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NEET MOVING CHARGES AND MAGNETISM — MOTION IN COMBINED ELECTRIC AND MAGNETIC FIELDS (VELOCITY SELECTOR, CYCLOTRON) — PYQS

Max. Marks: 32 **Questions:** 8

Section A (MCQ) — 8 questions

Q.1 An electron (mass 9×10^{-31} kg and charge 1.6×10^{-19} C) moving with speed c/100 (c = speed of light) is injected into a magnetic field $\vec{B}$ of magnitude 9×10^{-4} T perpendicular to its direction of motion. We wish to apply a uniform electric field $\vec{E}$ together with the magnetic field so that the electron does not deflect from its path. Then (speed of light $c = 3 \times 10^{8}$ m s^{-1}) [NEET (UG) 2025]

(1) $\vec{E}$ is parallel to $\vec{B}$ and its magnitude is 27×10^{2} V m^{-1}

(2) $\vec{E}$ is parallel to $\vec{B}$ and its magnitude is 27×10^{4} V m^{-1}

(3) $\vec{E}$ is perpendicular to $\vec{B}$ and its magnitude is 27×10^{4} V m^{-1}

(4) $\vec{E}$ is perpendicular to $\vec{B}$ and its magnitude is 27×10^{2} V m^{-1}

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Q.2 When a proton is released from rest in a room, it starts with an initial acceleration a_0 towards west. When it is projected towards north with a speed v_0 it moves with an initial acceleration $3a_0$ towards west. The electric and magnetic fields in the room are [NEET 2013]

(1) $\frac{ma_0}{e}$ east, $\frac{3ma_0}{ev_0}$ up

(2) $\frac{ma_0}{e}$ east, $\frac{3ma_0}{ev_0}$ down

(3) $\frac{ma_0}{e}$ west, $\frac{2ma_0}{ev_0}$ up

(4) $\frac{ma_0}{e}$ west, $\frac{2ma_0}{ev_0}$ down

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Q.3 An alternating electric field, of frequency ν, is applied across the dees (radius = R) of a cyclotron that is being used to accelerate protons (mass = m). The operating magnetic field (B) used in the cyclotron and the kinetic energy (K) of the proton beam, produced by it, are given by [AIPMT 2012 (Prelims)]

(1) $B = \frac{m\nu}{e}$ and $K = 2m\pi^2\nu^2R^2$

(2) $B = \frac{2\pi m\nu}{e}$ and $K = m^2\pi\nu R^2$

(3) $B = \frac{2\pi m\nu}{e}$ and $K = 2m\pi^2\nu^2R^2$

(4) $B = \frac{m\nu}{e}$ and $K = m^2\pi\nu R^2$

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Q.4 A uniform electric field and a uniform magnetic field are acting along the same direction in a certain region. If an electron is projected in the region such that its velocity is pointed along the direction of fields, then the electron [AIPMT 2011 (Prelims)]

(1) will turn towards right of direction of motion

(2) speed will decrease

(3) speed will increase

(4) will turn towards left of direction of motion

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Q.5 A particle having a mass of 10^{-2} kg carries a charge of 5×10^{-8} C. The particle is given an initial horizontal velocity of 10^{5} m s^{-1} in the presence of electric field $\vec{E}$ and magnetic field $\vec{B}$. To keep the particle moving in a horizontal direction, it is necessary that

Which one of the following pairs of statements is possible ?

A. $\vec{B}$ should be perpendicular to the direction of velocity and $\vec{E}$ should be along the direction of velocity

B. Both $\vec{B}$ and $\vec{E}$ should be along the direction of velocity

C. Both $\vec{B}$ and $\vec{E}$ are mutually perpendicular and perpendicular to the direction of velocity.

D. $\vec{B}$ should be along the direction of velocity and $\vec{E}$ should be perpendicular to the direction of velocity [AIPMT 2010 (Mains)]

(1) A and C only (2) C and D only

(3) B and C only (4) B and D only

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Q.6 A beam of cathode rays is subjected to crossed electric (E) and magnetic fields (B). The fields are adjusted such that the beam is not deflected. The specific charge of the cathode rays is given by (Where V is the potential difference between cathode and anode) [AIPMT 2010 (Prelims)]

(1) $\frac{B^2}{2VE^2}$ (2) $\frac{2VB^2}{E^2}$ (3) $\frac{2VE^2}{B^2}$ (4) $\frac{E^2}{2VB^2}$

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Q.7 A beam of electron passes undeflected through mutually perpendicular electric and magnetic fields. If the electric field is switched off, and the same magnetic field is maintained, the electrons move [AIPMT 2007]

(1) in a circular orbit (2) along a parabolic path

(3) along a straight line (4) in an elliptical orbit

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Q.8 In Thomson mass spectrograph, if $\vec{E} \perp \vec{B}$, then the velocity of electron beam will be [AIPMT 2001]

(1) $\frac{|\vec{E}|}{|\vec{B}|}$ (2) $\vec{E} \times \vec{B}$ (3) $\frac{|\vec{B}|}{|\vec{E}|}$ (4) $\frac{\vec{E}^2}{\vec{B}^2}$

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ANSWER KEY

Ques.	1	2	3	4	5	6	7	8			
Ans.	**4**	**4**	**3**	**2**	**3**	**4**	**1**	**1**			