5 **(a)** Explain why a charge moving perpendicular to a magnetic field will follow a *uniform circular* path.

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.....[2]

(b) An electron (e_1) enters a uniform magnetic field of flux density 7.5 mT with a speed of 8.5 x 10^7 m s^{-1}. The magnetic field only exists within a square **MNOP** measuring 5.0 cm x 5.0 cm, as shown in Fig. 5.1 below.

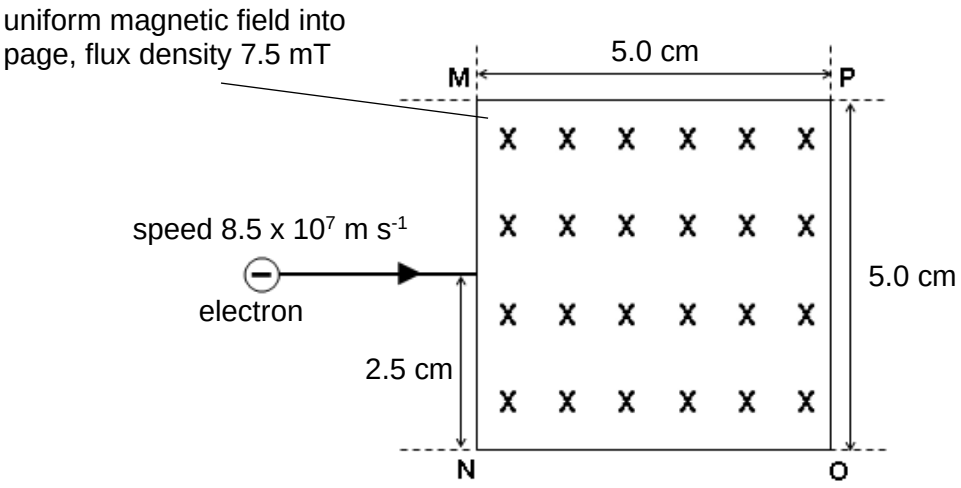

Fig. 5.1

(i) Calculate the radius of the path taken by the electron in the magnetic field.

radius = ...cm [2]

(ii) With reference to your answer in **(b)(i),** on Fig. 5.1, sketch the path of this electron as it passes through, and beyond the region of the magnetic field. [3]

(iii) Show that the period T (i.e. time to complete a circular path) of the motion of the electron when it is in the magnetic field is independent of its speed v and radius r of the path of the electron.

[1]

(iv) Another electron (e_2) moving with a **different** speed approaches the magnetic field along the same path as e_1. e_2 exits the field from side **MN**.

Hence, with reference to **(b)(iii),** explain which electron (i.e. e_1 or e_2), spends a longer time in the magnetic field.

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.....[2]

[Total: 10]