

## PART 1 - PHYSICS

Topic : Moving charges and magnetism

## SECTION-A : (Maximum Marks : 16)

This section contains **FOUR** questions.

Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).

For each question, choose the option(s) corresponding to (all) the correct answer(s).

Answer to each question will be evaluated according to the following marking scheme :

Full Marks : +4 ONLY if (all) the correct option(s) is(are) chosen;

Partial Marks : +3 If all the four options are correct but ONLY three options are chosen;

Partial Marks : +2 If three or more options are correct but ONLY two options are chosen, both of which are correct;

Partial Marks : +1 If two or more options are correct but ONLY one option is chosen and it is a correct option;

Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);

Negative Marks : -1 In all other cases.

For example, in a question, if (A), (B) and (D) are the ONLY three options corresponding to correct answers, then choosing ONLY (A), (B) and (D) will get +4 marks; choosing ONLY (A) and (B) will get +2 marks; choosing ONLY (A) and (D) will get +2 marks; choosing ONLY (B) and (D) will get +2 marks; choosing ONLY (A) will get +1 mark; choosing ONLY (B) will get +1 mark; choosing ONLY (D) will get +1 mark; choosing no option (i.e. the question is unanswered) will get 0 marks; and choosing any other combination of options will get -1 marks.

1. In a vacuum chamber, a particle of charge  $1\ \mu\text{C}$  and mass  $1\ \text{mg}$  is projected with a velocity  $(\hat{i} + 2\hat{j})\ \text{m s}^{-1}$  from the XZ plane at time  $t = 0$  in an electric field of  $1\hat{i}\ \text{V m}^{-1}$ . At  $t = 0.2\ \text{s}$ , the electric field is switched off and a magnetic field of  $6\hat{j}\ \text{T}$  is switched on. The acceleration due to gravity is  $-10\hat{j}\ \text{m s}^{-2}$ . Correct option(s) is/are: [JEE Advanced 2026 Paper 2]
- (A) The vertical distance of the particle from the XZ plane at  $t = 0.3\ \text{s}$  is  $15\ \text{cm}$ .  
 (B) The vertical distance of the particle from the XZ plane at  $t = 0.4\ \text{s}$  is  $10\ \text{cm}$ .  
 (C) The radius of the trajectory of the particle for  $t > 0.2\ \text{s}$  is  $20\ \text{cm}$ .  
 (D) The particle will be in the XZ plane at  $t = 0.35\ \text{s}$ .

Scan or tap for the full solution 

2. An infinitely long wire, located on the z-axis, carries a current  $I$  along the +z-direction and produces the magnetic field  $\vec{B}$ . The magnitude of the line integral  $\int \vec{B} \cdot d\vec{l}$  along a straight line from the point  $(-\sqrt{3}a, a, 0)$  to  $(a, a, 0)$  is given by

[ $\mu_0$  is the magnetic permeability of free space.]

[JEE Advanced 2024 Paper 1]

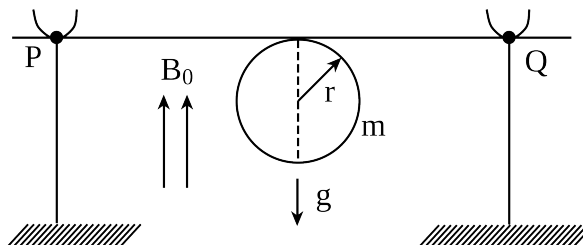
- (A)  $7\mu_0 I/24$  (B)  $7\mu_0 I/12$  (C)  $\mu_0 I/8$  (D)  $\mu_0 I/6$

Scan or tap for the full solution 

Space for Rough Work

3. A thin stiff insulated metal wire is bent into a circular loop with its two ends extending tangentially from the same point of the loop. The wire loop has mass  $m$  and radius  $r$  and it is in a uniform vertical magnetic field  $B_0$ , as shown in the figure. Initially, it hangs vertically downwards, because of acceleration due to gravity  $g$ , on two conducting supports at P and Q. When a current  $I$  is passed through the loop, the loop turns about the line PQ by an angle  $\theta$  given by

[JEE Advanced 2024 Paper 2]



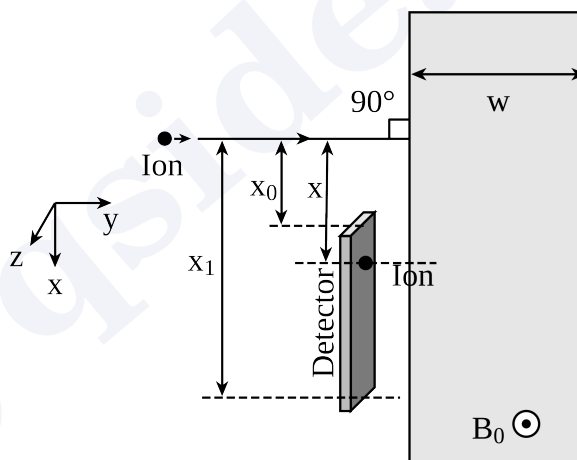
- (A)  $\tan \theta = \pi r I B_0 / (mg)$  (B)  $\tan \theta = 2\pi r I B_0 / (mg)$  (C)  $\tan \theta = \pi r I B_0 / (2mg)$  (D)  $\tan \theta = mg / (\pi r I B_0)$

Scan or tap for the full solution



4. A positive, singly ionized atom of mass number  $A_M$  is accelerated from rest by the voltage 192 V. Thereafter, it enters a rectangular region of width  $w$  with magnetic field  $\vec{B}_0 = 0.1\hat{k}$  Tesla, as shown in the figure. The ion finally hits a detector at the distance  $x$  below its starting trajectory.

[Given: Mass of neutron/proton =  $(5/3) \times 10^{-27}$  kg, charge of the electron =  $1.6 \times 10^{-19}$  C.]



Which of the following option(s) is(are) correct?

[JEE Advanced 2024 Paper 2]

- (A) The value of  $x$  for  $H^+$  ion is 4 cm.  
 (B) The value of  $x$  for an ion with  $A_M = 144$  is 48 cm.  
 (C) For detecting ions with  $1 \leq A_M \leq 196$ , the minimum height  $(x_1 - x_0)$  of the detector is 55 cm.  
 (D) The minimum width  $w$  of the region of the magnetic field for detecting ions with  $A_M = 196$  is 56 cm.

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**SECTION-B : (Maximum Marks : 8)**

This section contains **TWO** questions.

The answer to each question is a **NUMERICAL VALUE**.

For each question, enter the correct numerical value of the answer (in decimal notation, truncated / rounded-off to the **SECOND DECIMAL PLACE**; e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) in the place designated to enter the answer.

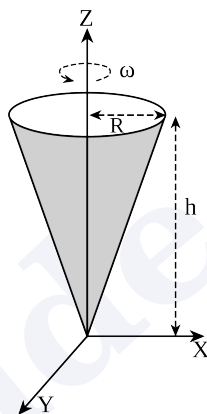
Answer to each question will be evaluated according to the following marking scheme :

Full Marks : +4 If **ONLY** the correct answer is entered;

Zero Marks : 0 In all other cases.

5. A hollow, right circular cone of base radius  $R$  and height  $h$ , with its tip at the origin is rotating about the  $Z$ -axis with an angular velocity  $\omega$ , as shown in the figure. The cone carries a total charge  $Q$  uniformly distributed on its curved surface. The magnitude of magnetic field at a point  $(0, 0, z)$ , where  $z \gg R$  and  $z \gg h$ , is  $\frac{n\mu_0 QR^2\omega}{4\pi z^3}$ . The value of  $n$  is:

[JEE Advanced 2026 Paper 1]



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6. A conducting solid sphere of radius  $R$  and mass  $M$  carries a charge  $Q$ . The sphere is rotating about an axis passing through its center with a uniform angular speed  $\omega$ . The ratio of the magnitudes of the magnetic dipole moment to the angular momentum about the same axis is given as  $\alpha \frac{Q}{2M}$ . The value of  $\alpha$  is \_\_\_\_

[JEE Advanced 2025 Paper 2]

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## JEE ADVANCED MOVING CHARGES AND MAGNETISM — PYQS

Test Pattern : **JEE (Advanced)**

## ANSWER KEY

## SECTION-A

[illegible]

## SECTION-B

|              |      |              |  |  |  |  |  |  |  |  |
|--------------|------|--------------|--|--|--|--|--|--|--|--|
| <b>Ques.</b> | 5    | 6            |  |  |  |  |  |  |  |  |
| <b>Ans.</b>  | 0.50 | 1.65 to 1.67 |  |  |  |  |  |  |  |  |