5 Fig. 5.1 shows two uniform magnetic fields P and Q next to each other. The fields do not affect each other.

Field P, with magnetic flux density 0.1 T, is pointing into the page. Field Q, of magnetic flux density 0.2 T, is pointing out of the page. The length of each magnetic field is 3.0 cm.

A small square coil with sides of length 1.0 cm moves at a constant velocity of 1.0 cm s^{-1} across the two fields, entering through field P and finally exiting through field Q.

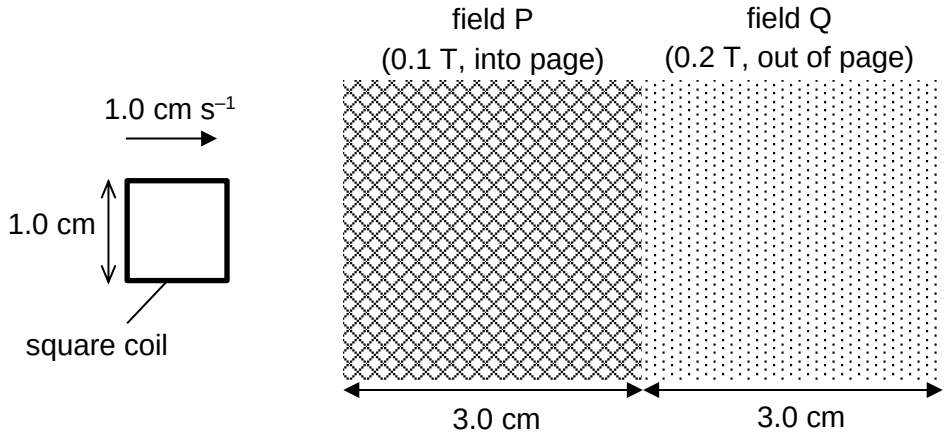

Fig. 5.1

(a) On Fig. 5.2, draw the variation with time t of the magnetic flux Φ through the square coil from the moment the coil enters field P ($t = 0$) to the moment it completely exits field Q.

Include appropriate values on the axes.

Fig. 5.2

[3]

(b) Using the laws of electromagnetic induction, explain why work needs to be done by an external force on the square coil to move it through the magnetic fields at a constant velocity.

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..... [3]

(c) Determine the magnitude of the maximum e.m.f. induced in the square coil.

e.m.f. = ... V [2]