7 **(a)** Define magnetic flux density.

.....

.....

..... [2]

(b) A particle of mass *m* and charge +*Q* moves at speed *v* into a region where there is a uniform magnetic field, as shown in Fig. 7.1.

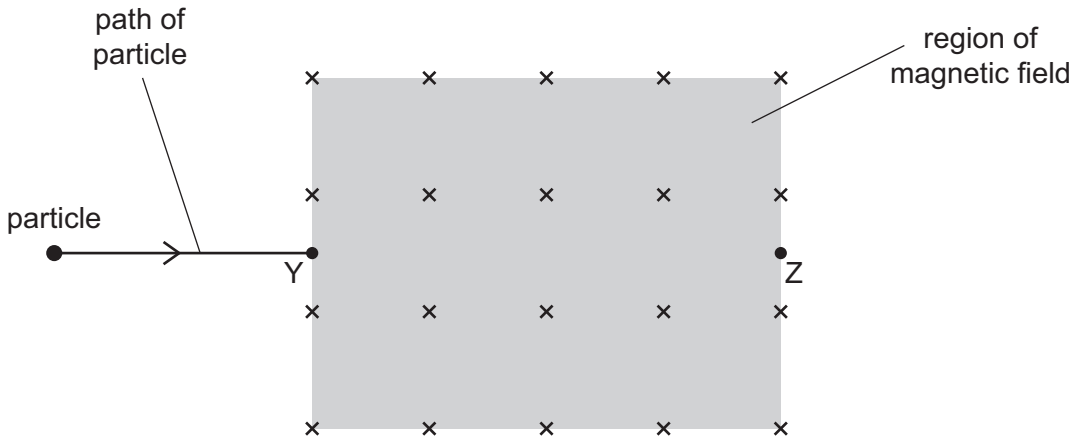

Fig. 7.1

The uniform magnetic field is into the page and has flux density *B*. The particle enters the region of the field at point Y.

(i) State an expression, in terms of some or all of m, Q, B and v, for the magnetic force F that acts on the particle when it is at point Y.

$F =$ ..... [1]

(ii) On Fig. 7.1, draw an arrow at point Y to indicate the direction of the force in **(b)(i)**. [1]

(iii) On Fig. 7.1, draw a line to show a possible path for the particle through the region of the magnetic field. [1]

(c) (i) Explain how an electric field can be used with the magnetic field to ensure that the particle in **(b)** now passes through point Z.

.....

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.....

.....

..... [3]

(ii) Derive an expression for v in terms of B and the electric field strength E.

$v =$ ..... [2]

[Total: 10]