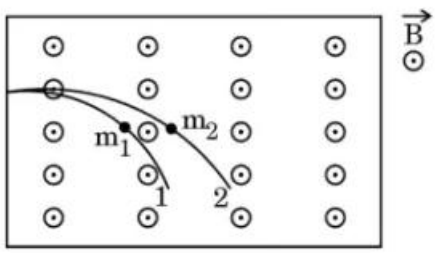
	INDIAN SCHOOL AL WADI AL KABIR	
Class: XII	**Department: SCIENCE 2026– 27** **SUBJECT: PHYSICS**	**Date: 25/07/2026**
Worksheet No: 4 **WITH ANSWERS**	**CHAPTER / UNIT:** **MOVING CHARGES AND MAGNETISM**	**Note:** **A4 FILE FORMAT**
NAME OF THE STUDENT:	**CLASS & SEC:**	**ROLL NO.:**

OBJECTIVE TYPE QUESTIONS

1. Two particles of masses m1 and m2 having charges q1and q2 , respectively, are projected with the same velocity in a region of uniform magnetic field $\vec{B}$ pointing vertically upward. If they describe circular paths as shown in the figure, one may conclude that : (CBSE 2025-26)



(A) $\frac{m1}{m2} > \frac{q1}{q2}$ (B) $\frac{m1}{m2} > \frac{q2}{q1}$

(C) $\frac{m1}{m2} < \frac{q1}{q2}$ (D) $\frac{m1}{m2} < \frac{q2}{q1}$

2. The magnetic field due to a current-carrying circular coil at a point far off on its axis at a distance ‘r’ from the centre of the coil is proportional to :

(A) $\frac{1}{r}$ (B) $\frac{1}{r^2}$

(C) $\frac{1}{r^{3/2}}$ (D) $\frac{1}{r^3}$

3. The magnetic field B within the solenoid of length L having N turns and carrying current I will be :

(A) $\mu_0 NIL$ (B) $\frac{\mu_0 NI}{L}$

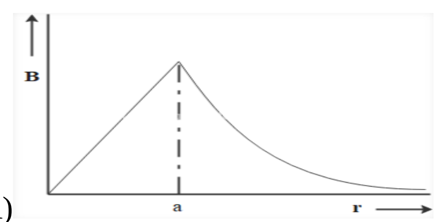
(C) $\frac{\mu_0 NI}{4\pi L}$ (D) $\mu_0 NI$

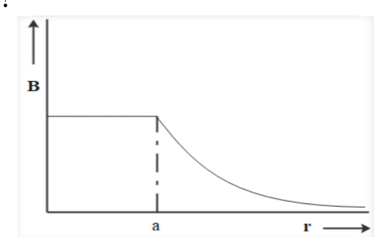
4. A circular loop of radius ‘a’ carries a current 3I through it. Another concentric circular loop of radius 2a carrying a current I is placed perpendicular to the first loop. The dipole moment of the equivalent magnetic dipole for the system is : (CBSE 2024)

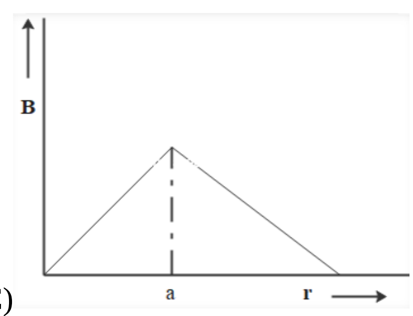
(A) $\pi I a^2$ (B) $5Ia$

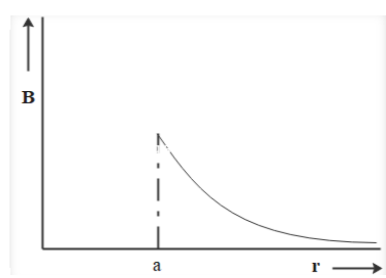
(C) $5\pi I a^2$ (D) $7\pi I a^2$

5. A loop carrying a current I clockwise is placed in x y plane, in a uniform magnetic field directed along the z-axis. The tendency of the loop will be to : (CBSE 2024)
   (A) move along x-axis (B) move along y-axis
   (C) shrink (D) expand
6. A 10 cm long wire lies along the y-axis. It carries a current of 1.0 A in the positive y-direction. A magnetic field $\vec{B} = (5\text{ mT})\hat{j} - (8\text{ mT})\hat{k}$ exists in the region. The force on the wire is :
   (A) $(0{\cdot}8\text{ mN})\hat{i}$ (B) $-(0{\cdot}8\text{ mN})\hat{i}$
   (C) $(80\text{ mN})\hat{i}$ (D) $-(80\text{ mN})\hat{i}$
7. A wire of length 4.4 m is bent round in the shape of a circular loop and carries a current of 1.0 A. The magnetic moment of the loop will be: (CBSE 2024)
   (A) 0.7 Am^2 (B) 1.54 Am^2 (C) 2.10 Am^2 (D) 3.5 Am^2
8. An electron enters a uniform magnetic field with speed v. It describes a semicircular path and comes out of the field. The final speed of the electron is: (CBSE *2023)*
   (A) Zero (B) v (C)v/2 (D) 2v
9. A straight wire carrying Current I is turned into a circular loop. If the magnitude of the magnetic moment associated with it is M, find the length of the wire
   (A) $\sqrt{\frac{2\pi M}{I}}$ (B) $\sqrt{\frac{4\pi M}{I}}$ (C) $\sqrt{\frac{\pi M}{I}}$ (D) $\sqrt{\frac{\pi M}{2I}}$
10. Two particles of equal charge, after being accelerated through the same potential difference, enter a uniform transverse magnetic field and describe circular paths of radii R1 and R2 respectively. Find the ratio of their masses
    (A) $[\frac{R1}{R2}]^2$ (B) $\frac{R1}{R2}$ (C) $[\frac{R2}{R1}]^2$ (D) $\frac{R2}{R1}$
11. Which of the following represents the magnetic field due to a straight conductor of uniform cross-section of radius 'a' and carrying a steady current?

(A) 

(B) 

(C) 

(D) 

12. Name the physical quantity having unit A m^2
    (A) magnetic flux (B) magnetic dipole moment

(C) intensity of magnetic field (D) magnetic polarity

13. A galvanometer is first converted into a voltmeter of range 0-3V and then into a voltmeter of range 0-6V. In which case would the resistance be higher?
    (A) 0-6v (B) 0-3V (C) can't be predicted (D)0-9 V
14. An ammeter of resistance 0.8 ohm can measure current up to 1A. What must be the value of shunt resistance to enable the ammeter to measure current up to 5A?
    (A) 0.1A (B) 0.2A (C) 0.3A (D) 0.5 A
15. A straight conductor of length L carrying a current I stays suspended horizontally in mid-air in a region where there is a uniform magnetic field B. The linear mass density of the wire is λ. Then the magnitude of the magnetic field is
    (A) $B = \frac{\lambda g}{L}$ perpendicular to the wire (B) $B= 2\frac{\lambda g}{L}$ perpendicular to the wire
    (C) $B = \frac{\lambda g}{2L}$ perpendicular to the wire (D) $B = 4\frac{\lambda g}{L}$ perpendicular to the wire
16. Name the physical quantity having unit A m
    (A) magnetic dipole moment (B) intensity of magnetic field
    (C) pole strength (D) magnetic flux
17. An electron moving with a velocity 10m/s enters a uniform magnetic field of 0.5 T, along a direction parallel to the field. Then the force acting on the charge is
    (A) 20 N (B) 10N (C) zero (D) 15 N
18. An electron moving with a velocity 10m/s enters a uniform magnetic field of 0.5 T, along a direction parallel to the field. Then the trajectory of this electron is
    (A) ellipse (B) circular (C) straight (D) parabolic

ASSERTION - REASON BASED QUESTIONS

Direction: - In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as:

(a) If both assertion and reason are true and reason is the correct explanation of assertion.
(b) If both assertion and reason are true but reason is not the correct explanation of assertion.
(c) If assertion is true, but reason is false.
(d) If both assertion and reason are false.

19. Assertion (A): The cylindrical soft iron core in a moving coil galvanometer only makes the magnetic field radial and does not affect the strength of the magnetic field.
    Reason (R): In a moving coil galvanometer, the plane of the coil is always perpendicular to the magnetic field.
20. Assertion (A): A current-carrying square loop made of a wire of length L is placed in a magnetic field. It experiences a torque which is greater than the torque on a circular loop made of the same wire carrying the same current in the same magnetic field.
    Reason (R): A square loop occupies more area than a circular loop, both made of wire of the same length.
21. Assertion (A): An electron and a proton enter with the same momentum p in a magnetic field B such that $p \perp B$. Then both describe a circular path of the same radius.
    Reason (R): The radius of the circular path described by the charged particle (charge q, mass m) moving in the magnetic field B is given by $r = qv/mB$
22. Assertion (A): A current- carrying conductor experiences a force in a magnetic field.
    Reason(R)- The force acting on a current-carrying conductor in a magnetic field is due to interaction between the magnetic field produced by the current conductor and the external magnetic field in which the conductor is placed.

23. Assertion (A): To convert a galvanometer into an ammeter a small resistance (shunt) is connected in parallel to the coil of the galvanometer.
Reason(R): An ideal ammeter has infinite resistance
24. Assertion (A): On increasing the current sensitivity of a galvanometer by increasing the number of turns, it may not necessarily increase its voltage sensitivity.
Reason(R): The resistance of the coil of the galvanometer increases on increasing the number of turns.
25. Assertion (A): When a magnetic dipole is placed in a non-uniform magnetic field, only a torque acts on the dipole.
Reason (R): Force would not act on the dipole if the magnetic field were non-uniform.
26. Assertion (A): The higher the range, the lower is the resistance of an ammeter.
Reason (R)-To increase the range of an ammeter, an additional shunt is added in series to it.

CASE STUDY BASED QUESTIONS: -

27. A charged particle +q in an electric field **E** experiences a force in the direction of the electric field. As a result, its kinetic energy changes. Similarly, the charged particle also experiences a force when it moves in a magnetic field **B**. But this magnetic force is perpendicular to both the velocity **v** of the charged particle and the magnetic field **B,** so it cannot change the kinetic energy of the charged particle. Consider two charged particles 1 and 2 of masses m and m 2 having charges − q and +2q respectively. They are accelerated from rest through the same potential difference V and acquire kinetic energy K_1 and K_2. Then they enter a region of uniform magnetic field **B** perpendicular to their velocities. CBSE 2025-26

i.

The ratio of their kinetic energies $\left(\frac{K_1}{K_2}\right)$ is :

(A) $\frac{1}{2}$ (B) $\frac{1}{4}$

(C) 4 (D) 1

ii.

The ratio of the radii of the circular paths described by them $\left(\frac{r_1}{r_2}\right)$ is :

(A) $\frac{1}{\sqrt{2}}$ (B) $\sqrt{2}$

(C) $\frac{1}{2}$ (D) 2

iii. Suppose particles 1 and 2 enter the magnetic field $\vec{B} = B_0\,\hat{k}$ with velocities $\vec{v}_1 = v_1\,\hat{i}$ and $\vec{v}_2 = v_2\,\hat{i}$. Then :

(A) both particles revolve clockwise
(B) both particles revolve anticlockwise
(C) particle 1 revolves clockwise while particle 2 revolves anticlockwise
(D) particle 1 revolves anticlockwise while particle 2 revolves clockwise

iv. (a) If the period of revolution for particle 1 is 4 s, then for particle 2, the period will be :

(A) 1 s (B) 2 s (C) 4 s (D) 8 s

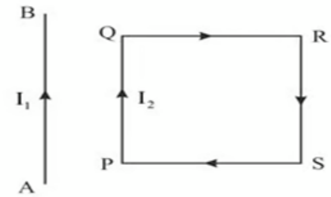
OR

(b) If the values of momentum for particles 1 and 2 are p1 and p2, then :

(A) p1 = p 2 /2 (B) p1 = p2 (C) p1 = 2p2 (D) p1 = 4p2

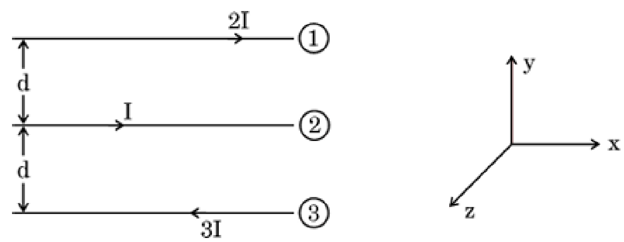
SHORT ANSWER TYPE QUESTIONS (2 marks)

28. How will the magnetic field intensity at the centre of a circular coil carrying current change if the current through the coil is doubled and the radius of the coil is halved?
29. An electron travels in a circular path of radius 20cm in a magnetic field of 20 mT. Calculate the speed of the electron. What is the potential difference through which the electron must be accelerated to acquire this speed?
30. A long straight wire carries a current of 2A. An electron travels with a speed of 4 x 10^4 m/s parallel to the wire at a distance of 0.1m from it in the direction opposite to the electric current. What force does the M.F of the current exert on the moving electron?
31. In the figure, the straight wire AB is fixed while the loop is free to move under the influence of the electric currents flowing in them. In which direction does the loop begin to move?



SHORT ANSWER TYPE QUESTIONS (3 marks)

32. (a) The figure given below shows three straight long parallel conductors ①, ② and ③ kept in the x-y plane, carrying currents 2I, I and 3I respectively as shown in the figure. CBSE 2025-26



Find the magnitude and direction of:
(i) net magnetic field at a point on conductor ① and
(ii) net magnetic force acting on unit length of conductor ①, due to conductors ② and ③.
33. A circular coil of 30 turns and radius 8·0 cm carrying a current of 6 A is suspended vertically in a uniform horizontal magnetic field of 1·0 T. The field lines make an angle of 30° with the plane of the coil. Calculate the magnitude of the external torque that must be applied to prevent the coil from turning. What would happen if the circular coil is replaced by a planar coil of irregular shape that encloses the same area, keeping other parameters unchanged? CBSE 2025-26
34. An alpha particle (mass $6\cdot4 \times 10^{-27}$ kg and charge $3\cdot2 \times 10^{-19}$ C) having 8·0 MeV energy, enters a region of a uniform magnetic field of 0·5 T. If the field is directed perpendicular to the velocity of the particle, find the radius of the circular path described by the particle. Mention the condition under which the particle in this region (i) describes a helical path, and (ii) goes straight undeviated. CBSE 2025-26
35. Two long straight wires carrying currents of 2A and 5A in the same direction are kept parallel, 10 cm apart from each other. Calculate the force acting between them and write its nature.
36. What is the radius of the path of an electron moving at a speed of $3x10^7$ m/s in a magnetic field of $6x10^{-4}$ T perpendicular to it? What is its frequency? Calculate its energy in Kev[mass = $9x10^{-31}$kg and charge = 1.6 $x10^{-19}$ C

37. A proton with kinetic energy $1 \cdot 3384 \times 10^{14}$ J moving horizontally from north to south, enters a uniform magnetic field B of $2 \cdot 0$ mT directed eastward.

Calculate :

(a) the speed of the proton

(b) the magnitude of acceleration of the proton

(c) the radius of the path traced by the proton [Take (q /m) for proton = $1 \cdot 0 \times 10^8$ C/kg]

38. A galvanometer with a coil resistance of 12 ohm shows full-scale deflection for a current of 50mA. How will you convert the galvanometer into [i] an ammeter of range 0- 0.5 A [ii] a voltmeter of range 0-10V?

LONG ANSWER TYPE QUESTIONS(5 marks)

39. [i] With the help of a diagram, explain the principle and working of a moving coil galvanometer.
[ii] What is the function of uniform radial field and how is it produced?
[iii] Define current sensitivity of a galvanometer. How is current sensitivity increased?

40. Write any 2 important points of similarities and differences each between Coulomb's law for the electrostatic field and Biot-Savart's law for the magnetic field. Use Biot-Savart's law to find the expression for the magnetic field due to a circular loop of radius 'r' carrying current I at the centre.

ANSWER KEY	
1)	(C) $\frac{m1}{m2} < \frac{q1}{q2}$
2)	(D) $\frac{1}{r^3}$
3)	(B) $\frac{\mu_0 NI}{L}$
4)	(C) $5\pi I a^2$
5)	(C) shrink
6)	(B) $-(0 \cdot 8\ \mathrm{mN})\hat{i}$
7)	(B) 1.54 Am^2
8)	(B) v
9)	(B) $\sqrt{(4\pi M/I)}$
10)	(A) [〖R1/R2]〗^2
11)	(A)
12)	(B) magnetic dipole moment
13)	(A) 0-6v
14)	(B) 0.2A
15)	(A) B = $\lambda g/L$ perpendicular to the wire
16)	(C) pole strength
17)	(C) zero
18)	(C) straight
19)	(d) If both assertion and reason are false.
20)	(d) If both assertion and reason are false.
21)	(a) If both assertion and reason are true and reason is the correct explanation of assertion.
22)	(a) If both assertion and reason are true and reason is the correct explanation of assertion.

23)	(c) If assertion is true, but reason is false.
24)	(a) If both assertion and reason are true and reason is the correct explanation of assertion.
25)	(d) If both assertion and reason are false.
26)	(c) If assertion is true, but reason is false.
27)	(i) (A) $\frac{1}{2}$ (ii) (D) 2 (iii) (D) Particle 1 revolves anticlockwise while particle 2 revolves clockwise (iv) (a) (A) 1s **OR** (b) (B) $p_1 = p_2$
28)	The expression for magnetic field intensity for the circular coil of radius R and carrying current I is $B = \frac{\mu_o}{4\pi}\frac{2\pi NI}{R}$ $= \frac{\mu_o NI}{2R}$ .....(1) • When the current is doubled, the new currency will be $I^{'} = 2I$, and also when the radius is halved, the new radius will be $R^{'} = \frac{R}{2}$ • When this condition is applied to equation (1), we get $B^{'} = \frac{\mu_o N \times 2I}{2(R/2)}$ $= \frac{4\mu_o NI}{2R}$ $= 4B$ Therefore, when the radius is halved and the current is doubled, the magnitude of the magnetic field will become four times more than that initial value.
29)	Given data: Radius= 20 cm = 20/100= 0.2m Magnetic field "B" = 2x10^{-3}T Mass (m)= 9.1x10^{-31} kg q = 1.6x10^{-19} C 1- Calculate speed by using the formula Bqr = mv2 /2 v= Bqr /m v = 2x 10-3 x 1.6x10-19 x 0.2 / 9.1x10-31 = 0.0703 x 10-3-19+31 = 0.0703 x 10^9 v = 7.03 x 10 ^ 7 m/s 2- Now calculate the potential difference by using the relation. eV = 1/2 mv ^ 2 V =1/2 mv ^ 2/e = 1 x 9.1x10-31 x (7.03 x 10^7)2 / 2 x 3.2 x 107.03 x 10^19 = 140.5 x 10^2 = 14050 V
30)	Given that, Current I = 2 A Speed =4 x 10^4 m/s Length l = 0.1 m

	The force exerted by the magnetic field is $F = qv \times B$ The magnetic field is $B = \frac{\mu_0 I}{2\pi \times d}$ B= $4\pi\times10^{-7}\times2 / 2\pi\times0.1= 4 \times 10^{-6}$T The force will be F= $1.6\times10^{-19}\times4\times 10^{4}\times4 \times 10^{-6}=2.56\times10^{-20}$ N	
31)	The Current in QR and PS has no effect on AB. There is a force of attraction between AB and PQ and a force of repulsion between AB and SR. But PQ is closer to AB than SR, so the force of attraction is stronger than the force of repulsion. So the loop begins to move towards AB.	
32)	(i) Magnetic field due to conductor (2) at a point on conductor (1) is $B_1 = \frac{\mu_0 I}{2\pi d}$ along positive z - axis.	½
	Magnetic field due to conductor (3) at a point on conductor (1) is $B_2 = \frac{3\mu_0 I}{4\pi d}$ along negative z - axis.	½
	Magnitude of net magnetic field is $B_2 - B_1 = \frac{3\mu_0 I}{4\pi d} - \frac{\mu_0 I}{2\pi d} = \frac{\mu_0 I}{4\pi d}$ along negative z – axis. Direction will be along negative z axis/ into the plane of the paper.	½
	(ii) Force per unit length on conductor (1) due to conductor (2) $= \frac{\mu_0 I_1 I_2}{2\pi d}$ $= \frac{\mu_0 I^2}{\pi d}$ (attractive)	½
	Force per unit length on conductor (1) due to conductor (3) $= \frac{3\mu_0 I^2}{2\pi d}$ (repulsive)	
	Magnitude of net force per unit length on conductor (1) due to (2) & (3) $= \frac{\mu_0 I^2}{2\pi d}$	½
	Direction of the net force per unit length will be repulsive or along positive y-axis.	½
33)	τ = NIBA $\sin\theta$	½
	$= 30 \times 6 \times 1 \times 3.14 \times (8 \times 10^{-2})^2 \times \sin 60^\circ$	½
	$= 90 \times 64 \times 3.14 \times 1.73 \times 10^{-4}$	½
	= 3.13 Nm	½
	Torque will remain the same.	1

34)	$K.E = \frac{q^2B^2r^2}{2m}$ $r = \frac{\sqrt{2 \times K.E. \times m}}{qB}$ $= \frac{\sqrt{2 \times 8 \times 1.6 \times 10^{-19} \times 10^6 \times 6.4 \times 10^{-27}}}{3.2 \times 10^{-19} \times 0.5}$ $= \frac{12.8 \times 10^{-20}}{1.6 \times 10^{-19}}$ $= 8 \times 10^{-1}$m = 80 cm (i) Particle enters the magnetic field at angle $0^o < \theta < 90^o$ **(Alternatively)** If a component of velocity is parallel or antiparallel to the magnetic field and another component is perpendicular to the magnetic field. (ii) Particle moves parallel or antiparallel to the magnetic field.	½ ½ ½ ½ ½ ½
35)	Given that, Current in first wire, $I_1 = 2\ A$ Current in second wire, $I_2 = 5\ A$ Distance between wires, d = 10 cm = 0.1 m **The force per unit length between wire is given by :** $\frac{F}{l} = \frac{\mu_o I_1 I_2}{2\pi d}$ $\frac{F}{l} = \frac{4\pi \times 10^{-7} \times 2 \times 5}{2\pi \times 0.1}$ $\frac{F}{l} = 2 \times 10^{-5}\ N/m$ **Here, the current is flowing in same direction, so the force between them is attractive. Hence, this is the required solution.**	
36)	r = mv/qB f = 2 x106 Hz K.E = ½ mv2 = 2.5Kev	

37)	Calculating a) the speed of the proton b) the magnitude of the acceleration of the proton c) the radius of the path traced by the proton a) $v = \sqrt{(\frac{2 \times K.E.}{m})}$ $= 4 \times 10^6$ m/s b) acceleration = qvB / m $= 8 \times 10^{11}$ m/s^2 c) r = mv / Bq = 20 m
38)	Shunt = $\frac{Ig \times G}{I - Ig}$ [s = 1.33ohm] R = $\frac{V}{Ig}$ - G = 188ohm
39)	Refer notes
40)	Refer notes

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