CLASS XII – PHYSICS (042)
PRACTICE PAPER – CHAPTER 4: MOVING CHARGES AND MAGNETISM

Academic Session 2026–27

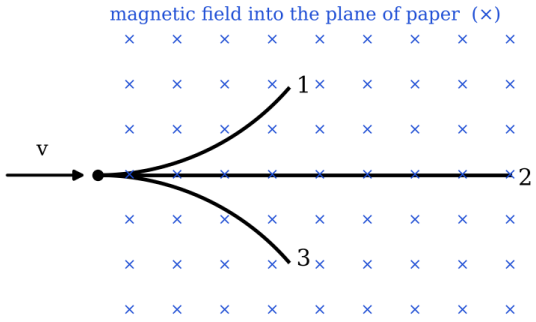
Maximum Marks : 35 **Time Allowed : 1 hour 15 minutes**

General Instructions

(1) There are 18 questions in all. All questions are compulsory.
(2) The question paper has five sections: Section A, B, C, D and E.
(3) Section A (Q.1–9) has seven MCQs and two Assertion–Reasoning questions of 1 mark each. Section B (Q.10–13) has four questions of 2 marks each. Section C (Q.14–16) has three questions of 3 marks each. Section D (Q.17) is one case study based question of 4 marks. Section E (Q.18) is one long answer question of 5 marks.
(4) There is no overall choice. An internal choice is provided in Q.12 (Section B), Q.15 (Section C), Q.17 part (iv) (Section D) and Q.18 (Section E). Attempt only one of the choices in such questions.
(5) Use of calculators is not allowed.
(6) You may use the following values of physical constants wherever necessary: $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}, e = 1.6×10^{-19} C, $m_e = 9.1 \times 10^{-31}$ kg, $\pi = 3.14$.

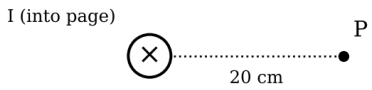
SECTION A (9 × 1 = 9)

1. Three particles 1, 2 and 3 enter a region of uniform magnetic field, directed into the plane of the paper, with the same velocity, as shown. The signs of their charges are **1**



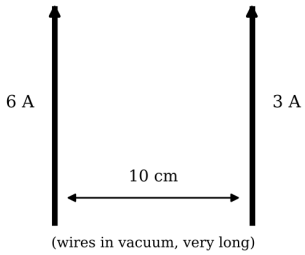
(a) 1: positive, 2: neutral, 3: negative
(b) 1: negative, 2: neutral, 3: positive
(c) 1: positive, 2: negative, 3: neutral
(d) 1: neutral, 2: positive, 3: negative

2. A long straight wire carries a current into the plane of the paper, as shown. The direction of the magnetic field at the point P is **1**



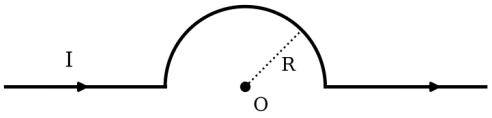
(a) upward, in the plane of the paper
(b) downward, in the plane of the paper
(c) into the plane of the paper
(d) towards the wire

3. Two very long parallel wires carry currents of 6 A and 3 A in the same direction, 10 cm apart, as shown. The force per unit length between them is **1**



(a) 3.6×10^{-5} N m^{-1}, repulsive
(b) 7.2×10^{-5} N m^{-1}, attractive
(c) 1.8×10^{-5} N m^{-1}, attractive
(d) 3.6×10^{-5} N m^{-1}, attractive

4. A wire carrying current I is bent into a semicircular arc of radius R with straight leads along a line through the centre O, as shown. The magnetic field at O is **1**



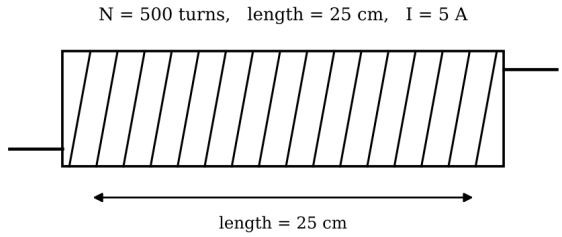
(a) $\mu_0 I/2R$, out of the plane of the paper
(b) $\mu_0 I/4R$, into the plane of the paper
(c) $\mu_0 I/4R$, out of the plane of the paper
(d) $\mu_0 I/2R$, into the plane of the paper

5. Four charged particles enter the same uniform magnetic field perpendicular to it, with the data given in the table. The particle that describes the circle of the largest radius is **1**

Particle	A	B	C	D
Charge (in units of e)	1	2	1	2
Mass (in units of mp)	1	4	2	1
Speed ($\times 10^5$ m s^{-1})	4	3	5	6

(a) A
(b) B
(c) C
(d) D

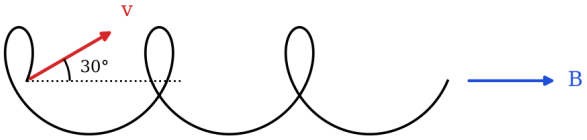
6. The figure shows a solenoid of 500 turns and length 25 cm, carrying a current of 5 A. The magnetic field inside it, near its centre, is **1**



(a) $4\pi \times 10^{-3}$ T
(b) $2\pi \times 10^{-3}$ T
(c) $8\pi \times 10^{-3}$ T
(d) $4\pi \times 10^{-5}$ T

---

7. A charged particle enters a uniform magnetic field with its velocity making an angle of 30° with the field, and follows the path shown. The ratio of the pitch of the path to the radius of the circular part is **1**



charged particle in a uniform magnetic field

(a) $2\pi/\sqrt{3}$
(b) $\pi\sqrt{3}$
(c) 2π
(d) $2\pi\sqrt{3}$

For Questions 8 and 9, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct answer from the options below.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

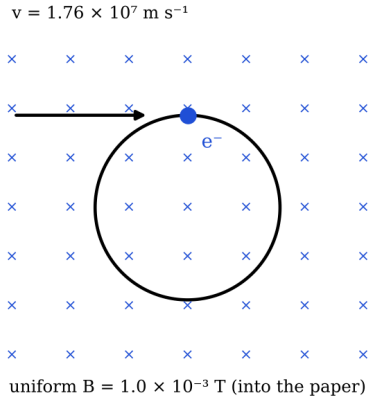
8. **Assertion (A):** A charged particle moving in a uniform magnetic field has constant kinetic energy. **1**
Reason (R): The magnetic force on a moving charge is always perpendicular to its velocity and therefore does no work.

---

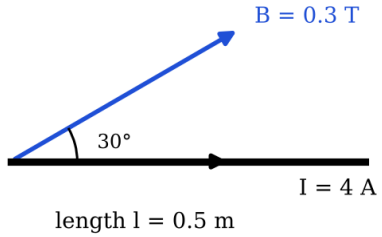
9. **Assertion (A):** Two long parallel wires carrying currents in opposite directions attract each other. **1**
Reason (R): Parallel currents attract and antiparallel currents repel each other.

SECTION B (4 × 2 = 8)

10. An electron enters a region of uniform magnetic field with the speed shown and moves in the circular path shown. Find the radius of its path and its time period of revolution. **2**



11. A straight horizontal wire of length 0.5 m carries a current of 4 A in a uniform magnetic field of 0.3 T, making an angle of 30° with the wire, as shown. Find the magnitude of the force on the wire and state its direction. **2**

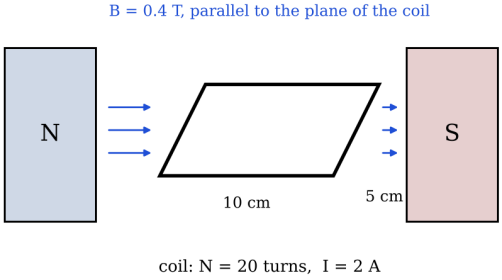


12. **(A)** A closely wound circular coil of 50 turns and radius 5 cm carries a current of 4 A. Find the magnetic field at its centre and its magnetic moment. **2**

OR

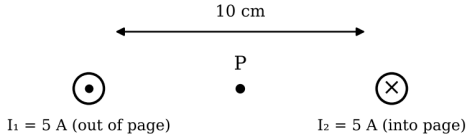
(B) A long straight wire of radius 2 mm carries a current of 10 A distributed uniformly over its cross-section. Find the magnetic field at distances of 1 mm and 4 mm from its axis.

13. A rectangular coil of 20 turns, 10 cm × 5 cm, carrying a current of 2 A, is placed with its plane parallel to a uniform magnetic field of 0.4 T, as shown. Find the magnetic moment of the coil and the torque acting on it. **2**



SECTION C (3 × 3 = 9)

14. Two long parallel wires carry equal currents of 5 A in opposite directions, 10 cm apart, as shown (the figure shows their cross-section). (a) Find the magnitude and direction of the magnetic field at the point P midway between the wires. (b) Find the force per unit length between the wires and state whether it is attractive or repulsive. **3**

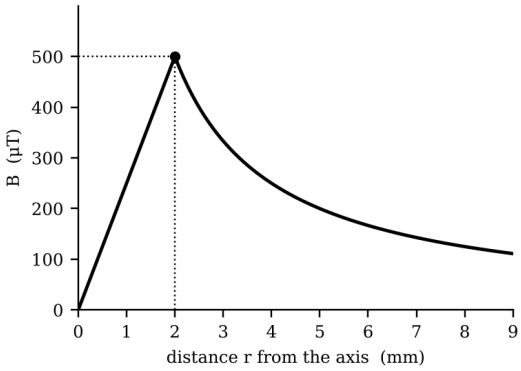


15. **(A)** Using the Biot–Savart law, derive an expression for the magnetic field at a point on the axis of a circular current loop. Hence obtain the field at its centre. **3**

OR

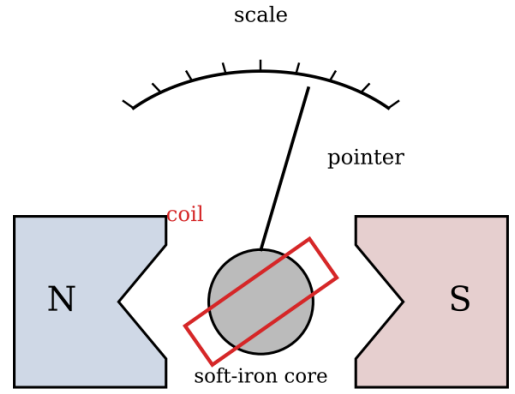
(B) State Ampere's circuital law. Use it to derive an expression for the magnetic field inside a long solenoid carrying a current.

16. The graph shows the magnetic field B due to a long straight wire of circular cross-section carrying a uniformly distributed current, as a function of the distance r from its axis. Use the graph to find (a) the radius of the wire, (b) the current in the wire, (c) the magnetic field at r = 4 mm. **3**



SECTION D (1 × 4 = 4)

17. **Case Study.** A moving coil galvanometer consists of a coil of many turns, free to rotate about a fixed axis, in the radial magnetic field between the poles of a permanent magnet. A soft-iron core is placed inside the coil. When a current flows, the torque on the coil is balanced by the restoring torque of a spring, and the deflection is proportional to the current. The galvanometer shown has a resistance G = 50 Ω and gives full-scale deflection for a current of 2 mA. Answer the following: **4**



N, S: permanent magnet poles giving a radial field

G = 50 Ω, full-scale deflection for I_g = 2 mA

(i) The soft-iron core is used in the galvanometer to

(a) reduce the resistance of the coil (b) increase the strength of the field and make it radial (c) insulate the coil (d) reduce the weight of the coil

(ii) If the number of turns of the coil is doubled (other quantities unchanged), the current sensitivity and the voltage sensitivity respectively become

(a) double, double (b) double, unchanged (c) unchanged, double (d) unchanged, unchanged

(iii) To convert it into an ammeter of range 0–1 A, the shunt resistance required (approximately) is

(a) 25 Ω (b) 0.02 Ω (c) 0.1 Ω (d) 50 Ω

(iv) To convert it into a voltmeter of range 0–10 V, the resistance to be connected in series is

(a) 5000 Ω (b) 4900 Ω (c) 50 Ω (d) 4950 Ω

OR

(iv) The resistance of the ammeter obtained in part (iii) is approximately

(a) 50 Ω (b) 25 Ω (c) 0.5 Ω (d) 0.1 Ω

SECTION E (1 × 5 = 5)

18. **(A)** Derive an expression for the torque on a rectangular current loop placed in a uniform magnetic field, and write it in terms of the magnetic moment of the loop. (3) **5**

A coil of 100 turns and area 2×10^{-2} m^2 carries a current of 0.5 A in a uniform field of 0.2 T. Find its magnetic moment and the torque on it when the normal to its plane makes an angle of 30° with the field. (2)

OR

(B) Derive an expression for the force per unit length between two long parallel current-carrying conductors. Hence define the ampere. (3)

Two long parallel wires 5 cm apart carry currents of 10 A and 20 A in the same direction. Find the force per unit length and the force on a 2 m length of one wire. Is it attractive or repulsive? (2)

— End of Question Paper —