

- 8 A slice of a conducting material has its face QRLK normal to a uniform magnetic field of flux density B , as illustrated in Fig. 8.1.

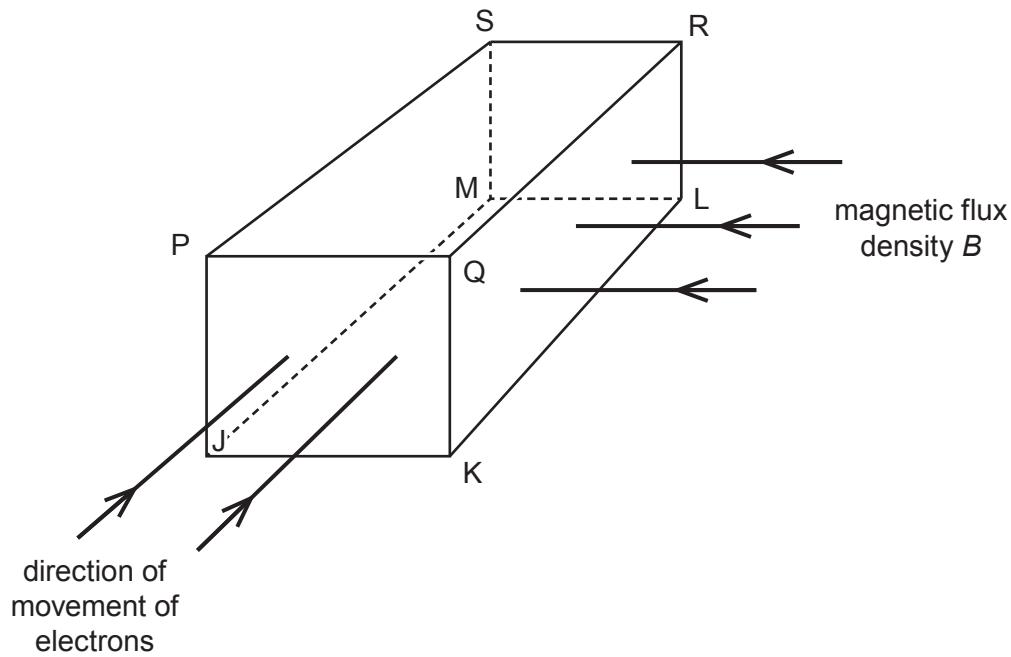


Fig. 8.1

Electrons enter the slice travelling perpendicular to face PQKJ.

- (a) For the free electrons moving in the slice:

- (i) state the direction of the force on an electron due to movement of the electron in the magnetic field

.....
..... [1]

- (ii) identify the faces, using the letters on Fig. 8.1, between which a potential difference is developed.

face and face [1]

- (b) Explain why the potential difference in (a)(ii) reaches a maximum value.

.....
.....
..... [2]

- (c) The number of free electrons per unit volume in the slice of material is $1.3 \times 10^{29} \text{ m}^{-3}$.
The thickness PQ of the slice is 0.10 mm.
The magnetic flux density B is $4.6 \times 10^{-3} \text{ T}$.

Calculate the potential difference across the slice for a current of $6.3 \times 10^{-4} \text{ A}$.

potential difference = V [2]

- (d) The slice in (c) is a metal.

By reference to your answer in (c), suggest why Hall probes are usually made using semiconductors rather than metals.

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[2]