomes half, then the deflection for the same current will become: **[1]**

a) same b) half

c) double d) four times

27. A proton travelling at 23° w.r.t the direction of a magnetic field of a strength 2.6 mT experiences, a magnetic force of 6.5×10^{-17} N. What is the speed of the proton? **[1]**

a) 6×10^5 m/second b) 8×10^5 m/second

c) 2×10^5 m/second d) 4×10^5 m/second

28. Electron is moving perpendicular to z-axis; the magnetic field B_0 is present along the z-axis; the radius of the circular path is a. Angular momentum is **[1]**

a) 0 b) eB_0a

c) eB_0a^2 d) $e^2B_0^2a^2$

29. A galvanometer of 50 ohm resistance has 25 divisions. A current of 4×10^{-4} A gives a deflection of 1 division. To convert this galvanometer into a voltmeter having a range of 25 V, it should be connected with a resistance of: **[1]**

a) 2,450 Ω in series b) 2,450 Ω as a shunt

c) 2,550 Ω in series d) 2,500 Ω as a shunt

30. A uniform magnetic field acts at right angles to the direction of motion of electrons. As a result, the electron moves in a circular path of radius 2 cm. If the speed of the electrons is doubled, then the radius of the circular path will be: **[1]**

a) 2.0 cm b) 4.0 cm

c) 1.0 cm d) 0.5 cm

31. A proton and an α-particle enters a uniform magnetic field perpendicular to y-axis with the same speed. If proton takes 25μ sec to make 5 revolutions, then time period for the α-particle would be **[1]**

a) 50 μsec b) 25 μsec

c) 10 μsec

d) 5 μsec

32. A long wire carries a steady current. It is bent into a circle of one turn and the magnetic field at the centre of the coil is B. It is then bent into a circular loop of n turns. The magnetic field at the centre of the coil will be **[1]**

a) nB

b) $2n^2B$

c) $3n^2B$

d) n^2B

33. In an ammeter 4% of the mains current is passing through galvanometer. If the galvanometer is shunted with a 3 Ω resistance. **[1]**

a) 116 Ω

b) 120 Ω

c) 118 Ω

d) 117 Ω

34. A magnetic needle lying parallel to a magnetic field requires W units of work to turn it, through 60^0. The torque needed to maintain the needle in this position will be **[1]**

a) $\sqrt{3}W$

b) $\frac{\sqrt{3}W}{2}$

c) 2W

d) W

35. In an ammeter, 0.2% of the main current passes through the galvanometer. If the resistance of the galvanometer is G, the resistance of the ammeter will be: **[1]**

a) $\frac{1}{499}G$

b) $\frac{499}{500}G$

c) $\frac{500}{499}G$

d) $\frac{1}{500}G$

36. A metallic rod of mass per unit length 0.5 kg m^{-1} is lying horizontally on a smooth inclined plane which makes an angle of 30° with the horizontal. The rod is not allowed to slide down by flowing a current through it when a magnetic field of induction 0.25 T is acting on it in the vertical direction. The current flowing in the rod to keep it stationary is **[1]**

a) 5.98 A

b) 11.32 A

c) 7.14 A

d) 14.76 A

37. A bar magnet is equivalent to **[1]**

a) toroid carrying current

b) circular coil carrying current

c) solenoid carrying current

d) straight conductor carrying current

38. A rectangular coil of length 0.12 m and width 0.1 m having 50 turns of wire is suspended vertically in a uniform magnetic field of strength 0.2 weber/m^2. The coil carries a current of 2 A. If the plane of the coil is inclined at an angle of 30° with the direction of the field, the torque required to keep the coil in stable equilibrium will be: **[1]**

a) 0.12 Nm

b) 0.20 Nm

c) 0.24 Nm

d) 0.15 Nm

39. An electron is travelling along the X-direction. It encounters a magnetic field in the Y-direction. Its subsequent motion will be: **[1]**

a) a circle in the YZ-plane

b) straight line along the X-direction

c) a circle in the XZ-plane

d) a circle in the XY-plane

40. The magnetic field in a circular loop of diameter 0.1 m carrying a current of 1 A is **[1]**

a) $3.8 \times 10^{-5} T$

b) $4.4 \times 10^{-5} T$

c) $1.25 \times 10^{-5} T$

d) $2.8 \times 10^{-5} T$

41. A current carrying loop is placed in a uniform magnetic field. The torque acting on it does not depend upon the **[1]**

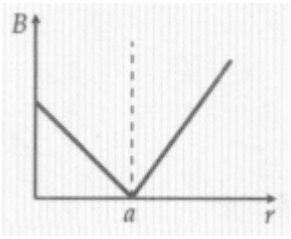
a) shape of the loop

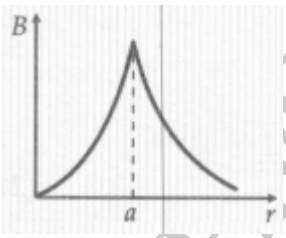
b) magnetic field

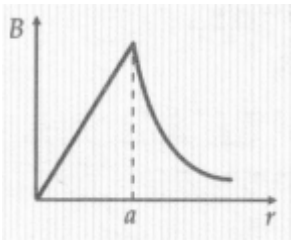
c) area of the loop

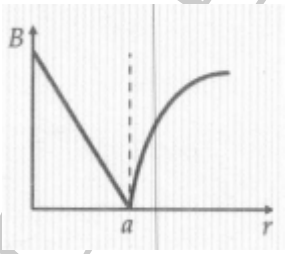
d) value of current

42. A long straight wire of circular cross-section (radius a) carries a steady current I and the current I is uniformly distributed across this cross-section. Which of the following plots represents the variation of the magnitude of magnetic field B with distance centre of the wire? **[1]**

a) 

b) 

c) 

d) 

43. A circular loop of area 0.01 m^2 carrying a current of 10 A, is held perpendicular to a magnetic field of intensity 0.1 T. The torque acting on the loop is **[1]**

a) 0.01 Nm

b) 0.8 Nm

c) zero

d) 0.001 Nm

44. The force on a charge due to a magnetic field can act **[1]**

a) on a charge which is at rest

b) moving in the opposite direction of the magnetic field

c) which is moving in the direction of the magnetic field

d) moving in the perpendicular direction

45. Two concentric and coplanar circular loops P and Q have their radii in the ratio 2: 3. Loop Q carries a current 9 A in the anti-clockwise direction. For the magnetic field to be zero at the common centre, loop P must carry **[1]**

a) 9 A in clockwise direction

b) 3 A in clockwise direction

c) 6 A in anti-clockwise direction

d) 6 A in the clockwise direction.

46. The SI unit of magnetic pole strength is **[1]**

a) ampere $metre^2$

b) ampere $metre^{-2}$

c) ampere per metre

d) ampere metre

47. Two horizontal thin long parallel wires, separated by a distance r carry current I each in the opposite directions. The net magnetic field at a point midway between them, will be **[1]**

a) $\left(\frac{\mu_0 I}{2\pi r}\right)$ vertically downward

b) zero

c) $\left(\frac{\mu_0 I}{\pi r}\right)$ vertically downward

d) $\left(\frac{2\mu_0 \mathrm{I}}{\mathrm{r}}\right)$ vertically upward

48. A current-carrying coil is subjected to a uniform magnetic field. The coil will orient so that its plane becomes: **[1]**

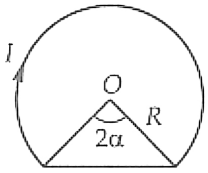
a) perpendicular to the magnetic field

b) inclined to 45° to the magnetic field

c) parallel to the magnetic field

d) inclined at any arbitrary angle to the magnetic field

49. The magnetic field intensity due to a thin wire carrying current I in the figure shown is **[1]**



a) $\frac{\mu_0}{2\pi R}(\pi + \alpha - \tan\alpha)$

b) $\frac{\mu_0 I}{2\pi R}(\pi - \alpha + \tan\alpha)$

c) $\frac{\mu_o I}{2\pi R}(\pi - \alpha)$

d) $\frac{\mu_o I}{2\pi R}(\pi + \alpha)$

50. The ratio of the time period of alpha particle to that of a proton circulating with the same speed in the same uniform magnetic field is: **[1]**

a) 1 : 2

b) $1 : \sqrt{2}$

c) 2 : 1

d) $\sqrt{2} : 1$

51. Three particles having charges in the ratio of 2 : 3 : 5 produces the same point on the photographic film in the Thomson experiment. Their masses are in the ratio of: **[1]**

a) 3 : 5 : 2

b) 5 : 3 : 2

c) 2 : 3 : 5

d) 15 : 10 : 6

52. A long solenoid carrying a current produces a magnetic field B along its axis. If the current is doubled and the number of turns per cm is halved, then the new value of the magnetic field is: **[1]**

a) B

b) $\frac{B}{2}$

c) 2B

d) 4B

53. Two identical galvanometers are converted into an ammeter and a milliammeter. The resistance of the shunt of milliammeter through which the current passes through will be: **[1]**

a) zero

b) less

c) equal

d) more

54. A galvanometer of resistance 25Ω is shunted by a 2.5Ω wire. The part of total current I_o that flows through the galvanometer is given by **[1]**

a) $\frac{I}{I_0} = \frac{2}{11}$

b) $\frac{I}{I_0} = \frac{4}{11}$

c) $\frac{I}{I_0} = \frac{1}{11}$

d) $\frac{I}{I_0} = \frac{3}{11}$

55. A constant current is flowing through a solenoid. An iron rod is inserted in the solenoid along its axis. Which of the following quantities will not increase? **[1]**

a) The magnetic field at the centre

b) The self-inductance of the solenoid

c) The rate of heating

d) The magnetic flux linked with the solenoid

56. A galvanometer having 30 divisions has a current sensitivity of 20 μA/div. It has a resistance of 25 ohm. How **[1]**

will you convert it into an ammeter measuring upto 1 ampere. Find the shunt to be used.

a) 0.30 Ω

b) 0.15 Ω

c) 0.015 Ω

d) 0.030 Ω

57. A voltmeter has range V. What resistance should be connected in series with it to increase its range to nV? Initial resistance is R_0. **[1]**

a) $\frac{R_0}{n}$

b) (n - 1)R_0

c) nR_0

d) (n + 1)R_0

58. A positively charged particle moving due east enters a region of uniform magnetic field directed vertically upward. The particle will: **[1]**

a) move in a circular path with an increased speed

b) get deflected in a vertically upward direction

c) move in a circular path with a decreased speed

d) move in a circular path with a uniform speed

59. A charged particle is moving in a uniform magnetic field in a circular path with a radius R. When energy of the particle is doubled, then the new radius will be: **[1]**

a) $R\sqrt{2}$

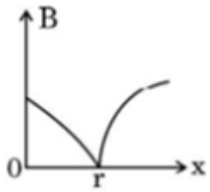
b) $\frac{R}{\sqrt{2}}$

c) $\frac{R}{2}$

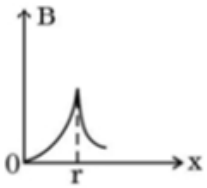
d) 2R

60. The current I flowing through a conductor of radius r is uniformly distributed across its cross-section. Which of the following graphs represents the variation of magnitude of magnetic field $\vec{B}$ with distance x from the axis of the conductor? **[1]**

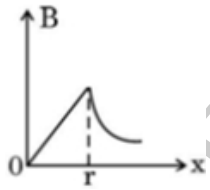
a)



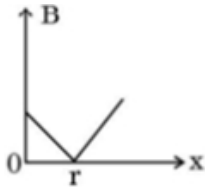
b)



c)



d)



61. To convert a galvanometer into a voltmeter: **[1]**

a) a low resistance is connected in series

b) a low resistance is connected in parallel

c) a high resistance is connected in series

d) a high resistance is connected in parallel

62. A particle having charge 100 times that of an electron is revolving in a circular path by radius 0.8 m with one rotation per second. The magnetic field produced at the centre is: **[1]**

a) $10^{-16}\mu_0$

b) $10^{17}\mu_0$

c) $10^{-15}\mu_0$

d) $10^{-17}\mu_0$

63. An electron having mass m, charge q and kinetic energy E enters a uniform magnetic field B perpendicularly. Then its frequency of rotation will be: **[1]**

a) $\frac{qB}{2\pi E}$ b) $\frac{qB}{2\pi m}$

c) $\frac{qBE}{2\pi m}$ d) $\frac{qB}{\pi m}$

64. The ratio of magnetic induction on the axis of a straight long current carrying solenoid at a point on end to that at the centre of solenoid is **[1]**

a) 1 : 1 b) $\sqrt{2}$: 1

c) 2 : 1 d) 1 : 2

65. An electron moves with a velocity of 10^3 ms^{-1} in a magnetic field of induction 0.3 T at an angle 30° If $\frac{e}{m}$ of electron is 1.76 $\times$ 10^{11} C kg^{-1}, the radius of the path is nearly: **[1]**

a) 10^{-8} m b) 10^{-10} m

c) 10^{-6} m d) 2×10^{-8} m

66. When a charged particle enters in a uniform magnetic field, its kinetic energy. **[1]**

a) decreases b) becomes zero

c) remains constant d) increases

67. The magnetic force on a point charge is $\vec{F} = q(\vec{v} \times \vec{B})$, The dimensions of $\vec{B}$are: **[1]**
(Here q = electric charge, $\vec{v}$ = velocity of point charge, $\vec{B}$ = magnetic field)

a) [MLT^{-1}A] b) [M^{1}L^{2}T^{-1}A^{-2}]

c) [MT^{-2} A^{-1}] d) [M^{2}LT^{-2}A^{-1}]

68. The magnetic force acting on a charged particle of charge -2μC in a magnetic field of 2T acting in the y-direction, when the particle velocity is $(2\hat{i} + 3\hat{j}) \times 10^6$ ms^{-1}, is: **[1]**

a) 8 N is y direction b) 4 N in z direction

c) 8 N in -z direction. d) 4 N in z direction

69. A voltmeter has a resistance of G ohm and a range of V volt. The value of resistance used in series to convert it into a voltmeter of range nV volt is **[1]**

a) (n-1)G b) nG

c) $\frac{G}{n-1}$ d) $\frac{G}{n}$

70. A long straight wire of circular cross section of radius a carries a steady current I. The current is uniformly distributed across its cross section. The ratio of the magnitudes of magnetic field at a point at a distance $\frac{a}{2}$ above the surface of wire to that at a point at a distance $\frac{a}{2}$ below its surface is **[1]**

a) 1 : 1 b) 4 : 3

c) 4 : 1 d) 3 : 4

71. The resistance of a galvanometer is 50Ω and the current required to give full scale deflection is $100\mu A$. In order to convert it into an ammeter for reading up to 10 A, it is necessary to put a resistance of **[1]**

a) $5 \times 10^{-2}\Omega$ b) $5 \times 10^{-5}\Omega$

c) 5×10^{-4} Ω d) $5 \times 10^{-3}\Omega$

72. A galvanometer of resistance 25μ is shunted by a 2.5μ wire. The part of the total current that flows through the **[1]**

galvanometer is given as:

a) $\frac{I}{I_0} = \frac{4}{11}$

b) $\frac{I}{I_0} = \frac{3}{11}$

c) $\frac{I}{I_0} = \frac{2}{11}$

d) $\frac{I}{I_0} = \frac{1}{11}$

73. A beam of ions enters normally into a uniform magnetic field of 4×10^{-2} tesla with velocity of 2×10^5 m/ s If the specific charge of the ion is 5×10^7 C/kg, then the radius of the circular path described will be **[1]**

a) 0.10 m

b) 0.25 m

c) 0.06 m

d) 0.20 m

74. A rectangular coil (dimension 5 cm $\times$ 2.5 cm) with 100 turns, carrying a current of 3A in the clockwise direction, is kept centred at the origin and in the X-Z plane. A magnetic field of 1 T is applied along X-axis. If the coil is tilted through 45^o about Z-axis, then the torque on the coil is **[1]**

a) 0.42 N-m

b) 0.27 N-m

c) 0.38 N-m

d) 0.55 N-m

75. The magnetic field at the centre of a current-carrying circular loop having 1 A current and number of turns one will be (radius of the loop is 1 m): **[1]**

a) $2\mu_0$

b) $\frac{\mu_0}{4}$

c) $\frac{\mu_0}{2}$

d) $4\mu_o$