5 (a) A thin slice of conducting material is placed normal to a uniform magnetic field of flux density *B*, as shown in Fig. 5.1.

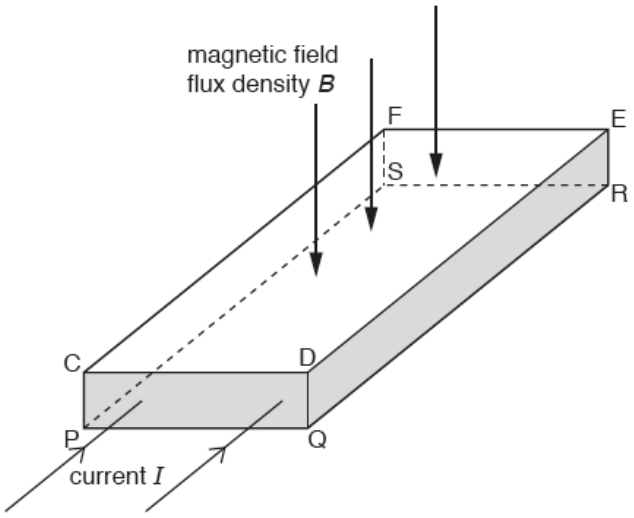

Fig. 5.1

The magnetic field is normal to face CDEF and to face PQRS.

A current I passes through the slice and is normal to the faces CDQP and FERS.

A potential difference, V_H, is developed across the slice at steady state.

(a) State the faces between which V_H is developed.

.....[1]

(b) The current *I* is produced by charge carriers, each of charge +*q* moving at speed *v* in the direction of the current. The number density of the charge carriers is *n*.

(i) Derive an expression relating V_H to *v*, *B* and *d*, where *d* is one of the dimensions of the slice.

[3]

(ii) Use your answer in **(b)(i)** and an expression for the current I in the slice to derive the

Expression

$$V_H = \frac{BI}{ntq}$$

where *t* is another of the dimensions of the slice. Explain your working.

[2]

(iii) Suggest why V_H is difficult to detect in a thin slice of copper.

.....

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.....[1]

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