Examiner's Use

4 A small coil is positioned so that its axis lies along the axis of a large bar magnet, as shown in Fig. 4.1.

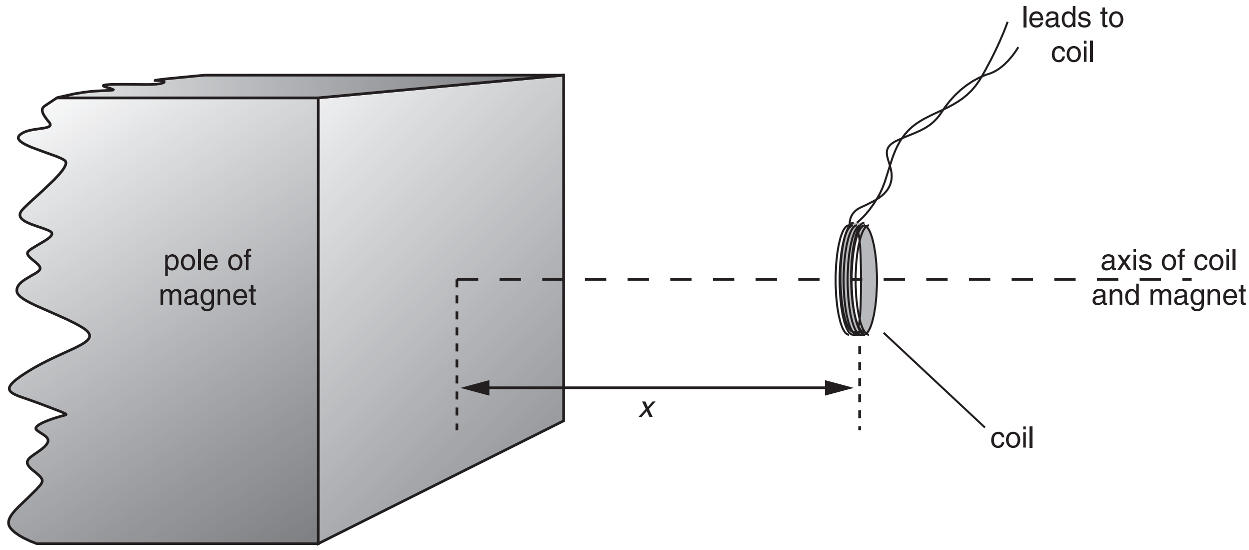

Fig. 4.1

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 the distance x between the face of the magnet and the plane of the coil as shown in Fig. 4.2.

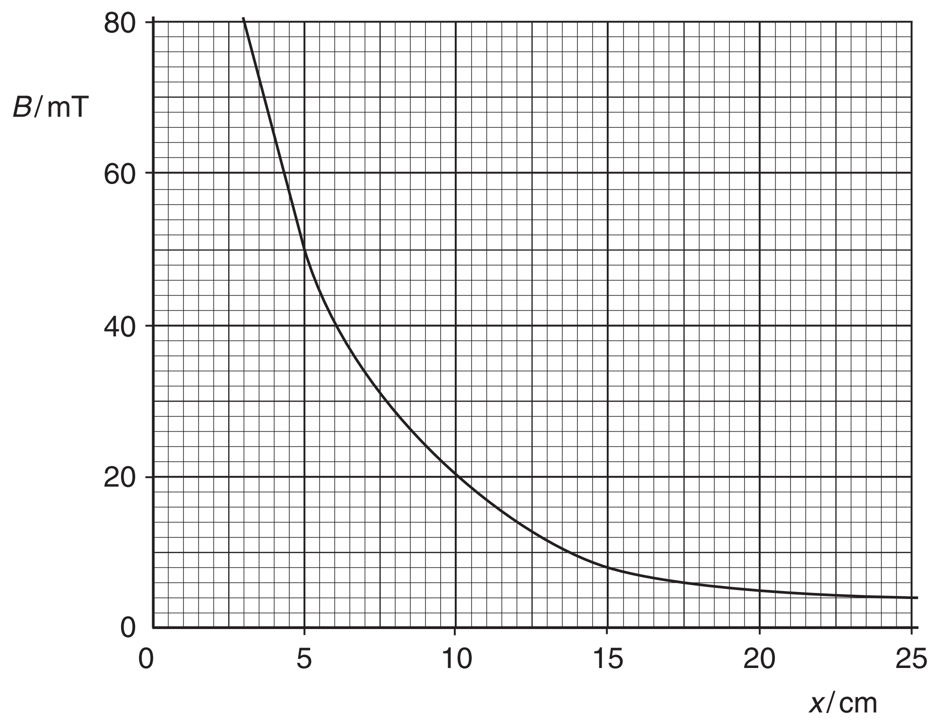

Fig. 4.2

(a) **(i)** The coil is 5.0 cm from the face of the magnet. Use Fig. 4.2 to determine the magnetic flux density in the coil.

magnetic flux density = ... T

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

[3]

(b) State Faraday's law of electromagnetic induction.

....

....

....[2]

(c) 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 = ... Wb [2]

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

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

(d) 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 **(c)**.

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....[3]