

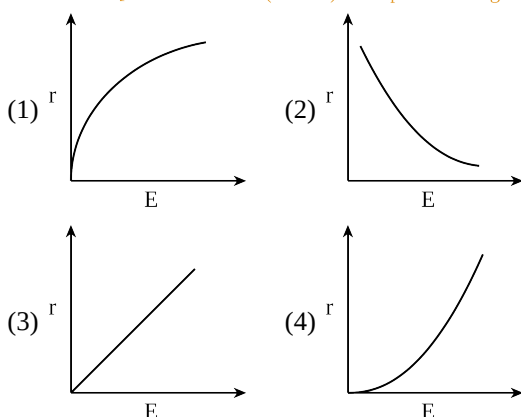
JEE MAIN MOVING CHARGES AND MAGNETISM — MOTION OF A CHARGE IN A MAGNETIC FIELD — PYQS

Max. Marks: 32

Questions: 8

Section A (MCQ) — 6 questions

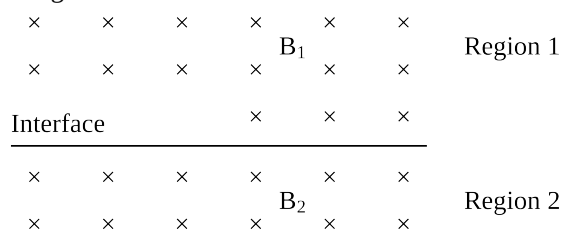
- Q.1** A particle of charge q , mass m and kinetic energy E enters a magnetic field perpendicular to its velocity and undergoes a circular arc of radius (r). Which of the following curves represents the variation of r with E ? [JEE Main 2025 (Online) 7th April Morning Shift]



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- Q.2** Uniform magnetic fields of different strengths (B_1 and B_2), both normal to the plane of the paper exist as shown in the figure. A charged particle of mass m and charge q , at the interface at an instant, moves into the region 2 with velocity v and returns to the interface. It continues to move into region 1 and finally reaches the interface. What is the displacement of the particle during this movement along the interface?



(Consider the velocity of the particle to be normal to the magnetic field and $B_2 > B_1$)

[JEE Main 2025 (Online) 7th April Morning Shift]

- (1) $\frac{mv}{qB_1} \left(1 - \frac{B_1}{B_2}\right) \times 2$ (2) $\frac{mv}{qB_1} \left(1 - \frac{B_2}{B_1}\right) \times 2$
 (3) $\frac{mv}{qB_1} \left(1 - \frac{B_2}{B_1}\right)$ (4) $\frac{mv}{qB_1} \left(1 - \frac{B_1}{B_2}\right)$

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- Q.3** Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**.

Assertion (A): If oxygen ion (O^{2-}) and hydrogen ion (H^+) enter normal to the magnetic field with equal momentum, then the path of O^{2-} ion has a smaller radius of curvature than that of H^+ .

Reason (R): A proton with same linear momentum as an electron will form a path of smaller radius of curvature on entering a uniform magnetic field perpendicularly.

In the light of the above statements, choose the correct answer from the options given below

[JEE Main 2025 (Online) 3rd April Evening Shift]

- (1) Both A and R are true but R is NOT the correct explanation of A
 (2) A is false but R is true
 (3) A is true but R is false
 (4) Both A and R are true and R is the correct explanation of A

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- Q.4** A monochromatic light of wavelength λ is incident on a metallic plate having work function ϕ . An electron, emitted normally to the plate from a point A with maximum kinetic energy, enters a constant magnetic field, perpendicular to the initial velocity of electron. The electron passes through a curve and hits back the plate at a point B. The distance between A and B is : (Given : The magnitude of charge of an electron is e and mass is m , h is Planck's constant and c is velocity of light. Take the magnetic field exists throughout the path of electron)

[JEE Main 2025 (Online) 2nd April Morning Shift]

- (1) $\sqrt{2m \left(\frac{hc}{\lambda} - \phi \right)} / eB$ (2) $\sqrt{8m \left(\frac{hc}{\lambda} - \phi \right)} / eB$
 (3) $\sqrt{m(hc/\lambda - \phi)} / eB$ (4) $2\sqrt{m(hc/\lambda - \phi)} / eB$

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- Q.5** An electron with mass 'm' with an initial velocity ($t=0$) $\vec{v} = v_0 \hat{i}$ ($v_0 > 0$) enters a magnetic field $\vec{B} = B_0 \hat{j}$. If the initial de Broglie wavelength at $t = 0$ is λ_0 then its value after time 't' would be :

[JEE Main 2025 (Online) 2nd April Evening Shift]

(1) $\frac{\lambda_0}{\sqrt{1 - \frac{e^2 B_0^2 t^2}{m^2}}}$ (2) λ_0
 (3) $\lambda_0 \sqrt{1 + \frac{e^2 B_0^2 t^2}{m^2}}$ (4) $\frac{\lambda_0}{\sqrt{1 + \frac{e^2 B_0^2 t^2}{m^2}}}$

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- Q.6** Consider a long thin conducting wire carrying a uniform current I. A particle having mass "m" and charge "q" is released at a distance "a" from the wire with a speed v_0 along the direction of current in the wire. The particle gets attracted to the wire due to magnetic force. The particle turns round when it is at distance x from the wire. The value of x is [μ_0 is vacuum permeability]

[JEE Main 2025 (Online) 28th January Morning Shift]

(1) $a \left[1 - \frac{mv_0}{2q\mu_0 I} \right]$ (2) $ae^{-\frac{4\pi mv_0}{q\mu_0 I}}$
 (3) $a \left[1 - \frac{mv_0}{q} \mu_0 I \right]$ (4) $\frac{a}{2}$

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Section B (Numerical) — 2 questions

- Q.7** A 5 mg particle carrying a charge of $5\pi \times 10^{-6}$ C is moving with velocity of $(3\hat{i} + 2\hat{k}) \times 10^{-2}$ m/s in a region having magnetic field $\vec{B} = 0.1 \hat{k}$ Wb/m². It moves a distance of α meter along $\hat{k}$ when it completes 5 revolutions. The value of α is _____.

[JEE Main 2026 (Online) 8th April Evening Shift]

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- Q.8** A particle of charge $1.6 \mu\text{C}$ and mass $16 \mu\text{g}$ is present in a strong magnetic field of 6.28 T. The particle is then fired perpendicular to magnetic field. The time required for the particle to return to original location for the first time is _____ s (rounded off to the nearest integer). ($\pi = 3.14$)

[JEE Main 2025 (Online) 4th April Evening Shift]

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ANSWER KEY

Section A (MCQ) — 6 questions

Ques.	1	2	3	4	5	6					
Ans.	1	1	3	2	2	2					

Section B (Numerical) — 2 questions

Ques.	7	8									
Ans.	2	0									