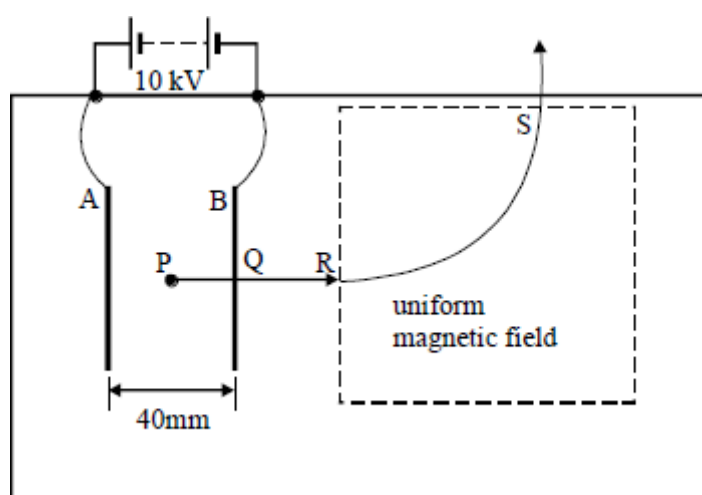


Name of the Student: _____

Max. Marks : 25 Marks

Time : 25 Minutes

Q1.



A positive ion with a mass of 3.4×10^{-26} kg and a charge of 3.2×10^{-19} C is initially at rest at a point P, midway between two parallel conducting plates, A and B which are separated by 40 mm. The ion is accelerated and passes through a hole Q in plate B. It enters a magnetic field of uniform flux density 0.10 T at R. After following a circular path the ion leaves the field at S. Assume that the magnetic field is uniform everywhere within the dotted rectangle and that the space within the solid rectangle is evacuated.

- (a) (i) Calculate the electric field strength between the plates AB.

- (ii) Calculate the force on the ion due to the electric field.

- (iii) Show that the speed of the ion just after it has passed through the hole at Q is 3.1×10^5 m s⁻¹.

(5)

- (b) (i) State the direction of the magnetic field.

- (ii) Explain why the ion follows a circular path in the magnetic field.

- (iii) Show that the radius of the circular path is proportional to the momentum of the ion and calculate the value of the radius.

(6)

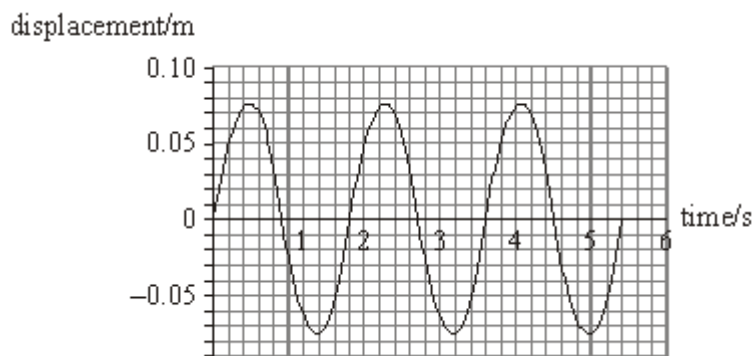
- (c) Explain how, if at all, the trajectory would be different for an ion with a slightly greater mass but carrying the same charge.

(2)

(Total 13 marks)

Q34.

The figure below shows how the displacement of the bob of a simple pendulum varies with time.



- (a) (i) Calculate the frequency of the oscillation.

(2)

- (ii) State the magnitude of the amplitude of the oscillation.

(1)

- (iii) State how the frequency and amplitude of a simple pendulum are affected by increased damping.

(2)

- (b) Draw on the figure above the displacement-time graph for a pendulum that has the same period and amplitude but oscillates 90° ($\pi/2$ radian) out of phase with the one shown.

(2)

- (c) The pendulum bob has a mass of 8.0×10^{-3} kg. Calculate

- (i) the maximum acceleration of the bob during the oscillation,

- (ii) the total energy of the oscillations.

(5)

(Total 12 marks)