

- 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.

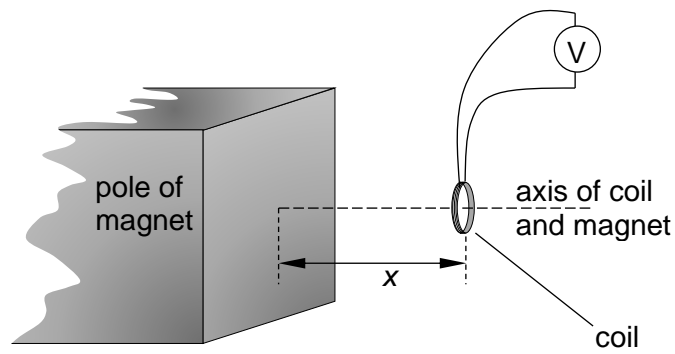


Fig. 6.1

The coil has a diameter of 5.3 mm and contains 180 turns of wire. The ends of the coil are connected to a voltmeter.

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. 6.2.

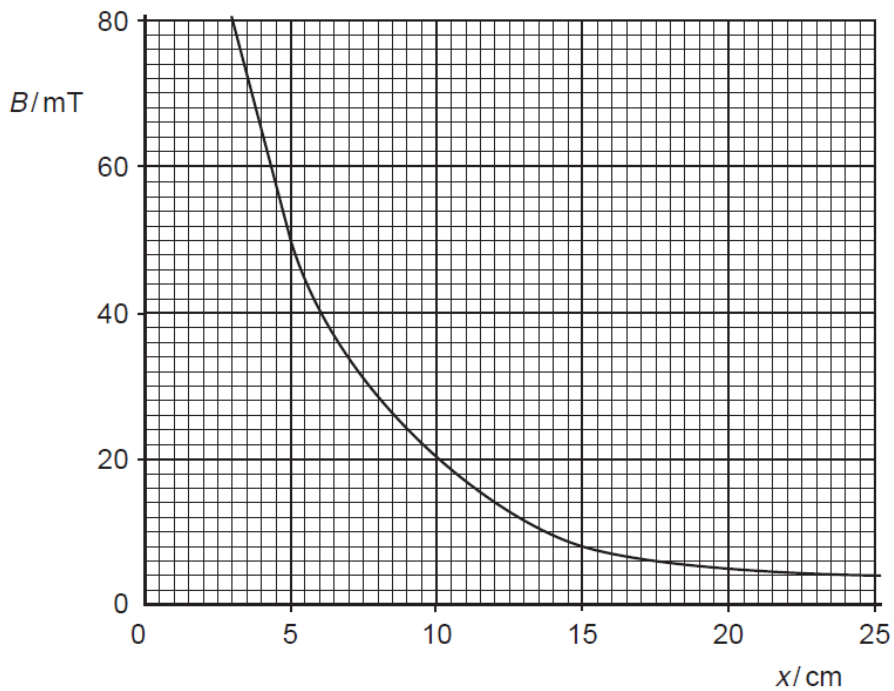


Fig. 6.2

The coil is initially 5.0 cm from the face of the magnet.

It is then moved at constant speed along the axis of coil and magnet to $x = 20$ cm in a time of 0.30 s.

As the coil is being moved, a deflection is observed in the voltmeter.

- (a) Determine the average induced e.m.f induced in the coil.

e.m.f = V [3]

- (b) The voltmeter is now replaced with a resistor and the coil is again moved away from the magnet at constant speed. As the coil moves, thermal energy is transferred in the resistor.

Use laws of electromagnetic induction to explain the origin of this thermal energy.

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[Total: 6]