4 Fig. 4.1 shows an electron with constant speed *v* moving in a region of uniform magnetic field of flux density 2.8×10^{-5} T. The direction of the magnetic field is perpendicular to the plane of to the paper. The electron follows a clockwise circular path in the plane of the paper.
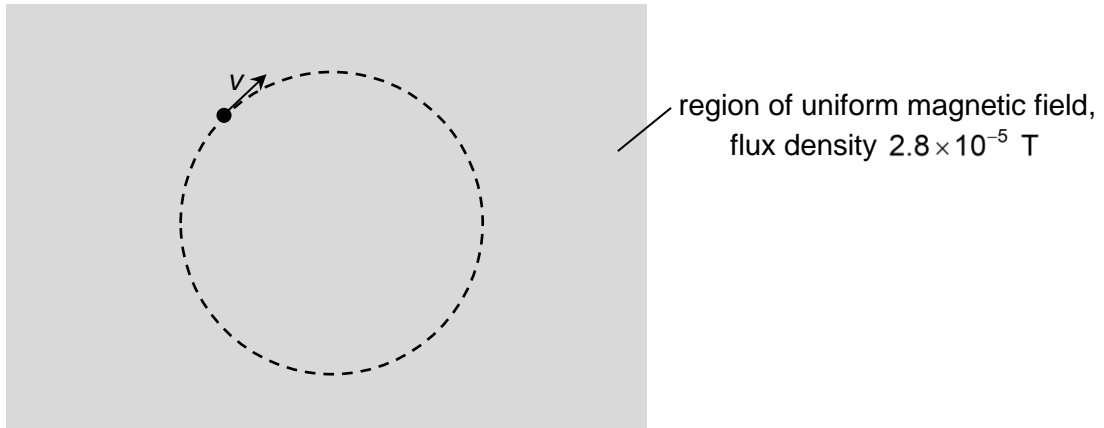

Fig. 4.1

(a) (i) Explain why the path of the electron in the magnetic field is circular.

....

....

....

....

....

.... [2]

(ii) Determine the frequency of revolution *f* of the electron.

f = ... Hz   [2]

9749/03   **[Turn over**

(b) A second electron, with twice the kinetic energy of the first electron in **(a)**, is injected in the same direction into the same magnetic field. The second electron also follows a circular path in the magnetic field.

Comparing the circular motion of the first and second electron, state and explain whether there are differences in each of the following quantities:

(i) radius of circular path,

....

....

....

.... [2]

(ii) period of revolution,

....

....

.... [1]

(iii) work done on the electron in one revolution.

....

....

.... [1]

(c) A uniform electric field is now applied together with the magnetic field. The direction of the electric field is in the same direction as the magnetic field in Fig. 4.1.

Describe and explain the subsequent motion of the electron.

....

....

....

....

.... [2]