5 **(a)** State Faraday's law of electromagnetic induction.

……

……

…… [1]

(b) A small coil C is placed inside a solenoid as shown in Fig. 5.1.

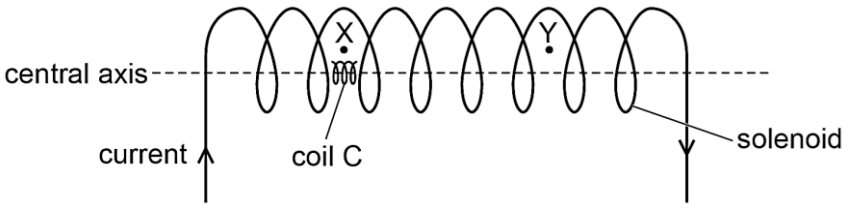

Fig. 5.1 (not to scale)

The centre of coil C is on the central axis of the solenoid.

There is a constant current in the solenoid and coil C is moved through the solenoid from position X to position Y.

Explain why the magnetic flux linkage in coil C is constant.

……

……

…… [1]

(c) Coil C is now held stationary at X and an alternating current (a.c.) power supply is now connected to the solenoid. The alternating current I varies with time t according to

$$I = 4.8\sin(10\pi t)$$

where I is in A and t is in s.

(i) Show that the period of the alternating current is 200 ms.

[1]

For Examiner's Use

(ii) Coil C has 71 turns and cross-sectional area 0.64 cm^2. The solenoid has 4000 turns per unit metre.

Show that the maximum magnetic flux linkage in coil C is 1.1×10^{-4} Wb.

[3]

(iii) Hence, determine the maximum electromotive force (e.m.f.) induced in coil C.

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

(iv) On Fig. 5.2, sketch the variation of the induced e.m.f. E in coil C with time between t = 0 and t = 400 ms.

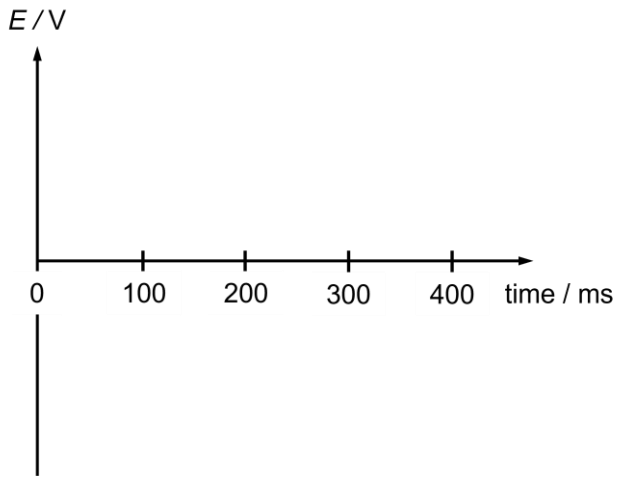

Fig. 5.2

[2]

[Total: 10]