8 A solenoid is connected in series with a battery and a switch, as illustrated in Fig. 8.1.

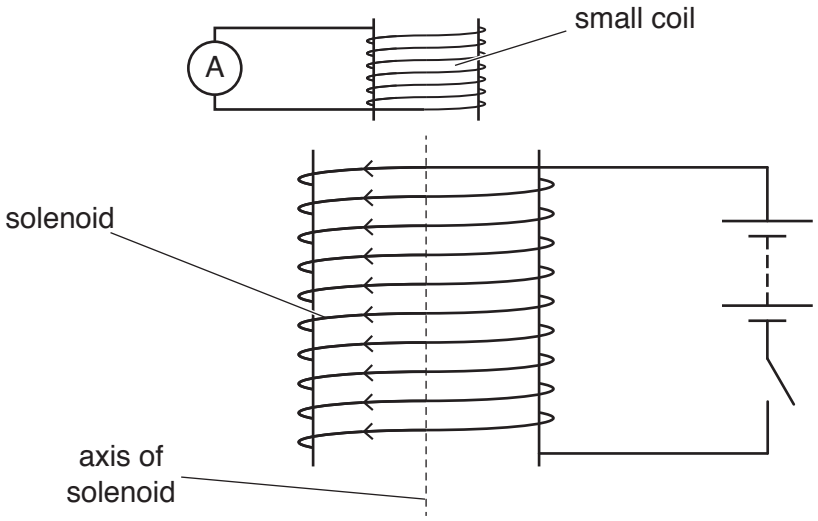

Fig. 8.1

A small coil, connected to a sensitive ammeter, is situated near one end of the solenoid.

As the current in the solenoid is switched on, there is a changing magnetic field inside the solenoid.

(a) (i) State what is meant by a *magnetic field*.

.....

..... [1]

(ii) On Fig. 8.1, draw an arrow on the axis of the solenoid to show the direction of the magnetic field inside the solenoid. Label this arrow P. [1]

(b) As the current in the solenoid is switched on, there is a current induced in the small coil. This induced current gives rise to a magnetic field in the small coil.

(i) State Lenz's law.

.....

.....

..... [2]

(ii) Use Lenz's law to state and explain the direction of the magnetic field due to the induced current in the small coil. On Fig. 8.1, mark this direction with an arrow inside the small coil.

.....

.....

.....

..... [3]

(c) The small coil has an area of cross-section $7.0 \times 10^{-4}\,m^2$ and contains 75 turns of wire.

A constant current in the solenoid produces a uniform magnetic flux of flux density 1.4 mT throughout the small coil.

The direction of the current in the solenoid is reversed in a time of 0.12 s.

Calculate the average e.m.f. induced in the small coil.

e.m.f. = ...V [3]

[Total: 10]

[Turn over

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