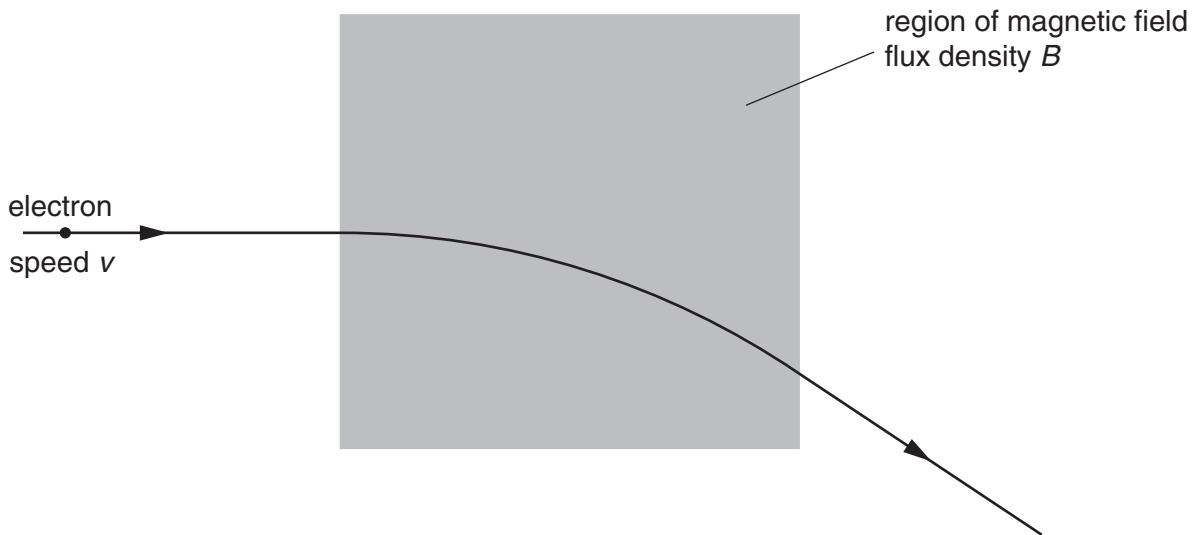


- 7 Electrons are moving through a vacuum in a narrow beam. The electrons have speed  $v$ . The electrons enter a region of uniform magnetic field of flux density  $B$ . Initially, the electrons are travelling at a right-angle to the magnetic field. The path of a single electron is shown in Fig. 7.1.



**Fig. 7.1**

The electrons follow a curved path in the magnetic field.

A uniform electric field of field strength  $E$  is now applied in the same region as the magnetic field.

The electrons pass undeviated through the region of the two fields.  
Gravitational effects may be neglected.

- (a) Derive a relation between  $v$ ,  $E$  and  $B$  for the electrons not to be deflected. Explain your working.

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[3]

- (b) An  $\alpha$ -particle has speed  $v$  and approaches the region of the two fields along the same path as the electron. Describe and explain the path of the  $\alpha$ -particle as it passes through the region of the two fields.

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[2]