6 A small coil is positioned so that its axis lies along the axis of a large bar magnet, as shown in Fig. 6.1.

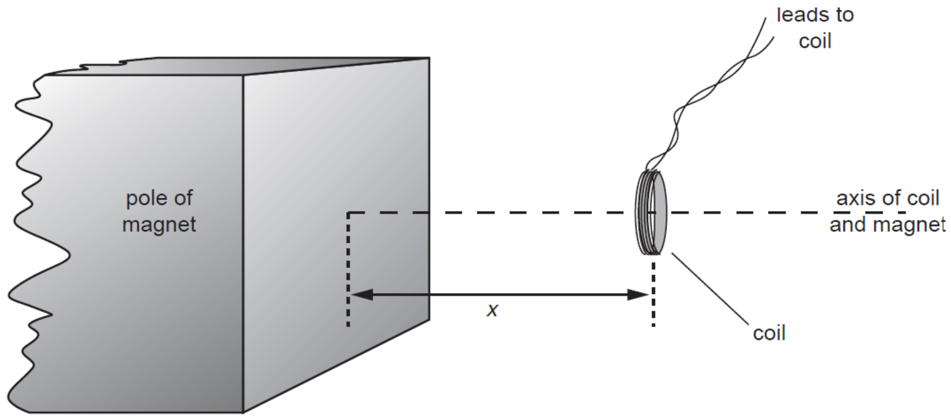

Fig. 6.1

The coil has a cross-sectional area of 0.40 cm^2 and contains 150 turns of wire.

The average magnetic flux density *B* through the coil varies with distance *x* between the face of the magnet and the plane of the coil as shown in Fig. 6.2.

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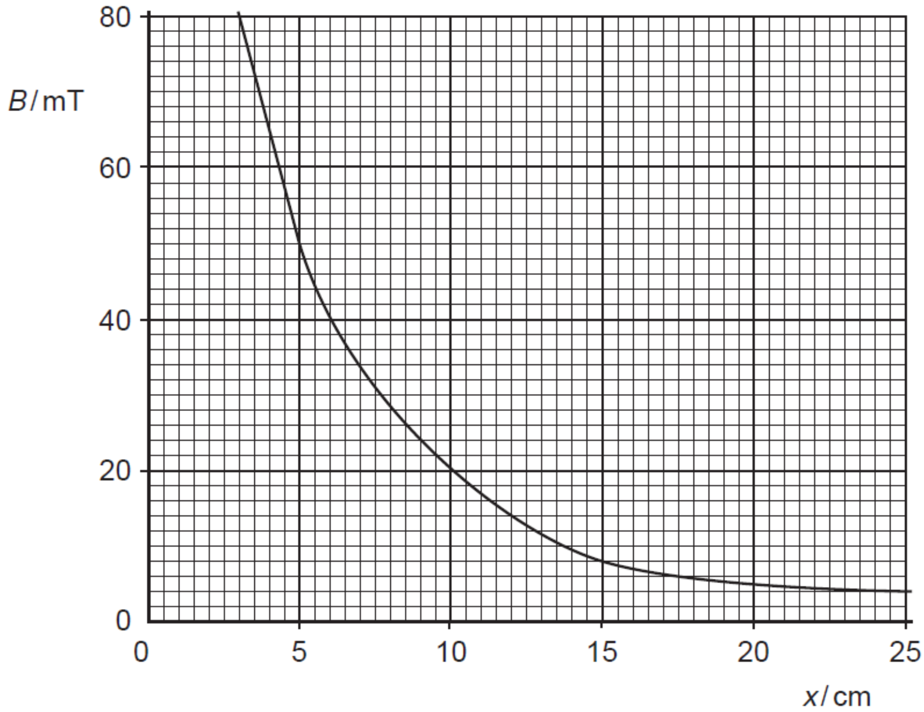

Fig. 6.2

(a) **(i)** The coil is 5.0 cm from the face of the magnet. Use Fig. 6.2 to determine the magnetic flux density in the coil

magnetic flux density = ... T [1]

(ii) Hence show that the magnetic flux linkage of the coil is 3.0×10^{-4} Wb. [2]

(b) The coil is moved along the axis of the magnet so that the distance *x* changes from $x = 5.0$ cm to $x = 15.0$ cm in a time of 0.30 s. Calculate

(i) the change in flux linkage of the coil,

change in flux linkage = ... Wb [1]

(ii) the average induced e.m.f. induced in the coil

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

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(c) State and explain the variation, if any, of the speed of the coil so that the induced e.m.f. remains constant during the movement in **(b)**.

....

....

....

.... [2]

(d) Use Lenz's law to explain why work has to be done to move the coil along the axis shown in Fig 6.1.

....

....

....

.... [2]